Adriatic Croatia International Club
za djelatnost marina d.d.,
Rudolfa Strohala 2, 51 000 Rijeka,
OIB: 17195049659
Redovne dionice: ISIN HRACI0RA0000
Djelatnost: R 9329
Tržište: Zagrebačka burza, Redovito tržište
LEI:7478000090X86WBQ6C10
Matična država članica: Hrvatska

Temeljem članka 277. st. 2. Zakona o trgovačkim društvima Uprava društva Adriatic Croatia International Club, za djelatnost marina d.d. (dalje: Društvo) je dana 24. listopada 2023. godine donijela odluku o sazivanju Glavne skupštine Društva te ovime dioničare Društva poziva na

GLAVNU SKUPŠTINU

Adriatic Croatia International Club, za djelatnost marina d.d., Rijeka, R. Strohala 2, koja će se održati u Rijeci, u sjedištu Društva, dana 04. prosinca 2023. godine, s početkom u 12,00 sati,
sa sljedećim dnevnim redom:

1. **Otvaranje Glavne skupštine i utvrđivanje kvoruma za pravovaljano donošenje odluka uz popis svih nazočnih dioničara i njihovih punomoćnika.**
2. **Donošenje odluke o izboru članova Nadzornog odbora.**
3. **Donošenje odluke o Revizijskom odboru.**
4. **Davanje suglasnosti na sklapanje Konzorcijskog ugovora i Ugovora o grantu.**

Prijedlozi odluka Glavne skupštine:

Ad.2.) Nadzorni odbor predlaže Glavnoj skupštini donošenje slijedeće odluke:
Za članove Nadzornog odbora Društva biraju se:
1.Dražen Ivanušec, dipl.iur., Zagreb, Zelinska ulica 4, OIB: 62473294634,
2.Marijeta Hladilo, dipl.oec., Na rivi 6, Prijevor, 20236 Mokošica, OIB: 29920886252,
3. Mr.sc.Tomislav Ninić, Novo Naselje 25 A, 22000 Bilice, OIB: 75376875606,
4. Danijel Imgrund, mag.oec, Pletenci 20 D, 51000 Rijeka, OIB: 48641134871,
Mandat izabranih članova Nadzornog odbora ACI d.d. traje 4 godine.

Ad.3.) Nadzorni odbor predlaže Glavnoj skupštini donošenje slijedeće odluke:
Za članove Revizijskog odbora Društva biraju se:
1. Marijeta Hladilo, dipl.oec., Na rivi 6, Prijevor, 20236 Mokošica, OIB: 29920886252,
2. Dr.sc. Denis Buterin, Tenčićevo 13, 51000 Rijeka, OIB: 33619976723,
3.Prof. dr.sc. Davor Vašiček, Hrelička 52, 10000 Zagreb, OIB: 72540969712,
na mandat od 4 godine, za koje razdoblje primaju naknadu za rad u iznosu od 238,90 eura neto mjesečno ukoliko nisu istodobno i članovi Nadzornog odbora odnosno 132,72 eura neto mjesečno ukoliko jesu istodobno članovi Nadzornog odbora te uz naknadu za rad imaju pravo na naknadu putnih troškova.

Rudolfa Strohala 2, 51000 Rijeka
Tel: +385 (0)51 271 288 | Fax: +385 (0)51 271 824 | E-mail: aci@aci-club.hr
MB: 3267628 | OIB: 17195049659
www.aci-marinas.com

Ad.4.) Uprava Društva predlaže Glavnoj skupštini donošenje slijedeće odluke:

Daje se suglasnost Upravi Društva na sklapanje Konzorcijskog ugovora i Ugovora o grantu, koji čine prilog dokumentacije za ovu Glavnu skupštinu i koji će po odobrenju Glavne skupštine činiti sastavni dio ove odluke.

Sudjelovanje i glasovanje na Glavnoj skupštini

Na prava dioničara da se koriste pravom glasa i sudjeluju u radu Glavne skupštine odgovarajuće se primjenjuju odredbe Zakona o trgovačkim društvima i Statuta Društva.

Na Glavnoj skupštini ima pravo sudjelovati svaki dioničar Društva, koji svoje sudjelovanje, osobno ili putem svog zastupnika odnosno punomoćnika, prijavi Društvu, najkasnije šest dana prije održavanja Glavne skupštine, u koji rok se ne uračunava dan prispijeća prijave Društvu, odnosno najkasnije 27. studenog 2023. godine. Dioničarom Društva s pravom sudjelovanja na Glavnoj skupštini smatra se pravna i fizička osoba koja je kao dioničar Društva evidentirana u depozitoriju Središnjeg klirinškog depozitarnog društva d.d., Zagreb, posljednjeg dana za prijavu sudjelovanja na Glavnoj skupštini odnosno dana 27. studenog 2023. godine.

Radi osiguravanja lakšeg pristupa dioničarima Glavnoj skupštini Uprava Društva je odlučila da će se dioničarima omogućiti sudjelovanje na Glavnoj skupštini i elektroničkom komunikacijom na daljinu u stvarnom vremenu, što podrazumijeva i davanje glasa elektroničkom komunikacijom.

U tom smislu valjanom prijavom smatraju se: prijava pisanim putem ili elektroničkom poštom, te davanje punomoći osobi prijavljenoj za sudjelovanje na Glavnoj skupštini i dostava te punomoći u Društvo. Prijava mora biti dostavljena u sjedište Društva, Rijeka, Rudolfa Strohala 2 ili elektroničkom poštom na adresu aci@aci-club.hr i mora sadržavati: ime i prezime odnosno tvrtku dioničara, adresu prebivališta odnosno sjedišta dioničara, OIB dioničara i e-mail dioničara na koji će dobiti pristupni kod za sudjelovanje na Glavnoj skupštini na daljinu. Ako prijavu ne podnosi dioničar osobno, prijava mora sadržavati i osobne podatke podnositelja prijave kao i dokaz podnositelja prijave o ovlaštenju za zastupanje dioničara (izvod iz sudskog registra ili punomoć) te e-mail podnositelja prijave na koji će dobiti pristupni kod za sudjelovanje na Glavnoj skupštini na daljinu.

Obrazac prijave dostupan je dioničarima na internetskoj stranici Društva www.aci-marinas.com.

Ako dioničar svoje pravo glasa u Glavnoj skupštini ostvaruje preko opunomoćenika, uz prijavu je dužan priložiti i pisanu punomoć. Punomoć mora sadržavati osobne podatke dioničara koji daje punomoć, ovlaštenje opunomoćeniku da sudjeluje u radu Glavne skupštine i glasuje, te datum izdavanja i vrijeme važenja punomoći. Ako je dioničar pravna osoba, uz punomoć se dostavlja i izvod iz sudskog ili drugog registra u koji je upisana pravna osoba, odnosno njegov preslik, iz kojeg je vidljivo da je punomoć potpisala osoba koja je ovlaštena zastupati tu pravnu osobu. Original punomoći mora biti dostavljen u Društvo prije održavanja Glavne skupštine. Obrazac punomoći dostupan je dioničarima na internetskoj stranici Društva www.aci-marinas.com.

Dioničar koji nije u roku ispunio obvezu prijavljivanja namjere sudjelovanja na Glavnoj skupštini ne može sudjelovati u radu Glavne skupštine.

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Član Uprave: Josip Ostrogović · Član Uprave: dr.sc. Ivan Herak · Predsjednik Nadzornog odbora Dražen Ivanušec
Raiffeisenbank d.d., Magazinska cesta 69, 10000 Zagreb, HR0524840081102033652 · Erste&Steiermärkische Bank d.d., Jadranski trg 3a, 51000 Rijeka, HR8624020061100387820

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Nakon što Društvo zaprimi urednu prijavu za sudjelovanje na Glavnoj skupštini, svakom sudioniku dostavit će na adresu elektroničke pošte navedenu u prijavi detaljnu uputu za sudjelovanje na Glavnoj skupštini na daljinu, ukoliko će sudionik sudjelovati na navedeni način na Glavnoj skupštini. Svaki sudionik odgovoran je za osiguravanje vlastitih tehničkih uvjeta za sudjelovanje u radu Glavne skupštine (računalo i mobilni uređaj s kamerom i mikrofonom, mogućnost instalacije računalnog programa za audio i video vezu, mogućnost instalacije računalnog programa za glasanje) prema uputama koje je dobio. U slučaju da pojedini uredno prijavljeni sudionik nema tehničke mogućnosti sudjelovanja na Glavnoj skupštini, dužan je o tome obavijestiti Društvo, koje će mu dati odgovarajuću uputu i ovlaštenje da svoje glasove za pojedine točke dnevnog reda dostavi Društvu najkasnije do početka održavanja Glavne skupštine pisanim putem ili putem elektroničke pošte poslane s adrese elektroničke pošte koja je naznačena u prijavi za sudjelovanje na Glavnoj skupštini.
Materijali za Glavnu skupštinu, poziv s dnevnim redom i prijedlozima odluka, te obrasci prijave i punomoći dostupni su dioničarima na internetskoj stranici Društva www.aci-marinas.com kao i na uvid u sjedištu Društva svakim radnim danom, od 10 do 12 sati i to od dana objave poziva na internetskim stranicama sudskog registra.
Radi pravodobne registracije osobnog prisustvovanja te prisustvovanja na daljinu i pripreme popisa sudionika na Glavnoj skupštini, mole se dioničari da osobno pristupe odnosno da pristupe uključivanju u sustav za održavanje Glavne skupštine na daljinu, barem 30 minuta prije početka Glavne skupštine.

Uvrštenje novih predmeta na dnevni red i protuprijedlozi dioničara

Ako dioničari koji zajedno imaju udjele u iznosu od dvadesetog dijela temeljnog kapitala Društva nakon što je sazvana Glavna skupština zahtijevaju da se neki predmet stavi na dnevni red i da se objavi, uz svaki novi predmet na dnevnom redu mora se dati obrazloženje i prijedlog odluke.
Zahtjev za stavljanje nekog predmeta na dnevni red Društvo mora primiti najmanje 30 dana prije održavanja Glavne skupštine. U taj se rok ne uračunava dan prispjeća zahtjeva Društvu. Propust navedenog roka ima za posljedicu da predložene točke dnevnog reda nisu valjano objavljene, te se o njima na Glavnoj skupštini ne može odlučivati.
Protuprijedlozi dioničara prijedlogu odluke koji je dala Uprava i/ili Nadzorni odbor o nekoj točki dnevnog reda, s navođenjem njihovih imena i prezimena, obrazloženja i eventualnog stava Uprave, moraju biti dostupni na internetskoj stranici Društva ako dioničar najmanje 14 dana prije održavanja Glavne skupštine dostavi Društvu svoj protuprijedlog na sljedeću adresu: ACI d.d., Rudolfa Strohala 2, 51000 Rijeka.
Dan prispijeća protuprijedloga Društvu ne uračunava se u ovaj rok od 14 dana. Protuprijedlog mora biti dostupan na internetskoj stranici Društva. Ako se dioničar ne koristi ovim pravom, to nema za posljedicu gubitak prava na stavljanje protuprijedloga na Glavnoj skupštini Društva. Navedeno se na odgovarajući način primjenjuje i na stavljanje prijedloga dioničara o izboru člana Nadzornog odbora ili o imenovanju revizora Društva. Ovaj prijedlog ne mora biti obrazložen. Uprava ne treba prijedlog učiniti dostupnim dioničarima ako on ne sadrži podatke koji se moraju objaviti uz prijedlog za izbor članova Nadzornog odbora i imenovanje revizora, te podatke o članstvima osoba predloženih za izbor u nadzornim odnosno upravnim odborima drugih društava i drugih nadzornih tijela u zemlji i inozemstvu.

Pravo na obaviještenost o poslovima društva

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Uprava mora na Glavnoj skupštini dati svakome dioničaru na njegov zahtjev obavještenja o poslovima Društva, ako je to potrebno za prosudbu pitanja koja su na dnevnom redu. Obveza davanja obavještenja odnosi se i na pravne i poslovne odnose Društva s povezanim društvima. Ako je Društvo kroz poslovnu godinu steklo vlastite dionice, Uprava mora u Izvješću o stanju Društva navesti razloge stjecanja, broj i nominalni iznos stečenih dionica, stekne li ih pak naplatnim putem i ono što je za to dalo, vlastite dionice koje je otuđilo i takve dionice koje još drži.

Izostanak kvoruma/nova sjednica Glavne skupštine

Ako na sazvanoj sjednici Glavne skupštine ne bude postignut kvorum, koji je određen Statutom Društva, naredna Glavna skupština održat će se dana 04. prosinca 2023. godine u 14,00 sati, na istome mjestu, uz nepromijenjeni dnevni red.

Naredna Glavna skupština održat će se bez obzira na broj prisutnih dioničara i vrijednost njihovih dionica, a odluke će se donositi većinom zastupljenih glasova na Glavnoj skupštini.

Predsjednik Uprave
Kristijan Pavić

ADRIATIC CROATIA INTERNATIONAL CLUB, za djelatnost marina d.d. | Rijeka

Adriatic Croatia International Club, za djelatnost marina d.d.
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TETIDA
Analytics Strategy Consulting

ECUBES
Hydrogen & Flexibility

Projekt „Koridor mobilnosti s nultom emisijom – Sjeverni Jadran“,
koji je pokrenula
Dolina vodika Sjeverni Jadran

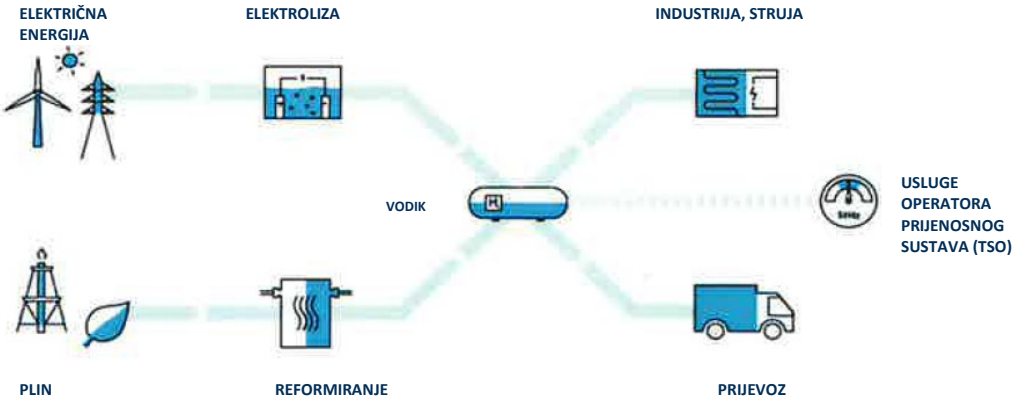
ECUBES klasteri vodikove tehnologije
za
ACI MARINE Opatija, Hrvatska

Predstudija izvodljivosti za klaster vodika ACI MARINE u OPATIJI

Zagreb, Nova Gorica, Rijeka; 21. 7. 2022.

Autori: Aleksander Gerbec ECUBES i Simon Ferjuc TETIDA

Novi energetski koncept temeljen na vodikovim tehnologijama i spajanju sektora koji je načinila tvrtka ECUBES Technologies:



Projekt je dio „Koridora mobilnosti s nultom emisijom – Sjeverni Jadran“ i uključuje:

- 22 projekta u ACI marinama i na hrvatskim otocima
- 15 projekata u Sloveniji (2 u razvoju, 5 u Kanalu i 9 u Sloveniji)
- 1 projekt u San Vitu, Italija

1. IDEJA PROJEKTA

U kontekstu energetske tranzicije partneri u regiji sjevernog Jadrana razvijaju mrežu energetski samodostatnih čvorišta vodikove tehnologije. Slijedeći preporuku REPOWEREU, projekti su u pripremi istovremeno, kako bi se ispunili energetski učinkoviti i ekološki ciljevi. Projekt je prvobitno izradio ECUBES, a danas se razvija s drugim partnerima iz triju sjevernojadranskih područja: Slovenija, Hrvatska i talijanska regija Furlanija-Julijska krajina.

Slovenija – prvo takvo čvorište gradi se na lokaciji Salonit Anhova. Dodatnih pet – Općina Kanal ob Soča prihvatila je prijedlog Salonita i ECUBES-a i definirala razvoj ovakvih vodikovih centara u strategiji razvoja općine. Konkretno, razvoj je definiran na pet planiranih lokacija. Tvrtka HSE Holding, slovenski proizvođač električne energije, razvija projekt na još dvije lokacije.

ECUBES

Projekt „Koridor mobilnosti s nultom emisijom“ u Sloveniji

2015. – 2027.

Ciljevi

- Održivi poslovni model za OIE – PROJEKT EU DEMO
- Smanjena emisija stakleničkih plinova
- Bolja upotreba energije iz prirodnog plina
- Fleksibilnost na razini operatora prijenosnog sustava (TSO)
- Povećana sigurnost opskrbe energijom
- Sigurniji i održiviji energetski model
- Poslovni model za prijevoz s nultom emisijom
- Skladištenje energije
- Državna sigurnost i obrambena sposobnost

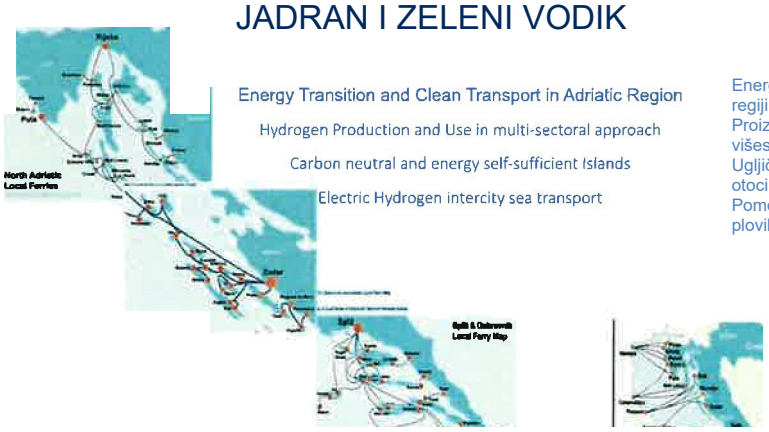
KAKO:

- Isporuka rješenja za mobilnost voznog parka; e-mobilnost pogonjena vodikom i povezanom infrastrukturom
- S pomoću distribuirane proizvodnje električne energije (DG) i kombinirane toplinske i električne energije (CHP) temeljene na tehnologiji gorivnih članaka
- Skladištenje energije

- Smanjenje CO_2 130.000 MT ekv/Y

U Hrvatskoj je tvrtka ACI CLUB ušla kao investitor u projekt Adriatic Green Hydrogen kako bi uspostavila energetski učinkovita i samodostatna energetska čvorišta u marinama i na odabranim hrvatskim otocima. Odlučeno je da se prvo vodikovo čvorište postavi u ACI marini u Opatiji.

JADRAN I ZELENI VODIK



Energetska tranzicija i čisti promet u jadranskoj regiji
Proizvodnja i upotreba vodika u višesektorskom pristupu
Ugljično neutralni i energetski samodostatni otoci
Pomorski promet između gradova električnim plovilima na vodik

O čvorištu vodikovih tehnologija ECUBES:

Vodikova čvorišta omogućuju zahvaćanje viška obnovljivih izvora energije, pretvorbu energije i skladištenje energije u obliku vodika, proizvodnju toplinske i električne energije s pomoću gorivnih članaka te punionice za električnu energiju i vodik. Čvorišta, koja će biti postavljena na odabranim lokacijama, također će osigurati višednevnu samodostatnost i podržati električnu mobilnost te tako snažno podržati razvoj energetskih zajednica.

Koncept omogućuje razvoj otočnih kapaciteta u slučaju ispada u elektroenergetskoj mreži, s ciljem smanjenja energetske ovisnosti o vanjskim izvorima, upotrebe obnovljivih izvora energije na odabranim lokacijama i infrastrukturi u vlasništvu onih koji su odabrani zajedno s investitorima ili lokalne zajednice te s pomoću otočnih izvora i skladištenjem energije doprinosi robusnosti opskrbe energijom.

Koncept omogućuje razvoj mobilnosti na bazi vodika bez emisija u cestovnom, pomorskom ili zračnom prometu te podupire sigurnost energetske samodostatnosti, čak i u ruralnim područjima, što je novost u europskom prostoru.

Koncept omogućuje ACI-ju razvoj električnog brodskog prijevoza baziranog na vodiku, koji će proizvoditi samostalno ili u partnerstvu s dobavljačima s tržišta.

Na temelju ovog projekta, koji je izradio ECUBES, nastao je obrambeni projekt RESHUB, koji je za provedbu odobrila Europska obrambena agencija EDA. https://www.gov.si/novice/2020-01-24-mreza-vozlisc-reshub/.

2. KONCEPT

Na lokalnoj razini, na odabranoj lokaciji, opskrba energijom osigurana je obnovljivim izvorima energije: solarnim elektranama, vjetroelektranama ili malim hidroelektranama. Postavlja se spremnik vodika (H_2) namjenskog kapaciteta, koji se puni vodikom dobivenim elektrolizom, koja upotrebljava energiju dobivenu iz obnovljivih izvora, električne mreže, ili vodikom proizvedenim novom tehnologijom H2GENIUM, pri čemu se vodik proizvodi iz viška topline iz industrijske proizvodnje. Proizvodnja vodika iz javne elektroenergetske mreže moguća je kada postoji višak električne energije u mreži.

Tehnološki klaster ECUBES, koji upotrebljava tehnologiju H2GENIUM, povezan je s javnom elektroenergetskom mrežom za potrebe uravnoteženja u javnoj elektroenergetskoj mreži i podržava upotrebu električnih vozila koja rade na temelju energije pohranjene u baterijama ili vodika kao pogonskog sredstva.

H2GENIUM ECUBES
Punionica vodikom i nov način skladištenja energije, Salonit Anhovo, Slovenija
Početak 14. studenog 2021.

Izgradnjom prvih petnaest čvorišta u Sloveniji očekuje se smanjenje emisije CO_2 za 130.000 tona godišnje. Istovremeno, čvorište osigurava lokalnu proizvodnju i skladištenje energije na duži vremenski period, čime se značajno smanjuje ovisnost o vanjskim izvorima energije, te nudi lokalni neovisan i pouzdan izvor energije u slučaju elementarnih nepogoda i kriza. Koristi lokalnoj zajednici pružajući tehnološku osnovu za razvoj zelenog javnog i privatnog prijevoza. Projekt podržava četiri politike EU-a: politiku zaštite okoliša, energetsku politiku, zajedničku sigurnosnu i obrambenu politiku i prometnu politiku te je u skladu s REPOWER EUROPE.

3. OPĆI UVJETI – ACI KLUB

ACI ima viziju postati vlasnik visokoenergetski učinkovitih i energetski samodostatnih marina, kao pionirska tvrtka u sektoru, s ciljem razvoja samodostatnih energetskih čvorišta:

- lokalna elektroenergetska mreža prvenstveno se napaja lokalno proizvedenom obnovljivom energijom,
- višak EE pretvara se u vodik,
- vodik se skladišti lokalno u prikladnom spremniku odgovarajućeg kapaciteta,
- vodik (i kisik) proizvodi se s pomoću elektrolizatora,
- vodik se također proizvodi iz viškova EE u mreži (usluge uravnoteženja za sustav EE),
- opskrba zelenom energijom iz zelenog vodika dobivenog u Sloveniji (uvjeti iz natječaja Hydrogen Valley/Dolina vodika)
- vodik će se upotrebljavati lokalno za objekte: gorivni članci za otočnu upotrebu i opskrbu marine EE, gorivni članci za otočnu upotrebu i opskrbu lokalne kritične infrastrukture EE;
- vodik se upotrebljava kao gorivo za brze električne hidrogliserske katamarane na vodik, koji su u vlasništvu i pod upravom ACI CLUB-a
- vodik se također upotrebljava:
    - za javne usluge, za pomorski i zračni promet; opskrbu vodikom plovila gostiju koja se koriste vodikom kao izvorom energije;
    - za opskrbu vodikom plovila u marinama koja se koriste vodikom kao izvorom energije;
    - toplina (toplinski gubici) nastala elektrolizom i gorivnim člancima upotrebljava se za grijanje i sanitarnu vodu,
    - energetski deficiti osigurani su upotrebom sustava za kogeneraciju EE i topline (CHP) iz prirodnog plina/bioplina/vodika.

4. TEHNIČKI UVJETI

Tehnički uvjeti osnovni su i mogu se prema potrebi prilagoditi. U načelu je potrebno razviti cijeli lanac vrijednosti vodika, upotrebljavati vodikove tehnologije u multisektorskom pristupu s opcijom redundancije, u partnerstvu s drugim partnerima u proizvodnji zelenog vodika

- Proizvodnja obnovljive energije
- Spremište energije za vodik, s mogućnošću nadogradnje
- Trajno skladištenje vodika za potrebe marine i lokalne kritične infrastrukture za potrebe grada Ičića,

- dio zaliha namijenjen prodaji vanjskim korisnicima i za uslugu uravnoteženja,
- zaliha od nekoliko dana za proizvodnju EE – 7 dana električne autonomije za kritičnu infrastrukturu.

4.1. Stacionarni dio

Tehnička su polazišta informativna i mogu se prilagoditi.

- Solarna elektrana 1,5 MWp,
- elektrolizator 1,2 MW, napajan iz SE i iz viškova u mreži,
- baterijski sklop,
- plinski spremnik min. 3 dana do 30 dana,
- gorivni članci na vodik i prirodni plin 300 kW EE,
- vrelovod do postojećeg spremnika tople vode za sanitarnu vodu i grijanje,
- priključak na distribucijsku mrežu EE,
- AI za cjelokupno upravljanje,
- opcionalno hvatanje kisika,
- opcionalna emisija viška toplinske energije,
- podrška cestovnoj mobilnosti:
    - brze električne punionice,
    - punionice vodika 350 bara i 700 bara.

Energija se proizvodi iz SE i iz viškova u mreži. Viškovi se u obliku vodika pohranjuju u plinskom reaktoru. Toplina se upotrebljava za grijanje. Energetski se deficiti dobivaju:
- iz prirodnog plina u vodik, a zatim s gorivnim člankom u EE, iz prirodnog plina u CHP u EE

5. RJEŠENJE

- dnevna potrošnja vodika (potrebna dnevna proizvodnja vodika) 120 kg,
- trajna pohrana vodika 500 kg + 1000 kg za vlastitu upotrebu električne energije u slučaju nužde za marinu (zajamčena 3-dnevna autonomija za punionice vodika za potrebe marine i za EE), 500 kg za rad plovila na vodik,
- priključna snaga na SN mrežu EE od 0,5 MW,
- postojeća dnevna potrošnja EE na lokaciji je 3 MWh, s maksimalnom snagom od 300 kW,
- gorivni članak za napajanje za slučaj nužde (vlastita upotreba) i napajanje vodikovih punionica nazivne snage 300 kW (potreban vodik za 3 dana autonomije).
- H2GENIUM s baterijskim sustavom za prebacivanje vrhunca proizvodnje EE na SE i osiguravanje jednodnevne opskrbe EE za otočnu upotrebu, sudjelovanje u uslugama uravnoteženja, kapaciteta 3 MWh i snage od 500 kW.
- opcionalna kogeneracija na prirodni plin nazivne električne snage od 300 kW.
- mogućnost osiguranja nedostajuće EE iz mreže s potvrdom o izvoru.

5.1. Solarna elektrana – PV 1,5 MWp

Na lokaciji marine, na krovovima zgrada i parkiralištima, te na odabranoj zapuštenoj lokaciji u blizini grada Opatije gradila bi se fotonaponska (PV) elektrana ukupne snage 1,5 MWp u fotonaponskim modulima, koja bi davala 1.650 MWh električne energije na godišnjoj razini (cca 1.100 sati rada godišnje nazivne snage solarne elektrane). Uz sunčano vrijeme mogli bismo osigurati cca 10 MWh električne energije, a zimi cca 5 MWh. Višak energije privremeno se pohranjuje u spremnik H2GENIUM i upotrebljava za proizvodnju vodika tijekom dana. Vodik bi se prevozio cestom s drugog mjesta uglavnom za upotrebu u pomorskom prometu.

Procijenjena investicijska vrijednost solarne elektrane snage 1,5 MWp jest 900 €/kWp, odnosno 1.550.000 €. Procijenjena investicijska vrijednost izgradnje nove TP 20/0,4 kV 1,6 MVA jest 100.000 €.

5.2. Proizvodni pogon za proizvodnju i skladištenje vodika

Cjelokupno postrojenje predstavlja sustav H2GENIUM, koji uključuje elektrolizator (procesni dio), upravljački dio napajanja s transformatorom, mjerni dio, postrojenje za pripremu vode (demineralizacija) i pomoćnu infrastrukturu. Procesni je dio kontejnerskog tipa i sastoji se od članaka za proizvodnju vodika s pripadajućom opremom, kao što je sustav za pročišćavanje vodika. Upravljački dio napajanja s pripadajućim mjerenjima i pripremom vode (demineralizacija) također je kontejnerskog tipa i nalazi se u dva dodatna spremnika. Iz rashladnog sustava dolazi rashladna voda za hlađenje elektrolizatora. Pomoćna infrastruktura neophodna je za rad proizvodne i infrastrukture za punjenje vozila, kao što su zatvoreni rashladni sustav, pripadajuća upravljačka, regulacijska i mjerna oprema i sl.

Osnovne karakteristike proizvodnog pogona:

Proizvodnja H_2 – maks. kapacitet:	100 Nm^3/h (213 kg H_2/dan, 8,8 kgH_2/h)
Napajanje električnom energijom:	Pmax = 700 kW (uključujući pomoćnu opremu)
Nazivna snaga elektrolizatora:	P = 500 kW
Raspon proizvodnje:	25% – 100%
Maks. potrošnja demineralizirane vode:	0,9 l/Nm^3 ili 90 l/h ili 2,16 m^3/dan ili 10l/kg H_2
Tlak vode prije demineralizacije:	5 bara
Ulazna temperatura vode:	0 °C – 25 °C
Ostvarena čistoća vodika:	99,9% (prije pročistača), 99,998% (nakon pročistača)
Temp. raspon upotrebe:	-20 °C do +35 °C
Izlazni tlak vodika:	30 bara
Sustav hlađenja:	zatvorena, rashladna voda
Certifikacija:	CE
spec. potrošnja energije (pri 30 bara):	58 kWh/kg H_2

Procijenjena vrijednost investicije jest 2.400.000 € .

5.3. Stanica za punjenje goriva – kompresorska stanica i stanica za punjenje vodikom

Punionica je potrebna za opskrbu vozila na vodikov pogon (autobusa, osobnih automobila, teških vozila) i plovila na vodik stlačenim vodikom. U slučaju upotrebe tekućeg vodika razvit će se namjenska studija izvodljivosti (FS).

Osnovne karakteristike punionice:

Nazivna snaga kompresora:	P = 75 kW
Protok kompresora:	130 Nm^3/h ili 11,7 kg/h (pri ulaznom tlaku od 30 bara)
Mjesto punjenja:	2 dozatora (dvostruki pritisak 350/700 bara)
Tlak punjenja:	>350 bara / >700 bara
Certifikacija:	CE
spec. potrošnja energije (pri 450/900 bara):	4 kWh/kg H_2

Procijenjena vrijednost investicije jest 1.600.000 €.

5.4. Spremnici za skladištenje vodika

Za potrebe trajnog skladištenja vodika, 500 kg za mobilne jedinice + 1000 kg za vlastitu upotrebu električne energije u slučaju nužde u marini (gorivni članci).

Niskotlačni rezervoar: p = 30 bara,
Srednjetlačni rezervoar: p = 450 bara,
Visokotlačni rezervoar: p = 900 bara

Ukupno količina pohranjenog vodika bit će 1500 kg, a kapaciteti pojedinačnih spremnika odredit će se u kasnijim fazama projekta.

Procijenjena vrijednost investicije jest 2.450.000 €.

Baterijski sustav pohrane takvih je dimenzija da može adekvatno akumulirati i ravnomjerno raspodijeliti proizvodnju električne energije iz solarne elektrane vršne snage 0,5 MW tijekom cijelog dana, za potrebe elektrolizatora priključne snage 500 kW. Pod punim kapacitetom omogućava jedan dan autonomije za opskrbu električnom energijom za rad marine (300 kWh), a inače se energija upotrebljava za proizvodnju vodika.

Procijenjena vrijednost investicije baterijskog sustava pohrane od 300 kWh s potrebnom infrastrukturom za rad jest 540.000 €.

Procijenjena vrijednost projektiranja, puštanja u pogon i obuke koju obavlja odabrani izvođač (za elektrolizator, kompresorsku stanicu i punionicu te spremnik vodika, točke 3.2, 3.3 i 3.4) jest 500.000 €.

Procijenjena vrijednost potrebnih građevinskih, strojarskih i električarskih radova jest 500.000 €, a ovisi o trenutnoj situaciji na lokaciji.

H2GENIUM	3.900.000 €, što se sastoji od:
Spremište H_2	2.450.000 €
Baterijski sustav pohrane	450.000 €
Projektiranje, puštanje u pogon, obuka	500.000 €
Projektiranje, nabava i izgradnja (EPC)	500.000 €

5.5. Gorivni članak

Gorivni članak služi za opskrbu marine električnom energijom u slučaju nužde bez mreže EE i plinske mreže. Upotrebljava se pohranjeni vodik. Očekivana nazivna snaga gorivnog članka iznosi 200 kW. Potrebno je osigurati cca 3 MWh električne energije dnevno, na temelju trenutne potrošnje (dnevnu potrošnju moguće je smanjiti, ali potrebno je definirati koji će se potrošači na lokaciji priključiti na napajanje za upotrebu električne energije u slučaju nužde).

Električna učinkovitost gorivnog članka ovisi o dizajnu i varira između 40 i 60%. Stoga je za trodnevnu autonomiju potrebno osigurati između 380 i 570 kg vodika. Toplinom možemo osigurati grijanje u nuždi zimi, a toplinu možemo ponuditi i lokalnoj zajednici dijelom kroz toplovod.

Gorivni članak integrirani je proizvod proizvoda H2GENIUM cijene oko 700.000 €.

5.6. EV – Stanice za punjenje električnih automobila

Za potrebe punjenja električnih vozila bit će postavljene dvije punionice snage 50 kW istosmjerne (DC) i dvije snage 22 kW izmjenične (AC) struje. Priključna snaga predloženih punionica iznosi cca 150 kW, što također treba osigurati i na postojećem priključku na distribucijsku mrežu EE.

5.7. ACI-jevi električni hidrogliserski katamarani na vodik za HRVATSKU

Električni hidrogliserski katamaran na vodik – brzo putničko plovilo

25 čv. brzina krstarenja; povećana učinkovitost do 50% i smanjeni troškovi rada na sat do 75%, u usporedbi s konvencionalnim brzim katamaranima na dizelsko gorivo

Referentni projekt izgrađen u Hrvatskoj 2019.

Usporedba operativnih troškova prikazana je u priloženoj tablici – vrijednosti su indikativne:

Tablica 1 – Usporedba pri brzini od 20 čvorova:

Usporedba katamarana i trajekta	Standardni ICE trajekt ili tradicionalni trajekt na dizel	ECUBES električni hidrogliserski katamaran na vodik, Model 3	Smanjenje
Potrebna snaga	750 kW	400 kW (20 kg H_2/sat)	-47% smanjenje
Potrošnja goriva/energije na sat pri 20 čvorova (litara ili kWh)	190 l/h	400 kWh/h (20 kg H_2/sat)	
Trošak goriva/energije po nm	13,30 €	3,70 €	-72% smanjenje
Trošak goriva/električne energije po satu	266 €	74 €	-72% smanjenje
Trošak dizelskog goriva/l ili H_2/kg	1,4	3,7	
Trošak servisiranja po satu	10 €	1 €	-90% smanjenje
Ukupni operativni trošak po satu	276,00 €	75 €	-73% smanjenje

Tablica 2 – Usporedba pri brzini od 25 čv.:

Usporedba katamarana i trajekta	Standardni ICE trajekt ili tradicionalni trajekt na dizel	ECUBES električni hidrogliserski katamaran na vodik, Model 3	Smanjenje
Potrebna snaga	1050 kW	500 kW (25 kg H_2/sat)	-52% smanjenje
Potrošnja goriva/energije na sat pri 25 čvorova (litara ili kWh)	270 l/h sat	500 kWh/h (25 kg H_2/sat)	
Trošak goriva/energije po nm	15,20 €	3,70 €	-76 % smanjenje
Trošak goriva/električne energije po satu	378 €	92,5 €	-76 % smanjenje
Trošak dizelskog goriva/l ili H_2/kg	1,4	3,7	
Trošak servisiranja po satu	10 €	1 € -	-90 % smanjenje
Ukupni operativni trošak po satu	388,00 €	93,5 €	-76 % smanjenje

Električni hidrogliserski katamarani na vodik izgrađeni u Hrvatskoj, kojima upravlja ACI, predstavljaju čvorište koje nedostaje za stvaranje cijelog lanca vrijednosti vodika, koji se povezuju obnovljive izvore energije u pomorskom prometu s jasnim poslovnim modelom.

Cijena proizvoda iznosi oko 4.000.000 €, za prvi je potreban razvojni projekt u vrijednosti od 450.000 €.

5.8. Uravnoteženje energije

Konceptualna skica:

Conceptual sketch:

6. PROCJENA INVESTICIJE NA LOKACIJI IČIĆI

ACI CLUB – Marina Ičići; Plan razvoja projekta za energetsku tranziciju i vodik

ACI MARINA Projektna lokacija:			H_2	H_2			H2			
Projektna faza	**Kapacitet proizvodnje H_2**	**Dostupan H_2**	**Skladištenje H_2 i H2GENIUM**	**STANICA ZA PUNJENJE VODIKOM H2GENIUM**	**GORIVNI ČLANCI**	**Izvor OIE**	**Cestovni promet**	**Prijevoz brzim plovilima na H_2**	**Vremenski okvir**	**Investicija bez plovila i EV**
Projektna lokacija Marina Ičići										
Status na današnji dan			FS (Izvedivost)	Pred-FS	Pred-FS	FS	Pred-FS	FS	2022.	300.000 €
1. faza Ičići 2023.			50 kg H_2 100 kWh el TBD/Demo 250.000 €	H2GENIUM demo 25 kg TBD/demo	50 kW 200K*	PV 300 kWp 400.000	1 FCEV (vozilo na gorivne članke) TOYOTA + 1 EV 0	Ugovor za isporuku prvog plovila na H_2 2024./25. 400.000 €	2023.	1.250.000€
2. faza "Ičići" završena	500 kW 120 kg H_2/d 2,4 mil. €	120 kg/d 40 t/a		30 kg/d 2 dozatora 1,6 mil. €		PV: 1,2 MWp 1,2 mil.	1 FCEV + 2 EV + lokalni javni prijevoz 1x		2024.	5,2 mil. €
3. faza			1500 kg H_2 +BAT 300 kWh 2,45 mil. €		Gorivni članci 200 kW 700.000 €			Električni brzi higrogliser na vodik 3,9 mil. €	2025.	7,05 mil. €
U KONAČNICI	500 Kw, H_2 120 kg/d 40 t/a	120 kg/d 40 t/a	1500 kg H_2 +BAT 300 kWh	30 kg/d 11,7 kg/h 2 dozatora	Gorivni članci 200 kW	PV: 1,5 MWp	Vozni park FCEV + lokalni javni prijevoz	Električni brzi higrogliser na vodik	2025.	**14,1 mil. €**
Ičići ukupno: 14,1 mil. € *- PV: 1,55 mil. € - Plovilo: 4,3 mil. € - Vodik:* 8,25 mil. €	2,4 M		2,450 M	1,6 M	200.000 € + 700.000 € = 900.000 €	1,2 M		4,3 mil. €	2025.	

>>>>>>>>>

5.1. PV – Procijenjena investicijska vrijednost solarne elektrane snage 1,5 MWp jest 900 €/kWp, odnosno 1.550.000 €. Procijenjena investicijska vrijednost izgradnje nove TP 20/0,4 kV 1,6 MVA jest 100.000 €.
5.2. Elektrolizator – Procijenjena vrijednost investicije jest 2.400.000 €.
5.3 Stanica za punjenje vodikom – Procijenjena vrijednost investicije jest 1.600.000 €.
5.4. Skladištenje vodika
Procijenjena vrijednost investicije jest 2.450.000 €.
Procijenjena vrijednost projektiranja, puštanja u pogon i obuke, koju izvodi odabrani izvođač (za elektrolizator, kompresorsku stanicu i punionicu te spremnik vodika (točke 3.2, 3.3 i 3.4) jest 500.000 €.
Procijenjena vrijednost potrebnih građevinskih, strojarskih i električarskih radova jest 500.000 €, a ovisi o trenutnoj situaciji na lokaciji
5.5. FC Fuel cell integrirani je proizvod proizvoda H2GENIUM cijene oko 700.000 €
5.6. Cijena stanice za punjenje EV iznosi oko 50.000 €
5.7. Trošak investicije u električne hidrogliserske katamarane na vodikov pogon iznosi oko 4.000.000, za prvi je potreban razvojni projekt u vrijednosti od 450.000 €

UKUPNO ulaganje s plovilom = 14,1 mil. €

7. PROCJENA INVESTICIJE NA LOKACIJAMA MARINA 2, 3, 4, 5, 6

ACI CLUB – Marina br. 2, 3, 4, 5, 6... 22; Plan razvoja projekta za energetsku tranziciju i vodik

ACI MARINA Projektna lokacija:										
Projektna faza	**Kapacitet proizvodnje H_2**	**Dostupan H_2**	**Skladištenje H_2 i H2GENIUM**	**STANICA ZA PUNJENJE VODIKOM**	**GORIVNI ČLANCI**	**Izvor OIE**	**Cestovni promet**	**Prijevoz brzim plovilima na H_2**	**Vremenski okvir**	**Investicija s plovilom na vodik**
Projektna lokacija Marina br. 2, 3, 4, 5, 6										
Status na današnji dan	/	/	/	/	/	/	/	/	2022.	/
1. faza Lokacija 1 – 5 2023.	FS		FS (Izvedivost)	FS	FS	FS	FS	FS	2023.	/
2. faza Isporuka završena u roku 1 godine	500 kW 120 kg H_2/d 2,4 mil. €	120 kg/d 40 t/a	50 kg H_2 +BAT 300 kWh 2,45 mil. €	30 kg/d 2 dozatora 1,6 mil. €	50 kW Gorivni članci 200 kW 700.000 €	PV: 1,5 MWp 1,55 mil.	1 FCEV + 2 EV + lokalni javni prijevoz 1x		2025.	8,7 mil. €
3. faza								Električni brzi higrogliser na vodik 4,0 mil. €	2026.	4,0 mil. €
KONAČNO STANJE	500 Kw, H_2 120 kg/d 40 t/a	120 kg/d 40 t/a	1500 kg H_2 +BAT 300 kWh	30 kg/d 11,7 kg/h 2 dozatora	Gorivni članci 200 kW	PV: 1,5 MWp	Vozni park FCEV + lokalni javni prijevoz	Električni brzi higrogliser na vodik	2026.	12,70 mil. €
Marina 2, 3, 4, 5, 6 Ukupno: 12,7 mil. € *- PV: 1,55 mil. € - Plovilo: 4,0 mil. € - Vodik: 7,15 mil. €*	2,4 M		2,450 M	1,6 M	700.000 €	1,55 M		4,0 mil. €	2026.	

Ova studija izrađena je za ACI CLUB, kao alat za podršku početku razvojnih aktivnosti između tvrtki ACI Club, TETIDA i ECUBES.

Podaci su povjerljivi, u skladu s potpisanim Ugovorom o povjerljivosti podataka.

Izradili:
Aleksander Gerbec i Simon Ferjuc

Preporuke:

- Klaster vodika Salonit Anhovo
  SI- Ministarstvo obrane

REPUBLIKA
SLOVENIJA
MINISTARSTVO OBRANE
UPRAVA ZA LOGISTIKU

Vojkova cesta 59, 1000 Ljubljana

Tel: + 386 1 471 25 46
Faks: + 386 1 471 24 23
E-mail: glavna.pisarna@mors.si
www.mors.si

ECUBES

Broj: 511-36/2019-218

Datum: 25. 2.2021.

Predmet: Pismo potpore za daljnji razvoj proizvoda „H2GENIUM – termalno zeleno skladištenje vodika“ (TGH)

Ministarstvo obrane Republike Slovenije obavijestila je tvrtka Ecubes o proizvodu H2GENIUM – TGH i njegovoj tehnologiji.

Vjerujemo da bi proizvod mogao omogućiti uspostavu samodostatnog energetskog kapaciteta za različite potrebe uvođenjem alternativnih izvora energije i skladištenja energije na dulja razdoblja bez degradacije. Nadalje, proizvod bi mogao omogućiti dugoročnu samodostatnost i autonomiju. Štoviše, mogao bi omogućiti punjenje vozila na električni i vodikov pogon, što je jedan od važnih prioriteta u području istraživanja i razvoja obrane.

Ministarstvo obrane stoga, bez preuzimanja pravne obveze, snažno podupire aktivnosti koje se odnose na daljnji razvoj proizvoda s mogućnošću kasnije nadogradnje i uvođenja novih tehnologija u sektor obrane te sektor civilne zaštite.

S poštovanjem,

Uroš Korošec
Tajnik
Generalni direktor
Uprava za logistiku

Prvi projekt Savjetodavnog foruma za energiju koji je dobio sredstva EU

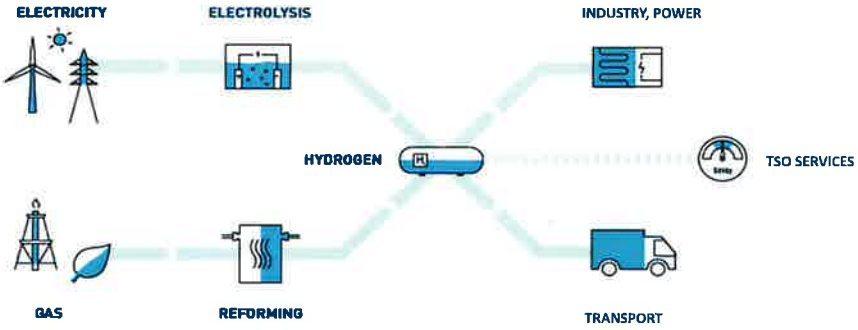
Project Zero Emission Mobility Corridor - North Adriatic,
driven by
North Adriatic Hydrogen Valley

ECUBES Hydrogen Technology Clusters
for
ACI MARINE Opatija, Croatia

Prefeasibility Study for Hydrogen Cluster ACI MARINE in OPATIJA.

Zagreb, Nova Gorica, Rijeka; 21.07.2022
Authors: Aleksander Gerbec ECUBES in Simon Ferjuc TETIDA

New Energy Concept based on hydrogen technologies and sector coupling designed by ECUBES Technologies:



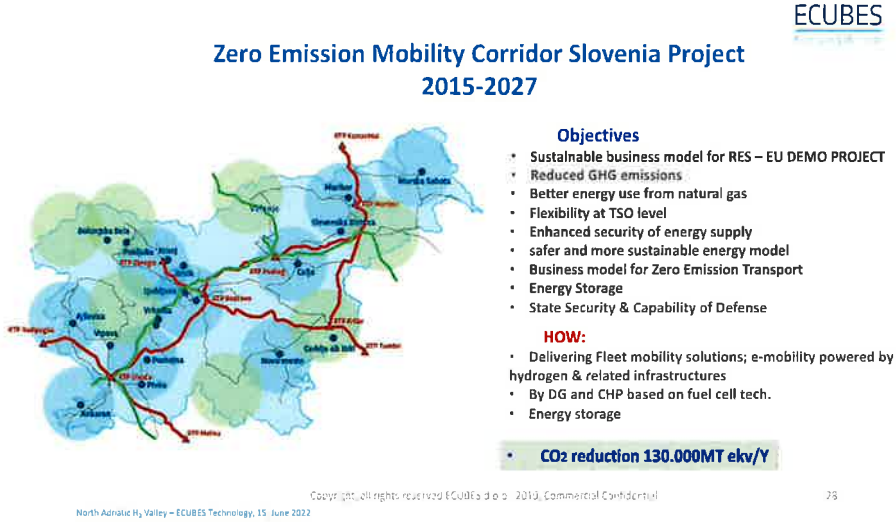
Project is part of Zero Emission Mobility Corridor North Adriatic with:

- 22 projects in ACI Marinas and Islands withinn Croatian archipelago
- 15 projects in Slovenia (2 under development, 5 Kanal and 9 in Slo)
- 1 Project in San Vito, Italy

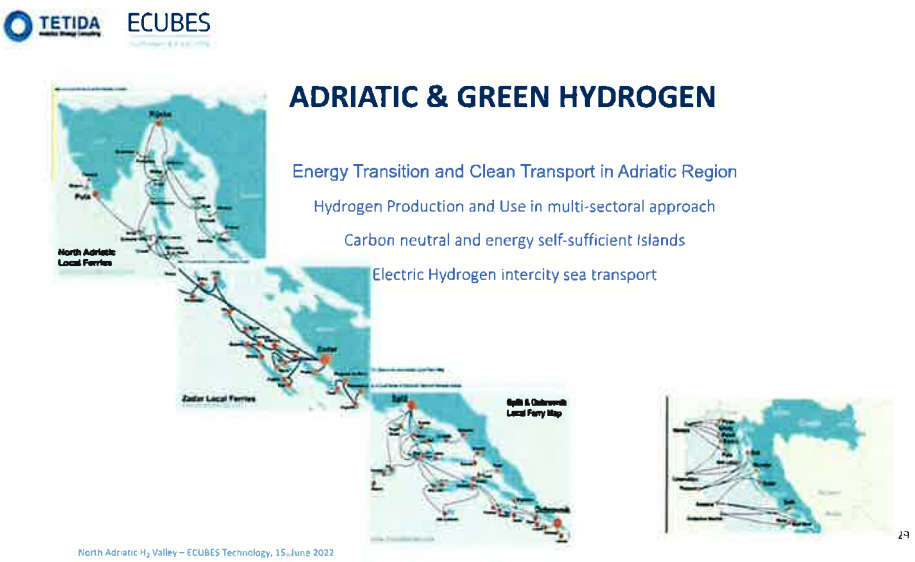
1. PROJECT IDEJA

In the context of energy transition, partners in the North Adriatic region are developing network of energy self suficient hydrogen technology hubs. Following recomendation REPOWEREU, Projects are under preparation simultaneously, to meet energy efficient and environemtal goals.Project was initially prepared by ECUBES and today developed with other partners from three teritories of North Adiratic; Slovenia, Croatia and Italian Region FVG.

Slovenia - the first such hub is being built at the location of Salonit Anhovem. Additional five - The municipality of Kanal ob Soča accepted the proposal of Salonit and ECUBES and defined the development of such hydrogen centers in the municipal development strategy. Concretely, development was defined in five planned locations. Company HSE Holding, slovenian power producer is developing a project on two other locations.



In Croatia, the company ACI CLUB has entered as investor into the project Adriatic Green Hydrogen to establish energy efficient and self sufficient energy hubs in marinas and selected croatian Islands. It was decided to setting up the first hydrogen hub in ACI Marine in Opatija.



About Hydrogen Technology Hub ECUBES:

Hydrogen HUBs are enabling the capture of excess renewable energy sources, energy conversion and energy storage in the form of hydrogen, production of heat and electricity with fuel cells and electric and hydrogen charging stations. The hubs, which will be placed on the selected land, will also ensure multi-day self-sufficiency and support electric mobility, thus generously supporting the development of energy communities.

The concept enables the development of island capacity in the event of power grid outages, in support of reducing energy dependence on external sources, the use of renewable energy sources in selected locations and infrastructure owned by those selected together with investors or the local community, in support of the robustness of energy supply with island sources and energy storage.

The concept enables the development of emission-free hydrogen-based mobility in road, sea or air transport and supports the security of energy self-sufficiency, even in rural areas, which is a novelty in the European area

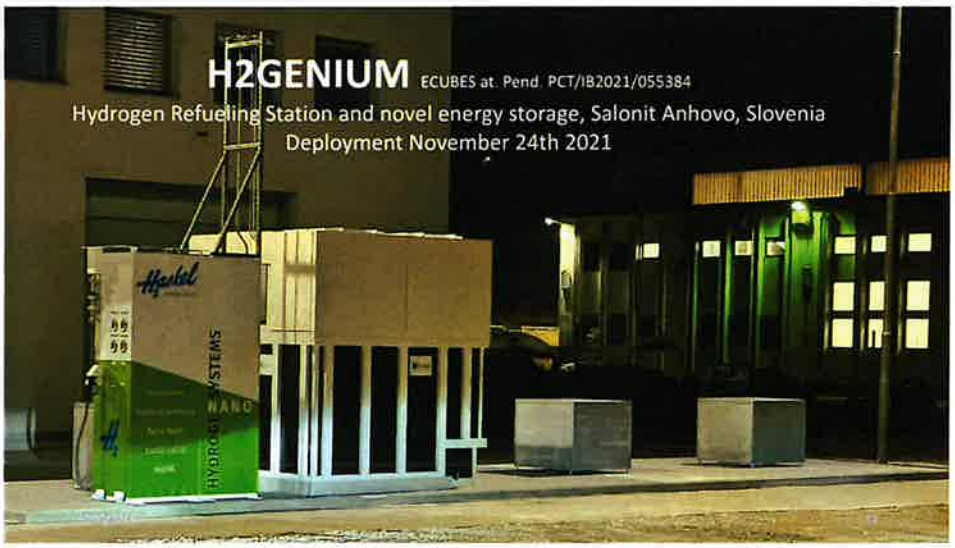
The concept allows ACI to develop electric sea transport based on hydrogen, which will be produce on its own or in partnership with providers from the market.

On the basis of this project prepared by ECUBES, the RESHUB defense project was created, which was approved for implementation by the European Defense Agency EDA. https://www.gov.si/novice/2020-01-24-mreza-vozlisc-reshub/.

2. THE CONCEPT

At the local level, in the selected location, energy supply is ensured with renewable energy sources: solar power plants, wind power plants or small hydropower plants. A hydrogen storage tank (H2) of dedicated capacity is set up, which is filled with hydrogen from electrolysis, which uses energy obtained from renewable sources, the electricity network, or with hydrogen produced by novel technology H2GENIUM, where hydrogen is produced from excess industrial heat. The production of hydrogen from the public electricity network is enabled when there is a surplus of electricity in the network.

The ECUBES technology cluster utilising H2GENIUM technology is connected to the public electricity grid for balancing purposes in the public electricity grid and supports the use of electric vehicles that operate on the basis of energy stored in batteries or hydrogen as a means of propulsion.



With the construction of the first fifteen hubs in Slovenia, a reduction in CO2 emissions of 130,000 tons per year is expected. At the same time, the hub ensures local production and storage of energy for a longer period of time, thereby significantly reducing dependence on external energy sources, and offers a local independent and reliable source of energy in case of natural disasters and crises. In support of the local population, it provides the technological basis for the development of green public and private transport. The project supports four EU policies: environmental policy, energy policy, common security and defense policy and transport policy and is consistent with REPOWER EUROPE.

3. GENERAL REQUIREMENTS - ACI CLUB

ACI has a vision to become owner of highly energy efficient and energy self-sufficient Marinas, as a pioneering comapny in the sector, to develop self sufficient energy hubs:

- the local electricity network is primarily powered by locally produced renewable energy,
- excess EE is converted into hydrogen,
- hydrogen is stored locally in a suitable storage tank of suitable capacity,
- hydrogen (and oxygen) is produced with an electrolyzer,
- hydrogen is also produced from EE surpluses in the network (balancing services for the EE system),
- supply of green energy from green hydrogen obtained in Slovenia (Hydrogen Valley call requirements)
- hydrogen will be used locally for facilities: fuel cells for island operation and supply of the marina with EE, o fuel cells for island operation and EE supply of local critical infrastructure;
- Hydrogen is used as a fuel for High Speed Electric Hydrogen Hydrofoil Catamarans, owned and operated by ACI CLUB
- hydrogen is used additionally:
  - for public service, for sea and air transport: o hydrogen supply of guests' own vessels that use hydrogen as an energy source;
  - hydrogen supply of vessels in marinas that use hydrogen as an energy source;
  - the heat (losses) generated during electrolysis and fuel cells is used for heating and sanitary water,
  - energy deficits are ensured by using a system for cogeneration of EE and heat (CHP) from natural gas/biogas/hydrogen.

4. TECNICAL REQUIRMENTS

Tecnical requirements are basic and can be adjusted accordingly. In the principle it is required to develop entire hydrogen value chain, to use hydrogen technologies in the multisectoral approach with redundancy option partnering wih other green hydrogen partners

- Production of renewable energy
- Energy storage for Hydrogen, with possibility for upgrade
- Permanent hydrogen storage stock for the needs of the marina and local critical infrastructure for the needs of the city of Ičiči,
- o part of the stock intended for marketing to external users and for the balancing service,
- a few days' supply for EE production - 7 days of electrical autonomy for critical infrastructure,

4.1. Stationary part

The technical starting points are informative and can be adjusted.

- Solar power plant 1,5 MWp,
- electrolyzer 1.2 MW, powered from SE and from surpluses in the network,
- battery assembly,
- gas temple min. 3 days to 30 days,
- hydrogen and natural gas fuel cell 300kW EE,
- hot water pipe to the existing hot water storage tank for sanitary water and heating,
- connection to the EE distribution network,
- AI for overall management,
- optional oxygen capture,
- optional emission of excess thermal energy,
- support for road mobility:
    - fast electric charging stations,
    - hydrogen filling stations 350 bar and 700 bar.

Energy is produced from SE and from surpluses in the network. Surpluses are stored in the form of hydrogen in a gas reactor. The heat is used for heating. Energy deficits are obtained:
- from natural gas to hydrogen and then with a fuel cell to EE from natural gas to CHP to EE

5. SOLUTION

- daily consumption of hydrogen (required daily production of hydrogen) 120 kg,
- permanent storage of hydrogen 500 kg + 1000 kg for emergency own use of electricity for the marina (guaranteed 3-day autonomy for hydrogen filling stations for the needs of the marina and for EE), 500 kg for operation of Hydrogen powered Ferry,
- connection power to the MV EE network 0.5 MW,
- the existing daily consumption of EE at the location is 3 MWh, with max. power of 300 kW,
- a fuel cell for powering the emergency own use and hydrogen charging stations with a nominal power of 300 kW (hydrogen requirement for 3 days of autonomy).
- H2GENIUM with a battery system for shifting the peak of EE production to SE and providing 1 daily supply of EE for island operation, participation in equalization services, capacity 3 MWh and power 500 kW.
- optional natural gas cogeneration with a nominal electric power of 300 kW.
- the possibility of providing the missing EE from the network with a certificate of origin.

5.1. Solar Power Plant – PV 1,5 MW_p

A PV power plant with a total capacity of 1.5MWp of photovoltaic modules would be built on the Marina location, on the roofs of buildings and parking lots, and on a selected degraded location near the town of Opatija, and the solar power plant would provide 1,650 MWh of electricity on an annual basis (approx. 1,100 hours of operation per year nominal power of the solar power plant). With sunny weather, we could provide approx. 10 MWh of electricity, and in winter approx. 5 MWh. Excess energy is temporarily stored in the H2GENIUM storage tank and used for hydrogen production during the day. The hydrogen would be transported by road from another location mainly for use on the sea transport.

The estimated investment value of a 1.5 MWp solar power plant is €900/kWp, or €1,550,000.
The estimated investment value for the construction of the new TP 20/0.4 kV 1.6 MVA is €100,000.

5.2. Production facility for the production and storage of hydrogen

The entire plant is represented by the H2GENIUM system, which includes an electrolyzer (process part), a power supply control part including a transformer, a measuring part, a water preparation plant (demineralization) and auxiliary infrastructure. The process part is of the container type and consists of hydrogen production cells with associated equipment, such as hydrogen purification system. The power supply control part with associated measurements and water preparation (demineralization) is also of the container type and is placed in two additional containers. To cool the electrolyzer, cooling water is provided from the cooling system. Auxiliary infrastructure is necessary for the operation of production and charging infrastructure for charging vehicles, such as closed cooling system, associated control, regulation and measuring equipment, etc.

Basic characteristics of the production facility:

H2 production – max. capacity:	100 Nm3/h (213 kgH2/day, 8.8 kgH2/h)
Power supply with electricity energy:	Pmax=700 kW (including auxiliary equipment)
Nominal power of the electrolyzer:	P=500 kW
Production range:	25% - 100%
Max. demi water consumption:	0.9 l/Nm3 or 90 l/h or 2.16 m3/day or 10l/kgH2
Water pressure before demineralization:	5 bar
Inlet water temperature:	0°C - 25°C
Hydrogen purity achieved:	99.9% (before the purifier), 99.998% (after the purifier)
Temp. range of use:	-20°C to +35°C
Hydrogen outlet pressure:	30 barg
Cooling system:	closed, cooling water
Certification:	CE
spec. energy consumption (at 30 bar):	58 kWh/kg_{H2}

The estimated investment value is € 2,400,000.

5.3. Refuiling station - compressor station and hydrogen filling station

A charging station is required to supply hydrogen powered vehicles (buses, passenger cars, heavy vehicles) and Hydrogen Ferry by compressed hydrogen. In case of use Liquid hydrgen a dedicated FS will be developed.
Basic characteristics of the charging station:

Nominal power of the compressor:	P=75 kW
Compressor flow:	130 Nm3/h or 11.7 kg/h (at inlet pressure 30 bar)
Filling point:	2 dispensers (dual-pressure 350/700 bar)
Filling pressure:	>350 bar / >700 bar
Certification:	CE
spec. energy consumption (at 450/900 bar):	4 kWh/kgH2

The estimated investment value is EUR 1,600,000.

5.4. Hydrogen Storage tanks

For the needs of permanent hydrogen storage, 500 kg for mobile units + 1000 kg for emergency own use of electricity in the marina (fuel cell).

Low-pressure reservoir: p=30 bar,
Medium pressure reservoirs: p=450 bar,
High-pressure reservoirs: p=900 bar

The total storage of hydrogen will amount to 1500 kg., the capacities of individual storage tanks will be determined in the later stages of the project.

The estimated investment value is EUR 2,450,000.

The battery storage is dimensioned so that it can properly accumulate and evenly distribute the production of electricity from a solar power plant with a peak power of 0.5 MW throughout the day, for the needs of an electrolyzer with a connected power of 500 kW. When fully charged, it provides one day of autonomy to supply electricity for the operation of the marina (300 kWh), otherwise the energy is used for hydrogen production.

The estimated investment value of the 300kWh battery storage with the necessary infrastructure for operation is EUR 540,000.

The estimated value for engineering, commissioning and training by the selected contractor (for the electrolyzer, compressor station and charging station and hydrogen storage tank, points 3.2, 3.3 and 3.4) is EUR 500,000.

The estimated value of the necessary construction, mechanical and electrical work is EUR 500,000, otherwise it depends on the current situation at the location

H2GENIUM	€ 3.900.000, consisting of:
H2 Storage	€2.450.000
Battery storage	€450.000
Engineering, comissioning, Training	€500.000
EPC	€500.000

5.5. Fuel Cell

The fuel cell serves the purpose of supplying the needs of the marina with electricity in the event of an emergency without EE network and gas network. Storage hydrogen is used. The expected nominal power of the fuel cell is 200 kW. It is necessary to provide approx. 3 MWh of electricity per day, based on the current consumption (it will be possible to reduce the daily consumption, but it is necessary to define which of the consumers in the barracks will be connected to emergency own use).

The electrical efficiency of the fuel cell depends on the design and varies between 40 and 60%. For a three-day autonomy, it is thus necessary to provide between 380 and 570 kg of hydrogen. With heat, we can provide emergency heating in winter, and heat can be offered to the local community partly through the heating pipe.

The fuel cell is an integrated product of the H2GENIUM product in the price range of EUR 700,000

5.6. EV - Electric Car charging stations

Two charging stations with a power of 50 kW DC and two with a power of 22 kW AC will be installed for the needs of charging electric vehicles. The connection power of the proposed charging stations is approx. 150 kW, which must also be provided on the existing connection to the EE distribution network.

5.7. Hydrogen Powered Electric Foil Catamarans for CROATIA by ACI

Hydrogen Electric Foiling Catamaran Passenger Fast Ferry

25 Kn Cruising speed; Increased efficiency by up to 50 % and reducing hourly operating costs by up to 75%, compared to conventional high speed catamarans powered by Diesel.

Refernce project built in Croatia in 2019

The Operating Costs comparison is shown in the attached table – values are indicative:

Table 1 – Comparison at Speed 20knots:

Catamaran Ferry Comparison	Standard ICE Ferry or Traditional Diesel Ferry	ECUBES Hydrogen Electric Foiling Catamaran, Model 3	Reduction
Power needed	750 kW	400 kW (20kg of H2/hour)	-47 % Reduction
Fuel / Energy consumption per hour at 20 knots (liter or kWh)	190 L/h	400kWh/h(20kg of H2/Hour)	
Fuel/Energy cost per nm	13,30€	3,70€	-72 % Reduction
Cost of Fuel/electricity per hour	266€	74€	-72 % Reduction
Cost of fuel Diesel/L or H2/ kg	1,4	3,7	
Service cost per hour	10 €	1 €	-90 % Reduction
Total Hourly Operating Cost	276,00 €	75 €	-73 % Reduction

Table 2, Comparison at Speed 25kn:

Catamaran Ferry Comparison	Standard ICE Ferry or Traditional Diesel Ferry	ECUBES Hydrogen Electric Foiling Catamaran, Model 3	Reduction
Power needed	1050 kW	500 kW (25kg of H2/hour)	-52 % Reduction
Fuel / Energy consumption per hour at 25 knots (liter or kWh)	270 L/h	500kWh/h (25kg of H2/hour)	
Fuel/Energy cost per nm	15,20€	3,70€	-76 % Reduction
Cost of Fuel/electricity per hour	378€	92,5€	-76 % Reduction
Cost of fuel Diesel/L or H2/ kg	1,4	3,7	
Service cost per hour	10 €	1 €	-90 % Reduction
Total Hourly Operating Cost	388,00 €	93,5 €	-76 % Reduction

Hydrogen Electric Hydrofoil Catamarans built in Croatia and operated by ACI represents missing node, to create entire hydrogen value chain, linking renewables by sea transport with clear business model.

The product is in the price range of EUR 4.000.000, for the firs one development project is required worth €450.000.

5.8. Energy balance:

Conceptual sketch:

6. INVESTMENT ASSESSMENT LOCATION IČIĆI

ACI CLUB – Marina Ičići; Energy Transition and Hydrogen Project development plan

ACI MARINA Project Location:			H_2				H2			
Project stage	**H2 production capacity**	**H2 available**	**H2 storage & H2GENIUM**	**HRS H2GENIUM**	**FUEL CELL**	**RES source**	**Road Transport**	**Fast Ferry H2 Transport**	**Time frame**	**Investment** Without Ferry and EV
Project Location Marina Ičići										
Status Today			FS (Feasibility)	Pre-FS	Pre-FS	FS	Pre-FS	FS	2022	€300K
1st Phase Ičići 2023			50kg H2 100kWh el. TBD/Demo €250K	H2GENIUM demo 25kg TBD/demo	50kW 200K*	PV 300kWp 400K	1 FCEV TOYOTA + 1EV 0	Contract to deliver first H2 Ferry 2024/25 €400K	2023	€1,250,000
2nd. Phase "Ičići" completed	500kW, 120 kg H2/d €2,4 Mio	120 kg/d 40 t/a		30 kg/d 2 dispenser €1,6Mio		PV: 1,2 MWp 1,2Mio	1 FCEV + 2 EV + local public transport 1x		2024	5,2 mio €
3rd Phase			1500 kg H2 +BAT 300kWh €2,45Mio		Fuel Cell 200kW €700K			Electric Hydrogen Hydrofoil Fast Ferry €3,9Mio	2025	7,05 mio €
FINAL	500 kW, H2 120kg/d 40t/a	120 kg/d 40 t/a	1500 kg H2 + BAT 300kWh	30 kg/d 11,7 kg/h 2 dispensers	Fuel Cell 200kW	PV: 1,5 MWp	Fleet FCEV + local public transport	Electric Hydrogen Hydrofoil Fast Ferry	2025	**€14,1 Mio**
Ičići Total: €14,1mio *- PV: €1,55 mio - Ferry: €4,3Mio -Hydrogen: €8,25Mio*	2,4M		2,450M	1,6M	€200K+€700K = €900K	1,2M		€4,3Mio	2025	

>>>>>>>>>
5.1.PV The estimated investment value of a 1.5 MWp solar power plant is €900/kWp, or €1,550,000.
The estimated investment value for the construction of the new TP 20/0.4 kV 1.6 MVA is €100,000.
5.2. Electrolyzer The estimated investment value is EUR 2,400,000.
5.3 HRS The estimated investment value is EUR 1,600,000.
5.4. Hydrogen storage
The estimated investment value is EUR 2,450,000.
The estimated value for engineering, commissioning and training by the selected contractor (for the electrolyzer, compressor station and charging station and hydrogen storage tank, points 3.2, 3.3 and 3.4) is EUR 500,000.
The estimated value of the necessary construction, mechanical and electrical work is EUR 500,000, otherwise it depends on the current situation at the location
5.5. FC Fuel cell is an integrated product of the H2GENIUM product in the price range of 700,000 Eur
5.6. EV Charging station is in the range € 50.000
5.7. Hydrogen Powered Electric Foil Catamarans CAPEX cost in the range 4.000.000, for the first one development project is required € 450.000

TOTAL Invesment with Ferry = € 14,1 Mio

7. INVESTMENT ASSESSMENT LOCATION MARINAS 2,3,4,5,6

ACI CLUB – Marina No.2,3,4,5,6...22; Energy Transition and Hydrogen Project development plan

ACI MARINA Project Location:										
Project stage	**H2 production capacity**	**H2 available**	**H2 storage & H2GENIUM**	**HRS**	**FUEL CELL**	**RES source**	**Road Transport**	**H2 Fast Ferry Transport**	**Time frame**	**Investment** With Hydrogen Ferry
Project Location Marina No. 2,3,4,5,6										
Status Today	/	/	/	/	/	/	/	/	2022	/
1st Phase Location 1-5 2023	FS		FS (Feasibility)	FS	FS	FS	FS	FS	2023	/
2nd. Phase Delivery completed in 1 year	500kW, 120 kg H2/d €2,4 Mio	120 kg/d 40 t/a	1500 kg H2 +BAT 300kWh €2,45Mio	30 kg/d 2 dispenser €1,6Mio	50kW Fuel Cell 200kW €700K	PV: 1,5 MWp 1,55Mio	1 FCEV + 2 EV + local public transport 1x		2025	8,7 Mio €
3rd Phase								Electric Hydrogen Hydrofoil Fast Ferry €4,0Mio	2026	4,0 Mio. €
FINAL STATUS	500 kW, H2 120kg/d 40t/a	120 kg/d 40 t/a	1500 kg H2 + BAT 300kWh	30 kg/d 11,7 kg/h 2 dispensers	Fuel Cell 200kW	PV: 1,5 MWp	Fleet FCEV + local public transport	Electric Hydrogen Hydrofoil Fast Ferry	2026	**€12,70 Mio**
Marina 2,3,4,5,6 Total: €12,7mio *- PV: €1,55 mio - Ferry: €4,0Mio -Hydrogen: €7,15Mio*	2,4M		2,450M	1,6M	€700K	1,55M		€4,0Mio	2026	

This Study was prepared for ACI CLUB, as a tool, to support beginning of development activities between companies ACI Club, TETIDA and ECBES.

Information is confidential, as per signed NDA.

Prepared by:
Aleksander Gerbec and Simon Ferjuc

References:

- Hydrogen Cluster Salonit Anhovo
- SI- Ministry for Defence

REPUBLIKA SLOVENIJA
MINISTRSTVO ZA OBRAMBO
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Št. dokumenta: 511-36/2019-218

REPUBLIC OF SLOVENIA
MINISTRY OF DEFENCE
LOGISTICS DIRECTORATE

Vojkova cesta 59, 1000 Ljubljana

T + 386 1 471 25 46
F + 386 1 471 24 23
E glavna.pisarna@mors.si
www.mors.si

ECUBES

Number: 511-36/2019-218
Date: 25. 02. 2021

Subject: **Letter of support for the further development of the product "H2GENIUM - thermal green hydrogen storage" (TGH)**

Ministry of Defence, Republic of Slovenia had been informed by Ecubes Company about the product H2GENIUM – TGH and its technology.

We believe that the product could enable the establishment of self-sufficient energy capacity for the various needs by introducing alternative energy sources and energy storage for longer periods without degradation. Furthermore the product could enable long-term self-sufficiency and autonomy. Moreover, it could enable charging of electric and hydrogen powered vehicles, which is one of the important priorities in defence research and development field.

Ministry of Defence therefore, without making a legal commitment, strongly supports activities, that are related to further development of the product with the possibility of later upgrading and introduction of new technologies into a defence sector as well as a civil protection sector.

Respectfully,

Uroš Korošec
Secretary
Director General
Logistics Directorate

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First Energy Consultation Forum project to receive EU funding

'RESHUB', a Slovenian-led project increasing& reliable and sustainable energy in the defence sector, has been selected to receive technical support thanks to funding from& the& EU's Structural Reform Support Programme (SRSP). EDA assisted the Slovenian Ministry of Defence in applying for the SRSP.

"RESHUB", which stands for 'Defence RESilience Hub Network in Europe', is a project conceived and led by the Slovenian Ministry of Defence under the Consultation Forum on Sustainable Energy in the Defence and Security Sector (CF SEDSS) which is currently in its third phase. Other participating countries in the project are Austria, Belgium, Germany and Hungary.

RELATED CONTENT

Access to "European Funding Gateway for Energy in Defence"

CF SEDSS

CF SEDSS: defence energy-related project ideas

GRANT AGREEMENT

Project 101111927 — NAHV

PREAMBLE

This **Agreement** ('the Agreement') is **between** the following parties:

on the one part,

Clean Hydrogen Joint Undertaking ('granting authority'), under the powers delegated by the European Commission ('European Commission'),

and

on the other part,

1. 'the coordinator':

HOLDING SLOVENSKE ELEKTRARNE DOO (HSE), PIC 914772275, established in KOPRSKA ULICA 92, LJUBLJANA 1000, Slovenia,

and the following other beneficiaries, if they sign their 'accession form' (see Annex 3 and Article 40):

2. **AREA DI RICERCA SCIENTIFICA E TECNOLOGICA DI TRIESTE (AREA)**, PIC 999549887, established in PADRICIANO 99, TRIESTE 34149, Italy,

3. **ECUBES TEHNOLOGIJE D.O.O. (ECUBES)**, PIC 891137837, established in ULICA GRADNIKOVE BRIGADE 49, NOVA GORICA 5000, Slovenia,

4. **INDELOOP DOO ZA PROIZVODNJU ELEKTRICE ENERGIJE I GOSPODARENJE (INDELOOP LTD)**, PIC 889967144, established in SLAVONSKA AVENIJA 22G, ZAGREB 10000, Croatia,

5. **MARITIME CENTER OF EXCELLENCE D.O.O (MCEoE)**, PIC 890309554, established in MARSALA TITA 198, OPATIJA 51410, Croatia,

6. **DILJ INDUSTRIJA GRADEVINSKOG MATERIJALA D.O.O. (Dilj d.o.o.)**, PIC 912302752, established in CIGLARSKA 33, VINKOVCI 32100, Croatia,

7. **GITONE KVARNER D.O.O. (Gitone)**, PIC 885404846, established in ULICA ANDRIJE HEBRANGA 32, ZAGREB 10000, Croatia,

8. **ADRIATIC CROATIA INTERNATIONAL CLUBZA DJELATNOST MARINA D. D. (ACI d.d.)**, PIC 885416389, established in RUDOLFA STROHALA 2, RIJEKA 51000, Croatia,

9. **STEKLARNA HRASTNIK DRUZBA ZA PROIZVPROIZVODNJO STEKLENIH IZDELKOV DOO (HRASTNIK 1860)**, PIC 896379523, established in CESTA 1 MAJA 14, HRASTNIK 1430, Slovenia,

10. **SALONIT ANHOVO GRADBENI MATERIALI D.D. (SALONIT)**, PIC 964288447, established in ANHOVO 1, DESKLE 5210, Slovenia,

11. **ACEGASAPSAMGA S.P.A. (ACEGAS)**, PIC 904079092, established in VIA DEL TEATRO 5, TRIESTE 34121, Italy,

12. **ACTIVE SOLERA JEDNOSTAVNO DRUSTVO S OGRANICENOM ODGOVORNOSCU ZA USLUGE (Active Solera)**, PIC 894700065, established in EDE MURTICA 2, ZAGREB 10000, Croatia,

13. **FABER INDUSTRIE SPA (FABER)**, PIC 986351291, established in VIA DELL INDUSTRIA 23, CIVIDALE DEL FRIULI 33043, Italy,

14. **ACCIAIERIE BERTOLI SAFAU SPA (ABS)**, PIC 888149946, established in VIA BUTTRIO 28, POZZUOLO DEL FRIULI 33050, Italy,

15. **CTS H2 S.R.L. (CTS H2)**, PIC 894678434, established in VIALE LINO ZANUSSI 1, BRUGNERA 33070, Italy,

16. **SNAM S.P.A. (SNAM S.P.A.)**, PIC 905331265, established in PIAZZA SANTA BARBARA 7, SAN DONATO MILANESE 20097, Italy,

17. **FONDAZIONE BRUNO KESSLER (FBK)**, PIC 999625450, established in VIA SANTA CROCE 77, TRENTO 38122, Italy,

18. **UNIVERSITA DEGLI STUDI DI TRIESTE (UNITS)**, PIC 999842051, established in PIAZZALE EUROPA 1, TRIESTE 34127, Italy,

19. **UNIVERZA V LJUBLJANI (UL)**, PIC 999923240, established in KONGRESNI TRG 12, LJUBLJANA 1000, Slovenia,

20. **SVEUCILISTE U RIJECI (UNIRI)**, PIC 997640733, established in TRG BRACE MAZURANICA 10, RIJEKA 51000, Croatia,

21. **MINISTRSTVO ZA INFRASTRUKTURO (MzI)**, PIC 952242696, established in TRZASKA CESTA 19, LJUBLJANA 1000, Slovenia,

22. **FUNDACION PARA EL DESARROLLO DE LAS NUEVAS TECNOLOGIAS DEL HIDROGENO EN ARAGON (FHA)**, PIC 997456918, established in CR ZARAGOZA N 330A KM 566 CUARTE, HUESCA 22197, Spain,

23. **TPL FVG S.C. A R.L. (Tpl Fvg)**, PIC 885121994, established in VIA CADUTI DI AN NASIRIYAH 6, GORIZIA 34170, Italy,

24. **META GROUP SRL (META)**, PIC 999735157, established in VIALE UMBERTO TUPINI 116, ROMA 00144, Italy,

25. **FERRIERE NORD SPA (FENO)**, PIC 960976479, established in VIA ZONA INDUSTRIALE FRAZ RIVOLI, OSOPPO UD 33010, Italy,

26. **REGIONE AUTONOMA FRIULI-VENEZIA GIULIA (REGIONE FVG)**, PIC 983174347, established in PIAZZA UNITA D ITALIA 1, TRIESTE 34121, Italy,

27. **MINISTARSTVO GOSPODARSTVA I ODRZIVOG RAZVOJA (MINGOR)**, PIC 916533310, established in RADNICKA CESTA 80, Zagreb 10000, Croatia,

Unless otherwise specified, references to 'beneficiary' or 'beneficiaries' include the coordinator and affiliated entities (if any).

If only one beneficiary signs the grant agreement ('mono-beneficiary grant'), all provisions referring to the 'coordinator' or the 'beneficiaries' will be considered — mutatis mutandis — as referring to the beneficiary.

The parties referred to above have agreed to enter into the Agreement.

By signing the Agreement and the accession forms, the beneficiaries accept the grant and agree to implement the action under their own responsibility and in accordance with the Agreement, with all the obligations and terms and conditions it sets out.

The Agreement is composed of:

Preamble

Terms and Conditions (including Data Sheet)

Annex 1	Description of the action[1]
Annex 2	Estimated budget for the action
Annex 2a	Additional information on unit costs and contributions (if applicable)
Annex 3	Accession forms (if applicable)[2]
Annex 3a	Declaration on joint and several liability of affiliated entities (if applicable)[3]
Annex 4	Model for the financial statements
Annex 5	Specific rules (if applicable)

[1] Template published on Portal Reference Documents.
[2] Template published on Portal Reference Documents.
[3] Template published on Portal Reference Documents.

TERMS AND CONDITIONS

TABLE OF CONTENTS

DATA SHEET

1. General data

Project summary:

Project summary
The North Adriatic Hydrogen Valley – NAHV project builds on the LoI signed in March 2022 by representatives of the Slovenian Ministry of Infrastructure, Croatian Ministry of Economy and Sustainable Development and Friuli Venezia Giulia (FVG) Autonomous Region in Italy, contributing to the European Green Deal and European Hydrogen Strategy goals. The project's high-level objective is the creation of a hydrogen-based economic, social and industrial ecosystem based on the capacity of the quadruple helix actors. This will drive economic growth, generating new job opportunities in the framework of both the green and digital transitions and, by creating the conditions for wider EU replicability, it will contribute to the creation of a European Hydrogen Economy, To fulfil these objectives the NAHV project involves a well-rooted partnership of 36 organizations (of which 2 in Hydrogen Europe, 3 in Hydrogen Europe Research), covering the transnational Central European area of 3 territories - Slovenia, Croatia and FVG Region, demonstrating cross-border integration of hydrogen production, distribution and consumption, and exchange of over 20% of NAHV annual hydrogen production of over 5000 tons. The project will activate 17 testbed applications in their related ecosystems, clustered in 3 main pillars - hard to abate, energy and transport sectors. These will act as real-life cases for piloting global hydrogen markets, moving from TRL 6 at the beginning to TRL 8 at the end of the project. Four fuel cell applications in the energy and transport sectors will be demonstrated. Testbeds will then be scaled up at industrial level as a replicable model, contributing to the decarbonisation of the 3 territories by harnessing renewables to improve system resilience, security of supply and energy independence. Replicability will also be ensured for the whole NAHV model, with the uptake of at least 5 additional hydrogen valleys in Europe, particularly in Central and South Eastern Europe.

Keywords:

- Innovation management
- hydrogen valley, hydrogen production, hydrogen consuption, hydrogen storage, cross - border utilization

Project number: 101111927

Project name: NORTH ADRIATIC HYDROGEN VALLEY

Project acronym: NAHV

Call: HORIZON-JTI-CLEANH2-2022-2

Topic: HORIZON-JTI-CLEANH2-2022-06-01

Type of action: HORIZON JU Innovation Actions

Granting authority: Clean Hydrogen Joint Undertaking

Grant managed through EU Funding & Tenders Portal: Yes (eGrants)

Project starting date: fixed date: 1 September 2023

Project end date: 31 August 2029

Project duration: 72 months

Consortium agreement: Yes

2. Participants

List of participants:

N°	Role	Short name	Legal name	Ctry	PIC	Total eligible costs (BEN and AE)	Max grant amount
1	COO	HSE	HOLDING SLOVENSKE ELEKTRARNE DOO	SI	914772275	201 792 500.00	4 705 880.93
1.1	AE	TES, d.o.o.	TERMOELEKTRARNA SOSTANJ D.O.O.	SI	884216984	127 781.25	89 446.88
1.2	AE	HSE INVEST	HSE INVEST DRUZBA ZA INZENIRING INIZGRADNJO ENERGETSKIH OBJEKTOV DOO	SI	950728817	304 375.00	213 062.50

N°	Role	Short name	Legal name	Ctry	PIC	Total eligible costs (BEN and AE)	Max grant amount
2	BEN	AREA	AREA DI RICERCA SCIENTIFICA E TECNOLOGICA DI TRIESTE	IT	999549887	746 250.00	461 060.00
3	BEN	ECUBES	ECUBES TEHNOLOGIJE D.O.O.	SI	891137837	8 408 125.00	1 500 000.00
4	BEN	INDELOOP LTD	INDELOOP DOO ZA PROIZVODNJU ELEKTRICE ENERGIJE I GOSPODARENJE	HR	889967144	756 250.00	68 658.29
5	BEN	MCEoE	MARITIME CENTER OF EXCELLENCE D.O.O	HR	890309554	4 905 087.50	445 322.20
6	BEN	Dilj d.o.o.	DILJ INDUSTRIJA GRADEVINSKOG MATERIJALA D.O.O.	HR	912302752	45 067 500.00	3 978 095.26
7	BEN	Gitone	GITONE KVARNER D.O.O.	HR	885404846	705 000.00	64 005.41
8	BEN	ACI d.d.	ADRIATIC CROATIA INTERNATIONAL CLUBZA DJELATNOST MARINA D. D.	HR	885416389	16 850 625.00	1 528 696.65
9	BEN	HRASTNIK 1860	STEKLARNA HRASTNIK DRUZBA ZA PROIZVPROIZVODNJO STEKLENIH IZDELKOV DOO	SI	896379523	8 042 500.00	500 000.00
10	BEN	SALONIT	SALONIT ANHOVO GRADBENI MATERIALI D.D.	SI	964288447	5 525 000.00	500 000.00
11	BEN	ACEGAS	ACEGASAPSAMGA S.P.A.	IT	904079092	12 213 370.93	1 691 253.00
12	BEN	Active Solera	ACTIVE SOLERA JEDNOSTAVNO DRUSTVO S OGRANICENOM ODGOVORNOSCU ZA USLUGE	HR	894700065	10 795 000.00	980 054.51
13	BEN	FABER	FABER INDUSTRIE SPA	IT	986351291	1 111 750.00	778 225.00
14	BEN	ABS	ACCIAIERIE BERTOLI SAFAU SPA	IT	888149946	7 380 000.00	788 710.90
14.1	AE	DANIELI	DANIELI CENTRO COMBUSTION SPA	IT	913920227	1 255 000.00	134 123.60
15	BEN	CTS H2	CTS H2 S.R.L.	IT	894678434	1 882 462.50	922 834.50
16	BEN	SNAM S.P.A.	SNAM S.P.A.	IT	905331265	1 882 250.00	952 834.50
17	BEN	FBK	FONDAZIONE BRUNO KESSLER	IT	999625450	653 375.00	457 362.50
18	BEN	UNITS	UNIVERSITA DEGLI STUDI DI TRIESTE	IT	999842051	803 500.00	401 750.00
19	BEN	UL	UNIVERZA V LJUBLJANI	SI	999923240	595 437.50	297 718.75
20	BEN	UNIRI	SVEUCILISTE U RIJECI	HR	997640733	230 697.71	115 348.86
20.1	AE	TEHN.FAKULT.	SVEUCILISTE U RIJECI-TEHNICKI FAKULTET	HR	986280675	100 899.29	50 449.64
20.2	AE	UNI SPLIT	SVEUCILISTE U SPLITU, FAKULTET ELEKTROTEHNIKE, STROJARSTVA I BRODOGRADNJE	HR	996558116	102 832.75	51 416.38
20.3	AE	UNI ZG FSB	SVEUCILISTE U ZAGREBU, FAKULTET STROJARSTVA I BRODOGRADNJE	HR	996827485	102 832.75	51 416.38
21	BEN	MzI	MINISTRSTVO ZA INFRASTRUKTURO	SI	952242696	708 281.25	354 140.81
22	BEN	FHA	FUNDACION PARA EL DESARROLLO DE LAS NUEVAS TECNOLOGIAS DEL HIDROGENO EN ARAGON	ES	997456918	357 000.00	214 200.00
23	BEN	Tpl Fvg	TPL FVG S.C. A R.L.	IT	885121994	60 000.00	6 077.94
23.1	AE	TRIESTETRASPORT	TRIESTE TRASPORTI SPA	IT	945489653	3 245 000.00	588 041.08
23.2	AE	A.P.T. S.P.A.	AZIENDA PROVINCIALE TRASPORTI SPA	IT	884987843	5 805 000.00	328 715.47
24	BEN	META	META GROUP SRL	IT	999735157	315 366.00	220 756.20
24.1	AE	META SPRL	META	BE	900146227	172 500.00	120 750.00
24.2	AE	META SLO	META CIRCULARITY, SVETOVANJE IN INOVACIJE DOO	SI	914861709	372 759.00	260 931.30
25	BEN	FENO	FERRIERE NORD SPA	IT	960976479	1 001 750.00	701 225.00
26	BEN	REGIONE FVG	REGIONE AUTONOMA FRIULI-VENEZIA GIULIA	IT	983174347	750 523.75	375 262.25
27	BEN	MINGOR	MINISTARSTVO GOSPODARSTVA I ODRZIVOG RAZVOJA	HR	916533310	198 000.00	99 000.00
Total						345 326 582.18	24 996 826.69

Coordinator:

– HOLDING SLOVENSKE ELEKTRARNE DOO (HSE)

3. Grant

Maximum grant amount, total estimated eligible costs and contributions and funding rate:

Total eligible costs (BEN and AE)	Funding rate (%)	Maximum grant amount (Annex 2)	Maximum grant amount (award decision)
345 326 582.18	100, 70	24 996 826.69	24 996 826.69

Grant form: Budget-based

Grant mode: Action grant

Budget categories/activity types:

- A. Personnel costs
  - A.1 Employees, A.2 Natural persons under direct contract, A.3 Seconded persons
  - A.4 SME owners and natural person beneficiaries
- B. Subcontracting costs
- C. Purchase costs
  - C.1 Travel and subsistence
  - C.2 Equipment
  - C.3 Other goods, works and services
- D. Other cost categories
  - D.2 Internally invoiced goods and services
- E. Indirect costs

Cost eligibility options:

- In-kind contributions eligible costs
- Parental leave
- Project-based supplementary payments
- Average personnel costs (unit cost according to usual cost accounting practices)
- Limitation for subcontracting
- Travel and subsistence:
  - Travel: Actual costs
  - Accommodation: Actual costs
  - Subsistence: Actual costs
- Equipment: depreciation and full costs for listed equipment
- Indirect cost flat-rate: 25% of the eligible direct costs (categories A-D, except volunteers costs, subcontracting costs, financial support to third parties and exempted specific cost categories, if any)
- VAT: Yes
- Other ineligible costs

Budget flexibility: Yes (no flexibility cap)

4. Reporting, payments and recoveries

4.1 Continuous reporting (art 21)

Deliverables: see Funding & Tenders Portal Continuous Reporting tool

4.2 Periodic reporting and payments

Reporting and payment schedule (art 21, 22):

Reporting					Payments	
Reporting periods			Type	Deadline	Type	Deadline (time to pay)
RP No	Month from	Month to				
					Initial prefinancing	30 days from entry into force/10 days before starting date – whichever is the latest
1	1	18	Periodic report	60 days after end of reporting period	Interim payment	90 days from receiving periodic report
2	19	36	Periodic report	60 days after end of reporting period	Interim payment	90 days from receiving periodic report
3	37	54	Periodic report	60 days after end of reporting period	Interim payment	90 days from receiving periodic report
4	55	72	Periodic report	60 days after end of reporting period	Final payment	90 days from receiving periodic report

Prefinancing payments and guarantees:

Prefinancing payment	
Type	Amount
Prefinancing 1 (initial)	9 998 730.68

Reporting and payment modalities (art 21, 22):

Mutual Insurance Mechanism (MIM): Yes

MIM contribution: 5% of the maximum grant amount (1 249 841.33), retained from the initial prefinancing

Restrictions on distribution of initial prefinancing: The prefinancing may be distributed only if the minimum number of beneficiaries set out in the call condititions (if any) have acceded to the Agreement and only to beneficiaries that have acceded.

Interim payment ceiling (if any): 90% of the maximum grant amount

Exception for revenues: Yes

No-profit rule: Yes

Late payment interest: ECB + 3.5%

Bank account for payments:

SI56101000060757303

Conversion into euros: Double conversion

Reporting language: Language of the Agreement

4.3 Certificates (art 24):

Certificates on the financial statements (CFS):

Conditions:

Schedule: only at final payment, if threshold is reached

Standard threshold (beneficiary-level):

- financial statement: requested EU contribution to costs ≥ EUR 430 000.00

Special threshold for beneficiaries with a systems and process audit(see Article 24): financial statement: requested EU contribution to costs ≥ EUR 725 000.00

4.4 Recoveries (art 22)

First-line liability for recoveries:

Beneficiary termination: Beneficiary concerned

Final payment: Each beneficiary for their own debt

After final payment: Beneficiary concerned

Joint and several liability for enforced recoveries (in case of non-payment):

Individual financial responsibility: Each beneficiary is liable only for its own debts (and those of its affiliated entities, if any)

Joint and several liability of affiliated entities — n/a

5. Consequences of non-compliance, applicable law & dispute settlement forum

Suspension and termination:

Additional suspension grounds (art 31)

Additional termination grounds (art 32)

Applicable law (art 43):

Standard applicable law regime: EU law + law of Belgium

Dispute settlement forum (art 43):

Standard dispute settlement forum:

EU beneficiaries: EU General Court + EU Court of Justice (on appeal)

Non-EU beneficiaries: Courts of Brussels, Belgium (unless an international agreement provides for the enforceability of EU court judgements)

6. Other

Specific rules (Annex 5): Yes

Standard time-limits after project end:

Confidentiality (for X years after final payment): 5

Record-keeping (for X years after final payment): 5 (or 3 for grants of not more than EUR 60 000)

Reviews (up to X years after final payment): 2

Audits (up to X years after final payment): 2

Extension of findings from other grants to this grant (no later than X years after final payment): 2

Impact evaluation (up to X years after final payment): 5 (or 3 for grants of not more than EUR 60 000)

CHAPTER 1 GENERAL

ARTICLE 1 — SUBJECT OF THE AGREEMENT

This Agreement sets out the rights and obligations and terms and conditions applicable to the grant awarded for the implementation of the action set out in Chapter 2.

ARTICLE 2 — DEFINITIONS

For the purpose of this Agreement, the following definitions apply:

Actions — The project which is being funded in the context of this Agreement.

Grant — The grant awarded in the context of this Agreement.

EU grants — Grants awarded by EU institutions, bodies, offices or agencies (including EU executive agencies, EU regulatory agencies, EDA, joint undertakings, etc.).

Participants — Entities participating in the action as beneficiaries, affiliated entities, associated partners, third parties giving in-kind contributions, subcontractors or recipients of financial support to third parties.

Beneficiaries (BEN) — The signatories of this Agreement (either directly or through an accession form).

Affiliated entities (AE) — Entities affiliated to a beneficiary within the meaning of Article 187 of EU Financial Regulation 2018/1046[4] which participate in the action with similar rights and obligations as the beneficiaries (obligation to implement action tasks and right to charge costs and claim contributions).

Associated partners (AP) — Entities which participate in the action, but without the right to charge costs or claim contributions.

Purchases — Contracts for goods, works or services needed to carry out the action (e.g. equipment, consumables and supplies) but which are not part of the action tasks (see Annex 1).

Subcontracting — Contracts for goods, works or services that are part of the action tasks (see Annex 1).

In-kind contributions — In-kind contributions within the meaning of Article 2(36) of EU Financial

[4] For the definition, see Article 187 Regulation (EU, Euratom) 2018/1046 of the European Parliament and of the Council of 18 July 2018 on the financial rules applicable to the general budget of the Union, amending Regulations (EU) No 1296/2013, (EU) No 1301/2013, (EU) No 1303/2013, (EU) No 1304/2013, (EU) No 1309/2013, (EU) No 1316/2013, (EU) No 223/2014, (EU) No 283/2014, and Decision No 541/2014/EU and repealing Regulation (EU, Euratom) No 966/2012 ('EU Financial Regulation') (OJ L 193, 30.7.2018, p. 1): "**affiliated entities** [are]:
(a) entities that form a sole beneficiary [(i.e. where an entity is formed of several entities that satisfy the criteria for being awarded a grant, including where the entity is specifically established for the purpose of implementing an action to be financed by a grant)];
(b) entities that satisfy the eligibility criteria and that do not fall within one of the situations referred to in Article 136(1) and 141(1) and that have a link with the beneficiary, in particular a legal or capital link, which is neither limited to the action nor established for the sole purpose of its implementation".

Regulation 2018/1046, i.e. non-financial resources made available free of charge by third parties.

Fraud — Fraud within the meaning of Article 3 of EU Directive 2017/1371[5] and Article 1 of the Convention on the protection of the European Communities' financial interests, drawn up by the Council Act of 26 July 1995[6], as well as any other wrongful or criminal deception intended to result in financial or personal gain.

Irregularities — Any type of breach (regulatory or contractual) which could impact the EU financial interests, including irregularities within the meaning of Article 1(2) of EU Regulation 2988/95[7].

Grave professional misconduct — Any type of unacceptable or improper behaviour in exercising one's profession, especially by employees, including grave professional misconduct within the meaning of Article 136(1)(c) of EU Financial Regulation 2018/1046.

Applicable EU, international and national law — Any legal acts or other (binding or non-binding) rules and guidance in the area concerned.

Portal — EU Funding & Tenders Portal; electronic portal and exchange system managed by the European Commission and used by itself and other EU institutions, bodies, offices or agencies for the management of their funding programmes (grants, procurements, prizes, etc.).

CHAPTER 2 ACTION

ARTICLE 3 — ACTION

The grant is awarded for the action **101111927** — **NAHV** ('action'), as described in Annex 1.

ARTICLE 4 — DURATION AND STARTING DATE

The duration and the starting date of the action are set out in the Data Sheet (see Point 1).

CHAPTER 3 GRANT

ARTICLE 5 — GRANT

5.1 Form of grant

The grant is an action grant[8] which takes the form of a budget-based mixed actual cost grant (i.e. a

[5] Directive (EU) 2017/1371 of the European Parliament and of the Council of 5 July 2017 on the fight against fraud to the Union's financial interests by means of criminal law (OJ L 198, 28.7.2017, p. 29).

[6] OJ C 316, 27.11.1995, p. 48.

[7] Council Regulation (EC, Euratom) No 2988/95 of 18 December 1995 on the protection of the European Communities financial interests (OJ L 312, 23.12.1995, p. 1).

[8] For the definition, see Article 180(2)(a) EU Financial Regulation 2018/1046: '**action grant**' means an EU grant to finance "an action intended to help achieve a Union policy objective".

grant based on actual costs incurred, but which may also include other forms of funding, such as unit costs or contributions, flat-rate costs or contributions, lump sum costs or contributions or financing not linked to costs).

5.2 Maximum grant amount

The maximum grant amount is set out in the Data Sheet (see Point 3) and in the estimated budget (Annex 2).

5.3 Funding rate

The funding rate for costs is 100% of the eligible costs for beneficiaries that are non-profit legal entities[9] and 70% of the eligible costs for beneficiaries that are profit legal entities.

Contributions are not subject to any funding rate.

5.4 Estimated budget, budget categories and forms of funding

The estimated budget for the action is set out in Annex 2.

It contains the estimated eligible costs and contributions for the action, broken down by participant and budget category.

Annex 2 also shows the types of costs and contributions (forms of funding)[10] to be used for each budget category.

If unit costs or contributions are used, the details on the calculation will be explained in Annex 2a.

5.5 Budget flexibility

The budget breakdown may be adjusted — without an amendment (see Article 39) — by transfers (between participants and budget categories), as long as this does not imply any substantive or important change to the description of the action in Annex 1.

However:

- changes to the budget category for volunteers (if used) always require an amendment
- changes to budget categories with lump sums costs or contributions (if used; including financing not linked to costs) always require an amendment
- changes to budget categories with higher funding rates or budget ceilings (if used) always require an amendment
- addition of amounts for subcontracts not provided for in Annex 1 either require an amendment or simplified approval in accordance with Article 6.2

[9] For the definition, see Article XX of the Horizon Europe Framework Programme and Rules for Participation Regulation (EU) XXX: '**non-profit legal entity**' means a legal entity which by its legal form is non-profit-making or which has a legal or statutory obligation not to distribute profits to its shareholders or individual members.

[10] See Article 125 EU Financial Regulation 2018/1046.

- other changes require an amendment or simplified approval, if specifically provided for in Article 6.2

- flexibility caps: not applicable.

ARTICLE 6 — ELIGIBLE AND INELIGIBLE COSTS AND CONTRIBUTIONS

In order to be eligible, costs and contributions must meet the **eligibility** conditions set out in this Article.

6.1 General eligibility conditions

The **general eligibility conditions** are the following:

(a) for actual costs:

(i) they must be actually incurred by the beneficiary

(ii) they must be incurred in the period set out in Article 4 (with the exception of costs relating to the submission of the final periodic report, which may be incurred afterwards; see Article 21)

(iii) they must be declared under one of the budget categories set out in Article 6.2 and Annex 2

(iv) they must be incurred in connection with the action as described in Annex 1 and necessary for its implementation

(v) they must be identifiable and verifiable, in particular recorded in the beneficiary's accounts in accordance with the accounting standards applicable in the country where the beneficiary is established and with the beneficiary's usual cost accounting practices

(vi) they must comply with the applicable national law on taxes, labour and social security and

(vii) they must be reasonable, justified and must comply with the principle of sound financial management, in particular regarding economy and efficiency

(b) for unit costs or contributions (if any):

(i) they must be declared under one of the budget categories set out in Article 6.2 and Annex 2

(ii) the units must:

- be actually used or produced by the beneficiary in the period set out in Article 4 (with the exception of units relating to the submission of the final periodic report, which may be used or produced afterwards; see Article 21)

- be necessary for the implementation of the action and

(iii) the number of units must be identifiable and verifiable, in particular supported by records and documentation (see Article 20)

(c) for flat-rate costs or contributions (if any):

(i) they must be declared under one of the budget categories set out in Article 6.2 and Annex 2

(ii) the costs or contributions to which the flat-rate is applied must:

- be eligible
- relate to the period set out in Article 4 (with the exception of costs or contributions relating to the submission of the final periodic report, which may be incurred afterwards; see Article 21)

(d) for lump sum costs or contributions (if any):

(i) they must be declared under one of the budget categories set out in Article 6.2 and Annex 2

(ii) the work must be properly implemented by the beneficiary in accordance with Annex 1

(iii) the deliverables/outputs must be achieved in the period set out in Article 4 (with the exception of deliverables/outputs relating to the submission of the final periodic report, which may be achieved afterwards; see Article 21)

(e) for unit, flat-rate or lump sum costs or contributions according to usual cost accounting practices (if any):

(i) they must fulfil the general eligibility conditions for the type of cost concerned

(ii) the cost accounting practices must be applied in a consistent manner, based on objective criteria, regardless of the source of funding

(f) for financing not linked to costs (if any): the results must be achieved or the conditions must be fulfilled as described in Annex 1.

In addition, for direct cost categories (e.g. personnel, travel & subsistence, subcontracting and other direct costs) only costs that are directly linked to the action implementation and can therefore be attributed to it directly are eligible. They must not include any indirect costs (i.e. costs that are only indirectly linked to the action, e.g. via cost drivers).

In-kind contributions provided by third parties free of charge may be declared as eligible direct costs by the beneficiaries which use them (under the same conditions as if they were their own, provided that they concern only direct costs and that the third parties and their in-kind contributions are set out in Annex 1 (or approved ex post in the periodic report, if their use does not entail changes to the Agreement which would call into question the decision awarding the grant or breach the principle of equal treatment of applicants; 'simplified approval procedure').

6.2 Specific eligibility conditions for each budget category

For each budget category, the **specific eligibility conditions** are as follows:

Direct costs

A. Personnel costs

A.1 Costs for employees (or equivalent) are eligible as personnel costs if they fulfil the general eligibility conditions and are related to personnel working for the beneficiary under an employment contract (or equivalent appointing act) and assigned to the action.

They must be limited to salaries (including net payments during parental leave), social security contributions, taxes and other costs linked to the remuneration, if they arise from national law or the employment contract (or equivalent appointing act) and be calculated on the basis of the costs actually incurred, in accordance with the following method:

{daily rate for the person

multiplied by

number of day-equivalents worked on the action (rounded up or down to the nearest half-day)}.

The daily rate must be calculated as:

{annual personnel costs for the person

divided by

215}.

The number of day-equivalents declared for a person must be identifiable and verifiable (see Article 20).

The actual time spent on parental leave by a person assigned to the action may be deducted from the 215 days indicated in the above formula.

The total number of day-equivalents declared in EU grants, for a person for a year, cannot be higher than 215, minus time spent on parental leave (if any).

For personnel which receives supplementary payments for work in projects (project-based remuneration), the personnel costs must be calculated at a rate which:

- corresponds to the actual remuneration costs paid by the beneficiary for the time worked by the person in the action over the reporting period
- does not exceed the remuneration costs paid by the beneficiary for work in similar projects funded by national schemes (‘national projects reference’)
- is defined based on objective criteria allowing to determine the amount to which the person is entitled

and

- reflects the usual practice of the beneficiary to pay consistently bonuses or supplementary payments for work in projects funded by national schemes.

The national projects reference is the remuneration defined in national law, collective labour agreement or written internal rules of the beneficiary applicable to work in projects funded by national schemes.

If there is no such national law, collective labour agreement or written internal rules or if the project-

based remuneration is not based on objective criteria, the national project reference will be the average remuneration of the person in the last full calendar year covered by the reporting period, excluding remuneration paid for work in EU actions.

If the beneficiary uses average personnel costs (unit cost according to usual cost accounting practices), the personnel costs must fulfil the general eligibility conditions for such unit costs and the daily rate must be calculated:

- using the actual personnel costs recorded in the beneficiary's accounts and excluding any costs which are ineligible or already included in other budget categories; the actual personnel costs may be adjusted on the basis of budgeted or estimated elements, if they are relevant for calculating the personnel costs, reasonable and correspond to objective and verifiable information

and

- according to usual cost accounting practices which are applied in a consistent manner, based on objective criteria, regardless of the source of funding.

A.2 and **A.3 Costs for natural persons working under a direct contract** other than an employment contract and costs for **seconded persons by a third party against payment** are also eligible as personnel costs, if they are assigned to the action, fulfil the general eligibility conditions and:

(a) work under conditions similar to those of an employee (in particular regarding the way the work is organised, the tasks that are performed and the premises where they are performed) and

(b) the result of the work belongs to the beneficiary (unless agreed otherwise).

They must be calculated on the basis of a rate which corresponds to the costs actually incurred for the direct contract or secondment and must not be significantly different from those for personnel performing similar tasks under an employment contract with the beneficiary.

A.4 The work of **SME owners** for the action (i.e. owners of beneficiaries that are small and medium-sized enterprises[11] not receiving a salary) or **natural person beneficiaries** (i.e. beneficiaries that are natural persons not receiving a salary) may be declared as personnel costs, if they fulfil the general eligibility conditions and are calculated as unit costs in accordance with the method set out in Annex 2a.

B. Subcontracting costs

Subcontracting costs for the action (including related duties, taxes and charges, such as non-deductible or non-refundable value added tax (VAT)) are eligible, if they are calculated on the basis

[11] For the definition, see Commission Recommendation 2003/361/EC: micro, small or medium-sized enterprise (SME) are enterprises

- engaged in an economic activity, irrespective of their legal form (including, in particular, self- employed persons and family businesses engaged in craft or other activities, and partnerships or associations regularly engaged in an economic activity) and

- employing fewer than 250 persons (expressed in 'annual working units' as defined in Article 5 of the Recommendation) and which have an annual turnover not exceeding EUR 50 million, and/or an annual balance sheet total not exceeding EUR 43 million.

of the costs actually incurred, fulfil the general eligibility conditions and are awarded using the beneficiary's usual purchasing practices — provided these ensure subcontracts with best value for money (or if appropriate the lowest price) and that there is no conflict of interests (see Article 12).

Beneficiaries that are 'contracting authorities/entities' within the meaning of the EU Directives on public procurement must also comply with the applicable national law on public procurement.

Subcontracting may cover only a limited part of the action.

The tasks to be subcontracted and the estimated cost for each subcontract must be set out in Annex 1 and the total estimated costs of subcontracting per beneficiary must be set out in Annex 2 (or may be approved ex post in the periodic report, if the use of subcontracting does not entail changes to the Agreement which would call into question the decision awarding the grant or breach the principle of equal treatment of applicants; 'simplified approval procedure').

C. Purchase costs

Purchase costs for the action (including related duties, taxes and charges, such as non-deductible or non-refundable value added tax (VAT)) are eligible if they fulfil the general eligibility conditions and are bought using the beneficiary's usual purchasing practices — provided these ensure purchases with best value for money (or if appropriate the lowest price) and that there is no conflict of interests (see Article 12).

Beneficiaries that are 'contracting authorities/entities' within the meaning of the EU Directives on public procurement must also comply with the applicable national law on public procurement.

C.1 Travel and subsistence

Purchases for **travel, accommodation** and **subsistence** must be calculated as follows:

- travel: on the basis of the costs actually incurred and in line with the beneficiary's usual practices on travel
- accommodation: on the basis of the costs actually incurred and in line with the beneficiary's usual practices on travel
- subsistence: on the basis of the costs actually incurred and in line with the beneficiary's usual practices on travel .

C.2 Equipment

Purchases of **equipment, infrastructure or other assets** used for the action must be declared as depreciation costs, calculated on the basis of the costs actually incurred and written off in accordance with international accounting standards and the beneficiary's usual accounting practices.

Only the portion of the costs that corresponds to the rate of actual use for the action during the action duration can be taken into account.

Costs for **renting or leasing** equipment, infrastructure or other assets are also eligible, if they do not exceed the depreciation costs of similar equipment, infrastructure or assets and do not include any financing fees.

Moreover, for the following equipment, infrastructure or other assets purchased specifically for the action (or developed as part of the action tasks): hydrogen production plant, distribution and storage infrastructure and hydrogen end-uses,

costs may exceptionally be declared as full capitalised costs, if they fulfil the cost eligibility conditions applicable to their respective cost categories.

'Capitalised costs' means:

- costs incurred in the purchase or for the development of the equipment, infrastructure or other assets and
- which are recorded under a fixed asset account of the beneficiary in compliance with international accounting standards and the beneficiary's usual cost accounting practices.

If such equipment, infrastructure or other assets are rented or leased, full costs for **renting or leasing** are eligible, if they do not exceed the depreciation costs of similar equipment, infrastructure or assets and do not include any financing fees.

C.3 Other goods, works and services

Purchases of **other goods, works and services** must be calculated on the basis of the costs actually incurred.

Such goods, works and services include, for instance, consumables and supplies, promotion, dissemination, protection of results, translations, publications, certificates and financial guarantees, if required under the Agreement.

D. Other cost categories

D.2 Internally invoiced goods and services

Costs for internally invoiced goods and services directly used for the action may be declared as unit cost according to usual cost accounting practices, if and as declared eligible in the call conditions, if they fulfil the general eligibility conditions for such unit costs and the amount per unit is calculated:

- using the actual costs for the good or service recorded in the beneficiary's accounts, attributed either by direct measurement or on the basis of cost drivers, and excluding any cost which are ineligible or already included in other budget categories; the actual costs may be adjusted on the basis of budgeted or estimated elements, if they are relevant for calculating the costs, reasonable and correspond to objective and verifiable information

and

- according to usual cost accounting practices which are applied in a consistent manner, based on objective criteria, regardless of the source of funding.

'Internally invoiced goods and services' means goods or services which are provided within the beneficiary's organisation directly for the action and which the beneficiary values on the basis of its usual cost accounting practices.

This cost will not be taken into account for the indirect cost flat-rate.

Indirect costs

E. Indirect costs

Indirect costs will be reimbursed at the flat-rate of 25% of the eligible direct costs (categories A-D, except volunteers costs, subcontracting costs, financial support to third parties and exempted specific cost categories, if any).

Contributions

Not applicable

6.3 Ineligible costs and contributions

The following costs or contributions are **ineligible**:

(a) costs or contributions that do not comply with the conditions set out above (Article 6.1 and 6.2), in particular:

(i) costs related to return on capital and dividends paid by a beneficiary

(ii) debt and debt service charges

(iii) provisions for future losses or debts

(iv) interest owed

(v) currency exchange losses

(vi) bank costs charged by the beneficiary's bank for transfers from the granting authority

(vii) excessive or reckless expenditure

(viii) deductible or refundable VAT (including VAT paid by public bodies acting as public authority)

(ix) costs incurred or contributions for activities implemented during grant agreement suspension (see Article 31)

(x) in-kind contributions by third parties: not applicable

(b) costs or contributions declared under other EU grants (or grants awarded by an EU Member State, non-EU country or other body implementing the EU budget), except for the following cases:

(i) Synergy actions: not applicable

(ii) if the action grant is combined with an operating grant[12] running during the same period and the beneficiary can demonstrate that the operating grant does not cover any (direct or indirect) costs of the action grant

[12] For the definition, see Article 180(2)(b) of EU Financial Regulation 2018/1046: '**operating grant**' means an EU grant to finance "the functioning of a body which has an objective forming part of and supporting an EU policy".

(c) costs or contributions for staff of a national (or regional/local) administration, for activities that are part of the administration's normal activities (i.e. not undertaken only because of the grant)

(d) costs or contributions (especially travel and subsistence) for staff or representatives of EU institutions, bodies or agencies

(e) other :

(i) country restrictions for eligible costs: not applicable

(ii) costs or contributions declared specifically ineligible in the call conditions.

6.4 Consequences of non-compliance

If a beneficiary declares costs or contributions that are ineligible, they will be rejected (see Article 27).

This may also lead to other measures described in Chapter 5.

CHAPTER 4 GRANT IMPLEMENTATION

SECTION 1 CONSORTIUM: BENEFICIARIES, AFFILIATED ENTITIES AND OTHER PARTICIPANTS

ARTICLE 7 — BENEFICIARIES

The beneficiaries, as signatories of the Agreement, are fully responsible towards the granting authority for implementing it and for complying with all its obligations.

They must implement the Agreement to their best abilities, in good faith and in accordance with all the obligations and terms and conditions it sets out.

They must have the appropriate resources to implement the action and implement the action under their own responsibility and in accordance with Article 11. If they rely on affiliated entities or other participants (see Articles 8 and 9), they retain sole responsibility towards the granting authority and the other beneficiaries.

They are jointly responsible for the *technical* implementation of the action. If one of the beneficiaries fails to implement their part of the action, the other beneficiaries must ensure that this part is implemented by someone else (without being entitled to an increase of the maximum grant amount and subject to an amendment; see Article 39). The *financial* responsibility of each beneficiary in case of recoveries is governed by Article 22.

The beneficiaries (and their action) must remain eligible under the EU programme funding the grant for the entire duration of the action. Costs and contributions will be eligible only as long as the beneficiary and the action are eligible.

The **internal roles and responsibilities** of the beneficiaries are divided as follows:

(a) Each beneficiary must:

(i) keep information stored in the Portal Participant Register up to date (see Article 19)

(ii) inform the granting authority (and the other beneficiaries) immediately of any events or circumstances likely to affect significantly or delay the implementation of the action (see Article 19)

(iii) submit to the coordinator in good time:

- the prefinancing guarantees (if required; see Article 23)
- the financial statements and certificates on the financial statements (CFS) (if required; see Articles 21 and 24.2 and Data Sheet, Point 4.3)
- the contribution to the deliverables and technical reports (see Article 21)
- any other documents or information required by the granting authority under the Agreement

(iv) submit via the Portal data and information related to the participation of their affiliated entities.

(b) The coordinator must:

(i) monitor that the action is implemented properly (see Article 11)

(ii) act as the intermediary for all communications between the consortium and the granting authority, unless the Agreement or granting authority specifies otherwise, and in particular:

- submit the prefinancing guarantees to the granting authority (if any)
- request and review any documents or information required and verify their quality and completeness before passing them on to the granting authority
- submit the deliverables and reports to the granting authority
- inform the granting authority about the payments made to the other beneficiaries (report on the distribution of payments; if required, see Articles 22 and 32)

(iii) distribute the payments received from the granting authority to the other beneficiaries without unjustified delay (see Article 22).

The coordinator may not delegate or subcontract the above-mentioned tasks to any other beneficiary or third party (including affiliated entities).

However, coordinators which are public bodies may delegate the tasks set out in Point (b)(ii) last indent and (iii) above to entities with 'authorisation to administer' which they have created or which are controlled by or affiliated to them. In this case, the coordinator retains sole responsibility for the payments and for compliance with the obligations under the Agreement.

Moreover, coordinators which are 'sole beneficiaries'[13] (or similar, such as European research infrastructure consortia (ERICs)) may delegate the tasks set out in Point (b)(i) to (iii) above to one of their members. The coordinator retains sole responsibility for compliance with the obligations under the Agreement.

The beneficiaries must have **internal arrangements** regarding their operation and co-ordination, to ensure that the action is implemented properly.

If required by the granting authority (see Data Sheet, Point 1), these arrangements must be set out in a written **consortium agreement** between the beneficiaries, covering for instance:

- the internal organisation of the consortium
- the management of access to the Portal
- different distribution keys for the payments and financial responsibilities in case of recoveries (if any)
- additional rules on rights and obligations related to background and results (see Article 16)
- settlement of internal disputes
- liability, indemnification and confidentiality arrangements between the beneficiaries.

The internal arrangements must not contain any provision contrary to this Agreement.

ARTICLE 8 — AFFILIATED ENTITIES

The following entities which are linked to a beneficiary will participate in the action as 'affiliated entities':

- **TERMOELEKTRARNA SOSTANJ D.O.O. (TES, d.o.o.)**, PIC 884216984, linked to HOLDING SLOVENSKE ELEKTRARNE DOO (HSE)
- **HSE INVEST DRUZBA ZA INZENIRING INIZGRADNJO ENERGETSKIH OBJEKTOV DOO (HSE INVEST)**, PIC 950728817, linked to HOLDING SLOVENSKE ELEKTRARNE DOO (HSE)
- **DANIELI CENTRO COMBUSTION SPA (DANIELI)**, PIC 913920227, linked to ACCIAIERIE BERTOLI SAFAU SPA (ABS)
- **SVEUCILISTE U RIJECI-TEHNICKI FAKULTET (TEHN.FAKULT.)**, PIC 986280675, linked to SVEUCILISTE U RIJECI (UNIRI)
- **SVEUCILISTE U SPLITU, FAKULTET ELEKTROTEHNIKE, STROJARSTVA I BRODOGRADNJE (UNI SPLIT)**, PIC 996558116, linked to SVEUCILISTE U RIJECI (UNIRI)

[13] For the definition, see Article 187(2) EU Financial Regulation 2018/1046: "Where several entities satisfy the criteria for being awarded a grant and together form one entity, that entity may be treated as the **sole beneficiary**, including where it is specifically established for the purpose of implementing the action financed by the grant."

- **SVEUCILISTE U ZAGREBU, FAKULTET STROJARSTVA I BRODOGRADNJE (UNI ZG FSB)**, PIC 996827485, linked to SVEUCILISTE U RIJECI (UNIRI)
- **TRIESTE TRASPORTI SPA (TRIESTETRASPORT)**, PIC 945489653, linked to TPL FVG S.C. A R.L. (Tpl Fvg)
- **AZIENDA PROVINCIALE TRASPORTI SPA (A.P.T. S.P.A.)**, PIC 884987843, linked to TPL FVG S.C. A R.L. (Tpl Fvg)
- **META (META SPRL)**, PIC 900146227, linked to META GROUP SRL (META)
- **META CIRCULARITY, SVETOVANJE IN INOVACIJE DOO (META SLO)**, PIC 914861709, linked to META GROUP SRL (META)

Affiliated entities can charge costs and contributions to the action under the same conditions as the beneficiaries and must implement the action tasks attributed to them in Annex 1 in accordance with Article 11.

Their costs and contributions will be included in Annex 2 and will be taken into account for the calculation of the grant.

The beneficiaries must ensure that all their obligations under this Agreement also apply to their affiliated entities.

The beneficiaries must ensure that the bodies mentioned in Article 25 (e.g. granting authority, OLAF, Court of Auditors (ECA), etc.) can exercise their rights also towards the affiliated entities.

Breaches by affiliated entities will be handled in the same manner as breaches by beneficiaries. Recovery of undue amounts will be handled through the beneficiaries.

If the granting authority requires joint and several liability of affiliated entities (see Data Sheet, Point 4.4), they must sign the declaration set out in Annex 3a and may be held liable in case of enforced recoveries against their beneficiaries (see Article 22.2 and 22.4).

ARTICLE 9 — OTHER PARTICIPANTS INVOLVED IN THE ACTION

9.1 Associated partners

Not applicable

9.2 Third parties giving in-kind contributions to the action

Other third parties may give in-kind contributions to the action (i.e. personnel, equipment, other goods, works and services, etc. which are free-of-charge) if necessary for the implementation.

Third parties giving in-kind contributions do not implement any action tasks. They may not charge costs or contributions to the action, but the costs for the in-kind contributions are eligible and may be charged by the beneficiaries which use them, under the conditions set out in Article 6. The costs will be included in Annex 2 as part of the beneficiaries' costs.

The third parties and their in-kind contributions should be set out in Annex 1.

The beneficiaries must ensure that the bodies mentioned in Article 25 (e.g. granting authority, OLAF, Court of Auditors (ECA), etc.) can exercise their rights also towards the third parties giving in-kind contributions.

9.3 Subcontractors

Subcontractors may participate in the action, if necessary for the implementation.

Subcontractors must implement their action tasks in accordance with Article 11. The costs for the subcontracted tasks (invoiced price from the subcontractor) are eligible and may be charged by the beneficiaries, under the conditions set out in Article 6. The costs will be included in Annex 2 as part of the beneficiaries' costs.

The beneficiaries must ensure that their contractual obligations under Articles 11 (proper implementation), 12 (conflict of interest), 13 (confidentiality and security), 14 (ethics), 17.2 (visibility), 18 (specific rules for carrying out action), 19 (information) and 20 (record-keeping) also apply to the subcontractors.

The beneficiaries must ensure that the bodies mentioned in Article 25 (e.g. granting authority, OLAF, Court of Auditors (ECA), etc.) can exercise their rights also towards the subcontractors.

9.4 Recipients of financial support to third parties

If the action includes providing financial support to third parties (e.g. grants, prizes or similar forms of support), the beneficiaries must ensure that their contractual obligations under Articles 12 (conflict of interest), 13 (confidentiality and security), 14 (ethics), 17.2 (visibility), 18 (specific rules for carrying out action), 19 (information) and 20 (record-keeping)also apply to the third parties receiving the support (recipients).

The beneficiaries must also ensure that the bodies mentioned in Article 25 (e.g. granting authority, OLAF, Court of Auditors (ECA), etc.) can exercise their rights also towards the recipients.

ARTICLE 10 — PARTICIPANTS WITH SPECIAL STATUS

10.1 Non-EU participants

Participants which are established in a non-EU country (if any) undertake to comply with their obligations under the Agreement and:

- to respect general principles (including fundamental rights, values and ethical principles, environmental and labour standards, rules on classified information, intellectual property rights, visibility of funding and protection of personal data)
- for the submission of certificates under Article 24: to use qualified external auditors which are independent and comply with comparable standards as those set out in EU Directive 2006/43/EC[14]
- for the controls under Article 25: to allow for checks, reviews, audits and investigations

[14] Directive 2006/43/EC of the European Parliament and of the Council of 17 May 2006 on statutory audits of annual accounts and consolidated accounts or similar national regulations (OJ L 157, 9.6.2006, p. 87).

(including on-the-spot checks, visits and inspections) by the bodies mentioned in that Article (e.g. granting authority, OLAF, Court of Auditors (ECA), etc.).

Special rules on dispute settlement apply (see Data Sheet, Point 5).

10.2 Participants which are international organisations

Participants which are international organisations (IOs; if any) undertake to comply with their obligations under the Agreement and:

- to respect general principles (including fundamental rights, values and ethical principles, environmental and labour standards, rules on classified information, intellectual property rights, visibility of funding and protection of personal data)

- for the submission of certificates under Article 24: to use either independent public officers or external auditors which comply with comparable standards as those set out in EU Directive 2006/43/EC

- for the controls under Article 25: to allow for the checks, reviews, audits and investigations by the bodies mentioned in that Article, taking into account the specific agreements concluded by them and the EU (if any).

For such participants, nothing in the Agreement will be interpreted as a waiver of their privileges or immunities, as accorded by their constituent documents or international law.

Special rules on applicable law and dispute settlement apply (see Article 43 and Data Sheet, Point 5).

10.3 Pillar-assessed participants

Pillar-assessed participants (if any) may rely on their own systems, rules and procedures, in so far as they have been positively assessed and do not call into question the decision awarding the grant or breach the principle of equal treatment of applicants or beneficiaries.

'Pillar-assessment' means a review by the European Commission on the systems, rules and procedures which participants use for managing EU grants (in particular internal control system, accounting system, external audits, financing of third parties, rules on recovery and exclusion, information on recipients and protection of personal data; see Article 154 EU Financial Regulation 2018/1046).

Participants with a positive pillar assessment may rely on their own systems, rules and procedures, in particular for:

- record-keeping (Article 20): may be done in accordance with internal standards, rules and procedures

- currency conversion for financial statements (Article 21): may be done in accordance with usual accounting practices

- guarantees (Article 23): for public law bodies, prefinancing guarantees are not needed

- certificates (Article 24):

    - certificates on the financial statements (CFS): may be provided by their regular internal

or external auditors and in accordance with their internal financial regulations and procedures

- certificates on usual accounting practices (CoMUC): are not needed if those practices are covered by an ex-ante assessment

and use the following specific rules, for:

- recoveries (Article 22): in case of financial support to third parties, there will be no recovery if the participant has done everything possible to retrieve the undue amounts from the third party receiving the support (including legal proceedings) and non-recovery is not due to an error or negligence on its part

- checks, reviews, audits and investigations by the EU (Article 25): will be conducted taking into account the rules and procedures specifically agreed between them and the framework agreement (if any)

- impact evaluation (Article 26): will be conducted in accordance with the participant's internal rules and procedures and the framework agreement (if any)

- grant agreement suspension (Article 31): certain costs incurred during grant suspension are eligible (notably, minimum costs necessary for a possible resumption of the action and costs relating to contracts which were entered into before the pre-information letter was received and which could not reasonably be suspended, reallocated or terminated on legal grounds)

- grant agreement termination (Article 32): the final grant amount and final payment will be calculated taking into account also costs relating to contracts due for execution only after termination takes effect, if the contract was entered into before the pre-information letter was received and could not reasonably be terminated on legal grounds

- liability for damages (Article 33.2): the granting authority must be compensated for damage it sustains as a result of the implementation of the action or because the action was not implemented in full compliance with the Agreement only if the damage is due to an infringement of the participant's internal rules and procedures or due to a violation of third parties' rights by the participant or one of its employees or individual for whom the employees are responsible.

Participants whose pillar assessment covers procurement and granting procedures may also do purchases, subcontracting and financial support to third parties (Article 6.2) in accordance with their internal rules and procedures for purchases, subcontracting and financial support.

Participants whose pillar assessment covers data protection rules may rely on their internal standards, rules and procedures for data protection (Article 15).

The participants may however not rely on provisions which would breach the principle of equal treatment of applicants or beneficiaries or call into question the decision awarding the grant, such as in particular:

- eligibility (Article 6)

- consortium roles and set-up (Articles 7-9)

- security and ethics (Articles 13, 14)
- IPR (including background and results, access rights and rights of use), communication, dissemination and visibility (Articles 16 and 17)
- information obligation (Article 19)
- payment, reporting and amendments (Articles 21, 22 and 39)
- rejections, reductions, suspensions and terminations (Articles 27, 28, 29-32)

If the pillar assessment was subject to remedial measures, reliance on the internal systems, rules and procedures is subject to compliance with those remedial measures.

Participants whose assessment has not yet been updated to cover (the new rules on) data protection may rely on their internal systems, rules and procedures, provided that they ensure that personal data is:

- processed lawfully, fairly and in a transparent manner in relation to the data subject
- collected for specified, explicit and legitimate purposes and not further processed in a manner that is incompatible with those purposes
- adequate, relevant and limited to what is necessary in relation to the purposes for which they are processed
- accurate and, where necessary, kept up to date
- kept in a form which permits identification of data subjects for no longer than is necessary for the purposes for which the data is processed and
- processed in a manner that ensures appropriate security of the personal data.

Participants must inform the coordinator without delay of any changes to the systems, rules and procedures that were part of the pillar assessment. The coordinator must immediately inform the granting authority.

Pillar-assessed participants that have also concluded a framework agreement with the EU, may moreover — under the same conditions as those above (i.e. not call into question the decision awarding the grant or breach the principle of equal treatment of applicants or beneficiaries) — rely on the provisions set out in that framework agreement.

SECTION 2 RULES FOR CARRYING OUT THE ACTION

ARTICLE 11 — PROPER IMPLEMENTATION OF THE ACTION

11.1 Obligation to properly implement the action

The beneficiaries must implement the action as described in Annex 1 and in compliance with the provisions of the Agreement, the call conditions and all legal obligations under applicable EU, international and national law.

11.2 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 28).

Such breaches may also lead to other measures described in Chapter 5.

ARTICLE 12 — CONFLICT OF INTERESTS

12.1 Conflict of interests

The beneficiaries must take all measures to prevent any situation where the impartial and objective implementation of the Agreement could be compromised for reasons involving family, emotional life, political or national affinity, economic interest or any other direct or indirect interest ('conflict of interests').

They must formally notify the granting authority without delay of any situation constituting or likely to lead to a conflict of interests and immediately take all the necessary steps to rectify this situation.

The granting authority may verify that the measures taken are appropriate and may require additional measures to be taken by a specified deadline.

12.2 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 28) and the grant or the beneficiary may be terminated (see Article 32).

Such breaches may also lead to other measures described in Chapter 5.

ARTICLE 13 — CONFIDENTIALITY AND SECURITY

13.1 Sensitive information

The parties must keep confidential any data, documents or other material (in any form) that is identified as sensitive in writing ('sensitive information') — during the implementation of the action and for at least until the time-limit set out in the Data Sheet (see Point 6).

If a beneficiary requests, the granting authority may agree to keep such information confidential for a longer period.

Unless otherwise agreed between the parties, they may use sensitive information only to implement the Agreement.

The beneficiaries may disclose sensitive information to their personnel or other participants involved in the action only if they:

(a) need to know it in order to implement the Agreement and

(b) are bound by an obligation of confidentiality.

The granting authority may disclose sensitive information to its staff and to other EU institutions and bodies.

It may moreover disclose sensitive information to third parties, if:

(a) this is necessary to implement the Agreement or safeguard the EU financial interests and

(b) the recipients of the information are bound by an obligation of confidentiality.

The confidentiality obligations no longer apply if:

(a) the disclosing party agrees to release the other party

(b) the information becomes publicly available, without breaching any confidentiality obligation

(c) the disclosure of the sensitive information is required by EU, international or national law.

Specific confidentiality rules (if any) are set out in Annex 5.

13.2 Classified information

The parties must handle classified information in accordance with the applicable EU, international or national law on classified information (in particular, Decision 2015/444[15] and its implementing rules).

Deliverables which contain classified information must be submitted according to special procedures agreed with the granting authority.

Action tasks involving classified information may be subcontracted only after explicit approval (in writing) from the granting authority.

Classified information may not be disclosed to any third party (including participants involved in the action implementation) without prior explicit written approval from the granting authority.

Specific security rules (if any) are set out in Annex 5.

13.3 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 28).

Such breaches may also lead to other measures described in Chapter 5.

ARTICLE 14 — ETHICS AND VALUES

14.1 Ethics

The action must be carried out in line with the highest ethical standards and the applicable EU, international and national law on ethical principles.

Specific ethics rules (if any) are set out in Annex 5.

14.2 Values

The beneficiaries must commit to and ensure the respect of basic EU values (such as respect for

[15] Commission Decision 2015/444/EC, Euratom of 13 March 2015 on the security rules for protecting EU classified information (OJ L 72, 17.3.2015, p. 53).

human dignity, freedom, democracy, equality, the rule of law and human rights, including the rights of minorities).

Specific rules on values (if any) are set out in Annex 5.

14.3 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 28).

Such breaches may also lead to other measures described in Chapter 5.

ARTICLE 15 — DATA PROTECTION

15.1 Data processing by the granting authority

Any personal data under the Agreement will be processed under the responsibility of the data controller of the granting authority in accordance with and for the purposes set out in the Portal Privacy Statement.

For grants where the granting authority is the European Commission, an EU regulatory or executive agency, joint undertaking or other EU body, the processing will be subject to Regulation 2018/1725[16].

15.2 Data processing by the beneficiaries

The beneficiaries must process personal data under the Agreement in compliance with the applicable EU, international and national law on data protection (in particular, Regulation 2016/679[17]).

They must ensure that personal data is:

- processed lawfully, fairly and in a transparent manner in relation to the data subjects
- collected for specified, explicit and legitimate purposes and not further processed in a manner that is incompatible with those purposes
- adequate, relevant and limited to what is necessary in relation to the purposes for which they are processed
- accurate and, where necessary, kept up to date
- kept in a form which permits identification of data subjects for no longer than is necessary for the purposes for which the data is processed and
- processed in a manner that ensures appropriate security of the data.

[16] Regulation (EU) 2018/1725 of the European Parliament and of the Council of 23 October 2018 on the protection of natural persons with regard to the processing of personal data by the Union institutions, bodies, offices and agencies and on the free movement of such data, and repealing Regulation (EC) No 45/2001 and Decision No 1247/2002/EC (OJ L 295, 21.11.2018, p. 39).

[17] Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC ('GDPR') (OJ L 119, 4.5.2016, p. 1).

The beneficiaries may grant their personnel access to personal data only if it is strictly necessary for implementing, managing and monitoring the Agreement. The beneficiaries must ensure that the personnel is under a confidentiality obligation.

The beneficiaries must inform the persons whose data are transferred to the granting authority and provide them with the Portal Privacy Statement.

15.3 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 28).

Such breaches may also lead to other measures described in Chapter 5.

ARTICLE 16 — INTELLECTUAL PROPERTY RIGHTS (IPR) — BACKGROUND AND RESULTS —ACCESS RIGHTS AND RIGHTS OF USE

16.1 Background and access rights to background

The beneficiaries must give each other and the other participants access to the background identified as needed for implementing the action, subject to any specific rules in Annex 5.

'Background' means any data, know-how or information — whatever its form or nature (tangible or intangible), including any rights such as intellectual property rights — that is:

(a) held by the beneficiaries before they acceded to the Agreement and

(b) needed to implement the action or exploit the results.

If background is subject to rights of a third party, the beneficiary concerned must ensure that it is able to comply with its obligations under the Agreement.

16.2 Ownership of results

The granting authority does not obtain ownership of the results produced under the action.

'Results' means any tangible or intangible effect of the action, such as data, know-how or information, whatever its form or nature, whether or not it can be protected, as well as any rights attached to it, including intellectual property rights.

16.3 Rights of use of the granting authority on materials, documents and information received for policy, information, communication, dissemination and publicity purposes

The granting authority has the right to use non-sensitive information relating to the action and materials and documents received from the beneficiaries (notably summaries for publication, deliverables, as well as any other material, such as pictures or audio-visual material, in paper or electronic form) for policy, information, communication, dissemination and publicity purposes — during the action or afterwards.

The right to use the beneficiaries' materials, documents and information is granted in the form of a royalty-free, non-exclusive and irrevocable licence, which includes the following rights:

(a) **use for its own purposes** (in particular, making them available to persons working for the granting authority or any other EU service (including institutions, bodies, offices, agencies, etc.) or EU Member State institution or body; copying or reproducing them in whole or in part, in unlimited numbers; and communication through press information services)

(b) **distribution to the public** (in particular, publication as hard copies and in electronic or digital format, publication on the internet, as a downloadable or non-downloadable file, broadcasting by any channel, public display or presentation, communicating through press information services, or inclusion in widely accessible databases or indexes)

(c) **editing or redrafting** (including shortening, summarising, inserting other elements (e.g. meta-data, legends, other graphic, visual, audio or text elements), extracting parts (e.g. audio or video files), dividing into parts, use in a compilation)

(d) **translation**

(e) **storage** in paper, electronic or other form

(f) **archiving**, in line with applicable document-management rules

(g) the right to authorise **third parties** to act on its behalf or sub-license to third parties the modes of use set out in Points (b), (c), (d) and (f), if needed for the information, communication and publicity activity of the granting authority

(h) **processing**, analysing, aggregating the materials, documents and information received and **producing derivative works**.

The rights of use are granted for the whole duration of the industrial or intellectual property rights concerned.

If materials or documents are subject to moral rights or third party rights (including intellectual property rights or rights of natural persons on their image and voice), the beneficiaries must ensure that they comply with their obligations under this Agreement (in particular, by obtaining the necessary licences and authorisations from the rights holders concerned).

Where applicable, the granting authority will insert the following information:

"© – [year] – [name of the copyright owner]. All rights reserved. Licensed to the [name of granting authority] under conditions."

16.4 Specific rules on IPR, results and background

Specific rules regarding intellectual property rights, results and background (if any) are set out in Annex 5.

16.5 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 28).

Such a breach may also lead to other measures described in Chapter 5.

ARTICLE 17 — COMMUNICATION, DISSEMINATION AND VISIBILITY

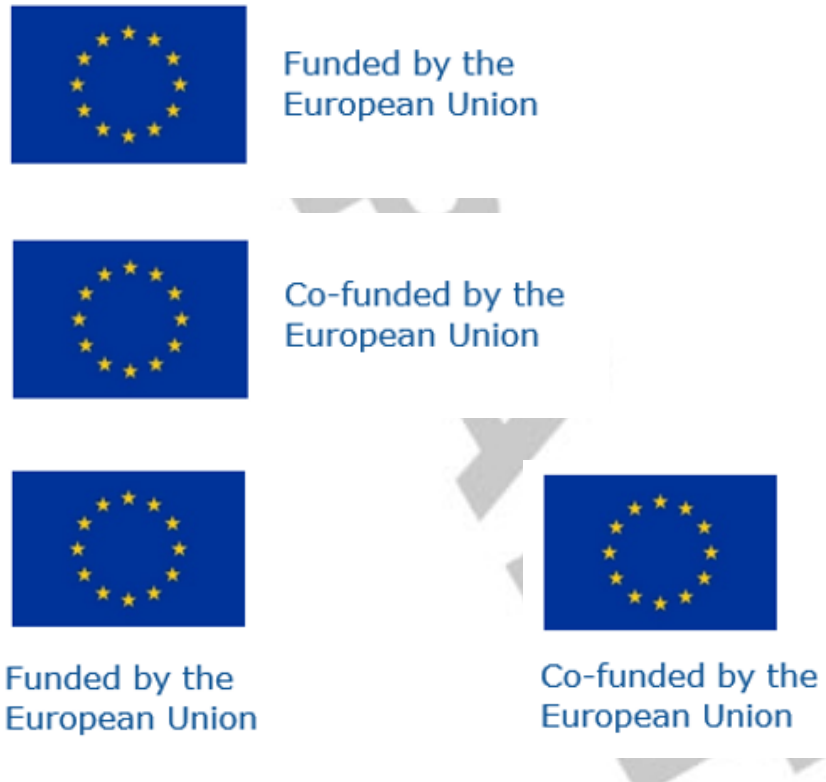
17.1 Communication — Dissemination — Promoting the action

Unless otherwise agreed with the granting authority, the beneficiaries must promote the action and its results by providing targeted information to multiple audiences (including the media and the public), in accordance with Annex 1 and in a strategic, coherent and effective manner.

Before engaging in a communication or dissemination activity expected to have a major media impact, the beneficiaries must inform the granting authority.

17.2 Visibility — European flag and funding statement

Unless otherwise agreed with the granting authority, communication activities of the beneficiaries related to the action (including media relations, conferences, seminars, information material, such as brochures, leaflets, posters, presentations, etc., in electronic form, via traditional or social media, etc.), dissemination activities and any infrastructure, equipment, vehicles, supplies or major result funded by the grant must acknowledge EU support and display the European flag (emblem) and funding statement (translated into local languages, where appropriate):



The emblem must remain distinct and separate and cannot be modified by adding other visual marks, brands or text.

Apart from the emblem, no other visual identity or logo may be used to highlight the EU support.

When displayed in association with other logos (e.g. of beneficiaries or sponsors), the emblem must be displayed at least as prominently and visibly as the other logos.

For the purposes of their obligations under this Article, the beneficiaries may use the emblem without first obtaining approval from the granting authority. This does not, however, give them the right to

exclusive use. Moreover, they may not appropriate the emblem or any similar trademark or logo, either by registration or by any other means.

17.3 Quality of information — Disclaimer

Any communication or dissemination activity related to the action must use factually accurate information.

Moreover, it must indicate the following disclaimer (translated into local languages where appropriate):

> "Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or [name of the granting authority]. Neither the European Union nor the granting authority can be held responsible for them."

17.4 Specific communication, dissemination and visibility rules

Specific communication, dissemination and visibility rules (if any) are set out in Annex 5.

17.5 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 28).

Such breaches may also lead to other measures described in Chapter 5.

ARTICLE 18 — SPECIFIC RULES FOR CARRYING OUT THE ACTION

18.1 Specific rules for carrying out the action

Specific rules for implementing the action (if any) are set out in Annex 5.

18.2 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 28).

Such a breach may also lead to other measures described in Chapter 5.

SECTION 3 GRANT ADMINISTRATION

ARTICLE 19 — GENERAL INFORMATION OBLIGATIONS

19.1 Information requests

The beneficiaries must provide — during the action or afterwards and in accordance with Article 7 — any information requested in order to verify eligibility of the costs or contributions declared, proper implementation of the action and compliance with the other obligations under the Agreement.

The information provided must be accurate, precise and complete and in the format requested, including electronic format.

19.2 Participant Register data updates

The beneficiaries must keep — at all times, during the action or afterwards — their information stored in the Portal Participant Register up to date, in particular, their name, address, legal representatives, legal form and organisation type.

19.3 Information about events and circumstances which impact the action

The beneficiaries must immediately inform the granting authority (and the other beneficiaries) of any of the following:

(a) **events** which are likely to affect or delay the implementation of the action or affect the EU's financial interests, in particular:

(i) changes in their legal, financial, technical, organisational or ownership situation (including changes linked to one of the exclusion grounds listed in the declaration of honour signed before grant signature)

(ii) linked action information: not applicable

(b) **circumstances** affecting:

(i) the decision to award the grant or

(ii) compliance with requirements under the Agreement.

19.4 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 28).

Such breaches may also lead to other measures described in Chapter 5.

ARTICLE 20 — RECORD-KEEPING

20.1 Keeping records and supporting documents

The beneficiaries must — at least until the time-limit set out in the Data Sheet (see Point 6) — keep records and other supporting documents to prove the proper implementation of the action in line with the accepted standards in the respective field (if any).

In addition, the beneficiaries must — for the same period — keep the following to justify the amounts declared:

(a) for actual costs: adequate records and supporting documents to prove the costs declared (such as contracts, subcontracts, invoices and accounting records); in addition, the beneficiaries' usual accounting and internal control procedures must enable direct reconciliation between the amounts declared, the amounts recorded in their accounts and the amounts stated in the supporting documents

(b) for flat-rate costs and contributions (if any): adequate records and supporting documents to prove the eligibility of the costs or contributions to which the flat-rate is applied

(c) for the following simplified costs and contributions: the beneficiaries do not need to keep specific records on the actual costs incurred, but must keep:

(i) for unit costs and contributions (if any): adequate records and supporting documents to prove the number of units declared

(ii) for lump sum costs and contributions (if any): adequate records and supporting documents to prove proper implementation of the work as described in Annex 1

(iii) for financing not linked to costs (if any): adequate records and supporting documents to prove the achievement of the results or the fulfilment of the conditions as described in Annex 1

(d) for unit, flat-rate and lump sum costs and contributions according to usual cost accounting practices (if any): the beneficiaries must keep any adequate records and supporting documents to prove that their cost accounting practices have been applied in a consistent manner, based on objective criteria, regardless of the source of funding, and that they comply with the eligibility conditions set out in Articles 6.1 and 6.2.

Moreover, the following is needed for specific budget categories:

(e) for personnel costs: time worked for the beneficiary under the action must be supported by declarations signed monthly by the person and their supervisor, unless another reliable time-record system is in place; the granting authority may accept alternative evidence supporting the time worked for the action declared, if it considers that it offers an adequate level of assurance

(f) additional record-keeping rules: not applicable

The records and supporting documents must be made available upon request (see Article 19) or in the context of checks, reviews, audits or investigations (see Article 25).

If there are on-going checks, reviews, audits, investigations, litigation or other pursuits of claims under the Agreement (including the extension of findings; see Article 25), the beneficiaries must keep these records and other supporting documentation until the end of these procedures.

The beneficiaries must keep the original documents. Digital and digitalised documents are considered originals if they are authorised by the applicable national law. The granting authority may accept non-original documents if they offer a comparable level of assurance.

20.2 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, costs or contributions insufficiently substantiated will be ineligible (see Article 6) and will be rejected (see Article 27), and the grant may be reduced (see Article 28).

Such breaches may also lead to other measures described in Chapter 5.

ARTICLE 21 — REPORTING

21.1 Continuous reporting

The beneficiaries must continuously report on the progress of the action (e.g. **deliverables, milestones, outputs/outcomes, critical risks, indicators,** etc; if any), in the Portal Continuous Reporting tool and in accordance with the timing and conditions it sets out (as agreed with the granting authority).

Standardised deliverables (e.g. progress reports not linked to payments, reports on cumulative expenditure, special reports, etc; if any) must be submitted using the templates published on the Portal.

21.2 Periodic reporting: Technical reports and financial statements

In addition, the beneficiaries must provide reports to request payments, in accordance with the schedule and modalities set out in the Data Sheet (see Point 4.2):

- for additional prefinancings (if any): an **additional prefinancing report**
- for interim payments (if any) and the final payment: a **periodic report**.

The prefinancing and periodic reports include a technical and financial part.

The technical part includes an overview of the action implementation. It must be prepared using the template available in the Portal Periodic Reporting tool.

The financial part of the additional prefinancing report includes a statement on the use of the previous prefinancing payment.

The financial part of the periodic report includes:

- the financial statements (individual and consolidated; for all beneficiaries/affiliated entities)
- the explanation on the use of resources (or detailed cost reporting table, if required)
- the certificates on the financial statements (CFS) (if required; see Article 24.2 and Data Sheet, Point 4.3).

The **financial statements** must detail the eligible costs and contributions for each budget category and, for the final payment, also the revenues for the action (see Articles 6 and 22).

All eligible costs and contributions incurred should be declared, even if they exceed the amounts indicated in the estimated budget (see Annex 2). Amounts that are not declared in the individual financial statements will not be taken into account by the granting authority.

By signing the financial statements (directly in the Portal Periodic Reporting tool), the beneficiaries confirm that:

- the information provided is complete, reliable and true
- the costs and contributions declared are eligible (see Article 6)
- the costs and contributions can be substantiated by adequate records and supporting documents (see Article 20) that will be produced upon request (see Article 19) or in the context of checks, reviews, audits and investigations (see Article 25)
- for the final periodic report: all the revenues have been declared (if required; see Article 22).

Beneficiaries will have to submit also the financial statements of their affiliated entities (if any). In case of recoveries (see Article 22), beneficiaries will be held responsible also for the financial statements of their affiliated entities.

21.3 Currency for financial statements and conversion into euros

The financial statements must be drafted in euro.

Beneficiaries with general accounts established in a currency other than the euro must convert the costs recorded in their accounts into euro, at the average of the daily exchange rates published in the C series of the *Official Journal of the European Union* (ECB website), calculated over the corresponding reporting period.

If no daily euro exchange rate is published in the *Official Journal* for the currency in question, they must be converted at the average of the monthly accounting exchange rates published on the European Commission website (InforEuro), calculated over the corresponding reporting period.

Beneficiaries with general accounts in euro must convert costs incurred in another currency into euro according to their usual accounting practices.

21.4 Reporting language

The reporting must be in the language of the Agreement, unless otherwise agreed with the granting authority (see Data Sheet, Point 4.2).

21.5 Consequences of non-compliance

If a report submitted does not comply with this Article, the granting authority may suspend the payment deadline (see Article 29) and apply other measures described in Chapter 5.

If the coordinator breaches its reporting obligations, the granting authority may terminate the grant or the coordinator's participation (see Article 32) or apply other measures described in Chapter 5.

ARTICLE 22 — PAYMENTS AND RECOVERIES — CALCULATION OF AMOUNTS DUE

22.1 Payments and payment arrangements

Payments will be made in accordance with the schedule and modalities set out in the Data Sheet (see Point 4.2).

They will be made in euro to the bank account indicated by the coordinator (see Data Sheet, Point 4.2) and must be distributed without unjustified delay (restrictions may apply to distribution of the initial prefinancing payment; see Data Sheet, Point 4.2).

Payments to this bank account will discharge the granting authority from its payment obligation.

The cost of payment transfers will be borne as follows:

- the granting authority bears the cost of transfers charged by its bank
- the beneficiary bears the cost of transfers charged by its bank

- the party causing a repetition of a transfer bears all costs of the repeated transfer.

Payments by the granting authority will be considered to have been carried out on the date when they are debited to its account.

22.2 Recoveries

Recoveries will be made, if — at beneficiary termination, final payment or afterwards — it turns out that the granting authority has paid too much and needs to recover the amounts undue.

Each beneficiary's financial responsibility in case of recovery is in principle limited to their own debt and undue amounts of their affiliated entities.

In case of enforced recoveries (see Article 22.4), affiliated entities will be held liable for repaying debts of their beneficiaries, if required by the granting authority (see Data Sheet, Point 4.4).

22.3 Amounts due

22.3.1 Prefinancing payments

The aim of the prefinancing is to provide the beneficiaries with a float.

It remains the property of the EU until the final payment.

For **initial prefinancings** (if any), the amount due, schedule and modalities are set out in the Data Sheet (see Point 4.2).

For **additional prefinancings** (if any), the amount due, schedule and modalities are also set out in the Data Sheet (see Point 4.2). However, if the statement on the use of the previous prefinancing payment shows that less than 70% was used, the amount set out in the Data Sheet will be reduced by the difference between the 70% threshold and the amount used.

The contribution to the Mutual Insurance Mechanism will be retained from the prefinancing payments (at the rate and in accordance with the modalities set out in the Data Sheet, see Point 4.2) and transferred to the Mechanism.

Prefinancing payments (or parts of them) may be offset (without the beneficiaries' consent) against amounts owed by a beneficiary to the granting authority — up to the amount due to that beneficiary.

For grants where the granting authority is the European Commission or an EU executive agency, offsetting may also be done against amounts owed to other Commission services or executive agencies.

Payments will not be made if the payment deadline or payments are suspended (see Articles 29 and 30).

22.3.2 Amount due at beneficiary termination — Recovery

In case of beneficiary termination, the granting authority will determine the provisional amount due for the beneficiary concerned. Payments (if any) will be made with the next interim or final payment.

The **amount due** will be calculated in the following step:

Step 1 — Calculation of the total accepted EU contribution

Step 1 — Calculation of the total accepted EU contribution

The granting authority will first calculate the 'accepted EU contribution' for the beneficiary for all reporting periods, by calculating the 'maximum EU contribution to costs' (applying the funding rate to the accepted costs of the beneficiary), taking into account requests for a lower contribution to costs and CFS threshold cappings (if any; see Article 24.5) and adding the contributions (accepted unit, flat-rate or lump sum contributions and financing not linked to costs, if any).

After that, the granting authority will take into account grant reductions (if any). The resulting amount is the 'total accepted EU contribution' for the beneficiary.

The **balance** is then calculated by deducting the payments received (if any; see report on the distribution of payments in Article 32), from the total accepted EU contribution:

{total accepted EU contribution for the beneficiary

minus

{prefinancing and interim payments received (if any)}}.

If the balance is **positive**, the amount will be included in the next interim or final payment to the consortium.

If the balance is **negative**, it will be **recovered** in accordance with the following procedure:

The granting authority will send a **pre-information letter** to the beneficiary concerned:

- formally notifying the intention to recover, the amount due, the amount to be recovered and the reasons why and
- requesting observations within 30 days of receiving notification.

If no observations are submitted (or the granting authority decides to pursue recovery despite the observations it has received), it will confirm the amount to be recovered and ask this amount to be paid to the coordinator (**confirmation letter**).

If payment is not made to the coordinator by the date specified in the confirmation letter, the granting authority may call on the Mutual Insurance Mechanism to intervene, if continuation of the action is guaranteed and the conditions set out in the rules governing the Mechanism are met.

In this case, it will send a **beneficiary recovery letter**, together with a **debit note** with the terms and date for payment.

The debit note for the beneficiary will include the amount calculated for the affiliated entities which also had to end their participation (if any).

If payment is not made by the date specified in the debit note, the granting authority will **enforce recovery** in accordance with Article 22.4.

The amounts will later on also be taken into account for the next interim or final payment.

22.3.3 Interim payments

Interim payments reimburse the eligible costs and contributions claimed for the implementation of the action during the reporting periods (if any).

Interim payments (if any) will be made in accordance with the schedule and modalities set out the Data Sheet (see Point 4.2).

Payment is subject to the approval of the periodic report. Its approval does not imply recognition of compliance, authenticity, completeness or correctness of its content.

The **interim payment** will be calculated by the granting authority in the following steps:

Step 1 — Calculation of the total accepted EU contribution

Step 2 — Limit to the interim payment ceiling

Step 1 — Calculation of the total accepted EU contribution

The granting authority will calculate the 'accepted EU contribution' for the action for the reporting period, by first calculating the 'maximum EU contribution to costs' (applying the funding rate to the accepted costs of each beneficiary), taking into account requests for a lower contribution to costs, and CFS threshold cappings (if any; see Article 24.5) and adding the contributions (accepted unit, flat-rate or lump sum contributions and financing not linked to costs, if any).

After that, the granting authority will take into account grant reductions from beneficiary termination (if any). The resulting amount is the 'total accepted EU contribution'.

Step 2 — Limit to the interim payment ceiling

The resulting amount is then capped to ensure that the total amount of prefinancing and interim payments (if any) does not exceed the interim payment ceiling set out in the Data Sheet (see Point 4.2).

Interim payments (or parts of them) may be offset (without the beneficiaries' consent) against amounts owed by a beneficiary to the granting authority — up to the amount due to that beneficiary.

For grants where the granting authority is the European Commission or an EU executive agency, offsetting may also be done against amounts owed to other Commission services or executive agencies.

Payments will not be made if the payment deadline or payments are suspended (see Articles 29 and 30).

22.3.4 Final payment — Final grant amount — Revenues and Profit — Recovery

The final payment (payment of the balance) reimburses the remaining part of the eligible costs and contributions claimed for the implementation of the action (if any).

The final payment will be made in accordance with the schedule and modalities set out in the Data Sheet (see Point 4.2).

Payment is subject to the approval of the final periodic report. Its approval does not imply recognition of compliance, authenticity, completeness or correctness of its content.

The **final grant amount for the action** will be calculated in the following steps:

Step 1 — Calculation of the total accepted EU contribution

Step 2 — Limit to the maximum grant amount

Step 3 — Reduction due to the no-profit rule

Step 1 — Calculation of the total accepted EU contribution

The granting authority will first calculate the 'accepted EU contribution' for the action for all reporting periods, by calculating the 'maximum EU contribution to costs' (applying the funding rate to the total accepted costs of each beneficiary), taking into account requests for a lower contribution to costs, CFS threshold cappings (if any; see Article 24.5) and adding the contributions (accepted unit, flat-rate or lump sum contributions and financing not linked to costs, if any).

After that, the granting authority will take into account grant reductions (if any). The resulting amount is the 'total accepted EU contribution'.

Step 2 — Limit to the maximum grant amount

If the resulting amount is higher than the maximum grant amount set out in Article 5.2, it will be limited to the latter.

Step 3 — Reduction due to the no-profit rule

If the no-profit rule is provided for in the Data Sheet (see Point 4.2), the grant must not produce a profit (i.e. surplus of the amount obtained following Step 2 plus the action's revenues, over the eligible costs and contributions approved by the granting authority).

'Revenue' is all income generated by the action, during its duration (see Article 4), for beneficiaries that are profit legal entities (— with the exception of income generated by the exploitation of results, which are not considered as revenues).

If there is a profit, it will be deducted in proportion to the final rate of reimbursement of the eligible costs approved by the granting authority (as compared to the amount calculated following Steps 1 and 2 minus the contributions).

The **balance** (final payment) is then calculated by deducting the total amount of prefinancing and interim payments already made (if any), from the final grant amount:

{final grant amount

minus

{prefinancing and interim payments made (if any)}}.

If the balance is **positive**, it will be **paid** to the coordinator.

The amount retained for the Mutual Insurance Mechanism (see above) will be released and **paid** to the coordinator (in accordance with the rules governing the Mechanism).

The final payment (or part of it) may be offset (without the beneficiaries' consent) against amounts owed by a beneficiary to the granting authority — up to the amount due to that beneficiary.

For grants where the granting authority is the European Commission or an EU executive agency,

offsetting may also be done against amounts owed to other Commission services or executive agencies.

Payments will not be made if the payment deadline or payments are suspended (see Articles 29 and 30).

If — despite the release of the Mutual Insurance Mechanism contribution — the balance is **negative**, it will be **recovered** in accordance with the following procedure:

The granting authority will send a **pre-information letter** to the coordinator:

- formally notifying the intention to recover, the final grant amount, the amount to be recovered and the reasons why
- requesting a report on the distribution of payments to the beneficiaries within 30 days of receiving notification and
- requesting observations within 30 days of receiving notification.

If no observations are submitted (or the granting authority decides to pursue recovery despite the observations it has received) and the coordinator has submitted the report on the distribution of payments, it will calculate the **share of the debt per beneficiary**, by:

(a) identifying the beneficiaries for which the amount calculated as follows is negative:

{{{total accepted EU contribution for the beneficiary

divided by

total accepted EU contribution for the action}

multiplied by

final grant amount for the action},

minus

{prefinancing and interim payments received by the beneficiary (if any)}}

and

(b) dividing the debt:

{{amount calculated according to point (a) for the beneficiary concerned

divided by

the sum of the amounts calculated according to point (a) for all the beneficiaries identified according to point (a)}

multiplied by

the amount to be recovered}.

and confirm the amount to be recovered from each beneficiary concerned (**confirmation letter**), together with **debit notes** with the terms and date for payment.

The debit notes for beneficiaries will include the amounts calculated for their affiliated entities (if any).

If the coordinator has not submitted the report on the distribution of payments, the granting authority will **recover** the full amount from the coordinator (**confirmation letter** and **debit note** with the terms and date for payment).

If payment is not made by the date specified in the debit note, the granting authority will **enforce recovery** in accordance with Article 22.4.

22.3.5 Audit implementation after final payment — Revised final grant amount — Recovery

If — after the final payment (in particular, after checks, reviews, audits or investigations; see Article 25) — the granting authority rejects costs or contributions (see Article 27) or reduces the grant (see Article 28), it will calculate the **revised final grant amount** for the beneficiary concerned.

The **beneficiary revised final grant amount** will be calculated in the following step:

Step 1 — Calculation of the revised total accepted EU contribution

Step 1 — Calculation of the revised total accepted EU contribution

The granting authority will first calculate the 'revised accepted EU contribution' for the beneficiary, by calculating the 'revised accepted costs' and 'revised accepted contributions'.

After that, it will take into account grant reductions (if any). The resulting 'revised total accepted EU contribution' is the beneficiary revised final grant amount.

If the revised final grant amount is lower than the beneficiary's final grant amount (i.e. its share in the final grant amount for the action), it will be **recovered** in accordance with the following procedure:

The **beneficiary final grant amount** (i.e. share in the final grant amount for the action) is calculated as follows:

{{total accepted EU contribution for the beneficiary

divided by

total accepted EU contribution for the action}

multiplied by

final grant amount for the action}.

The granting authority will send a **pre-information letter** to the beneficiary concerned:

- formally notifying the intention to recover, the amount to be recovered and the reasons why and
- requesting observations within 30 days of receiving notification.

If no observations are submitted (or the granting authority decides to pursue recovery despite the observations it has received), it will confirm the amount to be recovered (**confirmation letter**), together with a **debit note** with the terms and the date for payment.

Recoveries against affiliated entities (if any) will be handled through their beneficiaries.

If payment is not made by the date specified in the debit note, the granting authority will **enforce recovery** in accordance with Article 22.4.

22.4 Enforced recovery

If payment is not made by the date specified in the debit note, the amount due will be recovered:

(a) by offsetting the amount — without the coordinator or beneficiary's consent — against any amounts owed to the coordinator or beneficiary by the granting authority.

In exceptional circumstances, to safeguard the EU financial interests, the amount may be offset before the payment date specified in the debit note.

For grants where the granting authority is the European Commission or an EU executive agency, debts may also be offset against amounts owed by other Commission services or executive agencies.

(b) financial guarantee(s): not applicable

(c) joint and several liability of beneficiaries: not applicable

(d) by holding affiliated entities jointly and severally liable (if any, see Data Sheet, Point 4.4)

(e) by taking legal action (see Article 43) or, provided that the granting authority is the European Commission or an EU executive agency, by adopting an enforceable decision under Article 299 of the Treaty on the Functioning of the EU (TFEU) and Article 100(2) of EU Financial Regulation 2018/1046.

If the Mutual Insurance Mechanism was called on by the granting authority to intervene, recovery will be continued in the name of the Mutual Insurance Mechanism. If two debit notes were sent, the second one (in the name of the Mutual Insurance Mechanism) will be considered to replace the first one (in the name of the granting authority). Where the MIM intervened, offsetting, enforceable decisions or any other of the above-mentioned forms of enforced recovery may be used mutatis mutandis.

The amount to be recovered will be increased by **late-payment interest** at the rate set out in Article 22.5, from the day following the payment date in the debit note, up to and including the date the full payment is received.

Partial payments will be first credited against expenses, charges and late-payment interest and then against the principal.

Bank charges incurred in the recovery process will be borne by the beneficiary, unless Directive 2015/2366[18] applies.

For grants where the granting authority is an EU executive agency, enforced recovery by offsetting or enforceable decision will be done by the services of the European Commission (see also Article 43).

22.5 Consequences of non-compliance

[18] Directive (EU) 2015/2366 of the European Parliament and of the Council of 25 November 2015 on payment services in the internal market, amending Directives 2002/65/EC, 2009/110/EC and 2013/36/EU and Regulation (EU) No 1093/2010, and repealing Directive 2007/64/EC (OJ L 337, 23.12.2015, p. 35).

22.5.1 If the granting authority does not pay within the payment deadlines (see above), the beneficiaries are entitled to **late-payment interest** at the rate applied by the European Central Bank (ECB) for its main refinancing operations in euros ('reference rate'), plus the rate specified in the Data Sheet (Point 4.2). The reference rate is the rate in force on the first day of the month in which the payment deadline expires, as published in the C series of the *Official Journal of the European Union*.

If the late-payment interest is lower than or equal to EUR 200, it will be paid to the coordinator only on request submitted within two months of receiving the late payment.

Late-payment interest is not due if all beneficiaries are EU Member States (including regional and local government authorities or other public bodies acting on behalf of a Member State for the purpose of this Agreement).

If payments or the payment deadline are suspended (see Articles 29 and 30), payment will not be considered as late.

Late-payment interest covers the period running from the day following the due date for payment (see above), up to and including the date of payment.

Late-payment interest is not considered for the purposes of calculating the final grant amount.

22.5.2 If the coordinator breaches any of its obligations under this Article, the grant may be reduced (see Article 28) and the grant or the coordinator may be terminated (see Article 32).

Such breaches may also lead to other measures described in Chapter 5.

ARTICLE 23 — GUARANTEES

Not applicable

ARTICLE 24 — CERTIFICATES

24.1 Operational verification report (OVR)

Not applicable

24.2 Certificate on the financial statements (CFS)

If required by the granting authority (see Data Sheet, Point 4.3), the beneficiaries must provide certificates on their financial statements (CFS), in accordance with the schedule, threshold and conditions set out in the Data Sheet.

The coordinator must submit them as part of the periodic report (see Article 21).

The certificates must be drawn up using the template published on the Portal, cover the costs declared on the basis of actual costs and costs according to usual cost accounting practices (if any), and fulfil the following conditions:

(a) be provided by a qualified approved external auditor which is independent and complies with Directive 2006/43/EC[19] (or for public bodies: by a competent independent public officer)

(b) the verification must be carried out according to the highest professional standards to ensure that the financial statements comply with the provisions under the Agreement and that the costs declared are eligible.

The certificates will not affect the granting authority's right to carry out its own checks, reviews or audits, nor preclude the European Court of Auditors (ECA), the European Public Prosecutor's Office (EPPO) or the European Anti-Fraud Office (OLAF) from using their prerogatives for audits and investigations under the Agreement (see Article 25).

If the costs (or a part of them) were already audited by the granting authority, these costs do not need to be covered by the certificate and will not be counted for calculating the threshold (if any).

24.3 Certificate on the compliance of usual cost accounting practices (CoMUC)

Not applicable

24.4 Systems and process audit (SPA)

Beneficiaries which:

- use unit, flat rate or lump sum costs or contributions according to documented (i.e. formally approved and in writing) usual costs accounting practices (if any) or

- have formalised documentation on the systems and processes for calculating their costs and contributions (i.e. formally approved and in writing), have participated in at least 150 actions under Horizon 2020 or the Euratom Research and Training Programme (2014-2018 or 2019-2020) and participate in at least 3 ongoing actions under Horizon Europe or the Euratom Research and Training Programme (2021-2025 or 2026-2027)

may apply to the granting authority for a systems and process audit (SPA).

This audit will be carried out as follows:

Step 1 – Application by the beneficiary.

Step 2 – If the application is accepted, the granting authority will carry out the systems and process audit, complemented by an audit of transactions (on a sample of the beneficiary's Horizon Europe or the Euratom Research and Training Programme financial statements).

Step 3 – The audit result will take the form of a risk assessment classification for the beneficiary: low, medium or high.

Low-risk beneficiaries will benefit from less (or less in-depth) ex-post audits (see Article 25) and a higher threshold for submitting certificates on the financial statements (CFS; see Articles 21 and 24.2 and Data Sheet, Point 4.3).

[19] Directive 2006/43/EC of the European Parliament and of the Council of 17 May 2006 on statutory audits of annual accounts and consolidated accounts or similar national regulations (OJ L 157, 9.6.2006, p. 87).

24.5 Consequences of non-compliance

If a beneficiary does not submit a certificate on the financial statements (CFS) or the certificate is rejected, the accepted EU contribution to costs will be capped to reflect the CFS threshold.

If a beneficiary breaches any of its other obligations under this Article, the granting authority may apply the measures described in Chapter 5.

ARTICLE 25 — CHECKS, REVIEWS, AUDITS AND INVESTIGATIONS — EXTENSION OF FINDINGS

25.1 Granting authority checks, reviews and audits

25.1.1 Internal checks

The granting authority may — during the action or afterwards — check the proper implementation of the action and compliance with the obligations under the Agreement, including assessing costs and contributions, deliverables and reports.

25.1.2 Project reviews

The granting authority may carry out reviews on the proper implementation of the action and compliance with the obligations under the Agreement (general project reviews or specific issues reviews).

Such project reviews may be started during the implementation of the action and until the time-limit set out in the Data Sheet (see Point 6). They will be formally notified to the coordinator or beneficiary concerned and will be considered to start on the date of the notification.

If needed, the granting authority may be assisted by independent, outside experts. If it uses outside experts, the coordinator or beneficiary concerned will be informed and have the right to object on grounds of commercial confidentiality or conflict of interest.

The coordinator or beneficiary concerned must cooperate diligently and provide — within the deadline requested — any information and data in addition to deliverables and reports already submitted (including information on the use of resources). The granting authority may request beneficiaries to provide such information to it directly. Sensitive information and documents will be treated in accordance with Article 13.

The coordinator or beneficiary concerned may be requested to participate in meetings, including with the outside experts.

For **on-the-spot visits**, the beneficiary concerned must allow access to sites and premises (including to the outside experts) and must ensure that information requested is readily available.

Information provided must be accurate, precise and complete and in the format requested, including electronic format.

On the basis of the review findings, a **project review report** will be drawn up.

The granting authority will formally notify the project review report to the coordinator or beneficiary concerned, which has 30 days from receiving notification to make observations.

Project reviews (including project review reports) will be in the language of the Agreement.

25.1.3 Audits

The granting authority may carry out audits on the proper implementation of the action and compliance with the obligations under the Agreement.

Such audits may be started during the implementation of the action and until the time-limit set out in the Data Sheet (see Point 6). They will be formally notified to the beneficiary concerned and will be considered to start on the date of the notification.

The granting authority may use its own audit service, delegate audits to a centralised service or use external audit firms. If it uses an external firm, the beneficiary concerned will be informed and have the right to object on grounds of commercial confidentiality or conflict of interest.

The beneficiary concerned must cooperate diligently and provide — within the deadline requested — any information (including complete accounts, individual salary statements or other personal data) to verify compliance with the Agreement. Sensitive information and documents will be treated in accordance with Article 13.

For **on-the-spot** visits, the beneficiary concerned must allow access to sites and premises (including for the external audit firm) and must ensure that information requested is readily available.

Information provided must be accurate, precise and complete and in the format requested, including electronic format.

On the basis of the audit findings, a **draft audit report** will be drawn up.

The auditors will formally notify the draft audit report to the beneficiary concerned, which has 30 days from receiving notification to make observations (contradictory audit procedure).

The **final audit report** will take into account observations by the beneficiary concerned and will be formally notified to them.

Audits (including audit reports) will be in the language of the Agreement.

25.2 European Commission checks, reviews and audits in grants of other granting authorities

Where the granting authority is not the European Commission, the latter has the same rights of checks, reviews and audits as the granting authority.

25.3 Access to records for assessing simplified forms of funding

The beneficiaries must give the European Commission access to their statutory records for the periodic assessment of simplified forms of funding which are used in EU programmes.

25.4 OLAF, EPPO and ECA audits and investigations

The following bodies may also carry out checks, reviews, audits and investigations — during the action or afterwards:

- the European Anti-Fraud Office (OLAF) under Regulations No 883/2013[20] and No 2185/96[21]

- the European Public Prosecutor's Office (EPPO) under Regulation 2017/1939

- the European Court of Auditors (ECA) under Article 287 of the Treaty on the Functioning of the EU (TFEU) and Article 257 of EU Financial Regulation 2018/1046.

If requested by these bodies, the beneficiary concerned must provide full, accurate and complete information in the format requested (including complete accounts, individual salary statements or other personal data, including in electronic format) and allow access to sites and premises for on-the-spot visits or inspections — as provided for under these Regulations.

To this end, the beneficiary concerned must keep all relevant information relating to the action, at least until the time-limit set out in the Data Sheet (Point 6) and, in any case, until any ongoing checks, reviews, audits, investigations, litigation or other pursuits of claims have been concluded.

25.5 Consequences of checks, reviews, audits and investigations — Extension of results of reviews, audits or investigations

25.5.1 Consequences of checks, reviews, audits and investigations in this grant

Findings in checks, reviews, audits or investigations carried out in the context of this grant may lead to rejections (see Article 27), grant reduction (see Article 28) or other measures described in Chapter 5.

Rejections or grant reductions after the final payment will lead to a revised final grant amount (see Article 22).

Findings in checks, reviews, audits or investigations during the action implementation may lead to a request for amendment (see Article 39), to change the description of the action set out in Annex 1.

Checks, reviews, audits or investigations that find systemic or recurrent errors, irregularities, fraud or breach of obligations in any EU grant may also lead to consequences in other EU grants awarded under similar conditions ('extension to other grants').

Moreover, findings arising from an OLAF or EPPO investigation may lead to criminal prosecution under national law.

25.5.2 Extension from other grants

Results of checks, reviews, audits or investigations in other grants may be extended to this grant, if:

(a) the beneficiary concerned is found, in other EU grants awarded under similar conditions, to have committed systemic or recurrent errors, irregularities, fraud or breach of obligations that have a material impact on this grant and

[20] Regulation (EU, Euratom) No 883/2013 of the European Parliament and of the Council of 11 September 2013 concerning investigations conducted by the European Anti-Fraud Office (OLAF) and repealing Regulation (EC) No 1073/1999 of the European Parliament and of the Council and Council Regulation (Euratom) No 1074/1999 (OJ L 248, 18/09/2013, p. 1).

[21] Council Regulation (Euratom, EC) No 2185/96 of 11 November 1996 concerning on-the-spot checks and inspections carried out by the Commission in order to protect the European Communities' financial interests against fraud and other irregularities (OJ L 292, 15/11/1996, p. 2).

(b) those findings are formally notified to the beneficiary concerned — together with the list of grants affected by the findings — within the time-limit for audits set out in the Data Sheet (see Point 6).

The granting authority will formally notify the beneficiary concerned of the intention to extend the findings and the list of grants affected.

If the extension concerns **rejections of costs or contributions**: the notification will include:

(a) an invitation to submit observations on the list of grants affected by the findings

(b) the request to submit revised financial statements for all grants affected

(c) the correction rate for extrapolation, established on the basis of the systemic or recurrent errors, to calculate the amounts to be rejected, if the beneficiary concerned:

(i) considers that the submission of revised financial statements is not possible or practicable or

(ii) does not submit revised financial statements.

If the extension concerns **grant reductions**: the notification will include:

(a) an invitation to submit observations on the list of grants affected by the findings and

(b) the **correction rate for extrapolation**, established on the basis of the systemic or recurrent errors and the principle of proportionality.

The beneficiary concerned has **60 days** from receiving notification to submit observations, revised financial statements or to propose a duly substantiated **alternative correction method/rate**.

On the basis of this, the granting authority will analyse the impact and decide on the implementation (i.e. start rejection or grant reduction procedures, either on the basis of the revised financial statements or the announced/alternative method/rate or a mix of those; see Articles 27 and 28).

25.6 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, costs or contributions insufficiently substantiated will be ineligible (see Article 6) and will be rejected (see Article 27), and the grant may be reduced (see Article 28).

Such breaches may also lead to other measures described in Chapter 5.

ARTICLE 26 — IMPACT EVALUATIONS

26.1 Impact evaluation

The granting authority may carry out impact evaluations of the action, measured against the objectives and indicators of the EU programme funding the grant.

Such evaluations may be started during implementation of the action and until the time-limit set out

in the Data Sheet (see Point 6). They will be formally notified to the coordinator or beneficiaries and will be considered to start on the date of the notification.

If needed, the granting authority may be assisted by independent outside experts.

The coordinator or beneficiaries must provide any information relevant to evaluate the impact of the action, including information in electronic format.

26.2 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the granting authority may apply the measures described in Chapter 5.

CHAPTER 5 CONSEQUENCES OF NON-COMPLIANCE

SECTION 1 REJECTIONS AND GRANT REDUCTION

ARTICLE 27 — REJECTION OF COSTS AND CONTRIBUTIONS

27.1 Conditions

The granting authority will — at beneficiary termination, interim payment, final payment or afterwards — reject any costs or contributions which are ineligible (see Article 6), in particular following checks, reviews, audits or investigations (see Article 25).

The rejection may also be based on the extension of findings from other grants to this grant (see Article 25).

Ineligible costs or contributions will be rejected.

27.2 Procedure

If the rejection does not lead to a recovery, the granting authority will formally notify the coordinator or beneficiary concerned of the rejection, the amounts and the reasons why. The coordinator or beneficiary concerned may — within 30 days of receiving notification — submit observations if it disagrees with the rejection (payment review procedure).

If the rejection leads to a recovery, the granting authority will follow the contradictory procedure with pre-information letter set out in Article 22.

27.3 Effects

If the granting authority rejects costs or contributions, it will deduct them from the costs or contributions declared and then calculate the amount due (and, if needed, make a recovery; see Article 22).

ARTICLE 28 — GRANT REDUCTION

28.1 Conditions

The granting authority may — at beneficiary termination, final payment or afterwards — reduce the grant for a beneficiary, if:

(a) the beneficiary (or a person having powers of representation, decision-making or control, or person essential for the award/implementation of the grant) has committed:

(i) substantial errors, irregularities or fraud or

(ii) serious breach of obligations under this Agreement or during its award (including improper implementation of the action, non-compliance with the call conditions, submission of false information, failure to provide required information, breach of ethics or security rules (if applicable), etc.), or

(b) the beneficiary (or a person having powers of representation, decision-making or control, or person essential for the award/implementation of the grant) has committed — in other EU grants awarded to it under similar conditions — systemic or recurrent errors, irregularities, fraud or serious breach of obligations that have a material impact on this grant (see Article 25).

The amount of the reduction will be calculated for each beneficiary concerned and proportionate to the seriousness and the duration of the errors, irregularities or fraud or breach of obligations, by applying an individual reduction rate to their accepted EU contribution.

28.2 Procedure

If the grant reduction does not lead to a recovery, the granting authority will formally notify the coordinator or beneficiary concerned of the reduction, the amount to be reduced and the reasons why. The coordinator or beneficiary concerned may — within 30 days of receiving notification — submit observations if it disagrees with the reduction (payment review procedure).

If the grant reduction leads to a recovery, the granting authority will follow the contradictory procedure with pre-information letter set out in Article 22.

28.3 Effects

If the granting authority reduces the grant, it will deduct the reduction and then calculate the amount due (and, if needed, make a recovery; see Article 22).

SECTION 2 SUSPENSION AND TERMINATION

ARTICLE 29 — PAYMENT DEADLINE SUSPENSION

29.1 Conditions

The granting authority may — at any moment — suspend the payment deadline if a payment cannot be processed because:

(a) the required report (see Article 21) has not been submitted or is not complete or additional information is needed

(b) there are doubts about the amount to be paid (e.g. ongoing audit extension procedure, queries

about eligibility, need for a grant reduction, etc.) and additional checks, reviews, audits or investigations are necessary, or

(c) there are other issues affecting the EU financial interests.

29.2 Procedure

The granting authority will formally notify the coordinator of the suspension and the reasons why.

The suspension will **take effect** the day the notification is sent.

If the conditions for suspending the payment deadline are no longer met, the suspension will be **lifted** — and the remaining time to pay (see Data Sheet, Point 4.2) will resume.

If the suspension exceeds two months, the coordinator may request the granting authority to confirm if the suspension will continue.

If the payment deadline has been suspended due to the non-compliance of the report and the revised report is not submitted (or was submitted but is also rejected), the granting authority may also terminate the grant or the participation of the coordinator (see Article 32).

ARTICLE 30 — PAYMENT SUSPENSION

30.1 Conditions

The granting authority may — at any moment — suspend payments, in whole or in part for one or more beneficiaries, if:

(a) a beneficiary (or a person having powers of representation, decision-making or control, or person essential for the award/implementation of the grant) has committed or is suspected of having committed:

(i) substantial errors, irregularities or fraud or

(ii) serious breach of obligations under this Agreement or during its award (including improper implementation of the action, non-compliance with the call conditions, submission of false information, failure to provide required information, breach of ethics or security rules (if applicable), etc.), or

(b) a beneficiary (or a person having powers of representation, decision-making or control, or person essential for the award/implementation of the grant) has committed — in other EU grants awarded to it under similar conditions — systemic or recurrent errors, irregularities, fraud or serious breach of obligations that have a material impact on this grant.

If payments are suspended for one or more beneficiaries, the granting authority will make partial payment(s) for the part(s) not suspended. If suspension concerns the final payment, the payment (or recovery) of the remaining amount after suspension is lifted will be considered to be the payment that closes the action.

30.2 Procedure

Before suspending payments, the granting authority will send a **pre-information letter** to the beneficiary concerned:

- formally notifying the intention to suspend payments and the reasons why and
- requesting observations within 30 days of receiving notification.

If the granting authority does not receive observations or decides to pursue the procedure despite the observations it has received, it will confirm the suspension (**confirmation letter**). Otherwise, it will formally notify that the procedure is discontinued.

At the end of the suspension procedure, the granting authority will also inform the coordinator.

The suspension will **take effect** the day after the confirmation notification is sent.

If the conditions for resuming payments are met, the suspension will be **lifted**. The granting authority will formally notify the beneficiary concerned (and the coordinator) and set the suspension end date.

During the suspension, no prefinancing will be paid to the beneficiaries concerned. For interim payments, the periodic reports for all reporting periods except the last one (see Article 21) must not contain any financial statements from the beneficiary concerned (or its affiliated entities). The coordinator must include them in the next periodic report after the suspension is lifted or — if suspension is not lifted before the end of the action — in the last periodic report.

ARTICLE 31 — GRANT AGREEMENT SUSPENSION

31.1 Consortium-requested GA suspension

31.1.1 Conditions and procedure

The beneficiaries may request the suspension of the grant or any part of it, if exceptional circumstances — in particular *force majeure* (see Article 35) — make implementation impossible or excessively difficult.

The coordinator must submit a request for **amendment** (see Article 39), with:

- the reasons why
- the date the suspension takes effect; this date may be before the date of the submission of the amendment request and
- the expected date of resumption.

The suspension will **take effect** on the day specified in the amendment.

Once circumstances allow for implementation to resume, the coordinator must immediately request another **amendment** of the Agreement to set the suspension end date, the resumption date (one day after suspension end date), extend the duration and make other changes necessary to adapt the action to the new situation (see Article 39) — unless the grant has been terminated (see Article 32). The suspension will be **lifted** with effect from the suspension end date set out in the amendment. This date may be before the date of the submission of the amendment request.

During the suspension, no prefinancing will be paid. Costs incurred or contributions for activities implemented during grant suspension are not eligible (see Article 6.3).

31.2 EU-initiated GA suspension

31.2.1 Conditions

The granting authority may suspend the grant or any part of it, if:

(a) a beneficiary (or a person having powers of representation, decision-making or control, or person essential for the award/implementation of the grant) has committed or is suspected of having committed:

(i) substantial errors, irregularities or fraud or

(ii) serious breach of obligations under this Agreement or during its award (including improper implementation of the action, non-compliance with the call conditions, submission of false information, failure to provide required information, breach of ethics or security rules (if applicable), etc.), or

(b) a beneficiary (or a person having powers of representation, decision-making or control, or person essential for the award/implementation of the grant) has committed — in other EU grants awarded to it under similar conditions — systemic or recurrent errors, irregularities, fraud or serious breach of obligations that have a material impact on this grant

(c) other:

(i) linked action issues: not applicable

(ii) the action has lost its scientific or technological relevance, for EIC Accelerator actions: the action has lost its economic relevance, for challenge-based EIC Pathfinder actions and Horizon Europe Missions: the action has lost its relevance as part of the Portfolio for which it has been initially selected

31.2.2 Procedure

Before suspending the grant, the granting authority will send a **pre-information letter** to the coordinator:

- formally notifying the intention to suspend the grant and the reasons why and
- requesting observations within 30 days of receiving notification.

If the granting authority does not receive observations or decides to pursue the procedure despite the observations it has received, it will confirm the suspension (**confirmation letter**). Otherwise, it will formally notify that the procedure is discontinued.

The suspension will **take effect** the day after the confirmation notification is sent (or on a later date specified in the notification).

Once the conditions for resuming implementation of the action are met, the granting authority will formally notify the coordinator a **lifting of suspension letter**, in which it will set the suspension end date and invite the coordinator to request an amendment of the Agreement to set the resumption

date (one day after suspension end date), extend the duration and make other changes necessary to adapt the action to the new situation (see Article 39) — unless the grant has been terminated (see Article 32). The suspension will be **lifted** with effect from the suspension end date set out in the lifting of suspension letter. This date may be before the date on which the letter is sent.

During the suspension, no prefinancing will be paid. Costs incurred or contributions for activities implemented during suspension are not eligible (see Article 6.3).

The beneficiaries may not claim damages due to suspension by the granting authority (see Article 33).

Grant suspension does not affect the granting authority's right to terminate the grant or a beneficiary (see Article 32) or reduce the grant (see Article 28).

ARTICLE 32 — GRANT AGREEMENT OR BENEFICIARY TERMINATION

32.1 Consortium-requested GA termination

32.1.1 Conditions and procedure

The beneficiaries may request the termination of the grant.

The coordinator must submit a request for **amendment** (see Article 39), with:

- the reasons why
- the date the consortium ends work on the action ('end of work date') and
- the date the termination takes effect ('termination date'); this date must be after the date of the submission of the amendment request.

The termination will **take effect** on the termination date specified in the amendment.

If no reasons are given or if the granting authority considers the reasons do not justify termination, it may consider the grant terminated improperly.

32.1.2 Effects

The coordinator must — within 60 days from when termination takes effect — submit a **periodic report** (for the open reporting period until termination).

The granting authority will calculate the final grant amount and final payment on the basis of the report submitted and taking into account the costs incurred and contributions for activities implemented before the end of work date (see Article 22). Costs relating to contracts due for execution only after the end of work are not eligible.

If the granting authority does not receive the report within the deadline, only costs and contributions which are included in an approved periodic report will be taken into account (no costs/contributions if no periodic report was ever approved).

Improper termination may lead to a grant reduction (see Article 28).

After termination, the beneficiaries' obligations (in particular Articles 13 (confidentiality and security), 16 (IPR), 17 (communication, dissemination and visibility), 21 (reporting), 25 (checks,

reviews, audits and investigations), 26 (impact evaluation), 27 (rejections), 28 (grant reduction) and 42 (assignment of claims)) continue to apply.

32.2 Consortium-requested beneficiary termination

32.2.1 Conditions and procedure

The coordinator may request the termination of the participation of one or more beneficiaries, on request of the beneficiary concerned or on behalf of the other beneficiaries.

The coordinator must submit a request for **amendment** (see Article 39), with:

- the reasons why
- the opinion of the beneficiary concerned (or proof that this opinion has been requested in writing)
- the date the beneficiary ends work on the action ('end of work date')
- the date the termination takes effect ('termination date'); this date must be after the date of the submission of the amendment request.

If the termination concerns the coordinator and is done without its agreement, the amendment request must be submitted by another beneficiary (acting on behalf of the consortium).

The termination will **take effect** on the termination date specified in the amendment.

If no information is given or if the granting authority considers that the reasons do not justify termination, it may consider the beneficiary to have been terminated improperly.

32.2.2 Effects

The coordinator must — within 60 days from when termination takes effect — submit:

(i) a **report on the distribution of payments** to the beneficiary concerned

(ii) a **termination report** from the beneficiary concerned, for the open reporting period until termination, containing an overview of the progress of the work, the financial statement, the explanation on the use of resources, and, if applicable, the certificate on the financial statement (CFS; see Articles 21 and 24.2 and Data Sheet, Point 4.3)

(iii) a second **request for amendment** (see Article 39) with other amendments needed (e.g. reallocation of the tasks and the estimated budget of the terminated beneficiary; addition of a new beneficiary to replace the terminated beneficiary; change of coordinator, etc.).

The granting authority will calculate the amount due to the beneficiary on the basis of the report submitted and taking into account the costs incurred and contributions for activities implemented before the end of work date (see Article 22). Costs relating to contracts due for execution only after the end of work are not eligible.

The information in the termination report must also be included in the periodic report for the next reporting period (see Article 21).

If the granting authority does not receive the termination report within the deadline, only costs and contributions which are included in an approved periodic report will be taken into account (no costs/ contributions if no periodic report was ever approved).

If the granting authority does not receive the report on the distribution of payments within the deadline, it will consider that:

- the coordinator did not distribute any payment to the beneficiary concerned and that
- the beneficiary concerned must not repay any amount to the coordinator.

If the second request for amendment is accepted by the granting authority, the Agreement is **amended** to introduce the necessary changes (see Article 39).

If the second request for amendment is rejected by the granting authority (because it calls into question the decision awarding the grant or breaches the principle of equal treatment of applicants), the grant may be terminated (see Article 32).

Improper termination may lead to a reduction of the grant (see Article 31) or grant termination (see Article 32).

After termination, the concerned beneficiary's obligations (in particular Articles 13 (confidentiality and security), 16 (IPR), 17 (communication, dissemination and visibility), 21 (reporting), 25 (checks, reviews, audits and investigations), 26 (impact evaluation), 27 (rejections), 28 (grant reduction) and 42 (assignment of claims)) continue to apply.

32.3 EU-initiated GA or beneficiary termination

32.3.1 Conditions

The granting authority may terminate the grant or the participation of one or more beneficiaries, if:

(a) one or more beneficiaries do not accede to the Agreement (see Article 40)

(b) a change to the action or the legal, financial, technical, organisational or ownership situation of a beneficiary is likely to substantially affect the implementation of the action or calls into question the decision to award the grant (including changes linked to one of the exclusion grounds listed in the declaration of honour)

(c) following termination of one or more beneficiaries, the necessary changes to the Agreement (and their impact on the action) would call into question the decision awarding the grant or breach the principle of equal treatment of applicants

(d) implementation of the action has become impossible or the changes necessary for its continuation would call into question the decision awarding the grant or breach the principle of equal treatment of applicants

(e) a beneficiary (or person with unlimited liability for its debts) is subject to bankruptcy proceedings or similar (including insolvency, winding-up, administration by a liquidator or court, arrangement with creditors, suspension of business activities, etc.)

(f) a beneficiary (or person with unlimited liability for its debts) is in breach of social security or tax obligations

(g) a beneficiary (or person having powers of representation, decision-making or control, or person essential for the award/implementation of the grant) has been found guilty of grave professional misconduct

(h) a beneficiary (or person having powers of representation, decision-making or control, or person essential for the award/implementation of the grant) has committed fraud, corruption, or is involved in a criminal organisation, money laundering, terrorism-related crimes (including terrorism financing), child labour or human trafficking

(i) a beneficiary (or person having powers of representation, decision-making or control, or person essential for the award/implementation of the grant) was created under a different jurisdiction with the intent to circumvent fiscal, social or other legal obligations in the country of origin (or created another entity with this purpose)

(j) a beneficiary (or person having powers of representation, decision-making or control, or person essential for the award/implementation of the grant) has committed:

  (i) substantial errors, irregularities or fraud or

  (ii) serious breach of obligations under this Agreement or during its award (including improper implementation of the action, non-compliance with the call conditions, submission of false information, failure to provide required information, breach of ethics or security rules (if applicable), etc.)

(k) a beneficiary (or person having powers of representation, decision-making or control, or person essential for the award/implementation of the grant) has committed — in other EU grants awarded to it under similar conditions — systemic or recurrent errors, irregularities, fraud or serious breach of obligations that have a material impact on this grant (extension of findings from other grants to this grant; see Article 25)

(l) despite a specific request by the granting authority, a beneficiary does not request — through the coordinator — an amendment to the Agreement to end the participation of one of its affiliated entities or associated partners that is in one of the situations under points (d), (f), (e), (g), (h), (i) or (j) and to reallocate its tasks, or

(m) other:

  (i) linked action issues: not applicable

  (ii) the action has lost its scientific or technological relevance, for EIC Accelerator actions: the action has lost its economic relevance, for challenge-based EIC Pathfinder actions and Horizon Europe Missions: the action has lost its relevance as part of the Portfolio for which it has been initially selected

32.3.2 Procedure

Before terminating the grant or participation of one or more beneficiaries, the granting authority will send **a pre-information letter** to the coordinator or beneficiary concerned:

- formally notifying the intention to terminate and the reasons why and
- requesting observations within 30 days of receiving notification.

If the granting authority does not receive observations or decides to pursue the procedure despite the observations it has received, it will confirm the termination and the date it will take effect (**confirmation letter**). Otherwise, it will formally notify that the procedure is discontinued.

For beneficiary terminations, the granting authority will — at the end of the procedure — also inform the coordinator.

The termination will **take effect** the day after the confirmation notification is sent (or on a later date specified in the notification; 'termination date').

32.3.3 Effects

(a) for **GA termination**:

The coordinator must — within 60 days from when termination takes effect — submit a **periodic report** (for the last open reporting period until termination).

The granting authority will calculate the final grant amount and final payment on the basis of the report submitted and taking into account the costs incurred and contributions for activities implemented before termination takes effect (see Article 22). Costs relating to contracts due for execution only after termination are not eligible.

If the grant is terminated for breach of the obligation to submit reports, the coordinator may not submit any report after termination.

If the granting authority does not receive the report within the deadline, only costs and contributions which are included in an approved periodic report will be taken into account (no costs/contributions if no periodic report was ever approved).

Termination does not affect the granting authority's right to reduce the grant (see Article 28) or to impose administrative sanctions (see Article 34).

The beneficiaries may not claim damages due to termination by the granting authority (see Article 33).

After termination, the beneficiaries' obligations (in particular Articles 13 (confidentiality and security), 16 (IPR), 17 (communication, dissemination and visibility), 21 (reporting), 25 (checks, reviews, audits and investigations), 26 (impact evaluation), 27 (rejections), 28 (grant reduction) and 42 (assignment of claims)) continue to apply.

(b) for **beneficiary termination**:

The coordinator must — within 60 days from when termination takes effect — submit:

(i) a **report on the distribution of payments** to the beneficiary concerned

(ii) a **termination report** from the beneficiary concerned, for the open reporting period until termination, containing an overview of the progress of the work, the financial

statement, the explanation on the use of resources, and, if applicable, the certificate on the financial statement (CFS; see Articles 21 and 24.2 and Data Sheet, Point 4.3)

(iii) a **request for amendment** (see Article 39) with any amendments needed (e.g. reallocation of the tasks and the estimated budget of the terminated beneficiary; addition of a new beneficiary to replace the terminated beneficiary; change of coordinator, etc.).

The granting authority will calculate the amount due to the beneficiary on the basis of the report submitted and taking into account the costs incurred and contributions for activities implemented before termination takes effect (see Article 22). Costs relating to contracts due for execution only after termination are not eligible.

The information in the termination report must also be included in the periodic report for the next reporting period (see Article 21).

If the granting authority does not receive the termination report within the deadline, only costs and contributions included in an approved periodic report will be taken into account (no costs/ contributions if no periodic report was ever approved).

If the granting authority does not receive the report on the distribution of payments within the deadline, it will consider that:

- the coordinator did not distribute any payment to the beneficiary concerned and that
- the beneficiary concerned must not repay any amount to the coordinator.

If the request for amendment is accepted by the granting authority, the Agreement is **amended** to introduce the necessary changes (see Article 39).

If the request for amendment is rejected by the granting authority (because it calls into question the decision awarding the grant or breaches the principle of equal treatment of applicants), the grant may be terminated (see Article 32).

After termination, the concerned beneficiary's obligations (in particular Articles 13 (confidentiality and security), 16 (IPR), 17 (communication, dissemination and visibility), 21 (reporting), 25 (checks, reviews, audits and investigations), 26 (impact evaluation), 27 (rejections), 28 (grant reduction) and 42 (assignment of claims)) continue to apply.

SECTION 3 OTHER CONSEQUENCES: DAMAGES AND ADMINISTRATIVE SANCTIONS

ARTICLE 33 — DAMAGES

33.1 Liability of the granting authority

The granting authority cannot be held liable for any damage caused to the beneficiaries or to third parties as a consequence of the implementation of the Agreement, including for gross negligence.

The granting authority cannot be held liable for any damage caused by any of the beneficiaries or other participants involved in the action, as a consequence of the implementation of the Agreement.

33.2 Liability of the beneficiaries

The beneficiaries must compensate the granting authority for any damage it sustains as a result of the implementation of the action or because the action was not implemented in full compliance with the Agreement, provided that it was caused by gross negligence or wilful act.

The liability does not extend to indirect or consequential losses or similar damage (such as loss of profit, loss of revenue or loss of contracts), provided such damage was not caused by wilful act or by a breach of confidentiality.

ARTICLE 34 — ADMINISTRATIVE SANCTIONS AND OTHER MEASURES

Nothing in this Agreement may be construed as preventing the adoption of administrative sanctions (i.e. exclusion from EU award procedures and/or financial penalties) or other public law measures, in addition or as an alternative to the contractual measures provided under this Agreement (see, for instance, Articles 135 to 145 EU Financial Regulation 2018/1046 and Articles 4 and 7 of Regulation 2988/95[22]).

SECTION 4 FORCE MAJEURE

ARTICLE 35 — FORCE MAJEURE

A party prevented by force majeure from fulfilling its obligations under the Agreement cannot be considered in breach of them.

'Force majeure' means any situation or event that:

- prevents either party from fulfilling their obligations under the Agreement,
- was unforeseeable, exceptional situation and beyond the parties' control,
- was not due to error or negligence on their part (or on the part of other participants involved in the action), and
- proves to be inevitable in spite of exercising all due diligence.

Any situation constituting force majeure must be formally notified to the other party without delay, stating the nature, likely duration and foreseeable effects.

The parties must immediately take all the necessary steps to limit any damage due to force majeure and do their best to resume implementation of the action as soon as possible.

CHAPTER 6 FINAL PROVISIONS

ARTICLE 36 — COMMUNICATION BETWEEN THE PARTIES

36.1 Forms and means of communication — Electronic management

[22] Council Regulation (EC, Euratom) No 2988/95 of 18 December 1995 on the protection of the European Communities financial interests (OJ L 312, 23.12.1995, p. 1).

EU grants are managed fully electronically through the EU Funding & Tenders Portal ('Portal').

All communications must be made electronically through the Portal, in accordance with the Portal Terms and Conditions and using the forms and templates provided there (except if explicitly instructed otherwise by the granting authority).

Communications must be made in writing and clearly identify the grant agreement (project number and acronym).

Communications must be made by persons authorised according to the Portal Terms and Conditions. For naming the authorised persons, each beneficiary must have designated — before the signature of this Agreement — a 'legal entity appointed representative (LEAR)'. The role and tasks of the LEAR are stipulated in their appointment letter (see Portal Terms and Conditions).

If the electronic exchange system is temporarily unavailable, instructions will be given on the Portal.

36.2 Date of communication

The sending date for communications made through the Portal will be the date and time of sending, as indicated by the time logs.

The receiving date for communications made through the Portal will be the date and time the communication is accessed, as indicated by the time logs. Formal notifications that have not been accessed within 10 days after sending, will be considered to have been accessed (see Portal Terms and Conditions).

If a communication is exceptionally made on paper (by e-mail or postal service), general principles apply (i.e. date of sending/receipt). Formal notifications by registered post with proof of delivery will be considered to have been received either on the delivery date registered by the postal service or the deadline for collection at the post office.

If the electronic exchange system is temporarily unavailable, the sending party cannot be considered in breach of its obligation to send a communication within a specified deadline.

36.3 Addresses for communication

The Portal can be accessed via the Europa website.

The address for paper communications to the granting authority (if exceptionally allowed) is the official mailing address indicated on its website.

For beneficiaries, it is the legal address specified in the Portal Participant Register.

ARTICLE 37 — INTERPRETATION OF THE AGREEMENT

The provisions in the Data Sheet take precedence over the rest of the Terms and Conditions of the Agreement.

Annex 5 takes precedence over the Terms and Conditions; the Terms and Conditions take precedence over the Annexes other than Annex 5.

Annex 2 takes precedence over Annex 1.

ARTICLE 38 — CALCULATION OF PERIODS AND DEADLINES

In accordance with Regulation No 1182/71[23], periods expressed in days, months or years are calculated from the moment the triggering event occurs.

The day during which that event occurs is not considered as falling within the period.

'Days' means calendar days, not working days.

ARTICLE 39 — AMENDMENTS

39.1 Conditions

The Agreement may be amended, unless the amendment entails changes to the Agreement which would call into question the decision awarding the grant or breach the principle of equal treatment of applicants.

Amendments may be requested by any of the parties.

39.2 Procedure

The party requesting an amendment must submit a request for amendment signed directly in the Portal Amendment tool.

The coordinator submits and receives requests for amendment on behalf of the beneficiaries (see Annex 3). If a change of coordinator is requested without its agreement, the submission must be done by another beneficiary (acting on behalf of the other beneficiaries).

The request for amendment must include:

- the reasons why
- the appropriate supporting documents and
- for a change of coordinator without its agreement: the opinion of the coordinator (or proof that this opinion has been requested in writing).

The granting authority may request additional information.

If the party receiving the request agrees, it must sign the amendment in the tool within 45 days of receiving notification (or any additional information the granting authority has requested). If it does not agree, it must formally notify its disagreement within the same deadline. The deadline may be extended, if necessary for the assessment of the request. If no notification is received within the deadline, the request is considered to have been rejected.

An amendment **enters into force** on the day of the signature of the receiving party.

An amendment **takes effect** on the date of entry into force or other date specified in the amendment.

[23] Regulation (EEC, Euratom) No 1182/71 of the Council of 3 June 1971 determining the rules applicable to periods, dates and time-limits (OJ L 124, 8/6/1971, p. 1).

ARTICLE 40 — ACCESSION AND ADDITION OF NEW BENEFICIARIES

40.1 Accession of the beneficiaries mentioned in the Preamble

The beneficiaries which are not coordinator must accede to the grant by signing the accession form (see Annex 3) directly in the Portal Grant Preparation tool, within 30 days after the entry into force of the Agreement (see Article 44).

They will assume the rights and obligations under the Agreement with effect from the date of its entry into force (see Article 44).

If a beneficiary does not accede to the grant within the above deadline, the coordinator must — within 30 days — request an amendment (see Article 39) to terminate the beneficiary and make any changes necessary to ensure proper implementation of the action. This does not affect the granting authority's right to terminate the grant (see Article 32).

40.2 Addition of new beneficiaries

In justified cases, the beneficiaries may request the addition of a new beneficiary.

For this purpose, the coordinator must submit a request for amendment in accordance with Article 39. It must include an accession form (see Annex 3) signed by the new beneficiary directly in the Portal Amendment tool.

New beneficiaries will assume the rights and obligations under the Agreement with effect from the date of their accession specified in the accession form (see Annex 3).

Additions are also possible in mono-beneficiary grants.

ARTICLE 41 — TRANSFER OF THE AGREEMENT

In justified cases, the beneficiary of a mono-beneficiary grant may request the transfer of the grant to a new beneficiary, provided that this would not call into question the decision awarding the grant or breach the principle of equal treatment of applicants.

The beneficiary must submit a request for **amendment** (see Article 39), with

- the reasons why
- the accession form (see Annex 3) signed by the new beneficiary directly in the Portal Amendment tool and
- additional supporting documents (if required by the granting authority).

The new beneficiary will assume the rights and obligations under the Agreement with effect from the date of accession specified in the accession form (see Annex 3).

ARTICLE 42 — ASSIGNMENTS OF CLAIMS FOR PAYMENT AGAINST THE GRANTING AUTHORITY

The beneficiaries may not assign any of their claims for payment against the granting authority to

any third party, except if expressly approved in writing by the granting authority on the basis of a reasoned, written request by the coordinator (on behalf of the beneficiary concerned).

If the granting authority has not accepted the assignment or if the terms of it are not observed, the assignment will have no effect on it.

In no circumstances will an assignment release the beneficiaries from their obligations towards the granting authority.

ARTICLE 43 — APPLICABLE LAW AND SETTLEMENT OF DISPUTES

43.1 Applicable law

The Agreement is governed by the applicable EU law, supplemented if necessary by the law of Belgium.

Special rules may apply for beneficiaries which are international organisations (if any; see Data Sheet, Point 5).

43.2 Dispute settlement

If a dispute concerns the interpretation, application or validity of the Agreement, the parties must bring action before the EU General Court — or, on appeal, the EU Court of Justice — under Article 272 of the Treaty on the Functioning of the EU (TFEU).

For non-EU beneficiaries (if any), such disputes must be brought before the courts of Brussels, Belgium — unless an international agreement provides for the enforceability of EU court judgements.

For beneficiaries with arbitration as special dispute settlement forum (if any; see Data Sheet, Point 5), the dispute will — in the absence of an amicable settlement — be settled in accordance with the Rules for Arbitration published on the Portal.

If a dispute concerns administrative sanctions, offsetting or an enforceable decision under Article 299 TFEU (see Articles 22 and 34), the beneficiaries must bring action before the General Court — or, on appeal, the Court of Justice — under Article 263 TFEU.

For grants where the granting authority is an EU executive agency (see Preamble), actions against offsetting and enforceable decisions must be brought against the European Commission (not against the granting authority; see also Article 22).

ARTICLE 44 — ENTRY INTO FORCE

The Agreement will enter into force on the day of signature by the granting authority or the coordinator, depending on which is later.

SIGNATURES

For the coordinator

For the granting authority

ANNEX 1

Horizon Europe (HORIZON)

Description of the action (DoA)

Part A

Part B

DESCRIPTION OF THE ACTION (PART A)

COVER PAGE

Part A of the Description of the Action (DoA) must be completed directly on the Portal Grant Preparation screens.

PROJECT *Grant Preparation (General Information screen) — Enter the info.*	
Project number:	101111927
Project name:	NORTH ADRIATIC HYDROGEN VALLEY
Project acronym:	NAHV
Call:	HORIZON-JTI-CLEANH2-2022-2
Topic:	HORIZON-JTI-CLEANH2-2022-06-01
Type of action:	HORIZON-JU-IA
Service:	CLEANH2
Project starting date:	fixed date: 1 September 2023
Project duration:	72 months

TABLE OF CONTENTS

PROJECT SUMMARY

Project summary

Grant Preparation (General Information screen) — Provide an overall description of your project (including context and overall objectives, planned activities and main achievements, and expected results and impacts (on target groups, change procedures, capacities, innovation etc)). This summary should give readers a clear idea of what your project is about.

Use the project summary from your proposal.

The North Adriatic Hydrogen Valley – NAHV project builds on the LoI signed in March 2022 by representatives of the Slovenian Ministry of Infrastructure, Croatian Ministry of Economy and Sustainable Development and Friuli Venezia Giulia (FVG) Autonomous Region in Italy, contributing to the European Green Deal and European Hydrogen Strategy goals.
The project's high-level objective is the creation of a hydrogen-based economic, social and industrial ecosystem based on the capacity of the quadruple helix actors. This will drive economic growth, generating new job opportunities in the framework of both the green and digital transitions and, by creating the conditions for wider EU replicability, it will contribute to the creation of a European Hydrogen Economy,
To fulfil these objectives the NAHV project involves a well-rooted partnership of 36 organizations (of which 2 in Hydrogen Europe, 3 in Hydrogen Europe Research), covering the transnational Central European area of 3 territories - Slovenia, Croatia and FVG Region, demonstrating cross-border integration of hydrogen production, distribution and consumption, and exchange of over 20% of NAHV annual hydrogen production of over 5000 tons.
The project will activate 17 testbed applications in their related ecosystems, clustered in 3 main pillars - hard to abate, energy and transport sectors. These will act as real-life cases for piloting global hydrogen markets, moving from TRL 6 at the beginning to TRL 8 at the end of the project. Four fuel cell applications in the energy and transport sectors will be demonstrated. Testbeds will then be scaled up at industrial level as a replicable model, contributing to the decarbonisation of the 3 territories by harnessing renewables to improve system resilience, security of supply and energy independence. Replicability will also be ensured for the whole NAHV model, with the uptake of at least 5 additional hydrogen valleys in Europe, particularly in Central and South Eastern Europe.

LIST OF PARTICIPANTS

PARTICIPANTS

Grant Preparation (Beneficiaries screen) — Enter the info.

Number	Role	Short name	Legal name	Country	PIC
1	COO	HSE	HOLDING SLOVENSKE ELEKTRARNE DOO	SI	914772275
1.1	AE	TES, d.o.o.	TERMOELEKTRARNA SOSTANJ D.O.O.	SI	884216984
1.2	AE	HSE INVEST	HSE INVEST DRUZBA ZA INZENIRING INIZGRADNJO ENERGETSKIH OBJEKTOV DOO	SI	950728817
2	BEN	AREA	AREA DI RICERCA SCIENTIFICA E TECNOLOGICA DI TRIESTE	IT	999549887
3	BEN	ECUBES	ECUBES TEHNOLOGIJE D.O.O.	SI	891137837
4	BEN	INDELOOP LTD	INDELOOP DOO ZA PROIZVODNJU ELEKTRICE ENERGIJE I GOSPODARENJE	HR	889967144
5	BEN	MCEoE	MARITIME CENTER OF EXCELLENCE D.O.O	HR	890309554
6	BEN	Dilj d.o.o.	DILJ INDUSTRIJA GRADEVINSKOG MATERIJALA D.O.O.	HR	912302752
7	BEN	Gitone	GITONE KVARNER D.O.O.	HR	885404846

PARTICIPANTS

Grant Preparation (Beneficiaries screen) — Enter the info.

Number	Role	Short name	Legal name	Country	PIC
8	BEN	ACI d.d.	ADRIATIC CROATIA INTERNATIONAL CLUBZA DJELATNOST MARINA D. D.	HR	885416389
9	BEN	HRASTNIK 1860	STEKLARNA HRASTNIK DRUZBA ZA PROIZVPROIZVODNJO STEKLENIH IZDELKOV DOO	SI	896379523
10	BEN	SALONIT	SALONIT ANHOVO GRADBENI MATERIALI D.D.	SI	964288447
11	BEN	ACEGAS	ACEGASAPSAMGA S.P.A.	IT	904079092
12	BEN	Active Solera	ACTIVE SOLERA JEDNOSTAVNO DRUSTVO S OGRANICENOM ODGOVORNOSCU ZA USLUGE	HR	894700065
13	BEN	FABER	FABER INDUSTRIE SPA	IT	986351291
14	BEN	ABS	ACCIAIERIE BERTOLI SAFAU SPA	IT	888149946
14.1	AE	DANIELI	DANIELI CENTRO COMBUSTION SPA	IT	913920227
15	BEN	CTS H2	CTS H2 S.R.L.	IT	894678434
16	BEN	SNAM S.P.A.	SNAM S.P.A.	IT	905331265
17	BEN	FBK	FONDAZIONE BRUNO KESSLER	IT	999625450
18	BEN	UNITS	UNIVERSITA DEGLI STUDI DI TRIESTE	IT	999842051
19	BEN	UL	UNIVERZA V LJUBLJANI	SI	999923240
20	BEN	UNIRI	SVEUCILISTE U RIJECI	HR	997640733
20.1	AE	TEHN.FAKULT.	SVEUCILISTE U RIJECI-TEHNICKI FAKULTET	HR	986280675
20.2	AE	UNI SPLIT	SVEUCILISTE U SPLITU, FAKULTET ELEKTROTEHNIKE, STROJARSTVA I BRODOGRADNJE	HR	996558116
20.3	AE	UNI ZG FSB	SVEUCILISTE U ZAGREBU, FAKULTET STROJARSTVA I BRODOGRADNJE	HR	996827485
21	BEN	MzI	MINISTRSTVO ZA INFRASTRUKTURO	SI	952242696
22	BEN	FHA	FUNDACION PARA EL DESARROLLO DE LAS NUEVAS TECNOLOGIAS DEL HIDROGENO EN ARAGON	ES	997456918
23	BEN	Tpl Fvg	TPL FVG S.C. A R.L.	IT	885121994
23.1	AE	TRIESTETRASPOR	TRIESTE TRASPORTI SPA	IT	945489653
23.2	AE	A.P.T. S.P.A.	AZIENDA PROVINCIALE TRASPORTI SPA	IT	884987843
24	BEN	META	META GROUP SRL	IT	999735157
24.1	AE	META SPRL	META	BE	900146227
24.2	AE	META SLO	META CIRCULARITY, SVETOVANJE IN INOVACIJE DOO	SI	914861709
25	BEN	FENO	FERRIERE NORD SPA	IT	960976479

PARTICIPANTS

Grant Preparation (Beneficiaries screen) — Enter the info.

Number	Role	Short name	Legal name	Country	PIC
26	BEN	REGIONE FVG	REGIONE AUTONOMA FRIULI-VENEZIA GIULIA	IT	983174347
27	BEN	MINGOR	MINISTARSTVO GOSPODARSTVA I ODRZIVOG RAZVOJA	HR	916533310

LIST OF WORK PACKAGES

Work packages

Grant Preparation (Work Packages screen) — Enter the info.

Work Package No	Work Package name	Lead Beneficiary	Effort (Person-Months)	Start Month	End Month	Deliverables
WP1	PROJECT AND CONSORTIUM MANAGEMENT	1 - HSE	138.00	1	72	D1.1 – The draft of Project Management Handbook and Quality Plan D1.2 – The draft of Risk Management Plan D1.3 – IPR & Data Management Plan D1.4 – Annual data reporting D1.5 – Project meeting and Boards meeting D1.6 – SAF operational plan and activities
WP2	Hydrogen Valley System Definition	1 - HSE	254.00	1	72	D2.1 – Heuristic methodology for NAHV development D2.2 – NAHV AISBL set up D2.3 – NAHV Safety Plan D2.4 – Digital Twin D2.5 – NAHV general monitoring D2.6 – H2 renewable Certification scheme
WP3	Renewable Hydrogen Testbed Applications for industry & hard-to-abate sectors	9 - HRASTNIK 1860	331.00	1	72	D3.1 – DILJ production and usage of H2 in a kiln testbed application: set-up, operations and monitoring reports and business plan D3.2 – ABS H2 utilization for special steel production and treatment testbed application: set-up, operations and monitoring reports and business plan D3.3 – SNAM The scale-up of highly efficiency modular electromechanical compressor D3.4 – FENO blending mix usage in rolling mill for preheating testbed application: set-

Work packages

Grant Preparation (Work Packages screen) — Enter the info.

Work Package No	Work Package name	Lead Beneficiary	Effort (Person-Months)	Start Month	End Month	Deliverables
						up, operations and monitoring reports and business plan D3.5 – SALONIT H2 production for cement industry decarbonization testbed application: set-up, operations and monitoring reports and business plan D3.6 – Steklarna Hrastnik efficient utilization of water electrolyser system testbed application: set-up, operations and monitoring reports and business plan D3.7 – Final report on industry hard to abate sector test bed application projects main results
WP4	Renewable Hydrogen Testbed Applications for the energy sector	11 - ACEGAS	244.40	1	72	D4.1 – Active Solera clean H2 from recyclable waste testbed application: set-up, operations and monitoring reports and business plan D4.2 – ACEGAS H2 production through industrial symbiosis and asset enhancement: set-up, operations and monitoring reports and business plan D4.3 – ACEGAS Assessment of the suitability of the natural gas distribution network for the transport of mixtures of hydrogen and natural gas or hydrogen gas at 100%: set-up, operations and monitoring reports and business plan D4.4 – INDELOOP H2 production by gasification of organic material for small microgrid testbed application: set-up,

Work packages

Grant Preparation (Work Packages screen) — Enter the info.

Work Package No	Work Package name	Lead Beneficiary	Effort (Person-Months)	Start Month	End Month	Deliverables
						operations and monitoring reports and business plan D4.5 – HSE H2 ecosystem technology solutions & production testbed application: set-up, operations and monitoring reports and business plan D4.6 – Final report on the energy sector testbed application projects main results
WP5	Renewable Hydrogen Testbed Applications for the transport sector	5 - MCEoE	729.50	1	72	D5.1 – CTS H2 integrated hydroelectric and hfc power station testbed application: set-up, operations and monitoring reports and business plan D5.2 – FABER H2 storage system testbed application: set-up, operations and monitoring reports and business plan D5.3 – MCoE H2 propulsion vessels testbed application: set-up, operations and monitoring reports and business plan D5.4 – TPL FVG production & management models for H2 use in urban buses testbed application: set-up, operations and monitoring reports and business plan D5.5 – ACI MARINE H2 marinas testbed application: set-up, operations and monitoring reports and business plan D5.6 – ECUBES H2 energy storage & power generation testbed application: set-up, operations and monitoring reports and business plan

Work packages

Grant Preparation (Work Packages screen) — Enter the info.

Work Package No	Work Package name	Lead Beneficiary	Effort (Person-Months)	Start Month	End Month	Deliverables
						D5.7 – Final report on the transport sector testbed application projects main results
WP6	Cross Cutting and Cross Border Transport - Zero Emission Mobility Corridor North Adriatic	3 - ECUBES	70.40	1	72	D6.1 – Report on P2H2P node hosting capacity in the electric power system D6.2 – Hydrogen rail transport options D6.3 – Hydrogen heavy road transport D6.4 – Hydrogen passenger transport D6.5 – Network distribution of gas H2
WP7	Communication, Education, And Dissemination	24 - META	303.00	1	72	D7.1 – Communication and Dissemination Plan D7.2 – Communication and Dissemination Toolbox D7.3 – Video Pitches D7.4 – C&D report D7.5 – Awareness raising campaign D7.6 – Education activities report
WP8	Policies Analysis and Guidelines	27 - MINGOR	243.00	2	72	D8.1 – Analysis of H2 related policies D8.2 – Regulatory Sandbox D8.3 – Policy guidelines document D8.4 – Nationals (Slo and HR) and regional (FVG) H2 Strategy D8.5 – Report on incentives schemes
WP9	Inter-Regional Hydrogen R&D&I Development Joint Action Plan and NAHV Master Plan&Business Model	2 - AREA	155.00	1	60	D9.1 – JAP methodology D9.2 – Desk and field analysis Atlas D9.3 – Joint Action Plan- JAP D9.4 – Master plan methodology D9.5 – Information inventory D9.6 – NAHV masterplan D9.7 – Business accelerator model

Work packages

Grant Preparation (Work Packages screen) — Enter the info.

Work Package No	Work Package name	Lead Beneficiary	Effort (Person-Months)	Start Month	End Month	Deliverables
						D9.8 – NAHV business plan (BP) D9.9 – NAHV financial plan
WP10	Technical Demonstrator Plants Monitoring, Identification and Assessment Of Social, Economic and Environmental Impacts, Including Water Utilization	18 - UNITS	116.00	1	72	D10.1 – Guidelines on methodology to monitor the performances of the testbeds D10.2 – Report/KPI on testbeds and value chain performance D10.3 – Environmental Impact assessment D10.4 – Social impact assessment D10.5 – Cost-benefit analysis D10.6 – NAHV value chain analysis
WP11	NAHV Exploitation & Replication Activities	17 - FBK	256.70	6	72	D11.1 – Exploitation plan D11.2 – Networking with EU hydrogen valleys D11.3 – Middle term and final Exploitation plan D11.4 – International collaboration D11.5 – Plan for the collaboration with neighbourhood H2 valleys D11.6 – Replication package and labs D11.7 – Position papers collection

Work package WP1 – PROJECT AND CONSORTIUM MANAGEMENT

Work Package Number	WP1	Lead Beneficiary	1. HSE
Work Package Name	PROJECT AND CONSORTIUM MANAGEMENT		
Start Month	1	End Month	72

Objectives
WP1 entails actions and activities to ensure the effective and timely implementation of the workplan, compliant with all financial and organizational rules envisaged by the HE programme and by The Clean Hydrogen JU; evaluation and monitoring of risks and prompt provision of effective solutions; management of communication with the JU; management of internal communication; management of data and IPR, quality assessment. The project coordination and management will be carried out in relation to the project management and governance structure described in the section 1.2 “Methodology”.

Description
Task 1.1 Project management, communication management, quality management and progress monitoring. TL (TL): HSE, Project Partner (PP): all [Duration (D): M1 – M72] The Coordinator (HSE) will monitor the overall development of the project ensuring that project objectives are reached, certifying that the activities will not divert from the objectives. At M1 the Coordinator will draft the Project Management Handbook and quality plan. This document aims to ensure the quality of project processes and outputs and prevent possible deviations from the project work plan and to define key roles and responsibilities, the procedures, and standards to be used for deliverables and reports, the target to be reached by the consortium necessary to release the several tranches of payment to the partners, as stated in the consortium agreement, the quality assurance process, the communication flows, etc. At M3 the Coordinator will draft a Risk Management Plan to lay out the responsibilities, strategy and procedures regarding the risk management in the NAHV project. A first draft of the Risk Register for implementation is available in table 3.1e. Besides the official technical and financial reports, partners will submit periodically activity reports to the Coordinator. Different entities will be in charge of the different aspects of the management of the project, namely: the Executive Board (EB), responsible for the overall management and implementation of the project. It is the decision making body of the project, it is composed by 12 members: the coordinator, the 9 WP leaders and a representative of the Region FVG and the Ministry of Infrastructure of Slovenia. Those people will be in charge of supporting the coordinator for the day-to-day management of the project. the Project Management Board (PMB), is composed of 1 representative of each project partner. They will meet virtually every 3 months and physically every 6 months to discuss the advancement of the project. the Steering Group (SG), is the external steering body of the project composed by high-level external policy and scientific representatives. 7 independent experts will be invited. The Coordinator will manage the communication between the members of the consortium as an essential tool to ensure a proper project execution, ensuring the appropriate transparency and cooperation among PPs. 12 in person project meetings (including KOM, 2 yearly meetings, final PM together with the Final Conference) are already scheduled in relation to the planned activities, in order to: a) ensure constant coordination and sharing of information among partners throughout the project; b) consolidate relations among consortium members; c) keep the state of the art of the project activities monitored; d) assist partners in trouble with the implementation of the project to achieve their tasks; e) share and agree all decisions concerning the project. Smaller meetings with operational working groups will be organized on-line frequently to ensure strong cooperation between partners working on the same tasks. Monthly online project meetings will be organized among the members of the executive board. If needed, further online project meetings on specific tasks and activities, with the participation of the involved partners will be organized. Finally, to enable an efficient communication flow among partners, a project online repository will be established and organized in several folders corresponding to each WP to allow partners to share relevant information, working files, meetings details, draft and completed deliverables, administrative documents, etc. Apart from the envisaged reports, the Coordinator will keep the project officer updated with the latest major project achievements or with any ordinary or extraordinary problem (i.e. major budget changes, modification of the work plan and/or reallocation of budgetary headings, request of termination of a defaulting PP, etc.) in order to define proper and shared solutions to solve or avoid them. All PPs will be also made aware of the importance of fulfilling administrative deadlines. For such purpose, during the kick-off meeting the program procedures and financial rules will be explained in detail to all PPs and the tasks to be performed in the following months will be summarized. All those documents

and procedures will be codified in the consortium agreement which will fix the common operational ground for all the partners. It has been based on the DESCA model and has been tailored to the need of the consortium. This document has been already prepared and shared with the partners and it will be updated by the coordinator before the project start.

Given the complexity of the NAHV project and in order facilitate the future monitoring of the main technical and financial elements of the Hydrogen Valley (e.g. changes introduced in amendments), an indicative table with all main elements of the Hydrogen Valley that will be deployed, including investments/actions not supported directly by the JU grant (e.g. dedicated renewable energy plant or elements of the Hydrogen Valley supported by other programmes) has been added as an Annex to Part B, Annex 1. This table that will be kept updated throughout the project duration.

Task 1.2 External stakeholder's Advisory forum – SAF. TL: AREA, PP: All [D: M3 – M72]
An External Stakeholders Advisory Forum (1) will be established by month 3, coordinated by Area, to collect the voice of the citizens and of other stakeholders of the valley: business and business organizations, researchers, policy authorities, trade unions, etc. The SAF represents all local/national stakeholders, ensuring that their voice, vision and feedback will be seriously respected and considered and embedded in project deliverables and outputs. All stakeholders who signed a LOI expressed an interest to be included in the Forum. It guarantees coordination between the activities of the "core innovative system" and of the NAHV ecosystem at glance and to maximize the economic impact of the project. A list of organizations which have expressed the willingness to be part of this forum and which will support the project is in the second page of this application.

Task 1.3 Scientific and IPR management. TL: UNI TS, PP: All [D: M1 – M72]
IPR and Data Management Board is coordinated by the Innovation Manager appointed by the task leader.
The board is responsible for IPR & Data Management Plan (DMP) first release (M3) and updates (M30) for managing all issues related to data management and IPR. DMP will be delivered describing the data management for the data to be collected, processed and/or generated by NAHV project, see section 1.2.3 and will provide guidelines for how to include appropriate metadata automatically from all instruments.
The IPR and data management board is composed by 7 members, and it is chaired by UNITS. The members will be appointed by UNITS, FBK, AREA, META, the Universities of: Ljubljana, Rijeka and Split. This Board will meet upon request of partners and at least once a year.

Task 1.4 Annual Data Reporting. TL: HSE. PP: All [D: M1 – M72]
Annual reporting for the Clean Hydrogen JU: Project information will be collected e.g. according to one or more specific template(s) to be made available by the Clean Hydrogen JU. For the purpose of monitoring technology progress against state-of-art, but also to identify how each of the projects contributes to the Clean Hydrogen JU targets, objectives and indicators described in the SRIA, supported projects shall report directly or indirectly on an annual basis (e.g via a secure online data collection platform) managed by the Clean Hydrogen Joint Undertaking throughout the duration of Horizon Europe. The projects will submit all information included in the questionnaire(s), unless request and receive an exception from the Programme Office. The information will be submitted by default as public, however, it could be possible to request that certain fields are considered as "confidential" except for the fields that constitute or directly inform KPIs of the Clean Hydrogen JU.

Task 1.5 Synergies & Co-funding and financing of the NAHV. TL: HSE. PP: All [D: M1 – M72]
Updated information on the synergies established with other EU/national/regional programmes including the financing structure and strategy of the project will be provided in each of the reporting periods (as an Annex in part B of the periodic report). The information provided will include the sources (and type) of co-funding/financing distinguishing what has been granted to date, what has been secured and what is planned and include investments/actions not supported directly by the Clean Hydrogen JU grant.

(1)Several stakeholders already expressed their interest and intention to cooperate as a member of this external advisory forum by signing LOI.

Work package WP2 – Hydrogen Valley System Definition

Work Package Number	WP2	**Lead Beneficiary**	1. HSE
Work Package Name	Hydrogen Valley System Definition		
Start Month	1	**End Month**	72

Objectives
WP2 aims to: a) define the methodology for the development and management of the hydrogen valley that could be replicated also by other prospective hydrogen valleys; b) Define and implement the safety plan of the hydrogen valley; c) develop and implement the methodology to monitor the progress and impact of the valley and the related digital twin; d) Define a scheme for the certification of origin of the hydrogen produced within the NAHV.

Description
Description of work Task 2.1 NAHV approach & methodology. TL: UNI TS, PP: FHA, FBK, all P. [D: M1 – M8] The aim of this task is the definition of the methodology for the development of the NAHV also beyond project activities. By analyzing the approaches followed in designing other hydrogen valleys and the lessons learnt from previous projects, pros and cons of the different approaches will be highlighted, thus allowing to determine the optimal strategies and methodologies to be followed. Starting from the available state-of-the-art knowledge, and by promoting the share of expertise and competence from the partners involved, the characteristics of the system will be defined involving also the Stakeholder advisory forum. The final result will be a document that will provide a strategic vision and operational guidelines for all the parties involved. Task 2.2 NAHV AISBL set up. TL: AREA, PP: MZI, FVG, MINGOR, HSE [D: M1 – M6] The NAHV association will be established and registered in Belgium as Association Internationale Sans but Lucratif (AISBL) by M6. Under the coordination of Area, the first steps for the AISBL constitution have been already moved. Partners will work to: a) prepare all the formal documentation for the incorporation of the AISBL, b) definition of the business plan and organizational model, c) definition of the financial needs and source for covering those costs. The NAHV AISBL will be supported by the 3 involved countries, and it will become the governing body of the NAHV ecosystem going far beyond the NAHV project. Task 2.3 HV safety plan. TL: FBK, PP: All [D: M1 – M72] A (confidential) draft safety plan at the project level will be provided at the start of the project and further updated during project implementation. Deliverables will be reviewed by the European Hydrogen Safety Panel (EHSP) in the context of the activities the EHSP provides to the Clean Hydrogen JU. This document will follow as a reference, guidance documentation on safety planning which has been developed by the EHSP' https://www.clean-hydrogen.europa.eu/get-involved/european-hydrogen-safety-panel-0/reference-documents_en The safety plan document provides information about safety planning, implementation, and reporting for NAHV Project, involving hydrogen production, storage, fuel cell technologies and other end uses (see also section 1.2.9). The idea is to assist project and project partners in identifying hazards and associated risks, in prevention and/or mitigation of them through a proper safety plan, in implementing the safety plan, and reporting safety related events. This shall help in safely delivering the project and ultimately producing inherently safer systems, processes and infrastructure. The operational version of the NAHV safety plan will be developed from M1 and will be updated. periodically up to M72 in order to reflect any changes to chemical/other materials and their quantities, equipment, technologies and facilities. The NAHV Project safety plan will demonstrate how the issue of life safety, property and environmental protection will be addressed. Safety plan design and implementation will include the delivery of the following key tasks: 1) review the state-of-the-art in safety provisions of systems and processes related to the project; 2) identify system or process vulnerabilities, select incident scenarios, including low-frequency high consequences scenarios; 3) apply available hydrogen safety engineering models and tools to assess hazards and associated risks for selected scenarios; 4) continuously update the initial safety plan during the project to include new knowledge and information, appoint safety professionals to thoroughly monitor the plan's implementation by all partners and the project as a whole, and report results on safety findings in the reports, databases, through publications. The result will be a report on safety prepared, maintained and updated according to the structure already defined in the draft of the NAHV safety plan. Each partner involved in the testbed applications will be responsible for the safety approach, with FBK in charge to collect all safety partners contributes and provide support on best practice and on prevention and mitigation strategies. To perform safety review, FBK will appoint a safety team including representatives having education, training and experience in dealing with safety issues. The team will be composed of two groups of experts, the technical team responsible for solving challenging hydrogen safety issues and the operational management team dealing with overall safety arrangements beyond the specific hydrogen safety issue. The composition and responsibilities of both groups will be identified at the initial stage. The safety plan developed within NAHV will involve all partners in an open collaboration and support approach. Safety documentation will be updated regularly in order to reflect any changes to chemical/other materials and their quantities,

equipment, technologies and facilities. The knowledge gained throughout the project will be an important asset in the effective safety provisions within the project (also for WP8 working groups) and beyond its formal duration. On this topic, an open sharing and dissemination approach of useful safety information beyond project partners will be adopted.

The project will report any safety-related event that may occur during the project implementation to the European Commission's Joint Research Centre (JRC) dedicated mailbox JRC-PTT-H2SAFETY@ec.europa.eu, which manages the European hydrogen safety reference database, HIAD 2.0, and the Hydrogen Event and Lessons LEarNed database, HELLEN. Projects reporting on safety should report annually either the safety-related events: near misses, incidents, accidents, or the absence of events

Task 2.4 Development of Digital twin. TL: FBK, PP: UNITS, UNIRI, UL, HSE . [D: M6 – M55]
Partners involved will collaborate on the definition of a multi-sector and multi-scale digital twin for the whole H2 valley, exploiting the tools and experiences of the previous project to leverage the impact and boost progress in the NAHV project. Based on simulation models for hydrogen production and use, UNITS, UNIRI, and UL will make available the first training dataset for the digital twin, coordinated by FBK. Multi-scale concept of the digital twin will be realized in specific programming languages, in a user-friendly open-source programme environment or in a commercial simulation environment (Python, Modelica, etc..). It will systematically combine device/site level models and higher scale models of specific sites, regions, or inter-region, aiming to suggest the distribution of H2 demand/offer in H2 valley and consequently achieve the optimal operational costs by proper measures. The site-level models will be based on advanced modelling techniques, including advanced parametrization methodologies, and combined with advanced reduced methods for assessing degradation phenomena and including the possibility to optimize plants to increase the overall efficiency[2][3] and reduce operative cost.
Finally, according to the sensitivity analysis results, the most influent parameters will be monitored to improve the accuracy of the input data to the digital twin. The digital twin task would first present the simulation tool concept development for sector-coupled energy sector operation with hydrogen technology. This task would further explain the conceptual design of the mathematical model of a simulation tool, which connects the energy systems of Slovenia, Croatia and Italy with the implemented HV nodes. The operation criteria for creating a simulation tool will also be set. Functionalities will be designed for more reliable performance of specified analyses, which are intended for a broader spectrum of H2 consumers, producers, and carriers. The tool will be prepared for further development and coupling with the other energy sectors. This digital twin will be interoperable in different conditions and would provide the dynamic behaviour of the HV nodes in fully covered timeframes from the point of view of the electric power system operation. Estimates of the analytical simulation tool's CAPEX, OPEX and TOTEX and the necessary databases will be provided. FBK will develop the high-level model of the H2 valley, including all connections, handling and transport of H2 between production and consumption site, as well as the input/output to connect the single plant's models, developed by an industrial partner and the universities involved in the task.

Task 2.5 Monitoring TL: UNI TS, PP: UNIRI, FBK, UL [D: M8 – M72]
The monitoring activities of the overall development of the NAHV will be based on a set of KPIs mainly derived from of the Clean Hydrogen JU SRIA 2021-2027 including the technology related targets included in the SRIA Annexes 2-onwards according to the technologies deployed in the NAHV. The progress in hydrogen production, storage, distribution and use will be assessed, including all the connected activities. Relevant data and information will be available through the activities foreseen in WP10 and from the implementation and utilization of the digital twin (T2.4). The measurement system will be designed by keeping in mind possible application of data in advanced artificial intelligence methods, which could indicate potential problems in future designed hydrogen systems. Accurate monitoring of the complex mobility network will also be implemented, considering for example car fleets, buses, and energy intensive transportation, supported by vehicle specific models and digital twins . Finally, monitoring activity will include also the integration of hydrogen technologies in carbon intensive plant. The task will continue at least for other two years after the end of the project.
The assessment of the progress towards the achievement of the project KPIs will be provided in each of the reporting periods (as an Annex in part B of the periodic report).

The monitoring strategy for each of the testbeds will allow to assess compliance with the KPIs of the Clean Hydrogen JU SRIA 2021-2027 for each of the technologies covered. These activities will take place in WP10.

Task 2.6 Market integration. TL: ECUBES, PP: FHA [D: M3 – M60]
By developing a solid shared local infrastructure over the three countries involved, the NAHV will not only ensure local hydrogen supply chains, but it will also position itself on the international hydrogen export market. Assets maximization will be supported by digital solutions (T2.4), as well as by means of the evaluation and planning of storing capabilities of intermittent energy sources. Indeed, the international nature of the NAHV allows to explore on a relatively small scale the possibility of establishing an EU shared infrastructure for the production, storage, and use of hydrogen. The

digital tools developed within the NAHV project, in addition to crucially support the sustainable and cost-effective evolution of the valley, will also establish a cornerstone for further replication sites. The market integration proposal covers the assessment of the market sector coupling between the electricity, gas, and transport systems with the hydrogen technologies. This task also presents the definition of Power-to-X-to-Power nodes and represents a key high-level analysis of the cross-functional potential of the Power-to-Hydrogen-to-Power nodes while emphasizing the importance of hydrogen technologies in the transition to the green, reliable, and stable electric power system. This task develops a potential for new business cases in the power provision and energy storage market. A rough analysis of the costs of the envisaged solutions for the needs of the analysis of the range of necessary investments will be prepared. Financial evaluation and techno-economic feasibility of PXP nodes: CAPEX, OPEX & TOTEX estimation for every location and CBA sensitivity analysis according to different energy, climate, and infrastructural scenarios will be implemented.

Task 2.7 Pilot a new scheme for certified hydrogen trading at a transnational-regional/intra-EU hydrogen market. TL: FBK, PP: all [D: M1 – M72]
The goal of the task is the development and establishment of the renewable hydrogen certification scheme in the context of H2 valley (NAHV). FBK coordinates this activity including the registration to CertifHy platform as none-governmental certification scheme in absence of national one. CertifHy™ GO scheme grants a tradable value to renewable and non-renewable hydrogen. It is therefore essential that the GO scheme is reliable, accurate and verifiable. Controlling the information and the accuracy of the CertifHy™ GO is of critical importance. FBK manages the contact with issuing body (i.e certifhy) and the industrial partners, in order to support them for the plant audit, GO bath verification and production plant registration. The expected results for the end of project are the establishment of working certification scheme in the contest of NAHV, making autonomous any production and consumer plant for the GO trades and relative issuing procedures.

[2] This task will monitor the overall development of the Hydrogen Valley and project activities. The testbed projects should have their own monitoring plan to assess the effectiveness and efficiency of each technological solution.
[3] RAŠIĆ, Davor, KATRAŠNIK, Tomaž. Multi-domain and multi-scale model of a fuel cell electric vehicle to predict the effect of the operating conditions and component sizing on fuel cell degradation. Energy conversion and management, ISSN 0196-8904. [Print ed.], Sep. 2022, vol. 268, str. 1-27

Work package WP3 – Renewable Hydrogen Testbed Applications for industry & hard-to-abate sectors

Work Package Number	WP3	Lead Beneficiary	9. HRASTNIK 1860
Work Package Name	Renewable Hydrogen Testbed Applications for industry & hard-to-abate sectors		
Start Month	1	End Month	72

Objectives
WP3 aims to: a) implement and validate new solutions and testbed applications for renewable hydrogen valorisation in the industry sector; b) cover the complete value chain of renewable hydrogen from production to distribution, storage and end-use; c) support the decarbonisation of the industry sector, with particular focus on steel, glass industry and many other hard-to-abate companies, by replicable testbed plants distributed across all the three target involved territories.

Description
T3.1. Production and usage of hydrogen as a partial replacement for natural gas inside a kiln in a roof tile factory. TL: DILJ [D: M1 – M72] Industrial validation and implementation of a prototypal combustion system and electrical energy production and storage for the H2 usage as a partial replacement for natural gas inside a kiln in a roof tile factory in cooperation with university and manufacturer of hydrogen equipment. Combination of standard renewable H2 production with other renewable energy sources for direct use of renewable H2 produced as fuel in tunnel kiln (standard for ceramic roof tile industry). Analysis of technical requirements, on-line kiln testing analyzing adjustment of the burners and hydrogen distribution system, flame velocity and flashback, NOx emission, flame temperature, water generation and impact of the process and its energy efficiency on the kiln and products. T3.2. Hydrogen utilization in special steel production and treatment. TL: ABS [D: M1 – M50] Industrial validation and implementation of experimental hydrogen burners to transform steel ingot heat treatment

furnaces (typically divided into four control zones fed by a total of eighteen 233kW burners) to achieve effective total decarbonisation, using carbon-free energy carriers such as renewable hydrogen either as a blend or as a total replacement for traditional fossil fuels. Continuous fine-tuning and testing of control equipment, measuring systems, burners, operational and safety practices, and maintenance up to the replacement of all existing burners in a 100% hydrogen furnace, to assess the impact on the treated steel of an atmosphere composed of water vapour as well as nitrogen and oxygen. Similarly, the impact on refractory materials in the furnace chamber will be assessed.

T3.3 The scale-up of highly efficiency modular electromechanical compressor. TL: SNAM [D:M1–M72] The validation of an innovative H2 compressor at TRL 6-8 will be implemented. The project will improve the system CapEx from 7'700 €/kW to 5'600 €/kW, especially for HRS applications, and will test the production plant of green hydrogen in Torviscosa (Ud), in order to improve the carbon footprint of an new developed plant that produce green hydrogen from electrolysis process (4MW) with electrical energy supplied from co-developed renewable plant at site and to enter a new market where green hydrogen is used for mobility application and in the chemical and hard to abate industry. Notably, the innovative H2 compressor will target the achievement of the 2030 CHJU Strategic Research targets of 3 kWh/kg_H2 – for 5/900 bar compression, as well as a higher reliability by targeting a Mean Time Between Failure (MTBF) of 40'000 hours.

T3.4 Blending mix usage in rolling mill pre-heating furnace for hard to abate industrial application. TL: FENO [D: M1 – M69]
Industrial validation and implementation, in cooperation with the equipment supplier, of new burners (and relative piping, blending, and control systems) able to use renewable H2 blending with natural gas in reheating furnace of rebars rolling mills, to keep the billets at high temperature (typically 1,100-1,200°C) before rolling, to improve steel ductility, or to promote the formation of a specific microstructure. The prototypal reheating furnace will have to ensure at least the same level of safety during operation and quality of the product after rolling, surface quality in terms of scale formation, scale adhesion, and decarburization. Moreover, also air emissions will be verified in terms of CO2 reduction, and a particular focus will be devoted to NOX. Considering the large consumption of the burners around 19 MSm3/year of Natural Gas, systems able to work in blends of H2/Natural Gas, up to 50% H2, will lead to a consequent reduction of the emission of CO2, and other GHG of about 10.000 ton/year.

T3.5 H2 production for cement industry decarbonization. TL: SALONIT [D: M7– M72]
This task aims to build a containerized electrolyzer of 500kW size, with necessary storage and connections to use the H2 produced in several sectors and perform the feasibility study for direct use in production. The current storage and filling infrastructure will be upgraded (see also tasks 6.2 and 6.3). The scale-up of all systems will be studied in order to use also batteries to achieve 100% renewable sources and to offer ancillary services to balance the energy grid. The objective is to reduce the carbon footprint firstly by using the hydrogen directly in the kiln instead of currently used hydrocarbons and with hydrogenation of captured CO2 from the cement clinker chemical process into methane or methanol; secondly by decarbonizing the transport; within the plant and throughout the distribution channels.

T3.6. Efficient utilization of WE system in the glass industry. TL: Steklarna [D: M1 – M60]
To decarbonize the process and boost the reliability and security of renewable energy supply, a Water Electrolyser (WE) system comprising of 3MW water electrolyze and mid-pressure hydrogen storage unit will be coupled with an existing 120 MTPD oxyfuel glass furnace. WE's hydrogen and oxygen gases will be used at the furnace to improve overall energy efficiency. As the WE will be partially powered by RES and incorporated in auxiliary services to the TSO, electrolyser cells with great output flexibility will be deployed (PEM). Hydrogens storage and advance system control will compensate for fluctuations in hydrogen supply. A cutting-edge glass furnace hydrogen combustions system will be used to enable flexible hydrogen and oxygen intake into the furnace.

Work package WP4 – Renewable Hydrogen Testbed Applications for the energy sector

Work Package Number	WP4	Lead Beneficiary	11. ACEGAS
Work Package Name	Renewable Hydrogen Testbed Applications for the energy sector		
Start Month	1	End Month	72

Objectives
WP4 aims to: a) implement and validate new technologies and testbed applications for the energy sector's renewable hydrogen valorisation; b) support the decarbonisation of the energy sector applications, with particular focus on hydrogen

generation sets, backup-power systems, electric supply of infrastructures and gas grid injection in blending mixtures; c) cover the complete value chain of renewable hydrogen from productionto distribution, storage and end-use by replicable testbeds distributed across all the three target involved territories; d) develop a FCH application

Description

T4.1. Clean hydrogen from non recyclable waste through SMO (Solaire-MicroOndes) solar process. TL: Active Solera [D: M1 – M72]
Development and optimization of a patented (Family of patents: WO20097098375 A1, WO2013160467 A1, WO215l l8278 Al, WO2010/02a723 A2, WO20l l0l5727, and 2 pending) SMO Solar Process, an energy autonomous waste processor using exclusively solar thermal energy to transform non-recyclable carbon-based waste into competitively priced Clean Hydrogen and Energy, together with Carbon Products. After construction, the thermolyzer and gasifier will be tested and validated independently in the mechanical workshop, then modules will be connected in a complete SMO unit and tested. The Artificial Intelligence controlling system will be implemented to monitor the process, executing automated adjustments to ensure optimal operations. The completed SMO unit will be tested with local Croatian inputs, on the island of Cres prior to site commissioning. H2 purity will be analyzed. Measured KPIs will be compared to projected yields. In a second phase, the site will be operating, delivering clean Hydrogen converted to electricity (by using hydrogen engines and experimental fuel cell stationary power genset) directly injected to the grid. Operational phase will be monitored assessing production KPIs, logistic functionalities and human resources availability.

T4.2 H2 production through industrial symbiosis and asset enhancement. TL: ACEGAS [D: M1 – M69]
An electrolyser prototype of 2,5 MWe will produce renewable hydrogen. The hydrogen production plant will be electrically powered by renewable energy (20GWh/y) purchased from RES plants, including the waste-to-energy plant in Trieste, and produced by a photovoltaic field. In a perspective of industrial symbiosis, the hydrogen production plant will use the purging of the cooling towers of the waste-to-energy plant. the hydrogen produced will be stored and made available to users, including the logistics sector and the local public transport service (see Task 5.4). The goal is to increase the overall efficiency of the developed system, reduce the environmental impact of the process and thus develop a scalable solution that increases the size of the plant and the quantity of hydrogen produced up to 5 times.

T4.3 Assessment of the suitability of the natural gas distribution network for the transport of mixtures of hydrogen and natural gas or hydrogen gas at 100%. TL: ACEGAS [D: M1 – M39]
To obtain the "Technological Qualification" (TQ) of the existing distribution network, a testbed application will be conducted in order to evaluate the use of ACEGAS own methane gas distribution network assets for the injection of increasing% of hydrogen, beyond the current regulatory limits (2%), as well as the hydrogen storage in case of peaks production. The technical feasibility of an increase in the maximum permissible pressures will be evaluated, while continuing to ensure compliance with the highest safety and environmental protection standards, according to the innovative "Performance Based Design Method" of ASME B31.12: 2019.

T4.4 H2 by gasification of organic material for small microgrid in the industry area. TL: INDELOOP [D: M6 – M58]
The objective is the construction of a 2 MW PV plant coupled with a PEM electrolyser (430 kW) for daily hydrogen production of around 200 kg. The thermal conversion (gasification) plant turns organic material (such as non-recyclable plastics, sludge and textile) into hydrogen and carbon black. It consists of three main systems: thermal conversion, cleaning and cooling, and hydrogen preparation. The testbed plant could process also wastewater sludge. The estimated yearly production of hydrogen is about 80 tonnes. It is planned to install fuel cells (200 kW) along with hydrogen storage. Electricity produced in a 2 MW PV system will be used for hydrogen production on the PEM electrolyser. Produced hydrogen will be stored and used on fuel cells for electricity production in the industry when necessary. This system will create a small microgrid in the industry area in Zagreb, Croatia.

T 4.5 Hydrogen eco system technology solutions & production for next generation valuable market development. TL: HSE [D: M1 – M72]
In HSE Group on site of Thermal Power Plant Šoštanj (TEŠ) there is an established hydrogen production for cooling of generators for Blocks 5 and 6. 200 kW electrolyser and established storage of 48 kg of H2 is in operation. Production of renewable H2 is divided into two phases. Phase 1: It includes installation 2 MW electrolyzer with auxiliary equipment, filling stations infrastructure and small PV on degraded surfaces of Coal Mine company (Premogovnik Velenje) for RES electricity production. This phase will enable yearly production of up to 300 t of renewable H2 for usage in local transport and industry. This phase will serve as a pilot project and as a proof of concept. Phase 2: It will bring innovative large PV plant (floating PV and ground-mount PV on lake shores). Floating PV plant will be established on lake Družmirsko jezero of artificial origin and other degraded area around the lake which is in the availability of HSE. An electrolyzer with the capacity of 17,4 MW and auxiliary equipment for yearly production of up to 2.700 t of renewable H2 will be installed. Hydrogen and battery storages will be established in required capacity and performance to assure stable operation of

hydrogen production facility on site. Phase 1 and Phase 2 together will enable established production capacity of up to 3.000 t of renewable H2 per year.

Work package WP5 – Renewable Hydrogen Testbed Applications for the transport sector

Work Package Number	WP5	Lead Beneficiary	5. MCEoE
Work Package Name	Renewable Hydrogen Testbed Applications for the transport sector		
Start Month	1	End Month	72

Objectives

WP5 aims to: a) support the decarbonisation of the transport sector applications, with particular focus on waterborne applications, public transport fleets, and private vehicles; b) implement and validate testbed applications for the transport sector's renewable hydrogen valorisation, also enabling synergies with other sector of application and production; c) cover the complete value chain of renewable hydrogen from production to distribution, storage and end-use by replicable testbeds; d) develop three FCH applications.

Description

T5.1 Development of integrated hydroelectric and HFC power station for small distribution hydrogen refuelling stations. TL: CTS H2 [D: M1 – M42]
Industrial validation and implementation of small and distributed H2 refuelling station with onsite production of renewable H2, powered by a small hydroelectric power station. The renewable H2 will be produced by an AEM electrolyser (35 bar maximum pressure), reaching a 99,999% purity, powered by a hydroelectric power station (60kW peak load) and then stored in a 50 litres buffer. The system will collect rainwater from the roof of the cabinet with which, after a filtration phase, the electrolytic process will be powered. After a compression at 300 bar, H2 will be stored in a 2200 litres cylinder rack, from which vehicles can be refuelled according to SAEJ2601: 2010 "Refuelling table for communication failure 8-8 Type D-35 refuelling ramp speed and target pressure". The filling process will be in 2 phases, the first is a self-balancing of the pressures between the tank and the storage system, the second will intervene the same booster to bring the charge pressure to 300 bar. Fuel Cell (HFC) has also been included in the system which, powered by stored hydrogen, will be able to deliver up to 5kW of single-phase energy (240 Vac 50 Hz) to charge the batteries of bicycles and mini vehicles.

T5.2 Development of Hydrogen storage system for distribution. TL: FABER [D: M1 – M72]
Industrial validation of an innovative H2 storage composite vessel prototype with large water capacity (>300 l) and implementation of a full automated line suitable for efficient manufacturing at mass production scale (10,000 cylinders/year) of very high-pressure gas cylinders to be installed on road or rail trailers. This will provide the best compromise in terms of performance (high mechanical properties under extreme conditions, best reliability) and economics (manufacturing and maintenance costs). The increase in operating pressure to at least 500 bar and the advanced use of composite materials (with liner in the family of Polyamide which have the best properties against gas permeation against the state of the art which is HDPE), and based on regulatory/normative documents (as per example the recent EN 17339 that allows composite tubes with reduced burst factor), for an increment in the gravimetric efficiency of the cylinders to over 5% (kg transported hydrogen/ kg cylinder) will make it possible to create vehicles capable of reaching a payload of over 1.2 tonnes of hydrogen (respecting the mass limits for road transport).

T5.3 Hydrogen propulsion 4 vessels & maritime infrastructure in the Adriatic. TL: MCoE [D:M1–M60]
The innovative technology of green vessel powertrain will be demonstrated by the delivery of hydrogen-powered pilot vessel. Conceptual design and optimization will be performed in three main aspects:
1) renewable hydrogen propulsion, focussing on performance, safety, certification and supporting value chain infrastructure;
2) power management and control using advanced digital technologies coupled with build-up of the new digital data model;
3) extensive sea trials and data collection/operational performance optimization;
4) collection of know-how, lessons learned and preparation of road map for future commercialization .
More in detail the following activities will be performed:
- Hydrogen propulsion vessel conceptual design, including screening of existing Adriatic commercial fleet, data collection and evaluation of ship operating profiles, propulsion and power management systems, emission performance

and existing port infrastructure supporting full supply chain, hydrogen technology value chain assessment, technology solutions assessment and value proposition.
- Retrofit ship design and engineering, including complete engineering for basic and detailed design, safety and operating performance analysis and assessment, preparation of certification and class documents, liaison with certifying authorities and definition of supporting port infrastructure and complete fuel supply chain.
- Retrofit ship digital technologies development, including analysis of digital twin solution for hydrogen powertrains, development of digital technologies (digital signal processing, big data and artificial intelligence-based models for powertrain process optimization and new generation of power management, all of which is relevant for greener operations of existing fleet), sensor system secure networking and integration, development of digital twin for the complete retrofitted system and equipment and control system testing on testbed prior to installation.
- Pilot project – shipyard retrofit activities, including Pilot vessel retrofit preparation (engineering and activities for removal of existing powertrain and controls), Pilot vessel retrofit execution (vessel preparation and installation of hydrogen propulsion powertrain and controls), Pilot vessel commissioning and sea trials with monitoring and optimization of the complete process.
- Risk assessment relevant for the complete retrofit project.
- Monitoring and follow-up after completion of the trial.

T5.4 Production & management models for use of hydrogen for bus traction. TL: TPL FVG [D:M1–72]
The ecological transition of part of the TPLFVG fleet from diesel to hydrogen power will follow different paths for the use of hydrogen. Bus performances will be monitored by defining specific KPIs and two models of production/distribution/refueling/management will be defined which could be also replicated in other sites. APT (one company of TPL consortium) will build a new hydrogen production plant, powered by a photovoltaic plant (1 MW). Trieste Trasporti (another company of TPL consortium) will use the hydrogen produced by the ACEGAS plant (Task 4.2) and the storage and distribution plant will build. It is also planned to make connections with the local airport by extra-urban or suburban hydrogen buses. The comparison by data collection and modelling of two realities that choose different methods of hydrogen supply to activate a trial of a limited number of buses is a unique case in Italy.

Task 5.5 Maritime transport – entire hydrogen value chain- TL: ACI MARINE [D: M25 – M72]
Objective is to deliver solution for sustainable marine tourism through novel energy concepts with Hydrogen Production and Use of hydrogen in multi-sectoral approach in the transnational territory as Energy Transition has been seen as an opportunity for new role of Marinas and new challenges to marine and tourism industry sector are foreseen. The goal is to deliver 100% clean energy operations within marinas and, to deliver new concepts of see foot - passenger marine transport by hydrogen powered vessels. Hydrogen technology hubs are now envisaged in ACI marinas. Which will ensure multi-day self-sufficiency and support electric mobility, thus generously supporting the development of energy communities in coastal regions and islands. Project entire value chain from solar PV, hydrogen production by electrolysis, logistic of hydrogen in transnational territory and development of novel hydrofoil hydrogen vessels with integrated new cost-effective Fuel Storage Tanks Swap (FSTS) solution for hydrogen-fuelled fleet will be deployed and tested. Results at this task will serve as a nucleus for decarbonisation of maritime industry in archipelago territory between three territories. Product today at TRL6 will be at TRL8 by 2025.
Task 5.6 Energy storage, distributed power generation based on FC and accounting of carbon credits. TL: ECUBES [D: M1 – M72]
Easy deployable, containerised energy storage and power generation solution with 1MWh energy storage in a form of liquid hydrogen carrier will be deployed in any remote area to support hydrogen cars or e-v charging stations. Ecubes has developed a product from TRL2 until TRL-6 today and has been tested at Salonit cement factory. This solution will be further developed until TRL-8 in a period of two years and tested for two years. Solution enables to produce renewable hydrogen from industrial waste heat in a closed material flow, powered by excess-waste heat. Additionally, project addresses the insufficient use of renewable intermittent sources and its use in transport and stationary power applications. Fuel cell with battery pack will be providing power on demand. System will provide an option for alternative energy source from RES-like PV and biogas. Fuel cell CHP system will be integrated in the energy pack, three renewable energy sources will be supplying device to store energy – waste heat, flexibility services will be enabled. Hydrogen will be used in HRS (Hydrogen Refuelling Station) for transport or energy. Validation and implementation of a prototypal balanced system which, thanks to the monitoring of energy and water consumption, the storage of energy in the liquid form of renewable hydrogen and the intelligent management for use in transport, pursues to the reduction of the CO2 emissions, distributed testbed project on five locations in three countries, with feasibility study for large scale investment in the territory with 130.000 CO2 saving/year.

Work package WP6 – Cross Cutting and Cross Border Transport - Zero Emission Mobility Corridor North Adriatic

Work Package Number	WP6	Lead Beneficiary	3. ECUBES
Work Package Name	Cross Cutting and Cross Border Transport - Zero Emission Mobility Corridor North Adriatic		
Start Month	1	End Month	72

Objectives
WP6 aims to: a) prove feasibility on building a renewable energy harvesting and hydrogen (H2) energy storage capability and to facilitate a cross-border transportation, which will lower CO2 emissions and contribute to energy sustainability in the EU; As a result of studies there is envisaged Pilot project of fleet of 1100 Hydrogen cars/vans, 150 hydrogen trucks, 150 hydrogen buses and 20 hydrogen passanger catamarans and fleet of 10 hydrogen airplanes; b) demonstrate that a strong deployment of flexibility solutions is required to provide the power system with the ability to adapt to the dynamics of the residual load, on all timescales: from frequency response to inter-year flexibility.

Description
Task 6.1. P2H2P node hosting capacity in the electric power system of the Northern Adriatic region. TL:ECUBES [D: M2 – M48] In this feasibility study it will be evaluated the hosting capacity, operational impact, and the benefits of the electrolysers implementation in the power system. It represents a key step towards the exploration of the stateof- the-art functionalities' baselines of the Power-to-Hydrogen -to-Power nodes (P2H2P), emphasizes the importance of these technologies in the transition to the green, reliable, and stable power system. The development scenarios of ENTSO-E and ENTSO-G will be analyzed in this task according to the baselines of the Ten-Year Network Development Plan (TYNDP) 2022 & 2024 draft. A survey of good practice on the synergy of the energy systems will be developed. Macro forecast of the expected needs for energy demand and production until 2050 will be estimated by taking in consideration: a) installed capacities (MW) and dispatch (GWh) development of the conventional generation units and the renewable energy sources the Slovenian electric power system; b) peak and minimum consumption power (MW) in Slovenia; c) flexibility technology potential and development in Slovenia; d) electricity consumption (GWh) in Slovenia; e) Net Transfer Capacity and cross-border flow forecasts on Slovenian borders with Croatia and Italy, as well as with Austria and Hungary. Electrical Energy flows baselines over the Power Networks will cover the: Installed capacities and dispatch electrical energy the Slovenian electric power system, Peak and minimum consumption power, Flexibility technology potential, Electricity consumption, Net Transfer Capacity and cross-border flow forecasts. The electrical energy baselines are key to setting up the electric power system model for stationery and dynamic analysis scenarios of the system operation with Power2Hydrogen, Hydrogen2Power or P2H2P nodes, as well as determination of the impact of these nodes on ancillary system services for the Power Transmission System Operator. Furthermore, in this task the validation and implementation of a prototypal balanced system described under task 3.5, operating with a 500kW electrolyser pilot project to be used on several transport application in the cross-border territory will be done. Task 6.2. Rail transport. TL: Salonit Anhovo. PP: ECUBES [D: M12 – M48] Assessment of the feasibility of transitioning a portion or all the Salonit's rail from diesel to a hydrogen by deploying a Fuel Cell Electric Rail Trailor trucks (FCERT) on location at Salonit Cement factory by doing a techno-economic analysis-based system. Multiple alternative fuel options to achieve low-emission train operation relative to current diesel technologies will be analyzed and benchmarked to hydrogen fuel cells. The challenge is to identify ways to reduce emissions of rail trailer. The methodology will be based on cost curves for both truck and infrastructure, and a case study with various scenarios evaluated to find a profitable business case for both an FCET fleet and its infrastructure. The cost curves for FCERT will be based on total cost of ownership (TCO) as a function of hydrogen price, while the levelized cost of hydrogen (LCOH) is used to present the cost of infrastructure. At Cement factory Salonit there is already hydrogen refueling station HRS and the company is keen to invest into one rail trailer and to make trial period of two years at Salonit industrial rail with the objective to prove feasibility of shift towards hydrogen power. To demonstrate for future similar investments in the hydrogen rail transport. A Literature survey to identify tradeoffs and other examples where hydrogen

fuel cell technology was used in applications similar to rail will be done. An assessment of current rail standards to identify specific requirements that would need to be modified to accommodate hydrogen use
Industrial rail use will be conducted and a environmental impact, safety, performance, and public acceptance.

Task 6.3. Heavy road transport. TL: Salonit Anhovo PP: ECUBES [D: M12 – M48]
This task aims to assess the benefits linked to the use of a zero pollution heavy truck to better understand the environmental implications of fueling heavy transport with hydrogen, and consequently to invest into fleet of hydrogen powered trucks for transport of cement. This field study will be developed by using real data obtained
from one Hydrogen truck with the scope to analyze the possibilities to deploy Fuel Cell Electric Trucks (FCET) on the route Salonit Slovenia to Italy where about 100.000 Tonnes of cement are distributed yearly. The technoeconomic analysis will be based on cost curves for both truck and infrastructure, and a case study with various scenarios done to find a profitable business case for both an FCET fleet and its infrastructure. The cost curves for trucks will be based on total cost of ownership (TCO) as a function of hydrogen price, while the levelized cost of hydrogen (LCOH) will be used to present the cost of infrastructure. To identify the trucks component sizes and a FCET for this route to required an onboard hydrogen storage, nominal power of a fuel cell stack
and other components will be considered. To identify the most suitable refueling infrastructure, four different designs of hydrogen refueling stations (HRS) will be compared.

Task 6.4. Passenger transport in rural areas. TL: ECUBES. [D: M4 – M28]
This task aims to explore the potential benefits that rural communities could get from clean transportation developed in the industrial districts in their neighborhood. The study will be focused on Soča river valley between Italy, Slovenia and Kvarner in Croatia by involving at least five specific locations. The analyze will indicate approach to simultaneously encourage local energy storage deployment and hydrogen electric vehicle adoption and other clean transportation options in rural communities while developing energy communities, ensuring that the benefits of a clean transportation system are felt broadly across rural, suburban, and urban communities. The methodology based on cost curves for both vehicles and infrastructure will be applied, and a case study with various scenarios evaluated to find a profitable business case for both an FCET fleet and its infrastructure. The cost curves for cars will be based on total cost of ownership (TCO) as a function of hydrogen price, while the levelized cost of hydrogen (LCOH) will be used to present the cost of hydrogen energy storage
infrastructure with integrated refueling infrastructure. Those locations have been selected because the presence of a running hydrogen refueling station and because of the commitment toward H2 revolution showed by Slovenian municipality of Kanal, which has already set a strategy for H2 storage in rural areas as the very first
Municipality in Europe. The study will be based on real data from the operational fleet of hydrogen cars.

Task 6.5 Infrastructure's layout study for the transport of the quantities of H2 required by the NAHV project. TL: SNAM [D: M18 – M24]
The feasibility study will aim to define the infrastructure's layout necessary for the transmission of the quantities of H2 envisaged by the NAHV's project. The prefeasibility study has as objective the rough definition of the functional and performance requirements in terms of flow rate, pressure, temperature, and diameter characteristic of the pipeline's network (including cross-border transmission) among the different production and delivery points. The study will assess the need of compressors to ensure suitable pressure levels and will define the mechanical power to be installed for the transmission service, the type of driver and the number of compressors, as well as the type of power supply, both for the transmission and possible storage requirements
arising from the need for hourly / daily / weekly modulation. The study will analyze the need / opportunity for interconnections with the European H2 backbone under investigation, and the consequent arrangements. The study will define the number and performance of the pressure reduction and / or flow regulation systems, as well as the number of interception and pig launching / receiving systems. The study will also produce a preliminary estimate of the costs to be incurred for the construction.

Work package WP7 – Communication, Education, And Dissemination

Work Package Number	WP7	Lead Beneficiary	24. META
Work Package Name	Communication, Education, And Dissemination		
Start Month	1	End Month	72

Objectives

WP7 aims to: a) promote results to early-adopters, users and relevant stakeholders to enable their use; b) show and raise awareness of general public about project and its findings/success; c) ensure the most effective and efficient project data publication; d) train skilled human resources required for the transition to an hydrogen ecosystem

Description

Task 7.1 – Activating Communication & Dissemination TL: META, PP: All [D: M1 – M36]
At the KO meeting, META will present the overall approach to C&D and introduce the Media Task Force (MTF) (see sect 2.2). The C&D Plan will be issued by M6. It will describe, clearly distinguishing between Communication and Dissemination, amongst other visual identity (a specialised expertise will be involved), objectives, target audiences, channels, MTF operations and individual approaches for partners to regularly release information. Dissemination target groups will be carefully analysed through an early adopter/stakeholder mapping and engagement activities, involving all the NAHV partners (M3). Communication Target Groups, will be analysed through a preliminary surveys (M3) for gathering information regarding general public level of information and interest. Based on the obtained results, targeted information will be presented by means of different media, organized in the C&D toolbox which will be released at M6: the website to be launched at M4, mirrored with NAHV social channels, first videos (6 in total including stories from the testbeds and regional Ecosystems) will be prepared by M18. Pitches with a related slide deck of the KERs published by M30, first release of the electronic Brochure/leaflet prepared by M6. It will also be evaluated the possibility to participate at science dedicated radio or TV broadcasting (e.g. the Italian R.A.I./Slovenian RTV Slo/Croatian HRT). The Consortium will apply to the Horizon Results Booster to take advantage from joint (with other projects) Dissemination activities.

Task 7.2 – Awareness raising. TL: META , PP: All [D: M1 – M72]
The MTF will prepare content for C&D, processing information data and results, suitable for disclosure, following the MTF operations defined in the C&D plan. The MTF will be responsible to activate the C&D channels (see at 2.2) (e.g., list of relevant journals) and to overview to the quality of the publication. Starting from M6, the MTF will meet monthly to monitor activities and organise next steps according to C&D Plan and coordinate with the Exploitation leading partner for the use-oriented information and data. Contents will be arranged for the general public (Communication – channel website and articles on media), highlighting project impacts, using interviews with opinion leaders to promote key messages and for the specific audiences (dissemination to early adopters and potential customers – channels: demo-sites, workshops, publication on sectoral magazines, pitching events, etc..) highlight the Unique Value Proposition of KERs. NAHV's awareness campaign will include the use of performing and visual arts. 10 Scientific publications will be published in high-impact journals (as for example: International Journal of Hydrogen Energy, Energy, Energy Conversion and Management, Renewable & Sustainable Energy Reviews etc...) and will be made available directly in Open Access journals (Platinum and Gold model) or after an embargo period (Green model). The certification scheme will be promoted to the other H2 producers and HVs. Some peculiar activities will be implemented, to increase the awareness on the hydrogen potential:
7.2.1 Hydrogen café. Sub TL: UNITS, PP: ALL [D: M48 – M68]
The Italian "Caffè delle Scienze" (Science Cafés) organized by the UNI TS consists in informal conversations between professors and citizens on a wide range of scientific topics, which have been held for seventeen years in the historic Cafés of Trieste and, since 2017, also in other cities in FVG. At first the hydrogen valley topics will be introduced in the "Caffè delle Scienze" events in Trieste, proposing a sort of Hydrogen Cafés. Similar initiatives will then be proposed also in the other countries involved in the NAHV. In each country 4 events will be organized by involving at least 50 people each, for a total of 12 events and involving more than 600 citizens.
7.2.2 High Schools and professional schools' engagement. Sub TL: UNIRI PP: UNI TS, UL[D:M12 – M66]
Periodic meetings with local technical and professional schools are planned to establish collaboration with professors & students. Communication programs dedicated to high school students will be developed to promote the spreading of H2 friendly culture. A H2 week in which talks and visiting tours to existing hydrogen facilities will be organized at month 64. Periodic presentations of the project development will be made available to all grade students, by means of dedicated workshops (8) to be held since M18 adjusted for the student level of education, involving at least 500 participants overall. Internships and projects will be provided to establish greater connection of technical students with the industry.
7.2.3 Annual conference and technical workshops Sub TL: META PP: All [D: M18 – M72]
NAHV will build on the basis of previous experience [4] a cycle of conference held yearly to disseminate the ongoing status of the NAHV and to promote the NAHV concept to other HVs and stimulate networking among the partners and early adopters at regional and EU level and international level. The conferences will be conjunctly organized and alternatively hosted by the participating institutions. In conjunction with this event 3 H2 technical workshops will be organized.

Task 7.3 EDUCATION. TL: UNIRI, PP: UNITS, UL [D: M1 – M72]

Education related activities will be addressed to promote the training of future professionals and experts in the field of hydrogen technologies.

7.3.1 Vocational training programs Sub TL UNIRI, PP: ALL [D: M12– M72]

Vocational training program will be promoted, and organized and tr by UNIRI with the support of Region FVG and Slo and HR ministries and the other partner by deploying also European Social Fund-ESF, through the following actions: a) markets niches with higher potential of implementation and determination of most demanded profiles will be identified (such as operators for hydrogen refueling stations, or operators which will deal with hydrogen safety); b) technical knowledge and skills required for these profiles and innovative training methodologies to implement on the program will be defined; c) an innovative training program, branched to match different profiles, will be designed to promote future employment opportunities required to boost the hydrogen ecosystem. Specific focus will be devoted to programs related to monitoring activities and thus tailored to project partners and other partners involved in the NAHV. Particular attention will be dedicated in building the crucial skills required for monitoring and reporting project KPIs, and for leveraging such a knowledge in forthcoming strategic activities being crucial for expansion of H2 related activities.

7.3.2 Macro-Regional Competence Center for Hydrogen Research and Education TL: UNIRI. PP: GITONE, UNITES, UL [D: M1 – M72]

The NAHV's goal is to educate and create the experts and the engineers of the future. This education must be interdisciplinary, addressing not only the needed STEM knowledge but also financial and societal aspects of the changes new H2 technologies will bring. In the first stage, micro-credentials will be developed for the reskilling and upskilling of professionals working in related industry. Such micro-credentials can be developed at the university level and with strong collaboration between NAHV involved universities. In the second stage, related BA, MA, PhD degrees should be developed and offered as interdisciplinary and international prototypes of future EU degrees. All the education will be created in accordance to gender equality plan and policies, and should be open to professionals and universities outside NAHV region – particularly to SE and CE universities. To harmonize education, research, and communication activities a macro-regional competence center will be created. Such a center will be comprising representatives of both academia and industry and it will operate in order to facilitate their cooperation. The macro-regional competence center will deal with, for example: a) leading research activities dedicated to advanced material characterization for hydrogen technologies; b) study and development of cryogenic technologies dedicated to hydrogen storage; c) development and characterization of electrolyser systems; d) the establishment of a training center on hydrogen in marine applications; e) the evaluation for the creation of a new master's degree and a new PhD program focused on hydrogen technologies. Such educational path will be shared by the universities in partnership within the project and it will host an international, itinerant summer school (T7.3.4). The Center will be sustainable via to the financial funds listed in sect.1.2.

7.3.3 Training and educational mentoring programme H2STUDENT – open education for young people Sub TL: ECUBES [D: M24 – M72]

The training and mentoring programme "H2STUDENT" offers to students and teachers a new, different practice of educational workshops by using a pre-developed mentoring program and trained mentors. The aims of H2STUDENT is to strengthen competencies in hydrogen technologies with a focus on clean mobility & the green transition and to transfer to the participants the necessary competencies in the field of hydrogen technologies. H2STUDENT will see the implementation of educational workshops with qualified mentors. The programme will also aim to transfer good practices in order to ensure the sustainability of the project. It will be based on the successful experience already delivered by ECUBES together with the Imperial College of London in Indonesia in 2018 [5] , and replicated since 2019 in Slovenia and Croatia [6] , which have seen together about 3700 young people trained. The programme will be executed within four-year period and every year at least 1500 young people will be trained within a three-day course. In total we expect about 6.000 participants in 4 years. The training courses will be focalized to transfer to the youngs the concept that for the successful deployment of clean energy infrastructure the entire value chain shall be developed, from RES until end use – Transport. This is also related to avoid the NIMBY effect discussed above and to educate the youth population that hydrogen infrastructure is required for a fully sustainable future.

Task 7.3.4 Itinerant summer/winter school PhD students. Sub TL:UNIRI. PP UNITS, UL[D:M1–M72]

To direct scientists in the initial phase of their career to understand how the results of their research can be used to benefit society and introduce them to creative thinking, entrepreneurship, and innovation-from brainstorming, Through a guided workshop, assignments, examples, discussions, and the elaboration of their own knowledge-based ideas, doctoral students gain insight into fundamental concepts and modern tools in the field of innovation and entrepreneurship, which motivates them to transfer research findings to society and contribute to the collaboration of the academic sector with business and community organizations on innovative projects. The Summer/winter schools would be held 9 times for a total of 180 students. The main actors involved in the implementation of the summer / winter school are people from the community and the economy, since they hold heritage and the environment together. Summer and winter schools will be held in the scientific and educational center of the University of Rijeka, Moise Palace on the island of Cres. The

aim of the International Summer School is to revitalize the space for the exchange of opinions, discussion and critical reflection on contemporary research, practices, methodologies and processes.

[4] http://hydrogen-ecosystem-northadriatic.com/si/
[5] https://www.imperial.ac.uk/news/187713/imperial-celebrates-launch-2018-asian-games/
[6] https://h2student.si/en/home-en/

Work package WP8 – Policies Analysis and Guidelines

Work Package Number	WP8	Lead Beneficiary	27. MINGOR
Work Package Name	Policies Analysis and Guidelines		
Start Month	2	End Month	72

Objectives
WP8 analyses the current policies on H2, develop regulatory sandbox & policies guidelines to incentive the adoption of innovations in H2 value chain and to create a common legal framework regarding the production, use and distribution of H2, propose an incentive and funding system to support the production and adoption of H2 by the private sector and set up a sustainable renewable H2 market on the NAHV.

Description
The creation of an inter-ministerial broader working group (IMWG) is planned in which, in addition to members of the relevant ministries, other external members (experts from various institutions, companies, SRIPs, etc.) will be present. The team and activities have already been activated by the signature of the “Letter of Intent for the Establishment of a North Adriatic Cross Border Hydrogen Valley” (March 2022). The activities that will quickly lead to concrete outputs are fundamental for the constitution of the NAHV. They concern public contribution in terms of laws and regulations and economic support to companies, a fundamental element for the creation of a renewable H2 market, especially in a transnational perspective. Task 8.1 Policies analysis TL: MINGOR, PP: MZI, FVG, AREA [D: M6 – M72] IMWG with the involvement of the project’s stakeholders will map the existing policy and regulatory framework related to H2 value chain in the NAHV countries, moreover a policy review and a benchmarking of main existing regulations in the other EU countries will be performed. This analysis will allow having a clear understanding of the existing legal framework and of the possible gaps in some of the utilization areas (such as hydrogen bunkering in the port area). To reach this objective the interdisciplinary team will be set up composed by ministerial officers, researchers, and end representative of the end-users. Task 8.2 Regulation revision (including sandbox) TL: FVG, PP: MINGOR, MZI, AREA [D: M2–M72] Innovators often encounter regulatory barriers, as the current legal framework is not adequate to the new challenges, as it has co-evolved with long-established technological systems (e.g. distribution grids) and business models. Rapid adaptation of the regulatory framework in Slovenia, Croatia and Italy is often not possible in a short time. Nevertheless, the urgency of the energy transition and the constitution of the NAHV requires supportive framework conditions for the innovation ecosystem and for a sort of policy harmonization. To support a speed definition of the regulatory framework a Regulatory Sandbox (RS), a safe playground in which to experiment, collect experiences and play without having to face the strict rules of the “real world”, will be instituted. Whereas the sand of an actual sandbox protects against harm while playing, certain consumer safeguards are established to fulfil that task in its regulatory counterpart. Meanwhile clear entry and exit requirements, as well as a pre-defined scope, display the borders of the box. The motivation behind setting up a NAHV regulatory sandbox is two-fold: 1. allow innovators (industrial & research partners) to test new technologies and business models that are only partially compatible with the existing legal and regulatory framework. 2. allow regulators (institutional partners) to learn about particular innovations. As such, regulators can develop the right regulatory environment to accommodate them. In the energy sector, the use of regulatory sandboxes is quite new. The ISGAN Casebook on Innovative Regulatory Approaches with Focus on Experimental Sandboxes and a recent White Paper of the Vlerick Energy Centre cover several case studies in Australia, Austria, Germany, Italy, the Netherlands, Great Britain and the United States. At present, the Netherlands, Great Britain and Germany have gained specific and extensive experience with a sandbox-like approach to energy at the time of writing. In Germany the Federal Minister and representatives from the regional states launched the Northern Germany Regulatory Sandbox. The goal is to accelerate the process of translating research innovations into practical applications. The sandbox is focused on hydrogen. A total

of €52 million is available. The aim is to use green hydrogen to integrate industry, transport and the supply of heat in a consistent manner, thus saving large amounts of carbon dioxide. In this way, we will mitigate climate change and strengthen the economy.
The regulatory sandbox for the energy transition will be an instrument within the framework of the National (and regional) Government's Programmes. The funding provided by the NAHV will be used to support companies and research institutions that are developing tangible solutions for the energy transition to test innovative energy technologies under existing market conditions and on an industrial scale, thus helping to speed up the process from technological development to market penetration. The project partners participating in the NAHV Regulatory Sandbox, plus some of the organizations which have issued a letter of intent such as the Italian Fire Brigade, Ministry of Transport and Ecological Transition, will seek solutions for a holistic development of the transnational energy system with a focus on 3 geographical centres across Slovenia, Croatia & Italy (FVG region), developing integrated concepts for sector coupling with an emphasis on H2 and devising energy-efficient neighbourhood systems for the heating sector. The collaborative project includes participants from the private sector, government and science covering the entire energy value chain – including generation, transport, storage and consumption of renewable H2. Over a period of 7 years, the Policy maker level (Ministries and Regional authorities) will provide additional funding for the North Adriatic Hydrogen Valley. The lynchpin of the project is 'green' hydrogen, i.e. hydrogen that is produced using renewable electricity for the electrolysis of water. In the industrial sector, hydrogen can help to avoid carbon emissions by replacing natural gas, for example. And in private households too, hydrogen has the potential to become the fuel of the future. To this end, the North Adriatic Hydrogen Valley Regulatory Sandbox is, for example, to explore the prospects of converting the gas distribution system to hydrogen. the issue of certifications for the distribution, storage and transport of hydrogen in three Countries, or the regulations on safety and industrial production. With a view to speeding up the energy transition in the heating sector, the project partners are also planning to use waste heat from a waste incineration plant and an industrial plant in order to feed it into an existing district heating pipeline. Taken together, these measures could make it possible to save tons of carbon emissions per year.
The NAHV RS will increasingly be used as policy instrument to create experimental spaces to accelerate innovation processes under interactive technological, institutional and legislative conditions in the 3 involved countries. The goal of the NAHV Renewable Hydrogen regulatory sandbox is to accelerate the process of translating research innovations (technologies, business models…) into practical application.
Operationally, the Task will start from a technical table with institutional partners (ministries and regions) and legal experts, using the preparatory work begun with the Argo System, with the activation of a research grant (Area Science Park-University of Trieste) for the preparation of a Sandbox model in the area of Circular Economy-End of Waste. Regional thematic round-tables will be organized in the 3 territories to share and discuss the policy guidelines with stakeholders. Outcomes of round-tables will contribute to the formulation of a regulatory sandbox H2 value chain

Task 8.3 Policies guidelines TL: MZI, PP: MINGOR, FVG, AREA [D M12 – M24]
The output from the previous tasks will: contribute to a) the development of policy guidelines b) to raise awareness and commitment among policy makers and c) to orient decisions towards the formulation of policies that stimulate and favor innovation and adoption of H2. The guidelines will also focus on the need to create a suitable legal framework regarding the production, use and commercialization of H2 so to accelerate the creation of new markets and business opportunities within the NAHV regions but also in all EU. The objective is to support policy makers in the formulation of policies that will incentivize the adoption of innovations in H2 value chain and to create a common legal framework regarding the production, use and distribution of H2. The lack of an appropriate legislation has an impact in terms of legal and economic barriers to the production, use and distribution of H2. To solve those issues, it is essential to revise the current legislation. Furthermore, a clearer definition within the EU legislation would create a functioning, profitable and eco-friendly market for the H2 value chain across Europe. This activity foresees the elaboration of Policy guidelines and Regional roadmaps. The IMWG will propose to the policy makers possible regulations to be adopted. On this regard, regional thematic round-tables will be organized in the 3 territories to share and discuss the policy guidelines with stakeholders. Outcomes of round-tables will contribute to the formulation of regional roadmaps to define sustainable H2 value chain policies. The work of Task 8.3 will provide some useful elements for the development/implementation of the respective National Hydrogen Strategy.

Task 8.4 Incentives TL: FVG, PP: MZI, MINGOR, AREA [D M6 – M72]
Currently, renewable hydrogen is more than twice as expensive as grey hydrogen. For this reason, the IMWG at institutional level will study a complete package of incentives to develop a sustainable renewable H2 supply chain. The incentives schemes will be designed and proposed to the NAHV's policy makers, it will be organized under 5 main intervention lines, and it will take in due consideration the State Aid regulation:
1. Fiscal Support System: fiscal credit to lowering the high-cost barriers to entry in the supply chain. It will support both investors to develop new technologies for the renewable H2 supply chain activation, and industries that need to cover the high investment costs to purchase technologies to use renewable H2 and users that need to invest for the introduction of H2 technologies.

2. Grants and loans Support System: to reduce the investment costs and the necessary funding to support the transition from the fossil-based processes to climate-neutral solutions (for example, the early phase-out and conversion of BF-BOF). These instruments should be adopted at the inception of an industry's decarbonisation efforts, to assist first movers and to keep the impact on government budgets low. They will be focalised on the CAPEX and OPEX side.
3. Tax rebates System: The intention is to promote carbon emission reductions by reducing the overall tax liability faced by industrial firms for them to invest in renewable hydrogen consumption. For industries that buy hydrogen from commercial producers, rebates may be used to support the purchase of renewable hydrogen. The tax rebate will be determined by CO2 reduction per unit of output or for the adoption of specific new processes that the government wants to support. Carbon tax rebates may aim to avoid an industrial firm's overall tax liability increasing if certain conditions are met, for example specific activities to decarbonise processes (e.g. the installation of an in-situ electrolyser) [7] . In a similar way a refund mechanism will be studied be added to a similar tax, returning all of the revenues generated to the plants covered by the tax in proportion to the amount of energy they produced so awarding those plants with smaller emissions.
4. Carbon Contracts for difference for NAHV. Usually called feed-in tariffs (FITs) or feed-in premiums (FIPs). Tariffs and premiums will be introduced in various jurisdictions either administratively or competitively in NAHV. Specially Carbon contracts for difference (CCfDs) that can complement ETS systems. These CCfDs will be contracted between NAHV governments and companies that produce materials with reduced carbon intensity. A CCfD would guarantee a fixed "strike price" for tonnes of CO2 avoided for a predetermined number of years. If at the end of a year the average annual ETS price has been below the strike price, the company will receive, for each tonne of CO2 avoided, the difference between the two values.
5. Attraction of investment: this will support the investment in the NAHV area from actors which are interested in investing at the production or research and development level in the NAHV area. The support will be studied in order to reduce the CAPEX and OPEX.

[7] i.e: in Sweden a tax rate of SEK 40/kg of NOx emitted from any combustion plant producing at least 50 MWh per year has been set.

Work package WP9 – Inter-Regional Hydrogen R&D&I Development Joint Action Plan and NAHV Master Plan&Business Model

Work Package Number	WP9	Lead Beneficiary	2. AREA
Work Package Name	Inter-Regional Hydrogen R&D&I Development Joint Action Plan and NAHV Master Plan&Business Model		
Start Month	1	End Month	60

Objectives
Co-create with the relevant stakeholders the NAHV's Joint Action Plan to define its R&D&I roadmap. The JAP will identify a strategy for regional and cross border R&D&I and the related financial measures. The results will feed the masterplan for the NAHV's medium term development. The measures necessary for accompanying and supporting the private investments including the support of new start-ups will be defined, as well as measures to put in place for the wide territorial planning of the NAHV. Having an integrated masterplan for the valley will allow to better manage the overall intervention.

Description
T9.1 Joint Action Plan - JAP Methodology. TL: AREA PP: FHA, UNITS, HSE [D M1-M6] This task aims to specify and further develop the methodology set out below, after initial refinement. The methodology take inspiration by the European Guidelines (Guidance on joint action plans - Publications Office of the EU (europa.eu)) and will also shape the key element of Joint Action Plan- JAP so that the delivery and implementation of activities designed to promote the NAHV's cooperation is undertaken in such a way as to allow the process and impact of those actions to be effectively monitored and evaluated. The Methodology here identified will be used to gather information from the 3 project areas. Outcome of this task will be a Methodology Guidelines that will drive the full WP. T9.2 Information gathering and needs' analysis: field and desk. TL: AREA. PP: ECUBES, UNITS, UL, UNIRI [D M4-29 M60-M72] Starting from the existing baseline and research already developed, this task will focus on establishing the extent of

cooperation between researchers, innovators and policy makers within the NAHV area. To reach this objective: 1) a Electronic Survey will be undertaken across universities and private sector and policy makers active in the NAHV's area, focusing on the current cooperation in the energy and hydrogen, hard 2 abate field and transport; 2) a literature review will be undertaken to establish the research base on scientific and business/commercial cooperation across the NAHV area. This review will include an evidence review of metrics of scientific cooperation and uptake such as the number of international co-authored publications and the number of commercial interchanges; c) 100 qualitative interviews will be undertaken with stakeholder representatives of the quadruple helix operating in the hard 2 abate, hydrogen & energy and transport fields. These activities will be used to generate a baseline position (during this process the data listed in the table below under "Verifiable indicators" will be collected to ensure a consistent baseline), and then, to evaluate the impact of the JAP outcomes during and after the project life. The last year of the project the process will be reiterated to evaluate what the result has been after 5 years from the NAHV set up and to make a comparative study. This will be also useful to keep track of the results of the JAP and the Master Plan. Moreover, a desk analysis will be done to systematize the relevant policies, relevant initiatives and development plans. Finally focus groups will be arranged in all involved territories with the key stakeholders to elaborate and prioritize all the inputs collected so far. The field analysis will foresee a) interviews with the stakeholders aimed at verifying their real contribution in the process of innovation, technology transfer, any constraints they perceived and how to overcome those constraints that are able to highlight any perceived opportunities; b) reconstruction in field of cases of success and failure through interviews and interactive meetings with stakeholders (mainly researchers, enterprises, business support organizations, business organizations and policy makers), aimed at verifying what were the key success factors and what are the reasons for failure.
T9.3 JAP co-creation. TL: FHA. PP: AREA, ALL [D M4-M36]
Taking results of T9.1, 9.2 the JAP will be defined. The JAP will be based on regional, national and European priorities and trends so as to foster and to put into action a common RTD and innovation strategy and related financial plan for the next 12 years planned in T9.5. The main goal is to achieve a coherent trans-national plan across the NAHV, and equally to ensure that countries are able to valorize the research and innovation component of the ecosystem also by stimulating start up development and increasing the knowledge transfer between research and enterprises also via common R&D and innovation activities. The JAP will have two main objectives: a) supporting the improvement of research-innovation-business coordination of the NAHV; b) defining the R&D&I roadmap for the period 2023-2029 and 2029-2035 for the further development of the NAHV. The JAP will describe a first set of actions for improving the business and research cross border cooperation to guaranty a high level of competitive capacity of the NAHV's ecosystem. The JAP will also provide recommendations for: (1) NAVH policy makers by defining common R&D and investment lines to be funded with their national resources, (2) researchers by defining common R&D lines addressed to solve the gaps and weaknesses observed in the NAHV's area; (3) business community by indicating the profitable areas of investment for the years to come in the framework of the H2 economy, (4) design a collection system of rare earths and critical raw materials from end-life photovoltaic systems generated by NAHV. The collection will have to be connected to the distribution and transport network envisaged by the NAHV, involving the related partners. The analysis for the set-up of a single cross-border hub specialized in storage, processing, separation and recovery of the RAEs and CRMs produced". The JAP methodology will be based on a participative approach in order to share and to build a common vision. The participative approach that will envisage the organization of interactive meetings to present the drafts of the JAP and collect feedback will enable an active involvement of all the relevant actors and stakeholders as well as to synthesize multifaceted inputs and requirements. The JAP will be developed at two levels: a) regional level – measures to focus investment onto hydrogen valley's ecosystem in areas where the region can increase its potential; b) NAHV level – shared activities to stimulate innovation capacity, including training for a new cross border collaborations for the increase of R&D&I cooperation, as synthesized below:
Measures Outputs Verifiable indicators
measures to focus investment onto 'Hydrogen Valley ecosystem in areas where the region can increase its potential - new R&D+I products and services
- high - level of R&D infrastructures and facilities
- start- up of innovative firms and spin offs
- new technology transfer and innovation services
- brain circulation
- new high skilled professional profiles in the innovation management field
- set up of a network of R&D&I infrastructures
- regional investments focused in key NAHV's priorities
- new private equity investments
- start up of new Public-private partnerships
- private investments - n° of products and services proposed for the market
- equipment available
- variation (delta) of number of start ups
- delta of technologies transferred

- delta of researchers in mobility programme
- delta of professionals trained
- Concentration level of RTD found in the region
- Delta of public investments done
- Delta of partnerships done
- Delta amount of private investments planned in 5 years

shared activities to stimulate the NAHV crossborder ecosystem - trans-national and international R&D&I collaborations, such as collaborative projects, testbed projects and market replication projects

- bi-regional strategy implementation
- wide cross border hydrogen economy - Delta of projects done
- Delta of cross border activities carried out
- % increase of hydrogen economy in the NAHV area
- common management structure

T9.4 Masterplan methodology definition and information gathering. TL: AREA. PP: FHA [D M4-M42]
Within this task will be defined: the programme of activities, the source of information to be gathered, the methodology for assuring an effective stakeholders' engagement, how the data coming from all the other WPs must be integrated in the masterplan, the human resources to be involved in the following phases, etc. Furthermore, the Program Breakdown Structure will be drafted taking in consideration the several projects included in the NAHV's application and by the other projects, coherent with NAHV, which could arise over the time. Furthermore, the masterplan will have to define the operational and business model of the NAHV. The masterplan will define the methodology for supporting start-ups and innovative SME's development via the NAHV-H2B accelerator (see T9.6). All the NAHV' area will be analysed also with GIS. The main social and economic data will be collected and analysed. The data on main infrastructures will be collected as well (road, railways, hospitals, etc) in order to map additional potential hydrogen users and to better manage transportation, logistics, distribution and potential risks. Meetings with the stakeholders will be organized in the forms of think tanks, forums, one2 one with experts. Desk and field data analysis on the successful hydrogen valleys in Europe (Big Hit, Green Hysland, Heavenn and others) has been already started at the time of the project definition but will be further extended to analyse further developments and new initiatives and study visits will be organized in order to gather a benchmarking matrix and learn from their experience avoiding the same mistakes and capitalizing winning solutions. Gaps & Problems will be identified. All this work will lead to the definition of a SWOT analysis of the NAHV.
T9.5 NAHV's masterplan, business plan & financial scheme. TL: AREA. PP: ALL [D M4-M42]
All the info collected above, will allow to draft the projections of the NAHV growth plan at 12 years. The needs and requirements from the stakeholders will be considered such as how the society will evolve over the planned period. This work will lead to obtain the overall conceptual framework and the "vision for future growth and development". Some alternatives /what if scenarios will be analysed and evaluated. This modus operandi will lead to a first draft of NAHV's masterplan which will be notified to the citizens and other stakeholders to collect their feedback and suggestions which will allow to perform a refinement of the NAHV master plan. The master plan will also define the NAHV's business model and then the NAHV's business plan. It will address the NAHV organisational structure, the operational strategy & the operating plan, the investments plan and the operational cost. For the definition of the financial part, will be considered elements such as: cost of investment, cost of maintenance, insurance, personnel, interest rates, debt, tax impact, cash flow, pay-back time, etc. This task will also address what happens on conclusion of the project, analysing NAHV's viability. The results will provide evidence of the overall sustainability of the NAHV for all parties involved providing information regarding the: cost for public administrations and the return on investment for the public administration (in terms of new working places created, less pollution, tax income, etc) and for the private operators (ROI, debt, equity invested, new work force, payback, etc). The definition of the NAHV's business plan cost will allow to define the source of funding and co-funding for the overall development of the valley during and after the end of the project. For each project a funding/-co funding scheme will be defined also considering the possible source of funding listed in paragraph 1.2 table 8.
T9.6 NAHV hydrogen ecosystem business accelerator – H2B accelerator. TL: AREA. PP: UNITS [D M18-M60]
The interviews done in the NAHV's preparation phase have highlighted that at cross border and regional level there are some productive and innovation gaps in the hydrogen value chain. To fill those gaps NAHV will develop the business model of the NAHV hydrogen ecosystem business accelerator – NAHV - H2B accelerator. The H2B will be an acceleration programme implemented by Area and supported by the 3 public authorities with some of the external resources indicated in paragraph 1.2. table 8. The NAHV - H2B will follow the open innovation approach, it will launch one call per year starting from M24 for selecting innovative startups and SMEs aiming to develop proof of concept (PoC) solutions targeted to solve the NAHV's ecosystem problems. AREA by leveraging the ARGO programme will create a fund addressed to the FVG's SMEs &startups to fund about 10 PoC year. Under the management of AREA the large and medium companies partners of the NAHV and the startups and SMEs will work together to solve a predefined challenges identified by the JAP. The scope is the production of a PoC which will be tested and could be uptake by the large and medium companies of the NAHV's ecosystem. Specific actions will be put in place to favor women entrepreneurship.

Work package WP10 – Technical Demonstrator Plants Monitoring, Identification and Assessment Of Social, Economic and Environmental Impacts, Including Water Utilization

Work Package Number	WP10	Lead Beneficiary	18. UNITS
Work Package Name	Technical Demonstrator Plants Monitoring, Identification and Assessment Of Social, Economic and Environmental Impacts, Including Water Utilization		
Start Month	1	End Month	72

Objectives
To set the methodology for: a) the whole monitoring of the testbeds projects developed in WP3, WP4, WP5; b) the monitoring of the performance of the hydrogen production plants of the NAHV; c) the monitoring of the environmental data. The level of data sharing will be discussed and set in a specific confidentiality agreement with the partner in charge of each testbed.

Description
Task 10.1 Methodology TL: UNITS. PP: UR, UL [D: M1-M18] Environmental and system related parameters will be remotely monitored by means of an Internet-of-Things (IoT) based network of sensors and transducers. Devices will be connected following the common communication models used for IoT systems (e.g. Device-to-Device, Device-to-Cloud, Device-to-Gateway, and Back-End Data-Sharing). The recorded data will be real time processed to be fed to the digital twin of the NAHV (task 2.3) and for monitoring the status of the plant. Data processing will be also focused in highlighting the occurrence of undesired conditions which are known to be at the base of premature aging of the plant components (such as, high peaking current drawings for batteries or transient operating conditions of electrolysers and fuel cells as well as not-homogenous operative conditions in fuel cell stacks). Artificial intelligence algorithms will be developed and employed for the data processing for failure prediction. The remote access to the digital-twin-supported real time monitoring (T2.4) will be guaranteed by constituting a Wide Area Network, accessible from a web portal, based on the constitution of a secured database. Within this task the methodology for the monitoring of the testbeds will be delivered, while the effective monitoring will be performed in the framework of each task related to the testbed. Task 10.2 Monitoring of the production system TL: UNITS. PP: UR, UL [D: M36-M72] The monitoring production system is expected to be composed by a set of renewable energy power plants (such as photovoltaic and wind power plants) and by a hydrogen production plant (e.g. electrolyser). The monitoring system will acquire both environmental data related to the energy availability (e.g. solar irradiance, wind speed), and to the plant real time performances (e.g. performance of PV plant and auxiliaries). Evaluation of existing data regarding energy availability will be conducted to provide most appropriate design. Concerning the H2 production plants, dedicated instrumentation will be installed to measure H2 production rate over time and to monitor flow rates and pressures. Particular attention will be paid to oversee the performance degradation of the plants (e.g. due to membrane degradation of electrolysers) and the energy efficiency of the system, with the support of the developed digital twin (T2.4). Advanced data analysis will help to define the best operating strategies. Task 10.3 Monitoring of the storage system TL: UR, PP: UL, UNITS [D: M36-M72] The storage system is expected to include both hydrogen storage systems and electrical energy storage systems (e.g. batteries). In initial phase of the project hydrogen is expected to be stored either in compressed form or as liquefied gas. In the first case, the monitoring system will acquire data related to hydrogen compressor efficiency, hydrogen cylinders temperatures, and hydrogen pressure. In both cases, dedicated sensors will be installed to monitor stored hydrogen level over time. Regarding the electrical energy storage systems, operating temperatures, state of charge, and effect of charging/discharging profiles will be tracked. Task 10.4 Monitoring of the distribution system TL: UL, PP: UNIRI, UNITS [D: M36-M72] According to the chosen hydrogen distribution technology, real time data will be acquired to determine the hydrogen demand-supply ratio, hence defining the amount of hydrogen for NAHV internal use (e.g. self-consumption), and the amount hydrogen for export. Such data could be fundamental also for the definition of tailored incentives ad policies for enabling a local hydrogen market. Task 10.5 Monitoring and analysis of the final user hydrogen demand profile and energy efficiency TL: UNITS, PP: UR, UL [D: M36-M72] In collaboration with industrial and research institutions involved in the NAHV, data acquisition systems will be installed on the main users' testbeds and facilities (e.g. mobility users, industrial plants, CHP/micro-CHP) to define yearly hydrogen and energy demand, by considering both electrical, heating, and cooling power demands. In-use data and

digital-twins (T2.4) will be processed to obtain deeper insight into causal relation between operational patterns and degradation of the key components, which will enable environmentally focused and cost optimized planning of further activities, investments and operational patterns. This will include monitoring of inter-sectorial parameters to monitor sector-coupling and intra-sector production, storage and use. Users will be further classified according to the hydrogen consumption. Data will allow to find the optimal matching among the renewable hydrogen production and the user demand will be defined.

Task 10.6 Environmental impact assessment (e.g. including LCA) TL: UL, PP: UNITS, UNIRI [D:M6-M72]

The evaluation of environmental impacts associated to production, transportation, and distribution of hydrogen in the ambit of the NAHV can play a crucial role regarding the awareness about the main processes and components with the highest emissions. Particular attention will be paid to water utilization. The acknowledgement of such aspects can support decisions for improvements to reduce the overall emissions of the hydrogen life cycle. Such decisions should be based on comprehensive research and robust data applied to the specific life cycle of the hydrogen supply chain under analysis. In this way, a Life Cycle Assessment (LCA) will be used to assess environmental impacts of implemented components in the energy production, storage and end-use and benchmarked to the current energy distribution scenarios. Life cycle impact methodology (LCIA) will be defined with impact indicators relevant for hydrogen economy and energy storage systems. The innovative life cycle inventories (LCI) will be setup and integrated into digital twins to enable deeper insight of environmental performance of energy system. Furthermore, for those systems performing more than one function (e.g., multi-product systems), the approach followed to address multifunctionality has to be detailed. In particular, the possible approaches can be subdivision, system expansion, or allocation. In this regard, LCA standards prioritize process subdivision and system expansion over the use of allocation approaches. Specific software programs, such as openLCA and/or Simapro, will be used to perform the duly simulations and sensitivity analysis. To execute these simulations, the Ecoinvent database will be used as foundation for the inventory analysis following the four main steps defined by ISO 14040 and ISO 14044.

Task 10.7 Social impact analysis TL: UNIRI, PP: UL, UNITS [D: M12-M72]

Social impacts will be assessed using social life cycle assessment (S-LCA) that is the methodology to analyse the potential social impact of a product system through its life cycle. S-LCA will enable understanding the social conditions under which services and goods are produced and identifying potential social hotspots along the supply chain. S-LCA includes a wide range of social impact subcategories classified considering key stakeholders that can be associated with product systems. Each subcategory is evaluated according to a specific set of social indicators. S-LCA will include also an analysis of gender impact. It should be noted that that geopolitical and economic profile of the countries involved in the supply chain has a primary influence on the quantification of the social impacts associated with a product system. While in environmental LCA the activity variables are denoted by levels of emissions and elementary flows (referred to the FU) crossing the system's boundaries, in S-LCA the activity term is represented by the number of working hours per FU required to produce the flows from the country-specific industries involved.

Task 10.8 Cost-benefit analysis TL: UNIRI, PP: UL, UNITS; AREA [D: M12-M72]

Potential economic, environmental, and social costs and benefits that might be generated from the NAHV project will be evaluated in the ambit of different hydrogen production scenarios. Social and environmental costs are intimately connected since environmental changes are societal concerns. As regards the economic performance, LCC, which involves cash flow analyses of product systems over their useful life, will be used as methodology to provide economic indicators from a life-cycle perspective. LCC will enable the quantification of a significant number of economic and financial indicators (Net Present Value, Levelized Costs, Payback Period, Internal Rate of Investment) of product systems. These economic indicators allow integrating social and environmental effects into the cash flow analysis as a significant methodological enrichment. In this sense, such approach can potentially influence decisions for an entire economic sector and, subsequently, its evolution. To enrich the economic analysis, environmental LCC and social LCC will also be performed. The cost-benefit analysis within the project will be also conducted in accordance with the methodology for conducting the economic and financial analysis of costs and benefits defined by the European Commission, Guide to Cost-Benefit Analysis of Investment Projects, Economic appraisal tool for Cohesion Policy 2014-2020. The analysis will be carried out for a subsequently determined and defined economic system or subsystem. Particular focus will be dedicated to identifying and internalizing specific externalities related to hydrogen energy infrastructure and use. The economic costs and benefits associated with the NAHV plants will be assessed through thermoeconomic analysis (Thermoeconpmics analyss combines economic and thermodynamic analysis by applying the concept of cost, to exergy) to understand the cost flow throughout the system, as well as the cost formation process of the H2. Such an approach will allow providing a rational basis to allocate and control expenses, identify pathways for economic improvements of the plant, and for pricing the produced H2.

Furthermore, AREA will analize how the "NAHV supply chain" (which is already in operation, albeit at an early stage) will develops over time, and it will identify any correlated (and possibly also causal links) with the activities of the NAHV project. The development of NAHV supply chain could initially be traced through anecdotal evidence: the initial members of the supply chain are project partners, their direct or potential suppliers and customers, their research /

innovation propension and the effect of this on the business performance. For a broader and more quantitative description, sources such as partnerships from previous hydrogen research and innovation projects , companies that hold patents or other intellectual property rights, and companies that are similar in industry and structure will be considered. Finally, human resources with specialised hydrogen expertise are critical to the success of the NAHV project. Although not typically included in the classic supply chain definition, it is however necessary to track the people who play a key role in the system. This includes identifying the key individuals, keep track of staff turnover in critical positions, as well as job vacancies in the sector. A further improvement would be to tracking links between companies created by the mobility of researchers and technicians who are employed by project partners or other members of the NAHV supply chain. At the end this analysis will go further the simple job creation (which will be in any case tracked) but will assess how the NAHV is going to be impactful on the regional employment's dynamics. The analysis will track the impact of the NAHV on the research-innovation-business relationship.

Work package WP11 – NAHV Exploitation & Replication Activities

Work Package Number	WP11	Lead Beneficiary	17. FBK
Work Package Name	NAHV Exploitation & Replication Activities		
Start Month	6	End Month	72

Objectives
To maximise the impact of the NAHV, and, via a detailed plan, exploit the different dimensions of the NAHV's hydrogen value chain. To enable the exchange of lessons learnt among different experiences. Set up a working group to integrate with, collaborate and support the work of European hydrogen valleys in cooperation with the Clean Hydrogen Partnership and other EU initiatives

Description
TASK 11.1 Exploitation Plan TL: FBK, PP: ALL [M7 – M72] The Exploitation Plan (EXP Plan) will define a shared action programme to set a roadmap for the further development, after the conclusion of the project, of the proposed innovative hydrogen valley scheme. Actions which will be considered in the EXP plan, are Data management, market analysis, exploitation workshops, as well as the setup of the NAHV AISBL (see T2.2) and a Scaling up Plan (SU Plan) will be developed and included in the EXP plan. Particular attention will be paid to developing Commercial Agreements among the partners to be ready to exploit the achieve results. The consortium will complete a preliminary version of the EXP Plan by the end of the second year. The whole consortium will be involved in the exploitation workshops which will be organized in the last year of the project. Exploitation workshops regard: a) the characterisation of the exploitable results and identification of new results; b) the validation of the business opportunities for key results (replication potential); c) identification of the complementary solutions (both existing and emerging); d) identification and assessment of the risks and barriers to be overcome in order to enable the exploitation of the results – development of feasible mitigation plan; e) fine-tuning and validation of the EXP plan and IPR management. TASK 11.2 Peer exchange with other Hydrogen Valleys (HV) TL: FHA PP: ECUBES, FBK [M7-M72] The NAHV will establish, since the beginning of the project, a connection with some of the most relevant hydrogen Valleys in Europe, to benefit from the lessons learnt, to maximize the collaboration among the similar territories and experiences, to accelerate the realization of an optimized action plan. Success stories, already implemented, such as BIG HIT or HyBalance, will be taken as a reference from NAHV. A dialogue will be established. Peer exchange workshops will be organized 2 times per year with the managers and participants of other hydrogen valleys at the international level with the scope to enable the exchange of experiences, lessons learnt and the replication of good practices. Each workshop will see the participation of max 25 people and the participation of representatives of max 5 hydrogen valleys. This modus operandi will allow to facilitate the establishment of relationships among the participants. During the NAHV project's preparation phase, the partners have met several organizations which are in the process of constituting a hydrogen valley, and other organizations which have already settled a valley. A complete map and scouting of would-be valleys will be done and visits and meetings with their ecosystems will be organized. NAHV will operates at 2 levels 1) by keeping the peer exchange open to all Hydrogen Valleys promoted by Clean Hydrogen. 2) By engaging "followers" territories wanting to initiate an hydrogen valley

Via the peer exchange the advanced H2 Valleys can provide their expertise and lessons learned, and the ones in a more initial stage can obtained benefits from it but also share results and experiences with other Valleys at the same stage.
The peer section will be based on a series of topic such as: safety aspects, permitting, training, O&M, finance, value chain integration, etc.

TASK 11.3 Internationalization and Networking of experiences and know how TL: Active Solera PP: HSE, FBK. [D:M7-M72]
In Task 11.3, due to the relevance of the NAHV as one of the first cross boarder hydrogen valleys, it will be activated a contact with the most relevant initiatives at international scale, including those promoted by MISSION INNOVATION within the Clean Hydrogen Mission and monitored through the Hydrogen Valleys Platform. The NAHV representatives will participate to at least 6 international conferences, matchmaking events, to foster an open collaboration and implement a common realization of best practices as well as supporting the analysis of HV models together with other internationally based initiatives. At the same, NAHV will support the international Hydrogen Valleys platform co-created by EC and other countries within the Mission Innovation programme, in the specific innovation Challenge on hydrogen, with a yearly feed of statistics, models, practices, to support the standardization of the models, the identification of megatrends and drivers, the support to global studies on the HV trends, the establishment of a replicator model at a global scale.

Task 11.4 NAHV clusterization with neighboring HV TL: FBK, PP: AREA, [D: M25 – M64]
It aims to anticipate the extension of the NAHV, clustering with neighbourhood initiatives, such as Austria, the South Tyrol Hydrogen Valley, the Trentino HV part of the EUREGIO hydrogen strategy, and other initiatives in Austria, Veneto. This activity could anticipate and accelerate the uptake of common infrastructure and foresee the scaling up and realization of novel international infrastructures, such as the European Hydrogen Back bone. A specific plan for an intervalley approach will be realized. NAHV will so work to set up a “corridor” which will connect some of the existing HV crossing Austria, South Tyrol, FVG, Slovenia and Croatia. The NAHV Association will be in charge of identifying, contacting and establishing a meta clustering model to create synergies among the different valleys also in order to integrate elements of the different value chains and strengthen the H2 economies, infrastructures and initiatives.

Task 11.5 Replication package TL: FHA PP: FBK, UNITS, UNIRI, UL [D: M25-M72]
The replication package is a key tool to gather the NAHV’s experience and make it available to potential replicating institutions and organizations in the EU and abroad. The replication package will be a mix of tools developed during the NAHV project such as: a) detailed operational handbook reporting a description of NAHV’s methodology and process, b) prefeasibility analysis of up to 10 replicators using the HTP tool developed in BIG HIT, HEAVENN and GREENHYSLAND that can be improved if needed in the frame of NAVH and other hydrogen valley projects in which is used, c) the digital twin model which could be up taken by other HV; d) the monitoring tools and methodologies; etc. Following AREA’s open lab methodology, the labs of the project’s partner will be made available to external users in order to attract new stakeholders toward the NAHV ecosystem. The prefeasibility analysis to support the initial design of replicating HV will utilize the Hydrogen Territories Platform (HTP) , developed within the FCH JU project BIG HIT, and more recently supporting FCH JU projects HEAVENN and GREEN HYSLAND. This tool will support the collaborative learning and the replication actions. We will organize 10 workshops, one for each replicator starting from M36, this will be the opportunity to describe in detail NAHV’s experience with a hands-on approach, in an informal and collaborative environment, where each participant will be able to enquire and share questions, doubts and comments on the possibility to realize a scheme similar to NAHV in their areas. The workshops will gather representatives from at least four institutions per valley focussing primarily on regional/county level authorities, relevant enterprises, business associations, and universities and research organizations. The main output of the replication workshops will be the replication of the NAHV’s model (or a part of it) in at least 5 hydrogen valleys in Europe.
The methodology for the Task 11.5 Replication package will be included in the D11.6, first version of the Exploitation Plan. The replicators will be selected before submitting this report. Currently some of them have been identified but there is still work to do before this M24 to establish all the replicators.

Task 11.6 Common position papers in cooperation with other EU-HV TL: FBK PP: AREA, ALL [M24-M72].
Another cooperation step will be the publication of at least 5 joint documents/position papers for Policy Recommendations on topics such as: standards and safety, incentive schemes, H2 distribution integration, H2 industrial symbiosis approach, cross boarder hydrogen valley model. Those documents will take into consideration also WP8 outcomes and deliverables. The objective is to share the experience gathered during the execution of NAHV and during the implementation of the testbed projects. Those policy documents will be addressed to national governments, to the EC and EU parliament, to think tanks specialized on hydrogen and to research centers. They will also feed the JAP formulation.

STAFF EFFORT

Staff effort per participant

Grant Preparation (Work packages - Effort screen) — Enter the info.

Participant	WP1	WP2	WP3	WP4	WP5	WP6	WP7	WP8	WP9	WP10	Total Person-Months
1 - HSE	65.00	20.00		10.00			20.00		10.00		140.00
1.1 - TES, d.o.o.	3.00	2.00		25.00			6.00				41.00
1.2 - HSE INVEST	2.00			45.00					2.00		49.00
2 - AREA	4.00	16.00					3.00	13.00	44.00	10.00	105.00
3 - ECUBES	2.00	12.00			45.00	50.00	34.00		14.00		182.00
4 - INDELOOP LTD	2.00	3.00		19.00			2.00		2.00		32.00
5 - MCEoE	2.00	5.00			540.00		16.00		3.00		573.00
6 - Dilj d.o.o.	2.00	5.00	103.00				10.00		10.00		145.00
7 - Gitone	2.00	5.00					35.00		2.00		50.00
8 - ACI d.d.	2.00	5.00			25.00		4.00		2.00		43.00
9 - HRASTNIK 1860	2.00	5.00	70.00				5.00		2.00		90.00
10 - SALONIT	2.00	5.00	27.00			15.00	3.00		3.00		60.00
11 - ACEGAS	2.00	5.00		45.40			8.00		1.00		62.10
12 - Active Solera	2.00	6.00		100.00			10.00		2.00		150.00
13 - FABER	2.00	5.00			60.00		5.00		2.00		80.00
14 - ABS	2.00	3.00	37.00				3.00		1.00		50.00
14.1 - DANIELI		2.00	24.00				1.00		1.00		30.00
15 - CTS H2	2.00	3.00			23.50		3.00		2.00		37.50
16 - SNAM S.P.A.	2.00	3.00	40.00			5.40	3.00		2.00		59.40

Staff effort per participant

Grant Preparation (Work packages - Effort screen) — Enter the info.

Participant	WP1	WP2	WP3	WP4	WP5	WP6	WP7	WP8	WP9	WP10	Total Person-Months
17 - FBK	2.00	60.00					3.00				87.00
18 - UNITS	7.00	15.00					5.00		10.00	45.00	87.00
19 - UL	2.00	20.00					7.00		5.00	42.00	81.00
20 - UNIRI	4.00	7.00					13.00		4.00	9.00	42.00
20.1 - TEHN.FAKULT.	3.00	3.00					4.00		3.00	4.00	18.00
20.2 - UNI SPLIT	2.00	3.00					3.00		2.00	3.00	15.00
20.3 - UNI ZG FSB	2.00	3.00					3.00		2.00	3.00	15.00
21 - MzI	2.00	8.00						100.00			110.00
22 - FHA	2.00	8.00					2.00		18.00		50.00
23 - Tpl Fvg	2.00						4.00		2.00		8.00
23.1 - TRIESTETRASPORT					14.00						16.00
23.2 - A.P.T. S.P.A.					22.00						24.00
24 - META	1.00						20.00		1.00		42.00
24.1 - META SPRL	0.50						21.00		0.50		25.00
24.2 - META SLO	0.50						44.00		0.50		48.00
25 - FENO	2.00		30.00				3.00		2.00		43.00
26 - REGIONE FVG	2.00	7.00						70.00			79.00
27 - MINGOR	2.00	10.00						60.00			72.00
Total Person-Months	138.00	254.00	331.00	244.40	729.50	70.40	303.00	243.00	155.00	116.00	2841.00

Staff effort per participant

Grant Preparation (Work packages - Effort screen) — Enter the info.

Participant	WP11	Total Person-Months
1 - HSE	15.00	140.00
1.1 - TES, d.o.o.	5.00	41.00
1.2 - HSE INVEST		49.00
2 - AREA	15.00	105.00
3 - ECUBES	25.00	182.00
4 - INDELOOP LTD	4.00	32.00
5 - MCEoE	7.00	573.00
6 - Dilj d.o.o.	15.00	145.00
7 - Gitone	6.00	50.00
8 - ACI d.d.	5.00	43.00
9 - HRASTNIK 1860	6.00	90.00
10 - SALONIT	5.00	60.00
11 - ACEGAS	0.70	62.10
12 - Active Solera	30.00	150.00
13 - FABER	6.00	80.00
14 - ABS	4.00	50.00
14.1 - DANIELI	2.00	30.00
15 - CTS H2	4.00	37.50
16 - SNAM S.P.A.	4.00	59.40
17 - FBK	22.00	87.00
18 - UNITS	5.00	87.00

Staff effort per participant

Grant Preparation (Work packages - Effort screen) — Enter the info.

Participant	WP11	Total Person-Months
19 - UL	5.00	81.00
20 - UNIRI	5.00	42.00
20.1 - TEHN.FAKULT.	1.00	18.00
20.2 - UNI SPLIT	2.00	15.00
20.3 - UNI ZG FSB	2.00	15.00
21 - MzI		110.00
22 - FHA	20.00	50.00
23 - Tpl Fvg		8.00
23.1 - TRIESTETRASPORT	2.00	16.00
23.2 - A.P.T. S.P.A.	2.00	24.00
24 - META	20.00	42.00
24.1 - META SPRL	3.00	25.00
24.2 - META SLO	3.00	48.00
25 - FENO	6.00	43.00
26 - REGIONE FVG		79.00
27 - MINGOR		72.00
Total Person-Months	256.70	2841.00

LIST OF DELIVERABLES

Deliverables

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Deliverable No	Deliverable Name	Work Package No	Lead Beneficiary	Type	Dissemination Level	Due Date (month)
D1.1	The draft of Project Management Handbook and Quality Plan	WP1	1 - HSE	R — Document, report	SEN - Sensitive	1
D1.2	The draft of Risk Management Plan	WP1	1 - HSE	R — Document, report	SEN - Sensitive	3
D1.3	IPR & Data Management Plan	WP1	18 - UNITS	DMP — Data Management Plan	SEN - Sensitive	6
D1.4	Annual data reporting	WP1	1 - HSE	R — Document, report	SEN - Sensitive	7
D1.5	Project meeting and Boards meeting	WP1	1 - HSE	R — Document, report	SEN - Sensitive	6
D1.6	SAF operational plan and activities	WP1	2 - AREA	R — Document, report	PU - Public	6
D2.1	Heuristic methodology for NAHV development	WP2	18 - UNITS	R — Document, report	PU - Public	8
D2.2	NAHV AISBL set up	WP2	2 - AREA	R — Document, report	PU - Public	12
D2.3	NAHV Safety Plan	WP2	17 - FBK	R — Document, report	SEN - Sensitive	6
D2.4	Digital Twin	WP2	17 - FBK	R — Document, report	SEN - Sensitive	48
D2.5	NAHV general monitoring	WP2	18 - UNITS	R — Document, report	SEN - Sensitive	72
D2.6	H2 renewable Certification scheme	WP2	17 - FBK	R — Document, report	SEN - Sensitive	72
D3.1	DILJ production and usage of H2 in a kiln	WP3	6 - Dilj d.o.o.	R — Document, report	SEN - Sensitive	12

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Deliverable No	Deliverable Name	Work Package No	Lead Beneficiary	Type	Dissemination Level	Due Date (month)
	testbed application: set-up, operations and monitoring reports and business plan					
D3.2	ABS H2 utilization for special steel production and treatment testbed application: set-up, operations and monitoring reports and business plan	WP3	14 - ABS	R — Document, report	SEN - Sensitive	12
D3.3	SNAM The scale-up of highly efficiency modular electromechanical compressor	WP3	16 - SNAM S.P.A.	R — Document, report	SEN - Sensitive	12
D3.4	FENO blending mix usage in rolling mill for preheating testbed application: set-up, operations and monitoring reports and business plan	WP3	25 - FENO	R — Document, report	SEN - Sensitive	12
D3.5	SALONIT H2 production for cement industry decarbonization testbed application: set-up, operations and monitoring reports and business plan	WP3	10 - SALONIT	R — Document, report	SEN - Sensitive	12
D3.6	Steklarna Hrastnik efficient utilization of water electrolyser system testbed application: set-up, operations and monitoring reports and business plan	WP3	9 - HRASTNIK 1860	R — Document, report	SEN - Sensitive	12
D3.7	Final report on industry hard to abate sector test bed application projects main results	WP3	24 - META	R — Document, report	PU - Public	68

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Deliverable No	Deliverable Name	Work Package No	Lead Beneficiary	Type	Dissemination Level	Due Date (month)
D4.1	Active Solera clean H2 from recyclable waste testbed application: set-up, operations and monitoring reports and business plan	WP4	12 - Active Solera	R — Document, report	SEN - Sensitive	12
D4.2	ACEGAS H2 production through industrial symbiosis and asset enhancement: set-up, operations and monitoring reports and business plan	WP4	11 - ACEGAS	R — Document, report	SEN - Sensitive	12
D4.3	ACEGAS Assessment of the suitability of the natural gas distribution network for the transport of mixtures of hydrogen and natural gas or hydrogen gas at 100%: set-up, operations and monitoring reports and business plan	WP4	11 - ACEGAS	R — Document, report	SEN - Sensitive	12
D4.4	INDELOOP H2 production by gasification of organic material for small microgrid testbed application: set-up, operations and monitoring reports and business plan	WP4	4 - INDELOOP LTD	R — Document, report	SEN - Sensitive	12
D4.5	HSE H2 ecosystem technology solutions & production testbed application: set-up, operations and monitoring reports and business plan	WP4	1 - HSE	R — Document, report	SEN - Sensitive	12
D4.6	Final report on the energy sector testbed application projects main results	WP4	24 - META	R — Document, report	PU - Public	68

Deliverables

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Deliverable No	Deliverable Name	Work Package No	Lead Beneficiary	Type	Dissemination Level	Due Date (month)
D5.1	CTS H2 integrated hydroelectric and hfc power station testbed application: set-up, operations and monitoring reports and business plan	WP5	15 - CTS H2	R — Document, report	SEN - Sensitive	12
D5.2	FABER H2 storage system testbed application: set-up, operations and monitoring reports and business plan	WP5	13 - FABER	R — Document, report	SEN - Sensitive	12
D5.3	MCoE H2 propulsion vessels testbed application: set-up, operations and monitoring reports and business plan	WP5	5 - MCEoE	R — Document, report	SEN - Sensitive	12
D5.4	TPL FVG production & management models for H2 use in urban buses testbed application: set-up, operations and monitoring reports and business plan	WP5	23 - Tpl Fvg	R — Document, report	SEN - Sensitive	12
D5.5	ACI MARINE H2 marinas testbed application: set-up, operations and monitoring reports and business plan	WP5	8 - ACI d.d.	R — Document, report	SEN - Sensitive	12
D5.6	ECUBES H2 energy storage & power generation testbed application: set-up, operations and monitoring reports and business plan	WP5	3 - ECUBES	R — Document, report	SEN - Sensitive	12

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Deliverable No	Deliverable Name	Work Package No	Lead Beneficiary	Type	Dissemination Level	Due Date (month)
D5.7	Final report on the transport sector testbed application projects main results	WP5	24 - META	R — Document, report	PU - Public	68
D6.1	Report on P2H2P node hosting capacity in the electric power system	WP6	3 - ECUBES	R — Document, report	SEN - Sensitive	48
D6.2	Hydrogen rail transport options	WP6	3 - ECUBES	R — Document, report	SEN - Sensitive	48
D6.3	Hydrogen heavy road transport	WP6	10 - SALONIT	R — Document, report	SEN - Sensitive	48
D6.4	Hydrogen passenger transport	WP6	3 - ECUBES	R — Document, report	SEN - Sensitive	48
D6.5	Network distribution of gas H2	WP6	16 - SNAM S.P.A.	R — Document, report	SEN - Sensitive	24
D7.1	Communication and Dissemination Plan	WP7	24 - META	R — Document, report	SEN - Sensitive	6
D7.2	Communication and Dissemination Toolbox	WP7	24 - META	R — Document, report	PU - Public	6
D7.3	Video Pitches	WP7	24 - META	DEC —Websites, patent filings, videos, etc	PU - Public	30
D7.4	C&D report	WP7	24 - META	R — Document, report	PU - Public	72
D7.5	Awareness raising campaign	WP7	24 - META	R — Document, report	PU - Public	72
D7.6	Education activities report	WP7	20 - UNIRI	R — Document, report	PU - Public	72
D8.1	Analysis of H2 related policies	WP8	27 - MINGOR	R — Document, report	PU - Public	12
D8.2	Regulatory Sandbox	WP8	26 - REGIONE FVG	R — Document, report	PU - Public	12
D8.3	Policy guidelines document	WP8	21 - MzI	R — Document, report	PU - Public	42

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Deliverable No	Deliverable Name	Work Package No	Lead Beneficiary	Type	Dissemination Level	Due Date (month)
D8.4	Nationals (Slo and HR) and regional (FVG) H2 Strategy	WP8	21 - MzI	R — Document, report	PU - Public	24
D8.5	Report on incentives schemes	WP8	26 - REGIONE FVG	R — Document, report	PU - Public	18
D9.1	JAP methodology	WP9	2 - AREA	R — Document, report	PU - Public	9
D9.2	Desk and field analysis Atlas	WP9	2 - AREA	R — Document, report	PU - Public	36
D9.3	Joint Action Plan- JAP	WP9	22 - FHA	R — Document, report	PU - Public	36
D9.4	Master plan methodology	WP9	2 - AREA	R — Document, report	PU - Public	12
D9.5	Information inventory	WP9	2 - AREA	R — Document, report	PU - Public	36
D9.6	NAHV masterplan	WP9	2 - AREA	R — Document, report	PU - Public	36
D9.7	Business accelerator model	WP9	2 - AREA	R — Document, report	PU - Public	18
D9.8	NAHV business plan (BP)	WP9	2 - AREA	R — Document, report	PU - Public	36
D9.9	NAHV financial plan	WP9	2 - AREA	R — Document, report	PU - Public	36
D10.1	Guidelines on methodology to monitor the performances of the testbeds	WP10	18 - UNITS	R — Document, report	PU - Public	18
D10.2	Report/KPI on testbeds and value chain performance	WP10	18 - UNITS	R — Document, report	PU - Public	48
D10.3	Environmental Impact assessment	WP10	19 - UL	R — Document, report	PU - Public	48
D10.4	Social impact assessment	WP10	20 - UNIRI	R — Document, report	PU - Public	48

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Deliverable No	Deliverable Name	Work Package No	Lead Beneficiary	Type	Dissemination Level	Due Date (month)
D10.5	Cost-benefit analysis	WP10	20 - UNIRI	R — Document, report	PU - Public	48
D10.6	NAHV value chain analysis	WP10	2 - AREA	R — Document, report	PU - Public	48
D11.1	Exploitation plan	WP11	17 - FBK	R — Document, report	SEN - Sensitive	24
D11.2	Networking with EU hydrogen valleys	WP11	22 - FHA	R — Document, report	PU - Public	72
D11.3	Middle term and final Exploitation plan	WP11	17 - FBK	R — Document, report	PU - Public	48
D11.4	International collaboration	WP11	12 - Active Solera	R — Document, report	PU - Public	72
D11.5	Plan for the collaboration with neighbourhood H2 valleys	WP11	17 - FBK	R — Document, report	PU - Public	60
D11.6	Replication package and labs	WP11	17 - FBK	R — Document, report	PU - Public	72
D11.7	Position papers collection	WP11	17 - FBK	R — Document, report	PU - Public	72

Deliverable D1.1 – The draft of Project Management Handbook and Quality Plan

Deliverable Number	D1.1	Lead Beneficiary	1. HSE
Deliverable Name	The draft of Project Management Handbook and Quality Plan		
Type	R — Document, report	Dissemination Level	SEN - Sensitive
Due Date (month)	1	Work Package No	WP1

Description
Describes the different management procedures to be applied during the project lifetime and includes the quality plan to be followed by the project to ensure timely delivery of all results to EC.

Deliverable D1.2 – The draft of Risk Management Plan

Deliverable Number	D1.2	Lead Beneficiary	1. HSE
Deliverable Name	The draft of Risk Management Plan		
Type	R — Document, report	Dissemination Level	SEN - Sensitive
Due Date (month)	3	Work Package No	WP1

Description
The draft report includes processes, tools and procedures that will be used to manage and control those events that could have a negative impact on the project development

Deliverable D1.3 – IPR & Data Management Plan

Deliverable Number	D1.3	Lead Beneficiary	18. UNITS
Deliverable Name	IPR & Data Management Plan		
Type	DMP — Data Management Plan	Dissemination Level	SEN - Sensitive
Due Date (month)	6	Work Package No	WP1

Description
The document describes how the data collected and produced during the NAHV project will be handled. Updates will be made whenever necessary

Deliverable D1.4 – Annual data reporting

Deliverable Number	D1.4	Lead Beneficiary	1. HSE
Deliverable Name	Annual data reporting		
Type	R — Document, report	Dissemination Level	SEN - Sensitive
Due Date (month)	7	Work Package No	WP1

Description
Annual reporting for the Clean Hydrogen JU (due in March of every year unless indicated otherwise by the JU: Project

information will be collected e.g. according to one or more specific template(s) to be made available by the Clean Hydrogen JU. Report will be reopened every year

Deliverable D1.5 – Project meeting and Boards meeting

Deliverable Number	D1.5	**Lead Beneficiary**	1. HSE
Deliverable Name	Project meeting and Boards meeting		
Type	R — Document, report	**Dissemination Level**	SEN - Sensitive
Due Date (month)	6	**Work Package No**	WP1

Description
The report includes: meeting minutes, agenda, presentations, attendance list, photos. Updates will be made whenever necessary

Deliverable D1.6 – SAF operational plan and activities

Deliverable Number	D1.6	**Lead Beneficiary**	2. AREA
Deliverable Name	SAF operational plan and activities		
Type	R — Document, report	**Dissemination Level**	PU - Public
Due Date (month)	6	**Work Package No**	WP1

Description
This report includes Stakeholders Advisory Forum plan & activities. Updates will be made whenever necessary

Deliverable D2.1 – Heuristic methodology for NAHV development

Deliverable Number	D2.1	**Lead Beneficiary**	18. UNITS
Deliverable Name	Heuristic methodology for NAHV development		
Type	R — Document, report	**Dissemination Level**	PU - Public
Due Date (month)	8	**Work Package No**	WP2

Description
Document providing strategic vision of the cross border valley and methodological guidelines for all involved parties

Deliverable D2.2 – NAHV AISBL set up

Deliverable Number	D2.2	**Lead Beneficiary**	2. AREA
Deliverable Name	NAHV AISBL set up		
Type	R — Document, report	**Dissemination Level**	PU - Public
Due Date (month)	12	**Work Package No**	WP2

Description

Report on AISBL set up including the Statute

Deliverable D2.3 – NAHV Safety Plan

Deliverable Number	D2.3	**Lead Beneficiary**	17. FBK
Deliverable Name	NAHV Safety Plan		
Type	R — Document, report	**Dissemination Level**	SEN - Sensitive
Due Date (month)	6	**Work Package No**	WP2

Description
The report describes safety elements identified for a safety management of the project in order to guarantee life, property and environmental safety protection. Updates will be made whenever necessary

Deliverable D2.4 – Digital Twin

Deliverable Number	D2.4	**Lead Beneficiary**	17. FBK
Deliverable Name	Digital Twin		
Type	R — Document, report	**Dissemination Level**	SEN - Sensitive
Due Date (month)	48	**Work Package No**	WP2

Description
It describes the single models used to simulate H2 production and consumption plant and the whole NAHV model, including validation and main optimization results and sensitive cases.

Deliverable D2.5 – NAHV general monitoring

Deliverable Number	D2.5	**Lead Beneficiary**	18. UNITS
Deliverable Name	NAHV general monitoring		
Type	R — Document, report	**Dissemination Level**	SEN - Sensitive
Due Date (month)	72	**Work Package No**	WP2

Description
Report on monitoring overall progress in the NAHV – M48/M72

Deliverable D2.6 – H2 renewable Certification scheme

Deliverable Number	D2.6	**Lead Beneficiary**	17. FBK
Deliverable Name	H2 renewable Certification scheme		
Type	R — Document, report	**Dissemination Level**	SEN - Sensitive
Due Date (month)	72	**Work Package No**	WP2

Description
Report on the adopted scheme to certified H2 renewable production

Deliverable D3.1 – DILJ production and usage of H2 in a kiln testbed application: set-up, operations and monitoring reports and business plan

Deliverable Number	D3.1	**Lead Beneficiary**	6. Dilj d.o.o.
Deliverable Name	DILJ production and usage of H2 in a kiln testbed application: set-up, operations and monitoring reports and business plan		
Type	R — Document, report	**Dissemination Level**	SEN - Sensitive
Due Date (month)	12	**Work Package No**	WP3

Description
The report will be updated during the project life (and as necessary at the end of each reporting period to report on the progress of the test-bed). It will be composed by 5 sections describing the planning phase, the implementation activities carried out, the roll out, the final monitoring and the business plan. The delivery dates of the updates depend on the specific testbed application project gantt.

Deliverable D3.2 – ABS H2 utilization for special steel production and treatment testbed application: set-up, operations and monitoring reports and business plan

Deliverable Number	D3.2	**Lead Beneficiary**	14. ABS
Deliverable Name	ABS H2 utilization for special steel production and treatment testbed application: set-up, operations and monitoring reports and business plan		
Type	R — Document, report	**Dissemination Level**	SEN - Sensitive
Due Date (month)	12	**Work Package No**	WP3

Description
The report will be updated during the project life. It will be composed by 5 sections describing the planning phase, the implementation activities carried out, the roll out, the final monitoring and the business plan. The delivery dates of the updates depend on the specific testbed application project gantt.

Deliverable D3.3 – SNAM The scale-up of highly efficiency modular electromechanical compressor

Deliverable Number	D3.3	**Lead Beneficiary**	16. SNAM S.P.A.
Deliverable Name	SNAM The scale-up of highly efficiency modular electromechanical compressor		
Type	R — Document, report	**Dissemination Level**	SEN - Sensitive
Due Date (month)	12	**Work Package No**	WP3

Description
The report will be updated during the project life. It will be composed by 5 sections describing the planning phase, the implementation activities carried out, the roll out, the final monitoring and the business plan. The delivery dates of the updates depend on the specific testbed application project gantt.

Deliverable D3.4 – FENO blending mix usage in rolling mill for preheating testbed application: set-up, operations and monitoring reports and business plan

Deliverable Number	D3.4	Lead Beneficiary	25. FENO
Deliverable Name	FENO blending mix usage in rolling mill for preheating testbed application: set-up, operations and monitoring reports and business plan		
Type	R — Document, report	Dissemination Level	SEN - Sensitive
Due Date (month)	12	Work Package No	WP3

Description
The report will be updated during the project life. It will be composed by 5 sections describing the planning phase, the implementation activities carried out, the roll out, the final monitoring and the business plan. The delivery dates of the updates depend on the specific testbed application project gantt.

Deliverable D3.5 – SALONIT H2 production for cement industry decarbonization testbed application: set-up, operations and monitoring reports and business plan

Deliverable Number	D3.5	Lead Beneficiary	10. SALONIT
Deliverable Name	SALONIT H2 production for cement industry decarbonization testbed application: set-up, operations and monitoring reports and business plan		
Type	R — Document, report	Dissemination Level	SEN - Sensitive
Due Date (month)	12	Work Package No	WP3

Description
The report will be updated during the project life. It will be composed by 5 sections describing the planning phase, the implementation activities carried out, the roll out, the final monitoring and the business plan. The delivery dates of the updates depend on the specific testbed application project gantt.

Deliverable D3.6 – Steklarna Hrastnik efficient utilization of water electrolyser system testbed application: set-up, operations and monitoring reports and business plan

Deliverable Number	D3.6	Lead Beneficiary	9. HRASTNIK 1860
Deliverable Name	Steklarna Hrastnik efficient utilization of water electrolyser system testbed application: set-up, operations and monitoring reports and business plan		
Type	R — Document, report	Dissemination Level	SEN - Sensitive
Due Date (month)	12	Work Package No	WP3

Description
The report will be updated during the project life. It will be composed by 5 sections describing the planning phase, the implementation activities carried out, the roll out, the final monitoring and the business plan. The delivery dates of the updates depend on the specific testbed application project gantt.

Deliverable D3.7 – Final report on industry hard to abate sector test bed application projects main results

Deliverable Number	D3.7	Lead Beneficiary	24. META
Deliverable Name	Final report on industry hard to abate sector test bed application projects main results		
Type	R — Document, report	Dissemination Level	PU - Public
Due Date (month)	68	Work Package No	WP3

Description
This report contains a disclosed summary of the main results of all the projects of the related work package

Deliverable D4.1 – Active Solera clean H2 from recyclable waste testbed application: set-up, operations and monitoring reports and business plan

Deliverable Number	D4.1	Lead Beneficiary	12. Active Solera
Deliverable Name	Active Solera clean H2 from recyclable waste testbed application: set-up, operations and monitoring reports and business plan		
Type	R — Document, report	Dissemination Level	SEN - Sensitive
Due Date (month)	12	Work Package No	WP4

Description
The report will be updated during the project life. It will be composed by 5 sections describing the planning phase, the implementation activities carried out, the roll out, the final monitoring and the business plan. The delivery dates of the updates depend on the specific testbed application project gantt.

Deliverable D4.2 – ACEGAS H2 production through industrial symbiosis and asset enhancement: set-up, operations and monitoring reports and business plan

Deliverable Number	D4.2	Lead Beneficiary	11. ACEGAS
Deliverable Name	ACEGAS H2 production through industrial symbiosis and asset enhancement: set-up, operations and monitoring reports and business plan		
Type	R — Document, report	Dissemination Level	SEN - Sensitive
Due Date (month)	12	Work Package No	WP4

Description
The report will be updated during the project life. It will be composed by 5 sections describing the planning phase, the implementation activities carried out, the roll out, the final monitoring and the business plan. The delivery dates of the updates depend on the specific testbed application project gantt.

Deliverable D4.3 – ACEGAS Assessment of the suitability of the natural gas distribution network for the transport of mixtures of hydrogen and natural gas or hydrogen gas at 100%: set-up, operations and monitoring reports and business plan

Deliverable Number	D4.3	Lead Beneficiary	11. ACEGAS

Deliverable Name	ACEGAS Assessment of the suitability of the natural gas distribution network for the transport of mixtures of hydrogen and natural gas or hydrogen gas at 100%: set-up, operations and monitoring reports and business plan		
Type	R — Document, report	Dissemination Level	SEN - Sensitive
Due Date (month)	12	Work Package No	WP4

Description
The report will be updated during the project life. It will be composed by 5 sections describing the planning phase, the implementation activities carried out, the roll out, the final monitoring and the business plan. The delivery dates of the updates depend on the specific testbed application project gantt.

Deliverable D4.4 – INDELOOP H2 production by gasification of organic material for small microgrid testbed application: set-up, operations and monitoring reports and business plan

Deliverable Number	D4.4	Lead Beneficiary	4. INDELOOP LTD
Deliverable Name	INDELOOP H2 production by gasification of organic material for small microgrid testbed application: set-up, operations and monitoring reports and business plan		
Type	R — Document, report	Dissemination Level	SEN - Sensitive
Due Date (month)	12	Work Package No	WP4

Description
The report will be updated during the project life. It will be composed by 5 sections describing the planning phase, the implementation activities carried out, the roll out, the final monitoring and the business plan. The delivery dates of the updates depend on the specific testbed application project gantt.

Deliverable D4.5 – HSE H2 ecosystem technology solutions & production testbed application: set-up, operations and monitoring reports and business plan

Deliverable Number	D4.5	Lead Beneficiary	1. HSE
Deliverable Name	HSE H2 ecosystem technology solutions & production testbed application: set-up, operations and monitoring reports and business plan		
Type	R — Document, report	Dissemination Level	SEN - Sensitive
Due Date (month)	12	Work Package No	WP4

Description
The report will be updated during the project life. It will be composed by 5 sections describing the planning phase, the implementation activities carried out, the roll out, the final monitoring and the business plan. The delivery dates of the updates depend on the specific testbed application project gantt.

Deliverable D4.6 – Final report on the energy sector testbed application projects main results

Deliverable Number	D4.6	Lead Beneficiary	24. META
Deliverable Name	Final report on the energy sector testbed application projects main results		
Type	R — Document, report	Dissemination Level	PU - Public

Due Date (month)	68	Work Package No	WP4

Description
This report contains a disclosed summary of the main results of all the projects of the related work package

Deliverable D5.1 – CTS H2 integrated hydroelectric and hfc power station testbed application: set-up, operations and monitoring reports and business plan

Deliverable Number	D5.1	Lead Beneficiary	15. CTS H2
Deliverable Name	CTS H2 integrated hydroelectric and hfc power station testbed application: set-up, operations and monitoring reports and business plan		
Type	R — Document, report	Dissemination Level	SEN - Sensitive
Due Date (month)	12	Work Package No	WP5

Description
The report will be updated during the project life. It will be composed by 5 sections describing the planning phase, the implementation activities carried out, the roll out, the final monitoring and the business plan. The delivery dates of the updates depend on the specific testbed application project gantt.

Deliverable D5.2 – FABER H2 storage system testbed application: set-up, operations and monitoring reports and business plan

Deliverable Number	D5.2	Lead Beneficiary	13. FABER
Deliverable Name	FABER H2 storage system testbed application: set-up, operations and monitoring reports and business plan		
Type	R — Document, report	Dissemination Level	SEN - Sensitive
Due Date (month)	12	Work Package No	WP5

Description
The report will be updated during the project life. It will be composed by 5 sections describing the planning phase, the implementation activities carried out, the roll out, the final monitoring and the business plan. The delivery dates of the updates depend on the specific testbed application project gantt.

Deliverable D5.3 – MCoE H2 propulsion vessels testbed application: set-up, operations and monitoring reports and business plan

Deliverable Number	D5.3	Lead Beneficiary	5. MCEoE
Deliverable Name	MCoE H2 propulsion vessels testbed application: set-up, operations and monitoring reports and business plan		
Type	R — Document, report	Dissemination Level	SEN - Sensitive
Due Date (month)	12	Work Package No	WP5

Description

The report will be updated during the project life. It will be composed by 5 sections describing the planning phase, the implementation activities carried out, the roll out, the final monitoring and the business plan. The delivery dates of the updates depend on the specific testbed application project gantt.

Deliverable D5.4 – TPL FVG production & management models for H2 use in urban buses testbed application: set-up, operations and monitoring reports and business plan

Deliverable Number	D5.4	**Lead Beneficiary**	23. Tpl Fvg
Deliverable Name	TPL FVG production & management models for H2 use in urban buses testbed application: set-up, operations and monitoring reports and business plan		
Type	R — Document, report	**Dissemination Level**	SEN - Sensitive
Due Date (month)	12	**Work Package No**	WP5

Description
The report will be updated during the project life. It will be composed by 5 sections describing the planning phase, the implementation activities carried out, the roll out, the final monitoring and the business plan. The delivery dates of the updates depend on the specific testbed application project gantt.

Deliverable D5.5 – ACI MARINE H2 marinas testbed application: set-up, operations and monitoring reports and business plan

Deliverable Number	D5.5	**Lead Beneficiary**	8. ACI d.d.
Deliverable Name	ACI MARINE H2 marinas testbed application: set-up, operations and monitoring reports and business plan		
Type	R — Document, report	**Dissemination Level**	SEN - Sensitive
Due Date (month)	12	**Work Package No**	WP5

Description
The report will be updated during the project life. It will be composed by 5 sections describing the planning phase, the implementation activities carried out, the roll out, the final monitoring and the business plan. The delivery dates of the updates depend on the specific testbed application project gantt.

Deliverable D5.6 – ECUBES H2 energy storage & power generation testbed application: set-up, operations and monitoring reports and business plan

Deliverable Number	D5.6	**Lead Beneficiary**	3. ECUBES
Deliverable Name	ECUBES H2 energy storage & power generation testbed application: set-up, operations and monitoring reports and business plan		
Type	R — Document, report	**Dissemination Level**	SEN - Sensitive
Due Date (month)	12	**Work Package No**	WP5

Description
The report will be updated during the project life. It will be composed by 5 sections describing the planning phase, the implementation activities carried out, the roll out, the final monitoring and the business plan. The delivery dates of the updates depend on the specific testbed application project gantt.

Deliverable D5.7 – Final report on the transport sector testbed application projects main results

Deliverable Number	D5.7	Lead Beneficiary	24. META
Deliverable Name	Final report on the transport sector testbed application projects main results		
Type	R — Document, report	Dissemination Level	PU - Public
Due Date (month)	68	Work Package No	WP5

Description
This report contains a disclosed summary of the main results of all the projects of the related work package

Deliverable D6.1 – Report on P2H2P node hosting capacity in the electric power system

Deliverable Number	D6.1	Lead Beneficiary	3. ECUBES
Deliverable Name	Report on P2H2P node hosting capacity in the electric power system		
Type	R — Document, report	Dissemination Level	SEN - Sensitive
Due Date (month)	48	Work Package No	WP6

Description
Feasibility study about the hosting capacity, operational impact, and the benefits of the electrolysers implementation in the power system.

Deliverable D6.2 – Hydrogen rail transport options

Deliverable Number	D6.2	Lead Beneficiary	3. ECUBES
Deliverable Name	Hydrogen rail transport options		
Type	R — Document, report	Dissemination Level	SEN - Sensitive
Due Date (month)	48	Work Package No	WP6

Description
Report on the impact framework to assessment comparing locomotive fuelled with different fuels from diesel to H2

Deliverable D6.3 – Hydrogen heavy road transport

Deliverable Number	D6.3	Lead Beneficiary	10. SALONIT
Deliverable Name	Hydrogen heavy road transport		
Type	R — Document, report	Dissemination Level	SEN - Sensitive
Due Date (month)	48	Work Package No	WP6

Description
Feasibility study to develop Mobility in heavy transport sector.

Deliverable D6.4 – Hydrogen passenger transport

Deliverable Number	D6.4	Lead Beneficiary	3. ECUBES
Deliverable Name	Hydrogen passenger transport		
Type	R — Document, report	Dissemination Level	SEN - Sensitive
Due Date (month)	48	Work Package No	WP6

Description
Feasibility study to develop Mobility in Rural area with Hydrogen cars.

Deliverable D6.5 – Network distribution of gas H2

Deliverable Number	D6.5	Lead Beneficiary	16. SNAM S.P.A.
Deliverable Name	Network distribution of gas H2		
Type	R — Document, report	Dissemination Level	SEN - Sensitive
Due Date (month)	24	Work Package No	WP6

Description
Pre-feasibility study on gas network distribution pipeline

Deliverable D7.1 – Communication and Dissemination Plan

Deliverable Number	D7.1	Lead Beneficiary	24. META
Deliverable Name	Communication and Dissemination Plan		
Type	R — Document, report	Dissemination Level	SEN - Sensitive
Due Date (month)	6	Work Package No	WP7

Description
The plan, describe the objectives, the strategy the channels, the messages, the target groups of NAHV C&D. Updates will be made once per year

Deliverable D7.2 – Communication and Dissemination Toolbox

Deliverable Number	D7.2	Lead Beneficiary	24. META
Deliverable Name	Communication and Dissemination Toolbox		
Type	R — Document, report	Dissemination Level	PU - Public
Due Date (month)	6	Work Package No	WP7

Description
A set of all the tools which will be used for the implementation of the C&D activities. An updated will be released at M48.

Deliverable D7.3 – Video Pitches

Deliverable Number	D7.3	Lead Beneficiary	24. META
Deliverable Name	Video Pitches		
Type	DEC —Websites, patent filings, videos, etc	Dissemination Level	PU - Public
Due Date (month)	30	Work Package No	WP7

Description
Pitches, completed, slide deck, for the presentation of the KERs.

Deliverable D7.4 – C&D report

Deliverable Number	D7.4	Lead Beneficiary	24. META
Deliverable Name	C&D report		
Type	R — Document, report	Dissemination Level	PU - Public
Due Date (month)	72	Work Package No	WP7

Description
A public report regarding all the C&D activities carried out

Deliverable D7.5 – Awareness raising campaign

Deliverable Number	D7.5	Lead Beneficiary	24. META
Deliverable Name	Awareness raising campaign		
Type	R — Document, report	Dissemination Level	PU - Public
Due Date (month)	72	Work Package No	WP7

Description
Report on Awareness raising campaign

Deliverable D7.6 – Education activities report

Deliverable Number	D7.6	Lead Beneficiary	20. UNIRI
Deliverable Name	Education activities report		
Type	R — Document, report	Dissemination Level	PU - Public
Due Date (month)	72	Work Package No	WP7

Description
Report on Education activities implemented in WP7

Deliverable D8.1 – Analysis of H2 related policies

Deliverable Number	D8.1	Lead Beneficiary	27. MINGOR
Deliverable Name	Analysis of H2 related policies		
Type	R — Document, report	Dissemination Level	PU - Public
Due Date (month)	12	Work Package No	WP8

Description
This report includes the analysis developed by the IMWG in NAHV countries. Updates will be made whenever necessary.

Deliverable D8.2 – Regulatory Sandbox

Deliverable Number	D8.2	Lead Beneficiary	26. REGIONE FVG
Deliverable Name	Regulatory Sandbox		
Type	R — Document, report	Dissemination Level	PU - Public
Due Date (month)	12	Work Package No	WP8

Description
It includes details on regulatory sandbox. Updates will be made whenever necessary

Deliverable D8.3 – Policy guidelines document

Deliverable Number	D8.3	Lead Beneficiary	21. MzI
Deliverable Name	Policy guidelines document		
Type	R — Document, report	Dissemination Level	PU - Public
Due Date (month)	42	Work Package No	WP8

Description
This report includes all policies guidelines elaborated by the IMWG. Updates will be made whenever necessary

Deliverable D8.4 – Nationals (Slo and HR) and regional (FVG) H2 Strategy

Deliverable Number	D8.4	Lead Beneficiary	21. MzI
Deliverable Name	Nationals (Slo and HR) and regional (FVG) H2 Strategy		
Type	R — Document, report	Dissemination Level	PU - Public
Due Date (month)	24	Work Package No	WP8

Description
This document includes elements for the definition/improvement of Croatian and Slovenian and FVG Hydrogen Strategy. Updates will be made whenever necessary

Deliverable D8.5 – Report on incentives schemes

Deliverable Number	D8.5	Lead Beneficiary	26. REGIONE FVG
Deliverable Name	Report on incentives schemes		
Type	R — Document, report	Dissemination Level	PU - Public
Due Date (month)	18	Work Package No	WP8

Description
Report on incentives schemes for supporting the use of renewable H2. Updates will be made whenever necessary

Deliverable D9.1 – JAP methodology

Deliverable Number	D9.1	Lead Beneficiary	2. AREA
Deliverable Name	JAP methodology		
Type	R — Document, report	Dissemination Level	PU - Public
Due Date (month)	9	Work Package No	WP9

Description
The report will describe the methodology to be followed for the JAP's preparation

Deliverable D9.2 – Desk and field analysis Atlas

Deliverable Number	D9.2	Lead Beneficiary	2. AREA
Deliverable Name	Desk and field analysis Atlas		
Type	R — Document, report	Dissemination Level	PU - Public
Due Date (month)	36	Work Package No	WP9

Description
The report will collect and analyze the info gathered and present the baseline

Deliverable D9.3 – Joint Action Plan- JAP

Deliverable Number	D9.3	Lead Beneficiary	22. FHA
Deliverable Name	Joint Action Plan- JAP		
Type	R — Document, report	Dissemination Level	PU - Public
Due Date (month)	36	Work Package No	WP9

Description
Definition of a cross-border plan for the NAHV activities

Deliverable D9.4 – Master plan methodology

Deliverable Number	D9.4	Lead Beneficiary	2. AREA
Deliverable Name	Master plan methodology		
Type	R — Document, report	Dissemination Level	PU - Public
Due Date (month)	12	Work Package No	WP9

Description
The report describes the methodology to be followed for the NAHV's masterplan design

Deliverable D9.5 – Information inventory

Deliverable Number	D9.5	Lead Beneficiary	2. AREA
Deliverable Name	Information inventory		
Type	R — Document, report	Dissemination Level	PU - Public
Due Date (month)	36	Work Package No	WP9

Description
The report describes the main data collected, the results of the ctivites done with the stakeholders and the SWOT

Deliverable D9.6 – NAHV masterplan

Deliverable Number	D9.6	Lead Beneficiary	2. AREA
Deliverable Name	NAHV masterplan		
Type	R — Document, report	Dissemination Level	PU - Public
Due Date (month)	36	Work Package No	WP9

Description
The masterplan will design the NAHV development model

Deliverable D9.7 – Business accelerator model

Deliverable Number	D9.7	Lead Beneficiary	2. AREA
Deliverable Name	Business accelerator model		
Type	R — Document, report	Dissemination Level	PU - Public
Due Date (month)	18	Work Package No	WP9

Description
The model will plan how the accelerator should work, which are the themes & necessary resources

Deliverable D9.8 – NAHV business plan (BP)

Deliverable Number	D9.8	Lead Beneficiary	2. AREA
Deliverable Name	NAHV business plan (BP)		
Type	R — Document, report	Dissemination Level	PU - Public
Due Date (month)	36	Work Package No	WP9

Description
The BP will describe the NAHV organisational structure, operational strategy & the operating plan

Deliverable D9.9 – NAHV financial plan

Deliverable Number	D9.9	Lead Beneficiary	2. AREA
Deliverable Name	NAHV financial plan		
Type	R — Document, report	Dissemination Level	PU - Public
Due Date (month)	36	Work Package No	WP9

Description
The plan will describe capex and opex and source of funding

Deliverable D10.1 – Guidelines on methodology to monitor the performances of the testbeds

Deliverable Number	D10.1	Lead Beneficiary	18. UNITS
Deliverable Name	Guidelines on methodology to monitor the performances of the testbeds		
Type	R — Document, report	Dissemination Level	PU - Public
Due Date (month)	18	Work Package No	WP10

Description
This report will describe the methodology to monitor the performances of the different technologies included in the NAHV testbeds including an assessment against the Clean Hydrogen SRIA technology target.

Deliverable D10.2 – Report/KPI on testbeds and value chain performance

Deliverable Number	D10.2	Lead Beneficiary	18. UNITS
Deliverable Name	Report/KPI on testbeds and value chain performance		
Type	R — Document, report	Dissemination Level	PU - Public
Due Date (month)	48	Work Package No	WP10

Description
This report will include the KPIs on hydrogen production, storage systems, final user hydrogen demand profile and energy efficiency systems. Updates will be made whenever necessary

Deliverable D10.3 – Environmental Impact assessment

Deliverable Number	D10.3	Lead Beneficiary	19. UL
Deliverable Name	Environmental Impact assessment		
Type	R — Document, report	Dissemination Level	PU - Public
Due Date (month)	48	Work Package No	WP10

Description
Report on Environmental Impact assessment. Report on Environmental Impact assessment. Updates will be made whenever necessary

Deliverable D10.4 – Social impact assessment

Deliverable Number	D10.4	Lead Beneficiary	20. UNIRI
Deliverable Name	Social impact assessment		
Type	R — Document, report	Dissemination Level	PU - Public
Due Date (month)	48	Work Package No	WP10

Description
Report on Social impact assessment. Updates will be made whenever necessary

Deliverable D10.5 – Cost-benefit analysis

Deliverable Number	D10.5	Lead Beneficiary	20. UNIRI
Deliverable Name	Cost-benefit analysis		
Type	R — Document, report	Dissemination Level	PU - Public
Due Date (month)	48	Work Package No	WP10

Description
Report on Cost-benefit analysis. Updates will be made whenever necessary

Deliverable D10.6 – NAHV value chain analysis

Deliverable Number	D10.6	Lead Beneficiary	2. AREA
Deliverable Name	NAHV value chain analysis		
Type	R — Document, report	Dissemination Level	PU - Public
Due Date (month)	48	Work Package No	WP10

Description
Report on the NAHV impacts'on the value chain. Updates will be made whenever necessary

Deliverable D11.1 – Exploitation plan

Deliverable Number	D11.1	Lead Beneficiary	17. FBK
Deliverable Name	Exploitation plan		
Type	R — Document, report	Dissemination Level	SEN - Sensitive
Due Date (month)	24	Work Package No	WP11

Description
Plan for the exploitation of project activities, data and IPR management, test beds BP, replication

Deliverable D11.2 – Networking with EU hydrogen valleys

Deliverable Number	D11.2	Lead Beneficiary	22. FHA
Deliverable Name	Networking with EU hydrogen valleys		
Type	R — Document, report	Dissemination Level	PU - Public
Due Date (month)	72	Work Package No	WP11

Description
The report will describe the networking activities implemented and the meta clustering activity aiming to create synergies among the several valleys

Deliverable D11.3 – Middle term and final Exploitation plan

Deliverable Number	D11.3	Lead Beneficiary	17. FBK
Deliverable Name	Middle term and final Exploitation plan		
Type	R — Document, report	Dissemination Level	PU - Public
Due Date (month)	48	Work Package No	WP11

Description
The report will describe the exploitation pathway of the solutions developed by NAHV, it will contain an abstract of the testbed projects results and their pathways toward the market. Updates will be made whenever necessary

Deliverable D11.4 – International collaboration

Deliverable Number	D11.4	Lead Beneficiary	12. Active Solera
Deliverable Name	International collaboration		
Type	R — Document, report	Dissemination Level	PU - Public
Due Date (month)	72	Work Package No	WP11

Description
The report will describe the activities done & results from the international collaboration

Deliverable D11.5 – Plan for the collaboration with neighbourhood H2 valleys

Deliverable Number	D11.5	Lead Beneficiary	17. FBK
Deliverable Name	Plan for the collaboration with neighbourhood H2 valleys		
Type	R — Document, report	Dissemination Level	PU - Public
Due Date (month)	60	Work Package No	WP11

Description
The report will include the scenarios to extend the NAHV to neighborhood territories in terms of infrastructures, networks, facilities

Deliverable D11.6 – Replication package and labs

Deliverable Number	D11.6	Lead Beneficiary	17. FBK
Deliverable Name	Replication package and labs		
Type	R — Document, report	Dissemination Level	PU - Public
Due Date (month)	72	Work Package No	WP11

Description
The report will describe the contents of the replication package and the methodology applied for the labs. It will describe the activity's results and the data of the 5 HV which have replicated the NAHV model

Deliverable D11.7 – Position papers collection

Deliverable Number	D11.7	Lead Beneficiary	17. FBK
Deliverable Name	Position papers collection		
Type	R — Document, report	Dissemination Level	PU - Public
Due Date (month)	72	Work Package No	WP11

Description
The collection will systematize the position and policy papers issued by NAHV

LIST OF MILESTONES

Milestones *Grant Preparation (Milestones screen) — Enter the info.*					
Milestone No	**Milestone Name**	**Work Package No**	**Lead Beneficiary**	**Means of Verification**	**Due Date (month)**
1	IPR&Data management plan	WP1	1-HSE	D1.3.	6
2	NAHV AISBL set up	WP2	2-AREA	Report on AISBL set up	12
3	NAHV Safety Plan	WP2	17-FBK	D 2.3	6
4	Report finished on the Digital twin	WP2	17-FBK	D2.4.	48
5	DILJ production and usage of H2 in a kiln: start of construction phase	WP3	6-Dilj d.o.o.	Report (Factsheet) on startup of testbed installation	29
6	DILJ production and usage of H2 in a kiln: start of operation	WP3	6-Dilj d.o.o.	Report (Factsheet) on operating phase main parameters to be considered and values to be monitored: the main operating parameters of the plant will be described in relation to the objective of the pilot project	48
7	DILJ production and usage of H2 in a kiln	WP3	6-Dilj d.o.o.	DILJ production and usage of H2 in a kiln: Report (Factsheet) on the main results at the end of the monitoring phase	60
8	ABS H2 utilisation for special steel production and treatment start of construction phase	WP3	14-ABS	Report (Factsheet) on start up of testbed installation	15
9	ABS H2 utilisation for special steel production and treatment: start of operation phase	WP3	14-ABS	Report (Factsheet) on operating phase main parameters to be considered and values to be monitored: the main operating parameters of the plant will be described in relation to the objective of the pilot project	33
10	ABS H2 utilisation for special steel production and treatment: 2 years of operation	WP3	14-ABS	Report (Factsheet) on the main results at the end of the monitoring phase	57

Milestones

Grant Preparation (Milestones screen) — Enter the info.

Milestone No	Milestone Name	Work Package No	Lead Beneficiary	Means of Verification	Due Date (month)
11	SNAM – report on start-up of testbed installation	WP3	16-SNAM S.P.A.	Report (Factsheet) on start up of testbed installation	12
12	SNAM operating phase report	WP3	16-SNAM S.P.A.	Report (Factsheet) on operating phase main parameters to be considered and values to be monitored: the main operating parameters of the plant will be described in relation to the objective of the pilot project	30
13	SNAM report on the main results of the monitoring	WP3	16-SNAM S.P.A.	Report (Factsheet) on the main results at the end of the monitoring phase	65
14	FENO blending mix usage in rolling mill for preheating: start of construction phase	WP3	25-FENO	Report (Factsheet) on start up of testbed installation	20
15	FENO blending mix usage in rolling mill for preheating: start of operation phase	WP3	25-FENO	Report (Factsheet) on operating phase main parameters to be considered and values to be monitored: the main operating parameters of the plant will be described in relation to the objective of the pilot project	44
16	FENO blending mix usage in rolling mill for preheating: 2 years of operation	WP3	25-FENO	Report (Factsheet) on the main results at the end of the monitoring phase.	69
17	SALONIT H2 production for cement industry: start of construction phase	WP3	10-SALONIT	Report (Factsheet) on start up of testbed installation	30
18	SALONIT H2 production for cement industry: start of operation phase	WP3	10-SALONIT	Report (Factsheet) on operating phase main parameters to be considered and values to be monitored: the main operating parameters of the plant will be described in relation to the objective of the pilot project	48
19	SALONIT H2 production for cement industry: 2 years of operation	WP3	10-SALONIT	Report (Factsheet) on the main results at the end of the monitoring phase	72

Milestones

Grant Preparation (Milestones screen) — Enter the info.

Milestone No	Milestone Name	Work Package No	Lead Beneficiary	Means of Verification	Due Date (month)
20	Steklarna Hrastnik efficient utilization of water electrolyser system: start of construction phase	WP3	9-HRASTNIK 1860	Report (Factsheet) on start up of testbed installation	20
21	Steklarna Hrastnik efficient utilization of water electrolyser system: start of operation phase	WP3	9-HRASTNIK 1860	Report (Factsheet) on operating phase main parameters to be considered and values to be monitored: the main operating parameters of the plant will be described in relation to the objective of the pilot project	38
22	Steklarna Hrastnik efficient utilization of water electrolyser system: 2 years of operation	WP3	9-HRASTNIK 1860	Report (Factsheet) on the main results at the end of the monitoring phase	66
23	Active Solera clean H2 from recyclable waste: start of construction phase	WP4	12-Active Solera	Report (Factsheet) on start up of testbed installation	23
24	Active Solera clean H2 from recyclable waste: start of operation phase	WP4	12-Active Solera	Report (Factsheet) on operating phase main parameters to be considered and values to be monitored: the main operating parameters of the plant will be described in relation to the objective of the pilot project	48
25	Active Solera clean H2 from recyclable waste: 2 years of operation	WP4	12-Active Solera	Report (Factsheet) on the main results at the end of the monitoring phase	72
26	ACEGAS H2 production through industrial symbiosis: start of construction phase	WP4	11-ACEGAS	Report (Factsheet) on start up of testbed installation	36
27	ACEGAS H2 production through industrial symbiosis: start of operation phase	WP4	11-ACEGAS	Report (Factsheet) on operating phase main parameters to be considered and values to be monitored: the main operating parameters of the plant will be described in relation to the objective of the pilot project	50

Milestones

Grant Preparation (Milestones screen) — Enter the info.

Milestone No	Milestone Name	Work Package No	Lead Beneficiary	Means of Verification	Due Date (month)
28	ACEGAS H2 production through industrial symbiosis: 2 years of operation	WP4	11-ACEGAS	Report (Factsheet) on the main results at the end of the monitoring phase	72
29	ACEGAS assessment of H2 blending in natural gas distribution network: start of construction phase	WP4	11-ACEGAS	Report (Factsheet) on start up of testbed installation	8
30	ACEGAS assessment of H2 blending in natural gas distribution network: start of operation phase	WP4	11-ACEGAS	Report (Factsheet) on operating phase main parameters to be considered and values to be monitored: the main operating parameters of the plant will be described in relation to the objective of the pilot project.	21
31	ACEGAS assessment of H2 blending in natural gas distribution network: 2 years of operation	WP4	11-ACEGAS	Report (Factsheet) on the main results at the end of the monitoring phase	45
32	INDELOOP H2 production by gasification of organic material for small microgrid: start of construction phase	WP4	4-INDELOOP LTD	Report (Factsheet) on start up of testbed installation	20
33	INDELOOP H2 production by gasification of organic material for small microgrid: start of operation phase	WP4	4-INDELOOP LTD	Report (Factsheet) on operating phase main parameters to be considered and values to be monitored: the main operating parameters of the plant will be described in relation to the objective of the pilot project	35
34	INDELOOP H2 production by gasification of organic material for small microgrid: 2 years of operation	WP4	4-INDELOOP LTD	Report (Factsheet) on the main results at the end of the monitoring phase	58
35	HSE H2 ecosystem technology solutions & production: start of construction phase	WP4	1-HSE	Report (Factsheet) on start up of testbed installation	24

Milestones

Grant Preparation (Milestones screen) — Enter the info.

Milestone No	Milestone Name	Work Package No	Lead Beneficiary	Means of Verification	Due Date (month)
36	HSE H2 ecosystem technology solutions & production: start of operation phase	WP4	1-HSE	Report (Factsheet) on operating phase main parameters to be considered and values to be monitored: the main operating parameters of the plant will be described in relation to the objective of the pilot project	57
37	HSE H2 ecosystem technology solutions & production: 2 years of operation	WP4	1-HSE	Report (Factsheet) on the main results at the end of the monitoring phase	72
38	CTS H2 integrated hydroelectric and hfc power station: start of construction phase	WP5	15-CTS H2	Report (Factsheet) on start up of testbed installation	12
39	CTS H2 integrated hydroelectric and hfc power station: start of operation phase	WP5	15-CTS H2	Report (Factsheet) on operating phase main parameters to be considered and values to be monitored: the main operating parameters of the plant will be described in relation to the objective of the pilot project	18
40	CTS H2 integrated hydroelectric and hfc power station: 2 years of operation	WP5	15-CTS H2	Report (Factsheet) on the main results at the end of the monitoring phase	65
41	FABER H2 storage system :start of construction phase	WP5	13-FABER	Report (Factsheet) on start up of testbed installation	18
42	FABER H2 storage system: start of construction phase	WP5	13-FABER	Report (Factsheet) on operating phase main parameters to be considered and values to be monitored: the main operating parameters of the plant will be described in relation to the objective of the pilot project	36
43	FABER H2 storage system : start of operation phase	WP5	13-FABER	Report (Factsheet) on the main results at the end of the monitoring phase	72
44	MCoE H2 propulsion vessels: start of construction phase	WP5	5-MCEoE	Report (Factsheet) on start up of testbed installation	24

Milestones

Grant Preparation (Milestones screen) — Enter the info.

Milestone No	Milestone Name	Work Package No	Lead Beneficiary	Means of Verification	Due Date (month)
45	MCoE H2 propulsion vessels: start of operation phase	WP5	5-MCEoE	Report (Factsheet) on operating phase main parameters to be considered and values to be monitored: the main operating parameters of the plant will be described in relation to the objective of the pilot project	36
46	MCoE H2 propulsion vessels: 2 years of operation	WP5	5-MCEoE	Report (Factsheet) on the main results at the end of the monitoring phase	60
47	TPL FVG production & management models for H2 use in urban buses: start of construction phase	WP5	23-Tpl Fvg	Report (Factsheet) on start up of testbed installation	20
48	TPL FVG production & management models for H2 use in urban buses: start of operation phase	WP5	23-Tpl Fvg	Report (Factsheet) on operating phase main parameters to be considered and values to be monitored: the main operating parameters of the plant will be described in relation to the objective of the pilot project	33
49	TPL FVG production & management models for H2 use in urban buses: 2 years of operation	WP5	23-Tpl Fvg	Report (Factsheet) on the main results at the end of the monitoring phase	72
50	ACI MARINE H2 marinas: start of construction phase	WP5	8-ACI d.d.	Report (Factsheet) on start up of testbed installation	36
51	ACI MARINE H2 marinas: start of operation phase	WP5	8-ACI d.d.	Report (Factsheet) on operating phase main parameters to be considered and values to be monitored: the main operating parameters of the plant will be described in relation to the objective of the pilot project	48
52	ACI MARINE H2 marinas: 2 years of operation	WP5	8-ACI d.d.	Report (Factsheet) on the main results at the end of the monitoring phase	72

Milestones

Grant Preparation (Milestones screen) — Enter the info.

Milestone No	Milestone Name	Work Package No	Lead Beneficiary	Means of Verification	Due Date (month)
53	ECUBES H2 energy storage & power generation: start of construction phase	WP5	3-ECUBES	Report (Factsheet) on start up of testbed installation	24
54	ECUBES H2 energy storage & power generation: start of operation phase	WP5	3-ECUBES	Report (Factsheet) on operating phase main parameters to be considered and values to be monitored: the main operating parameters of the plant will be described in relation to the objective of the pilot project	48
55	ECUBES H2 energy storage & power generation: 2 years of operation	WP5	3-ECUBES	Report (Factsheet) on the main results at the end of the monitoring phase	72
56	Feasibility studies completed for Zero Emissions Mobility Corridor	WP6	3-ECUBES	D6.1, D6.2, D6.3, D6.4, D6.5	48
57	Policy Guidelines	WP8	27-MINGOR	D8.3.	24
58	NAHV's Joint Action Plan is ready	WP9	2-AREA	D9.3.	36
59	Guidelines for monitoring	WP10	18-UNITS	D10.1	18
60	Clustering scenario with neighbourhood territories	WP11	17-FBK	Following results and agreements included in D11.5	60
61	Regulatory issues milestone	WP5, WP3, WP6, WP4	1-HSE	All needed permits obtained	30
62	Spatial issues milestone	WP5, WP3, WP6, WP4	1-HSE	All needed spatial planning activities accomplished	30
63	Update on secured co-funding status	WP5, WP11, WP3, WP8, WP6, WP4, WP1, WP9, WP10, WP2, WP7	1-HSE	The beneficiaries have to get access to the required public funding (besides the grant funds by JU) for all stages of the project	30
64	Update on status of each of the 17 test-beds	WP5, WP3, WP4	1-HSE	Deliverables included for each test-beds in WP3,4,5: in particular first version due in M12	12

Milestones

Grant Preparation (Milestones screen) — Enter the info.

Milestone No	Milestone Name	Work Package No	Lead Beneficiary	Means of Verification	Due Date (month)
	showing progress towards the start of the construction phase			for each test bed will provide an update on the planning phase for each test-bed	

LIST OF CRITICAL RISKS

Critical risks & risk management strategy

Grant Preparation (Critical Risks screen) — Enter the info.

Risk number	Description	Work Package No(s)	Proposed Mitigation Measures
1	Regulatory issues, e.g. denial of necessary permits or opposing provisions of national law (medium/ high)	WP5, WP11, WP3, WP8, WP6, WP4, WP1, WP9, WP10, WP2, WP7	The institutional partners of the Consortium together with the future AISBL will use their best efforts to facilitate and speed up the applicable permit procedures . Further, the Consortium will strive to re-allocate a particular testbed within the territory at an alternative location where regulatory issues may be solved more efficiently.
2	Spatial issues, e.g. denial or severely hindered possibility of the placement of new Renewable Energy Sources such as a source for renewable hydrogen and/or hydrogen infrastructure in the envisaged region (medium/high)	WP5, WP11, WP8, WP3, WP6, WP4, WP1, WP9, WP10, WP2, WP7	The institutional partners of the Consortium will use their best efforts to facilitate and speed up the applicable spatial planning and permit procedures. Further, the Consortium will strive to re-allocate a particular testbed within the territory at an alternative location where spatial issues may be solved more efficiently. If applicable considering Renewable Energy Sources, Consortium will strive to re-allocate a particular testbed and/or Renewable Energy Source, as appropriate, within the territory at an alternative location where spatial issues may be solved more efficiently.
3	Substantial opposition (e.g. during permit (administrative) procedures, court cases) from local communities, environmental activists, NGOs, which make a successful implementation of the project de facto impossible (medium/high)	WP5, WP11, WP3, WP8, WP6, WP4, WP1, WP9, WP10, WP2, WP7	The Consortium will take care of effective communication and PR within local communities where there has been negative experience with environmental activists and NGOs in the past in order to pre-empt future complications. The Consortium will strive to re-allocate a particular testbed within the territory at an alternative location where substantial opposition may be solved more efficiently.

Critical risks & risk management strategy

Grant Preparation (Critical Risks screen) — Enter the info.

Risk number	Description	Work Package No(s)	Proposed Mitigation Measures
			If applicable considering Renewable Energy Sources, Consortium will strive to re-allocate a particular testbed and/or Renewable Energy Source, as appropriate, within the territory at an alternative location where substantial opposition may be solved more efficiently.
4	Substantial lack of public funding; taking into account that a sustainable business model for renewable hydrogen is anticipated to come into existence only after 2030 and all investments into hydrogen production, storage and distribution infrastructure during the life time of this project depend on public funding. Other sources like bank loans or private funds (including those of beneficiaries themselves) cannot be used due to the currently not yet existing business model. This is why a substantial lack of public funding during the project will put the beneficiaries into a position where they must suspend or terminate their participation in the project. Established hydrogen production facility of beneficiary depends exclusively on availability of public funds (i.e. grant funds by JU as well as other public funding besides JU's grant). (high/high)	WP5, WP11, WP3, WP8, WP6, WP4, WP1, WP9, WP10, WP2, WP7	An effective project monitoring will be established with a special emphasis to the availability of grants and their development within the territory, including all possible cross-border funding outside the territory. This specifically includes the necessary co-funding from the side of the participating Member States and regional authorities. The beneficiaries will establish a maximum possible facility for hydrogen production, storage and distribution with the use of available grant funds. The Consortium will together with support of future AISBL help particular beneficiaries to find missing public funding and/or try to allocate a particular testbed or project task within the territory to allow for further funding. Termination is a means of last resort. The project partners will therefore first try with their best efforts to find alternative solutions to allow for a successful continuation of the project. To this end, the project partners would follow the following step-by-step approach in order to mitigate the risk of a termination of the project: In the case (a) particular beneficiary(/-ies) lack(s) substantial public funding to perform their actions, the Consortium will first strive to re-allocate the thus affected actions to other beneficiaries. If this is not possible, secondly, those beneficiary's(/-ies') actions and corresponding commitments may be reduced to reflect the public funding available. Even in the case an agreement on such reduction cannot be reached, this risk-mitigation measure is deemed to have been followed.
5	A project partner may leave the consortium due to its external and internal problems according to the rules and procedures foreseen in the Grant Agreement (low/medium)	WP5, WP11, WP3, WP8, WP6, WP4, WP1, WP9, WP10, WP2, WP7	The Coordinator will monitor early signs of possible partner withdrawal; the consortium is wide and well connected so it in most scenarios should be able to replace a partner terminating its participation without causing major disruption to the project implementation.
6	Safety requirements cannot be fulfilled from a timing or budget point of view (low/high)	WP5, WP3, WP6, WP4	The Coordinator will strive to anticipate such risks by using experiences from former EU projects, in particular by implementing an efficient early risk analysis. Further, the identification of an alternative and comparable suitable site for pilot testing will be done. Definition of sandbox and revision of rule and standards. Key actors may be involved in the mitigation of such risks.

Critical risks & risk management strategy

Grant Preparation (Critical Risks screen) — Enter the info.

Risk number	Description	Work Package No(s)	Proposed Mitigation Measures
7	Opposition from local population to hydrogen infrastructures and vehicles (medium/low)	WP5, WP11, WP3, WP8, WP6, WP4, WP1, WP9, WP10, WP2, WP7	WP 7 will address this issue informing the public at large of the benefits renewable hydrogen can bring to local communities and of the effective level of risk of the infrastructure. Active involvement of local stakeholders will be required and organised.
8	External factors, e.g. war, global crisis, serious and not only momentary disturbances of supply chains lead to delays in the delivery of equipment, critical components (e.g., solar panels, hydrogen infrastructure or other RES) and materials required for e.g. pilot projects or the implementation of test bed projects and related new Renewable Energy Sources and/or Action (medium/high)	WP5, WP11, WP3, WP8, WP6, WP4, WP9, WP10, WP1, WP2, WP7	The market dynamics will be closely monitored by the Consortium. If required, alternative and comparable suited solutions will be investigated. The workplan is designed in a way that some months of delay in a test bed project would not impact the successful and timely implantation of the project as a whole.
9	IPR issues (low/medium)	WP11	A consortium agreement will be signed at the start of the project to prevent any later disagreement. Concerning patentability, the industrial PPs have over the years built up a lot of patent know-how and collaboration with industrial property agents.
10	No business case or too low market potential or insurmountable market barriers; the Action has lost its economic, scientific, or technological relevance; or the action has lost its relevance as part of the Portfolio for which it has been initially selected (low/high)	WP5, WP11, WP3, WP8, WP6, WP4, WP1, WP9, WP10, WP2, WP7	The market analysis in WP 11 is done to estimate the potential of the market and business case. A SWOT and PESTEL analysis will be performed, together with an analysis of the barriers to the market. In absence of demand (properly supported by demand-side policy intervention), envisaged volumes will need to be reduced to avoid producing while creating economical loss.
11	Price gap between renewable hydrogen and natural gas (medium/low)	WP5, WP11, WP3, WP8, WP6, WP4, WP2	In WP8 a set of incentives and fiscal benefits will be designed to compensate the price gap and promote a wide adoption of hydrogen technologies that will lead to an economy of scales.
12	Companies face difficulties in recruiting staff with proper qualification in H2 tech	WP5, WP3, WP6, WP4, WP7	In WP7 specific activities are designed to launch educational and training vocation programme at all levels. Institutional partners will promote institutionalization of these programmes.
13	Lack of coordination with other initiatives and	WP5, WP11, WP3,	WP2 will consider not just the activities directly implemented by the project but also all other

Critical risks & risk management strategy

Grant Preparation (Critical Risks screen) — Enter the info.

Risk number	Description	Work Package No(s)	Proposed Mitigation Measures
	ongoing projects in the three territories (low/ medium)	WP8, WP6, WP4, WP1, WP9, WP10, WP2, WP7	relevant initiatives (that have been already monitored at the time of project submission), The AISBL will be established as governing body of the valley and the SAF (T1.2) will be set to coordinate and actively involve all relevant stakeholders
14	Elections might lead to changes in the political agenda that could affect the implementation of the project (medium/low)	WP5, WP11, WP3, WP8, WP6, WP4, WP1, WP9, WP10, WP2, WP7	The relevance of the transition to a hydrogen-based economy will help in building up a political consensus on these policies. In any case the governance of the hydrogen valleys will be appointed to the future AISBL that will help in keeping continuity in the management of the valley even in case of changes in the governments of the participating Member States and regional authorities.

PROJECT REVIEWS

Project Reviews *Grant Preparation (Reviews screen) — Enter the info.*			
Review No	**Timing** (month)	**Location**	**Comments**
RV1	21	remote/brussels/on-site (tbd according to project progress)	
RV2	39	remote/brussels/on-site (tbd according to project progress)	
RV3	58	remote/brussels/on-site (tbd according to project progress)	

JU CONTRIBUTIONS

PIC	Legal Name	Membership	IKOP	Financial Contribution	IKAA
884987843	A.P.T. S.P.A. AZIENDA PROVINCIALE TRASPORTI S.P.A.	No	€ 0.00	€ 0.00	€ 0.00
885121994	Tpl Fvg s.c.ar.l.	No	€ 0.00	€ 0.00	€ 0.00
885404846	Gitone Kvarner d.o.o.	No	€ 0.00	€ 0.00	€ 0.00
885416389	ACI d.d.	No	€ 0.00	€ 0.00	€ 0.00
885607576	HALO INDUSTRY S.P.A.	No	€ 0.00	€ 0.00	€ 0.00
888149946	ACCIAIERIE BERTOLI SAFAU SPA	No	€ 0.00	€ 0.00	€ 0.00
889967144	INDELOOP DOO ZA PROIZVODNJU ELEKTRICE ENERGIJE I GOSPODARENJE	No	€ 0.00	€ 0.00	€ 0.00
890309554	MARITIME CENTER OF EXCELLENCE D.O.O	No	€ 0.00	€ 0.00	€ 0.00

PIC	Legal Name	Membership	IKOP	Financial Contribution	IKAA
891137837	ECUBES tehnologije d.o.o.	No	€ 0.00	€ 0.00	€ 0.00
894678434	CTS H2	No	€ 0.00	€ 0.00	€ 0.00
894700065	Active Solera	No	€ 0.00	€ 0.00	€ 0.00
896379523	STEKLARNA HRASTNIK DRUZBA ZA PROIZVPROIZVODNJO STEKLENIH IZDELKOV DOO	No	€ 0.00	€ 0.00	€ 0.00
904079092	ACEGASAPSAMGA S.P.A.	No	€ 0.00	€ 0.00	€ 0.00
905331265	SNAM S.P.A.	No	€ 0.00	€ 0.00	€ 0.00
912302752	Dilj d.o.o.	No	€ 0.00	€ 0.00	€ 0.00
913920227	DANIELI CENTRO COMBUSTION SPA	No	€ 0.00	€ 0.00	€ 0.00
914772275	HOLDING SLOVENSKE ELEKTRARNE DOO	No	€ 0.00	€ 0.00	€ 0.00
916533310	MINISTARSTVO GOSPODARSTVA I ODRZIVOG RAZVOJA	No	€ 0.00	€ 0.00	€ 0.00
944624025	CIMOLAI SPA	No	€ 0.00	€ 0.00	€ 0.00
945489653	TRIESTE TRASPORTI SPA	No	€ 0.00	€ 0.00	€ 0.00
952242696	MINISTRSTVO ZA INFRASTRUKTURO	No	€ 0.00	€ 0.00	€ 0.00
960976479	FERRIERE NORD SPA	No	€ 0.00	€ 0.00	€ 0.00
964288447	SALONIT ANHOVO GRADBENI MATERIALI D.D.	No	€ 0.00	€ 0.00	€ 0.00
983174347	REGIONE AUTONOMA FRIULI-VENEZIA GIULIA	No	€ 0.00	€ 0.00	€ 0.00
986280675	SVEUCILISTE U RIJECI-TEHNICKI FAKULTET	No	€ 0.00	€ 0.00	€ 0.00
986351291	FABER INDUSTRIE SPA	No	€ 0.00	€ 0.00	€ 0.00
996558116	SVEUCILISTE U SPLITU, FAKULTET ELEKTROTEHNIKE, STROJARSTVA I BRODOGRADNJE	No	€ 0.00	€ 0.00	€ 0.00
997456918	FUNDACION PARA EL DESARROLLO DE LAS NUEVAS TECNOLOGIAS DEL HIDROGENO EN ARAGON	No	€ 0.00	€ 0.00	€ 0.00
997640733	SVEUCILISTE U RIJECI	No	€ 0.00	€ 0.00	€ 0.00

PIC	Legal Name	Membership	IKOP	Financial Contribution	IKAA
999549887	AREA DI RICERCA SCIENTIFICA E TECNOLOGICA DI TRIESTE	No	€ 0.00	€ 0.00	€ 0.00
999625450	FONDAZIONE BRUNO KESSLER	No	€ 0.00	€ 0.00	€ 0.00
999735157	META GROUP SRL	No	€ 0.00	€ 0.00	€ 0.00
999842051	UNIVERSITA DEGLI STUDI DI TRIESTE	No	€ 0.00	€ 0.00	€ 0.00
999923240	UNIVERZA V LJUBLJANI	No	€ 0.00	€ 0.00	€ 0.00

ANNEX 1

Horizon Europe (HORIZON)

Description of the action (DoA)

Part B

TABLE OF CONTENTS

HISTORY OF CHANGES				
VERSION	PUBLICATION DATE	Reasons why the changes were made	Where the changes have been made	CHANGES MADE
GAP/1.0	13.2.2023	Comment from ESR: Although the renewable hydrogen Testbed applications for the transport, energy, and industry and hard-to-abate sectors are clearly defined in the proposal, a TRL6 and TRL8 at the start and at the end of the project is not sufficiently demonstrated for some of the applications. For example, the clean hydrogen production from non-recyclable waste through SMO (Solaire-MicroOndes) solar process.	Part B, page 6	Adding the description of: SMO, a patented tech employing solar pyrolysis and plasma gasification to produce clean hydrogen in 4 steps: 1) input preparation: transforming biomass and non-recyclable fractions of municipal solid waste into dry standardized granules. 2) Dry granules are transformed into a homogenous product through Solar pyrolysis step where all the products are conducted through a closed system into the next step reaction. 3) Plasma gasification using filtered waste water to produce hydrogen rich syngas. k4) Hydrogen purification and storage for power generation or transport. Solar Process energy-autonomous waste processor using exclusively solar thermal energy to transform non-recyclable carbon-based waste into competitively priced Clean Hydrogen and Energy, together with carbon products.
G**AP**/1.0	13.2.2023	More detailed explanation on the replicability of the NAHV project was added after ESC comment: The proposal is not sufficiently clear in specifying which approach it will follow to the replication of hydrogen valley. In other terms, the target of 5 additional valleys has not been adequately descr	Part B, page 27	The NAHV's high-level objective aims at contributing to the creation of a European Hydrogen Economy piloting global hydrogen markets by creating the conditions for a wider EU replicability. The task 11.5 of the NAVH project, Replication package & laboratories, explains the tools that the consortium is going to use try to replicate the H2V concept in 5 additional territories. The first replicability actions of the project should pursue the objective of: • sharing the project and partners experience in the fields of preparation for the deployment of a H2V, deployment and execution of the infrastructure and equipment of a H2V, and the project operation (training, operation, maintenance, etc.); • offer a pre-feasibility tool to analyse the financial viability of a H2V concept in a new territory. The Hydrogen Territories Platform (HTP), developed within the FCH JU project BIG HIT, and more recently supporting FCH JU projects HEAVENN and GREEN HYSLAND, will be the tool to make possible reach these 2 objectives, by using the pre-feasibility model developed in BIG HIT and improved in HEAVENN and GREEN HYSLAND, and promoting different cooperative learning actions like webinars or specialized discussion panels. In addition to that, and after the M36 of the project, once the project will be able to share lessons learned via the HTP, a set of 10 laboratories/workshops will be launched to try to replicate the H2V concept in other territories. This will be a more in-depth analysis about how to build a new H2V in other territories working with specific interested stakeholders. It is expected that at least 5 of this case studies will become new H2 valleys. Additionality, the Replication activity will be fostered by: o Organisation of NAHV annual conferences, to promote the NAHV results and approach to other existing and would-be HVs and stimulate discussion of future joint activities and networking with relevant actors at the regional, EU, and international levels. o Dissemination of replication packages, to transfer the lesson learned and NAHV's experience to other target institutions and organizations in the EU and abroad. The replication package will be a mix of tools, developed in NAHV, such as a handbook with NAHV methodology, digital twin model, and monitoring tools, including tools,

				such as Hydrogen Territories Platform (HTP), developed in a previous project for prefeasibility analysis of replicating HVs. o Dissemination of joint documents/position papers (at least 5) for Policy Recommendations, on key topics (standards and safety, incentive schemes, H2 industrial symbiosis approach), aiming at sharing the experience gathered during the implementation of the NAHV project. o Publication of policy guidelines, to promote joint regulatory frameworks to ease the use and distribution of hydrogen, raise awareness among policymakers and enable the formulation of new policies to support the adoption of H2. o Creation of a special purpose vehicle (SPV) to provide the continuation of the dissemination and communication activities and support the use of NAHV's key exploitable results after the end of the project. The SPV will also act as a reference point for collaboration with other valleys and joint policy actions.
GAP/1.0	13.2.2023	Technological barriers were added.	Part B, page 31	Technological barriers were added.
GAP/1.0	13.2.2023	Legal barriers were added	Part B	Legal barriers were added.
GAP/1.0	13.2.2023	More detailed explanation on exploitation of the project was added	Part B, page 34	The Consortium will develop an EXP Plan (EXP Plan) to identify potential routes for future exploitation and up scaling of NAHV initiative. Three dedicated exploitation workshops will be organized to focus on exploitation issues. The third workshop will be conducted with the assistance of external stakeholders such as the EU Horizon Result Booster and external stakeholders from the different target groups. The output of the workshop will be used to complete the EXP Plan (at M24, M48 and M72), which will focus on the main KERs and will include the following main contents: • Exploitation workshops (2 internal and 1 involving external stakeholders) on characterization of the exploitable results, validation of the business opportunities for key results, identification of the main competitors, identification and assessment of the risks and barriers to be overcame in order to enable the exploitation of the results, development of a feasible risk mitigation plan, fine-tuning and validation of the EXP Plan and IPR management. • IPR Agreement among the partners, to be ready to exploit the achieve results soon after the project conclusion, IPR protection of NAHV results and identification of ownership, considering possible co-ownerships. • Market Analysis & Business Case for the scaling up and extension of the NAHV impact as well as enlarging the collaboration network to other hydrogen valleys (including replicators) with the identification of main NAHV stakeholders and their requirements, market barriers to NAHV operations and an overview of the market potential for the use of hydrogen in the specific Cross Boarder territories on all the identified priority end uses. • Market Deployment Plan with market expectations, a market introduction strategy, business models for commercialization of solutions with the highest exploitation potential, a business plan with up-scaling and go-to-market strategy, profit-and-loss analysis. The IPR & knowledge management rules and processes will be described in the data & intellectual property management plan section of the EXP Plan. FBK will support the NAHV ecosystem and in a particular way the testbed projects in identifying the key exploitable results and the most effective ways to protect the generated IP. AREA, which is linked to the European Patent Office with its Patlib Office, will do a pre patentability study supporting the role of the Innovation Manager (IM). The IM will be nominated to coordinate and foster innovation across the project work packages, and to ensure the quality and post-project impact of the

				exploitation strategy. The NAHV's IM will also assist the consortium in identifying protectable IP and in building on existing IP searches, both from within and outside the consortium. Once all KERs are defined, the rules for the distribution of the Intellectual Property Rights (IPR) among partners will be determined, also in accordance with the Consortium Agreement (CA). Nonetheless, partners have already achieved a preliminary agreement on the IP strategy. Each partner owns its IP background and will provide free access to it, to project partners during the implementation of the project. The overall rules are: 1) Participants in the same action will inform each other before their access to the grant agreement of any legal restriction or limit to granting access to their background. 2) Participants will have access rights (on a royalty-free basis) to the results of another participant in the same action if those results are needed by the former to carry out its work under the action. 3) Participants will have access rights to the results of another participant in the same action if those results are needed by the former to exploit its own results, such access shall be granted under fair and reasonable conditions outline the plans for the exploitation of results. 4) Partners keep the ownership of any work contributing to project success. Regarding the foreground, the consortium has identified three levels of IP which will be created from the project: (i) Individual and joint IP, which belongs to individual partners or is jointly owned by partners working in a particular task and is restricted to those partners. Where several partners within the consortium have jointly carried out the work generating the foreground and where their respective share of work cannot be ascertained, they will have joint ownership of such foreground. In this case, partners will jointly apply to obtain and/or maintain the relevant IPRs; (ii) Generic IP, which can be used by all partners of the consortium; (iii) Publicly available IP which will be published on NAHV website and made available with no restrictions. Provisions for use of IP background will be determined during the commercialization strategy. Insights that enhance partners' services or enable the launch of new solutions within partners' strategic go-to-market plan or at the aggregated level of the hydrogen valley will be kept private and protected via non-registered Soft IP measures (confidential information, company know, etc.). IPR will be dealt since the beginning of exploitation activities, starting with a joint exploitation workshop, feeding the Library of Key Exploitable Results. The IPR Clinic, will be (re)done towards the end of the project to do an IP assessment of the project's joint outcomes. It is the policy of the NAHV project that each partner owns the Foreground IP that is solely developed by its developers within the Programme of Innovation and may decide and at its own expense, to register and maintain any protection for the Foreground IP, including filing and prosecuting patent applications for any of the Foreground IP. Once a result is available, the Innovation Manager shall be in charge of investigating the novelty of the invention and proposing to the consortium the possibility to apply for a patent protecting the generated IP. Within NAHV several actions will contribute to the implementation of the exploitation strategy and the regulation of the IPRs, among all, the most important for the IP are the following ones. - D1.3 IPR and Data management plan: a preliminary deliverable on IPR issues will be prepared at M3, identifying the initial list of KERs and related measures to maximize their impact and outreach. The document will describe how the data collected and produced during the NAHV project will be handled and it will be updated at M30 and M72 - D11.1 Exploitation plan: Plan for the exploitation of project activities, data and IPR management, test beds BP, replication

				- D11.3 Middle term and final Exploitation plan: The report will describe the exploitation pathway of the solutions developed by NAHV, it will contain an abstract of the testbed projects results and their pathways toward the market
GAP/1.0	13.2.2023	New target groups subjected to the replication, as suggested by AREA PARK	Part B, page 40	New target groups subjected to the replication, as suggested by AREA PARK
		Budget breakdown proposed by Project financial officer was added	Part B, page 45	HSE equipment budget break down
GAP/2.0.	24.4.2023		Part A, page 8,	Description of the Task 1.1. was modified. The role of co-coordinator (AREA) was defined, the number of members in the Executive board was added.
GAP/2.0.	24.4.2023		Part A, page 9,	Description of the Task 1.3. was modified. The IPR and data management board was detailed explained.
GAP/2.0.	24.4.2023		Part A, page 9,	Description of the Task 1.4 was added by PO regarding the annual data reporting
GAP/2.0.	24.4.2023		Part A, page 10,	Description of the Task 1.5 was added by PO regarding the synergies and co-funding of the NAHV projects.
GAP/2.0.	24.4.2023		Part A, page 10,	Description of the Task 2.3. was modified by PO regarding the safety plan (draft of the plan and deliverables for the monitoring the plan)
GAP/2.0.	24.4.2023		Part A, page 11,	Description of the Task 2.5. was modified by PO (the assessment of the progress towards the achievement of the project KPIs)
GAP/2.0.	24.4.2023		Part A, page 14,	Description of the Task 3.5. was modified by SALONIT (redefinition of the work regarding the upgrading storage and filling infrastructure)
GAP/2.0.	24.4.2023		Part A, page 16,	Task 4.5 was removed due to the withdrawal of partner CIMOLAI from the consortium
GAP/2.0.	24.4.2023		Part A, page 17,	Description of the Task 5.3. was modified by MCoE with more detailed explanation of their work done in the testbed.
GAP/2.0.	24.4.2023		Part A, page 19,	Description of the Task 6.1. was modified by ECUBES regarding the feasibility study for hydrogen transmission in hydrogen carriers in ammonia or methanol.
GAP/2.0.	24.4.2023		Part A, page 24,	Description of the Task 8.2. was modified by AREA regarding the explanation of regulatory sandbox
GAP/2.0.	24.4.2023		Part A, page 30,	Description of the Task 10.1 was modified by UNITS to explain what the task will deliver.
GAP/2.0.	24.4.2023		Part A, page 32,	Description of the Task 10.8. was modified by AREA with addition in task to analyse the NAHV supply chain.
GAP/2.0.	24.4.2023		Part A, page 33,	Description of the Task 11.2. was modified by AREA how the NAHV will operates regarding peer exchange.
GAP/2.0.	24.4.2023		Part A, page 34,	Description of the Task 11.5. was modified by FHA renaming laboratories with workshops and explaining the prefeasibility analysis.
GAP/2.0.	24.4.2023		Part A, page 37-57,	New list of deliverables was prepared
GAP/2.0.	24.4.2023		Part A, page 58-62	New list of milestones was prepared (61 milestones)
GAP/2.0.	24.4.2023		Part B, page 42	New Gantt chart was prepared/modified to be aligned with deliverables and milestones
GAP/2.0.	24.4.2023		Part A, page 42	Table of subcontracting was modified
GAP/2.0.	24.4.2023		Part A, page 46	Table of purchase costs was modified
GAP/2.0.	24.4.2023		Part A, page 54	Table of other costs categories was modified
GAP/2.0.	24.4.2023		Annex 1	Indicative table was prepared (initial stage)

GAP/2.0.	24.4.2023	Addition of Affiliated Entities: For beneficiary 1 HSE the following AE have been added: (AE) 1.1-TES d.o.o and (AE) 1.2 – HSE INVEST. For beneficiary 20 UNIRI the following AE has been added: (AE) 20.3- UNI ZG FSB. For beneficiary 24 META the following AE have been added: (AE) 24.1- META SRL, (AE) 24.2- META SLO.	Annex 1 Part A and B, Annex 2 (budget)	Annex 1 Part A (task allocation and person/months) and Part B (table of costs), Annex 2 (budget) modified to reflect the added Affiliated Entities (detail justification submitted to the Project Officer via the Grant Management portal)
GAP/3.0.	30.5.2023		Part A, page 16	Description of the Task 3.3. was modified by SNAM regarding their testbed description
GAP/3.0.	30.5.2023		Part A, page 17	Description of the Task 4.2. was modified by ACEGAS regarding their testbed description
GAP/3.0.	30.5.2023		Part A, page 18	Description of the Task 4.5. was modified by HSE regarding their testbed description
GAP/3.0.	30.5.2023		Part A, page 21	Objective of WP6 was modified
GAP/3.0.	30.5.2023		Part A, page 40	Delivery D3.3. was renamed according to SNAM testbed
GAP/3.0.	30.5.2023	After discussion with CHJU and legal department we have created a new list of milestones	Part A, page 48	New list of milestones was created
GAP/3.0.	30.5.2023	After discussion with CHJU and legal department we have created a new list of critical risks	Part A, page 54	New list of critical risks was created
GAP/3.0.	30.5.2023	After completion the process of GAP, new Figure 1 was needed	Part B, page 7	Figure 1 was updated.
GAP/3.0.	30.5.2023	On the PO advice, the acronyms of the partners were added to pilot testbed name, to know who is working on which testbed	Part B, page 12	Acronyms of the partners was added in the table 4, 5 and 6.
GAP/3.0.	30.5.2023	After CIMOLAI – one of the beneficiaries left the consortia, new Table 7 had to be prepared	Part B, page 16	New table 7
GAP/3.00	18.6.2023	Affiliated entity HALO Industry informed they need to leave the project due to the strategic changes in their portfolio left the consortium	Annex 1 Part A and B, Annex 2 (budget)	Annex 1 Part A (task allocation and person/months) and Part B (table of costs), Annex 2 (budget) modified to reflect the added Affiliated Entities (detail justification submitted to the Project Officer via the Grant Management portal)
GAP/4.0	4.7.2023	Partner SNAM updated their testbed in T.3.3.	Part A, page 15, Part B, page 13	The scale-up of highly efficiency modular electromechanical compressor. TL: SNAM [D:M1–M72] The validation of an innovative H2 compressor at TRL 6-8 will be implemented. The project will improve the system CapEx from 7'700 €/kW to 5'600 €/kW, especially for HRS applications, and will test the production plant of green hydrogen in Torviscosa (Ud), in order to improve the carbon footprint of an new developed plant that produce green hydrogen from electrolysis process (4MW) with electrical energy supplied from co-developed renewable plant at site and to enter a new market where green hydrogen is used for mobility application and in the chemical and hard to abate industry. Notably, the innovative H2 compressor will target the achievement of the 2030 CHJU Strategic Research targets of 3 kWh/kg_H2 – for 5/900 bar compression, as well as a higher reliability by targeting a Mean Time Between Failure (MTBF) of 40'000 hours.
GAP/4.0	4.7.2023	Values in the Figure 3 were updated	Part B, page 21	After updating SNAM testbed T3.3. updating of the Figure 3 was necessary to align H2 production.

GAP/4.0	4.7.2023	Steklarna Hrastnik changes depreciated costs of equipment to the full capitalized costs purchase.	Part B, page 56	After discussion with the partner, they would like to use Full capitalized costs for their equipment used for hydrogen testbed.

1 EXCELLENCE

1.1 Objectives and ambition

Renewable Hydrogen is universally considered to be an important energy vector for combating climate change. It enables the decarbonization of hard-to-abate sectors, acting as a no emission fuel with a vast potential for industrial development and job creation. Its benefits are also acknowledged through the many dedicated national hydrogen (H2) strategies that have been published globally in recent years. Simultaneously, the emergence of a hydrogen market economically stimulates regions where hydrogen is produced, and associated technologies are deployed by creating new jobs and showcasing the regions as environmental forerunners.

North Adriatic Hydrogen Valley – NAHV is **one of the most promoted hydrogen valleys in Europe**[1][2]. It is the first transnational Hydrogen Valley in the EU, merging two countries and one region, and as a result on November 29, 2021, it was mentioned by President Ursula von der Leyen[3] at her opening speech on Hydrogen Week, as an example of how Europe can develop other hydrogen valleys. Furthermore, NAHV has contributed to linking central Europe with the Balkans as explained in the impact section. The NAHV clusters unites several industrial and research initiatives to carry out testbed applications across the complete hydrogen value chain (production, transport, distribution, and end use with storage). NAVH originated as a result of the stimulus of the North Adriatic cross-regional innovation ecosystem (industries have already implemented important investment into the North Adriatic Region, including building the first privately funded hydrogen refuelling station - HRS) which expressed the need to be orchestrated and it provides guidance to the several initiatives already put in place by the industries and the research organizations. In fact, the NAHV is a strong industry driven initiative, built with a bottom-up approach, supported by universities and governments. The current NAHV project involves an inter-national geographical area shown in Figure 1 and represents testbed applications from Friuli Venezia Giulia Region in Italy, Slovenia and Croatia, and their related ecosystem.

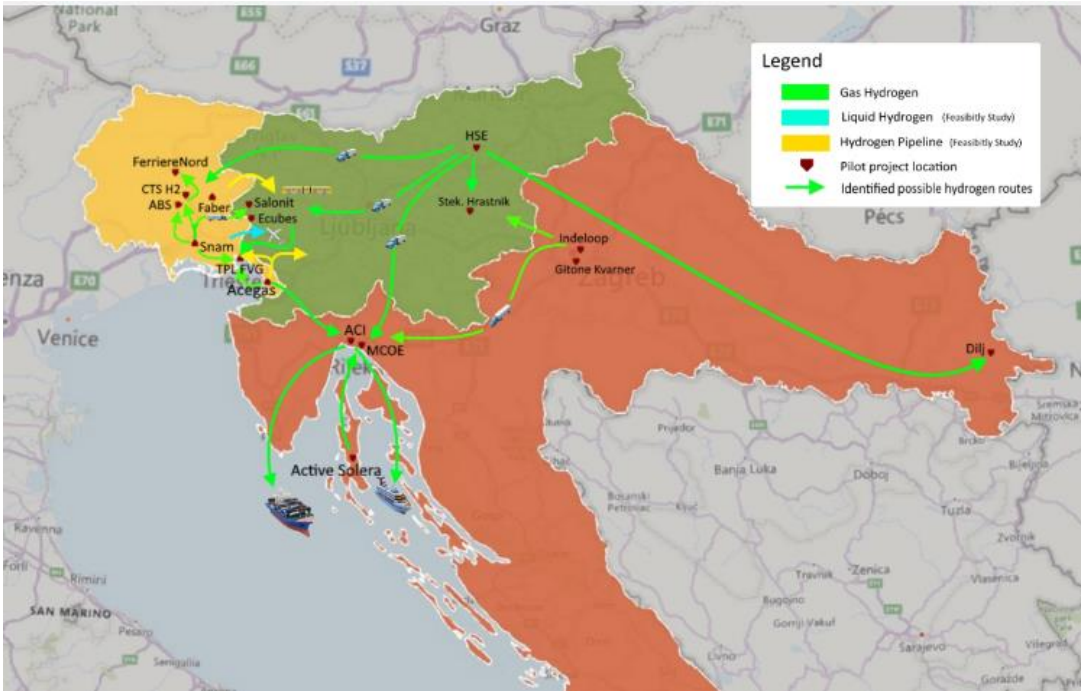


Figure 1: NAHV testbed projects ecosystem

[1] https://www.youtube.com/watch?app=desktop&v=oIXL28VSVUU&feature=youtu.be

[2] Fuel Cells and Hydrogen Joint Undertaking and ECUBES – SET Plan2021

[3] (573) Ursula Von der Leyen Full speech - YouTube

As a response to the request from the cross-regional innovation ecosystem, on the 14/03/2022 the Slovenian State Secretary in the Ministry of Infrastructure, the Croatian State Secretary in the Ministry of Economy and Sustainable Development and the President of the Friuli Venezia Giulia Autonomous Region, **signed a joint letter of intent (LoI)** in which they recognized the relevance of regional cooperation and cross-border hydrogen valley in boosting energy transition and promoting sectorial integration between transport, hard to abate industries, and end users in an integrated ecosystem. With this LoI the 3 signatories jointly committed to implementing a common innovation agenda and cooperation projects to accelerate the deployment of hydrogen-based solutions, strengthening local hydrogen ecosystems and building inter-regional value chains. The commitment toward the implementation of the hydrogen valley (HV) has also been formalized on 08/06/2022 by the Memorandum of Understanding (MoU) signed between the President of the Italian Government and the President of FVG for the establishment and financing of the Hydrogen Valley in FVG[4]. The three territories FVG (IT), Slovenia and Croatia, which constitute the NAHV, have been considered by the European Hydrogen Backbone[5] as one part of the larger pan-European hydrogen supply and import corridors which will connect industrial clusters, ports, and hydrogen valleys to regions of abundant hydrogen supply. To meet the objectives of the European Hydrogen Strategy and the European Green Deal, the NAHV project foresees, amongst other things, the development of 17 testbeds which cover the complete hydrogen value chain from production to distribution, storage and end-use with specific applications also developed to decarbonise the 3 NAHV territories by harnessing renewables such as solar energy with the aim of improving system resilience, security of supply and energy independence in line with the REPowerEU[6] action plan. NAHV will contribute in the next few years to the REpowerEU target of 10 million tonnes of domestic renewable hydrogen to replace natural gas, coal and oil in hard-to-decarbonise industries and transport sectors. Within NAHV, specific attention will be paid to the analysis of the economic, social and environmental impacts, including water utilization. Throughout the project, NAHV will follow the quadruple helix methodology which is based on the university-industry-government-public interactions within a knowledge economy. To fulfil those objectives the NAHV project has been built around a well rooted partnership which includes 38 organizations (27 partners and 11 affiliated) of which 2 belong to Hydrogen Europe and 3 to Hydrogen Europe Research. The NAHV is based on a "core system" of 17 testbed projects which will act as the first real-life cases for piloting global hydrogen markets, and which will have a TRL 6 at the beginning of the project and 8 at the end. Those testbeds will be further implemented by the companies to scale them up at industrial/operational level. Those "core testbed projects" are integrated into a mature ecosystem which has been working for decades in the hydrogen economy and in which several relevant initiatives funded with European, national and regional funds, are already led by players such as Fincantieri[7], Adriafer[8], Universities of Udine and Trieste[9] OGS[10] Toyota, University Maribor, Slovenian Railways, Institute Jožef Stefan, DOMEL, Chemical Institute, University of Split, INA, Altpro, Adria Wind Power, Crodux Energetica, HOPS, and Gradska plinara Zagreb, constituting the wide NAHV ecosystem. The project also received broader support in the form of a LoI from the Eurelectric, a leading association of utilities and electricity distributors in Europe and +40 other organizations.

Moreover, NAHV is structurally connected with the Argo System (ARGO & E-ARGO complex projects) created by the Institutional Protocol signed in March 2018 between the President of Friuli Venezia Giulia Region, the Italian Ministry of Economic Development (MISE) and the Italian Ministry of University and Research (MUR) which benefit from a yearly contribution of more than 5.200.000 euro for a period of 10 years. Argo is a public and private ecosystem that operates in 4 strategic sectors following a tested hub and spoke model: 1) FVG Digital Hub (IP4FVG) to support companies in the digital transition; the setting up of the Technology Platforms for industrial applied research; 2) business generation and development (Lab for Tech) and 3) Green Technologies for the Ecological transition (Energy, Hydrogen and Circular Economy). The integration between ARGO and NAHV is already active. In July 2022 FVG activated additional funds giving ARGO the mandate to create an experimental station for

[4] Cooperation agreement for the implementation of flagship projects "hydrogen valley" according to art. 33, parag 3. b) D.L 06/11/2021, n. 152, ex Low 29/12/ 2021, n. 233

[5] European Hydrogen Backbone "A European Hydrogen Infrastructure Vision Covering 28 Countries" – April 2022

[6] Communication REPowerEU Plan COM(2022)230

[7] Fincantieri | FINCANTIERI ED ENEL GREEN POWER ITALIA FIRMANO INTESA PER IDROGENO VERDE

[8] https://www.adriaports.com/en/logistics/in-trieste-adriafer-ready-to-test-hydrogen-locomotive-in-partnership-with-snam/ - https://adriafer.com/en/energetic-transition/

[9] Interconnected Nord-Est Innovation Ecosystem -iNEST" project funded with 109.866.032 euro

[10] Hystories - Hydrogen Storage in European Subsurface - Hystories

Hydrogen Valley ("in operando spectroscopy") and to strengthen the existing Data Center to support the storage and data management of the NAHV.

1.1.1 NAHV objectives

The North Adriatic Hydrogen Valley NAHV pursues two High Level Objectives (HLO) and a set of Specific Objectives (SO).

Table 1: NAHV's high level objectives 1

HLO 1: To create a North Adriatic Hydrogen economic, social and industrial ecosystem based on current and in development stage capacity of the quadruple helix actors leading to economic growth and new job opportunities in the framework of the double green and digital transition.			
SOs	**What the project will do**	**KPIs**	**Related WP**
SO 1.1	Showcase the ability of H2 and its associated technologies to decarbonize different sectors in the North Adriatic region and demonstrate how hydrogen enables sector coupling and integration of renewable energy.	17 test bed projects. 5 feasibility studies 3 sectors decarbonized	WP: 3, 4, 5, 6
SO 1.2	Showcase testbed innovative solutions for production, distribution, storage and end use of hydrogen in hard to abate (H), energy (E) and transport (T) sectors to decarbonize the regional economies by also integrating the potentiality offered by digital technologies.	H: 6 testbeds E: 5 testbeds T: 6 testbeds	WP: 3, 4, 5, 6
SO 1.3	Stimulate the NAHV renewable hydrogen capacity, the exchange of at least 20% H2 across the borders of the three HVs. H2 consumption 52% for industrial applications, 28% for transport applications and 20% for other energy sector applications.	Tot renewable hydrogen: 5.899Tonnes/year 1.200 across borders	WP: 2, 3, 4, 5, 6
SO 1.4	Put in place a common R&D&I Joint Action Plan (JAP) for organic development of the NAHV territories built upon the experience of other, pre-existing hydrogen valleys	Business plan and model done JAP approved	WP: 9, 11
SO 1.5	Demonstrate fuel cell applications in energy and transport sectors.	4 FCH used	WP: 4,5
SO 1.6	Set up a replicable monitoring strategy integrated with digital twin and platform for each of the testbed technologies covered, and for the general development of the whole NAHV.	17 tech/testbeds monitored 1 whole NAHV monitoring plan	WP: 10, 2

Table 2: NAHV's high level objectives 2

HLO 2: To contribute to the creation of a European Hydrogen Economy piloting global hydrogen markets by creating the conditions for a wider EU replicability			
SOs	**What the project will do**	**KPIs**	**Related WP**
SO 2.1	Develop joint regulatory frameworks to ease the use and distribution of hydrogen, overcoming the current regulatory gaps and barriers.	Policy documents: 6	WP8
SO 2.2	Increase hydrogen awareness and acceptance by the population at large and by the industrial sectors for a new green reindustrialization.	N° 500.000 citizens reached	WP 7
SO 2.3	Demonstrate the feasibility of the NAHV concept and create the framework conditions for its replicability in other locations in Europe by networking it with other similar initiatives in the EU, contributing to the activities of Mission Innovation 2.0 -Clean Hydrogen Mission.	5 Position papers published	WP 11
SO 2.4	Develop the skills of the existing workforce and of the future workforce, including at university level and job creation as well as via business acceleration and business development programmes.	School students reached: 500; Educational programs implemented: 4; H2STUDENT: 6.000 University students; summer/winter school:180 PhD students; Startups involved: 120. PoC funded: 40	WP 7, WP 9
SO 2.5	Pilot a new scheme for certified hydrogen trading at a transnational-regional/intra-EU hydrogen market.	1 hydrogen certification scheme	WP 2
SO 2.6	Demonstrate solutions developed by the partners by covering existing markets and creating new fields of application.	New solutions demonstrated:	WP: 3, 4, 5, 6

1.1.2 Ambition and progress beyond the state of the art

As seen above, NAHV aims at significantly contributing towards the creation of new knowledge and the expansion of current knowledge and state-of-the-art (SoA) in several areas, as shown in the following table.

Table 3: NAHV's Ambition and progress compared to state of the art

	Current achievement	NAHV -advances to the SoA
SoA-1	The NAHV regions have small-scale, renewable hydrogen production plants, and with low power installed for electrolysers.	Development of renewable H_2 production plants with an overall capacity of about 6.000 tonnes of H_2 per year. Production plants involve the installation of higher electrolyser installed power with respect to the existing and operative plants with the aim of reducing levelized cost of hydrogen.
SoA-2	Monitoring and management is relegated to small-scale plants, most of which are not seen as an interconnected component of the renewable H2 supply chain. No organized recording and analysis of data. Lack of a monitoring capacity of the several components of the hydrogen valley	Monitoring of the entire supply chain of renewable hydrogen, from the production to the distribution, storage and use of H_2. Creation of data base of recorded data with the aim of using it to optimize the process by the implementation of artificial intelligence technologies. Using IoT data to simulate the process when conditions change and predict undesired failure. Implementation of Digital Twins to help the technicians to make decisions and to predict plant productivity. Performance assessment of economic, environmental and social impact.
SoA-3	No relevant transnational/cross border projects considering renewable H_2 production, distribution and use has been developed yet in an interconnected ecosystem with cross border exchange of H_2.	Development of a transnational renewable H_2 supply chain that involves the connection of the 3 different countries through H_2 distribution system. Outcomes of NAHV will help in the definition of international rules and standards. Enabling transnational collaboration and the establishment of a common shared energy infrastructure.
SoA-4	Several projects have considered the development of H_2 ships, from small to medium size. Few vessels are operating and are usually mostly for demonstrative use. Lack of a H2 operational bunkering in harbours/marine.	Development of infrastructures to refuel ships in port areas. The geographical position of the proposal, the availability of renewable H_2 and infrastructures for H_2 refuelling will drive the renewable H_2 use in shipping.
SoA-5	Several legislative acts are in place for the use and distribution of hydrogen, however no specific rules are in place to incentivize the uptake and use in sensitive environments (ie. bunkering in harbours/marinas; cross border transport, etc.) and to incentivize the production, utilization and development of value chain	Development of a regulation sandbox to harmonize certain procedures and legislation. Development of a set of incentives to trigger H_2 production and utilization and the development of the value chain

The NAHV's R&I maturity level

The NAHV project aims to move from a conceptual idea of several scattered, unconnected initiatives active in the hydrogen economy but spread across North Adriatic area and covering the H_2 value chain, toward an organized and integrated ecosystem where the hydrogen applications are combined/integrated to improve the territory from a socio-

economic and environmental point of view. The NAVH project is composed of 17 "vertical" testbed applications clustered in 3 main pillars: hard to abate, energy, transport. All those testbed applications have been considered because of their initial TRL 6 and during the NAHV project, with industrial validations and implementations under expected operational conditions they will move from TRL 6 to TRL 8. Furthermore, the testbeds planned by NAHV aim to demonstrate 4 fuel cells applications in the energy and transport sectors.

Table 4: Renewable Hydrogen Testbed Applications for the Industry and Hard-To-Abate Sector (WP3)

Testbed Title	**Value Chain position**	**TRL6-8: industrial validation and implementation in an industrial context of the prototypal solution**
DILJ Production and usage of H_2 as a partial replacement for natural gas inside a kiln in a roof tile factory	end user	combustion system and electrical energy production and storage for the H_2 usage as a partial replacement for natural gas inside a kiln in a roof tile factory.
ABS H_2 utilization in special steel production and treatment	end user	H_2 burners to transform steel ingot heat treatment furnaces to achieve effective total decarbonisation, using carbon-free energy carriers such as renewable hydrogen either as a blend or as a total replacement for traditional fossil fuels.
SNAM The scale-up of highly efficiency modular electromechanical compressor	producer	The validation of an innovative H2 compressor at TRL 6-8 will be implemented. The project will improve the system CapEx from 7'700 €/kW to 5'600 €/kW, especially for HRS applications, and will test the production plant of green hydrogen in Torviscosa (Ud), in order to improve the carbon footprint of an new developed plant that produce green hydrogen from electrolysis process (4MW) with electrical energy supplied from co-developed renewable plant at site and to enter a new market where green hydrogen is used for mobility application and in the chemical and hard to abate industry.
FENO Blended mix usage in rolling mill preheating furnace for hard to abate industrial application	end user	new burners (and relative piping, blending, and control systems) able to use renewable H_2 blended with natural gas in reheating furnace of rebars rolling mills, ensuring at least the same level of safety during operation and quality of the product. Air emissions will be verified in terms of CO_2 reduction and NO_X.
SALONIT H_2 production for cement industry decarbonization	producer/ end user	Building a containerized electrolyser with necessary storage and connections to use the H_2 produced in transport. The system will be functional to test the sustainability/feasibility of the introduction of a hydrogen-fueled cargo locomotive and truck in the cement factory distribution chain.
STEKLARNA Efficient utilization of Water Electrolyser (WE) system in the glass industry	end user/ producer	WE's H_2 and O_2 gases used in a cutting-edge glass furnace to improve overall energy efficiency. As the WE will be partially powered by RES and incorporated in auxiliary services to the TSO, electrolyser cells with great output flexibility will be deployed (PEM). H_2 storage and advance system control will compensate for fluctuations in H_2 supply.

Table 5: Renewable Hydrogen Testbed Applications for the Energy Sector (WP 4)

Testbed Title	Value Chain position	TRL6-8: industrial validation and implementation in an industrial context of the prototypal solution
ACTIVE SOLERA Clean hydrogen from non-recyclable waste through SMO (Solaire-MicroOndes) solar process	producer	SMO, a patented tech employing solar pyrolysis and plasma gasification to produce clean hydrogen in 4 steps: 1) input preparation: transforming biomass and non-recyclable fractions of municipal solid waste into dry standardized granules. 2) Dry granules are transformed into a homogenous product through Solar pyrolysis step where all the products are conducted through a closed system into the next step reaction. 3) Plasma gasification using filtered waste water to produce hydrogen rich syngas. k4) Hydrogen purification and storage for power generation or transport. Solar Process energy-autonomous waste processor using exclusively solar thermal energy to transform non-recyclable carbon-based waste into competitively priced Clean Hydrogen and Energy, together with carbon products.
ACEGAS H2 production through industrial symbiosis and asset enhancement	producer/ distributor	An electrolyser prototype of 2,5 MWe will produce renewable hydrogen. The hydrogen production plant will be electrically powered by renewable energy (20GWh/y) purchased from RES plants, including the waste-to-energy plant in Trieste, and produced by a photovoltaic field. In a perspective of industrial symbiosis, the hydrogen production plant will use the purging of the cooling towers of the waste-to-energy plant. The hydrogen produced will be stored and made available to users, including the logistics sector and the local public transport service (see Task 5.4). The goal is to increase the overall efficiency of the developed system, reduce the environmental impact of the process and thus develop a scalable solution that increases the size of the plant and the quantity of hydrogen produced up to 5 times.
ACEGAS Assessment of the suitability of the natural gas distribution network for the transport of mixtures of H_2 and gas or H_2 at 100%	distributor	Technological Qualification of the existing distribution network, to evaluate the use of own methane gas distribution network assets for the injection of increasing % H_2 percentage of H_2, beyond the current regulatory limits, as well as the H2 storage in case of peaks production.
INDELOOP H2 by gasification of organic material for small microgrid in the industry area	producer	Plant coupled with a PEM electrolyser H_2 production. The thermal conversion (gasification) plant turns organic material (such as non-recyclable plastics, sludge and textile) into H_2 and black carbon. FC application and wastewater sludge reusage.
HSE H2 ecosystem technology solutions and production for next generation valuable market development	producer/ distributor	Renewable H_2 supply chain solutions using novel large floating PV power plants to produce 3000 t of green hydrogen on site in Slovenia for fuelling station and market integration

Table 6: Renewable Hydrogen Testbed Applications for the Transport Sector (WP5)

Testbed Title	Value Chain position	TRL6-8: industrial validation and implementation in transport sector context of the prototypal solution
CTS H2 Integrated hydroelectric and HFC power station for small distribution H2 refuelling stations	producer/ end user	Small and distributed H2 refuelling station with onsite production of renewable H2, powered by a small hydroelectric power station. The system collects rainwater to power the electrolytic process. FC included to charge batteries of bicycles and mini vehicles.
FABER Hydrogen storage system for distribution	distributor	Innovative H2 storage composite vessel prototype with large water capacity and implementation of a fully automated line suitable for efficient manufacturing at mass production scale of very high-pressure gas cylinders to be installed on road or rail trailers.
MCoE Hydrogen propulsion for vessels and maritime infrastructure in the Adriatic	end user	Green vessel powertrain demonstrated by retrofitting a fully operational harbour tug, with FC application. Renewable H2 propulsion retrofit, focusing on performance, safety, certification and supporting infrastructure, power management and control using digital technologies.
TPL FVG Production and management models for the use of H2 for bus traction	end user/ producer	Ecological transition of part of the fleet from diesel to H2 power. Bus performances monitored by two models of production/distribution/refuelling/management.
ACI MARINE Fuel storage tanks swap (FSTS) solution for H2-fueled fleet	producer/ end user	Novel hydrofoil hydrogen vessels with integrated new cost effective FSTS solution for hydrogen-fuelled fleet will be deployed and tested. Results from this task will serve as a nucleus for decarbonisation of maritime industry.
ECUBES Energy storage, distributed power generation based on FC and accounting of carbon credits	producer/ end user	Easy deployable, containerized energy storage and power generation with energy storage in a form of liquid H2 carrier for cars or e-v charging stations. Renewable H2 from industrial waste heat in a closed material flow, powered by excess-waste heat with FC application.

1.2 Methodology

1.2.1 The North Adriatic Hydrogen Valley- NAHV methodology

The North Adriatic Hydrogen Valley will be a wide open-air living laboratory where new challenges will be faced and solved. From this point of view, the NAHV model will be tested in the unique condition of a sort of North Adriatic (NA) cross border conurbation, which involves an area of 84.769 square kilometers and about 7.2 million inhabitants. It is relevant to highlight the current, strong level of business and social interaction among the geographical target areas of the project. In fact, on a daily basis, a large number of people move in the cross- border area or work in one of the three countries[11] and the 3 economic regions are strongly interlinked and interdependent (Italy is the main destination and Slovenia the third for Croatian exports, Italy is the second and Croatia the third

[11] Mobilità transfrontaliera del Friuli Venezia Giulia Italia-Slovenia e Italia- Austria, Regione Autonoma Friuli Venezia Giulia, 20/06/2020.

destination for Slovenian exports[12] whereas Slovenia is the 19th and Croatia the 25th destination for Italian exports [13] but if we look at the single FVG region, Slovenia is the 7th destination of exports[14]). As already discussed before, the NAHV is systematizing the effort for the advancement of the green and digital transition individually carried out by the several stakeholders in the North Adriatic region. Starting from the interest showed by the economic actors of the territories and by the uncertainty over and by the contingency economic crisis, the policy authorities of the 3 NAHV's areas have identified the hydrogen economy as a flagship initiative for their development and energy strategies.[15][16][17] In this framework, the JU Clean Hydrogen NAHV project is the cornerstone of a wider strategy for the decarbonization of the North Adriatic economy and for placing the NAHV's stakeholders at the forefront of the hydrogen economy.

The NAHV project is based on a wide ecosystem with the involvement of more than 210 stakeholders who have expressed their interest in the hydrogen economy, they are representatives of the quadruple helix components: 12 from research and academia, 170 from industry and business, 12 policy makers, 16 from civil society. In this framework, the NAHV project is emerged as a heuristic ecosystem where we can observe 2 main "components":

a) a "core system" made by the 37 partners and affiliated organizations of the present project which will bring innovation in the system via a series of 17 testbed projects, regulatory and fiscal incentives proposals, innovative business model definition, monitoring & certification activity and awareness raising. This component will start at TRL 6.
b) a "mature ecosystem" (see also at page 2 the list of some of them which have issued the letter of interest -LoI) of organizations which are already involved in activities with a high level of TRL 8-9 and which operate in the wide hydrogen economy, which are not directly involved in the NAHV's application but are in any case part of the NAHV's value chain as producers, users, distributors, etc.

The NAHV at core system level will see an investment within the testbeds of about 230 M euros[18] which will trigger a leverage[19] effect, leading to an overall investment of about 710 M euros. In the table below, for each testbed project the initial investment (the level of investment planned during the project/grant agreement life) and the investment planned from the end of the testbed to bring the testbed to scale it up after the project end is indicated.

[12] https://www.adrioninterreg.eu/wp-content/uploads/2020/09/ADRION-territorial-analysis-post-2020-final-approved.pdf"https://www.adrioninterreg.eu/wp-content/uploads/2020/09/ADRION-territorial-analysis-post-2020-final-approved.pdf

[13] https://www.infomercatiesteri.it/osservatorio-economico-interscambio-commerciale-italiano-mondo.php

[14] https://www.iresfvg.org/lexport-del-friuli-venezia-giulia-1-trimestre-2022/

[15] Cooperation agreement for the implementation of flagship projects "hydrogen valley" according to art. 33, parag 3. b) D.L 06/11/2021, n. 152, ex Law 29/12/ 2021, n. 233

[16] Croatian Hydrogen Strategy ENG FIN 22 8.pdf (gov.hr)

[17] Slovenian Integrated National Energy and Climate plan, approved in 2020 and to be updated in 2024

[18] This refers to the equipment needed to implement each of the 17 testbeds included in the project/grant agreement

19 Leverage refers to the upgrade at an industrial scale of the several testbeds

Table 7: investment table with projects and investment

Testbed Title	company name	initial investment[20]	investment at operation level[21]
PRODUCTION AND USAGE OF HYDROGEN AS A PARTIAL REPLACEMENT FOR NATURAL GAS INSIDE A KILN IN A ROOF TILE FACTORY	**Dilj**	8.000.000,00€	30.695.000,00€
HYDROGEN UTILIZATION IN SPECIAL STEEL PRODUCTION AND TREATMENT	**ABS**	7.000.000,00€	20.000.000,00€
THE SCALE-UP OF HIGHLY EFFICIENCY MODULAR ELECTROMECHANICAL COMPRESSOR	**Snam**	1.890.000,00 €	5.000.000,00 €
BLENDING MIX USAGE IN ROLLING MILL PRE HEATING FURNANCE FOR HARD TO ABATE INDUSTRIAL APPLICATION	**FENO**	2.500.000,00 €	6.500.000,00 €
H2 PRODUCTION FOR CEMENT INDUSTRY DECARBONIZATION	**Salonit**	4.180.000,00 €	60.000.000,00 €
EFFICIENT UTILIZATION OF WE SYSTEM IN THE GLASS INDUSTRY	**Steklarna**	4.526.000,00 €	7.118.000,00 €
CLEAN HYDROGEN FROM NON-RECYCLABLE WASTE THROUGH SMO SOLAR PROCESS	**Active Solera**	6.500.000,00 €	500.000,00 €
H2 PRODUCTION THROUGH INDUSTRIAL SYMBIOSIS AND ASSET ENHANCEMENT	**Acegas**	10.000.856,74 €	3.500.000,00 €
ASSESSMENT OF THE SUITABILITY OF THE NATURAL GAS DISTRIBUTION NETWORK FOR THE TRANSPORT OF MIXTURES OF HYDROGEN AND NATURAL GAS OR HYDROGEN GAS AT 100%	**Acegas**	168.000,00 €	300.000,00 €
H2 BY GASIFICATION OF ORGANIC MATERIAL FOR SMALL MICROGRID IN THE INDUSTRY AREA	**Indeloop**	4.630.000,00 €	10.035.000,00 €
HYDROGEN **E**CO **S**YSTEM **TE**CHNOLOGY **S**OLUTIONS & **P**RODUCTION for **N**EXT **G**ENERATION **V**ALUABLE **M**ARKET **D**EVELOPMENT	**HSE**	160.710.000,00 €	188.425.000,00 €
INTEGRATED HYDROELECTRIC AND HFC POWER STATION FOR SMALL DISTRIBUTION HYDROGEN REFUELLING STATIONS	**CTS H2**	1.217.970,00 €	5.000.000,00 €
HYDROGEN STORAGE SYSTEM FOR DISTRIBUTION	**Faber**	1.111.750,00 €	10.000.000,00 €
HYDROGEN PROPULSION FOR VESSELS AND MARITIME INFRACTRUCTURE IN THE ADRIATIC	**MCoE.**	5.750.000,00 €	750.000,00 €
PRODUCTION AND MANAGEMENT MODELS FOR THE USE OF HYDROGEN FOR BUS TRACTION	**TPL FVG**	7.000.000,00 €	25.000.000,00 €
ADRIATIC & GREEN HYDROGEN	**ACI Marine**	13.420.000,00 €	296.000.000,00 €
ENERGY STORAGE, DISTRIBUTED POWER GENERATION BASED ON FC AND ACCOUNTING	**ECUBES**	5.844.000,00 €	90.000.000,00 €
		229.48.576,74 €	**708.128.000,00 €**

Those investment will lead to a total production of about 5.899 tonnes of H2 within the duration of the grant. The above investment will be covered partly by the companies' internal resources (it is relevant to highlight that most of the companies involved in the testbed projects are noted national/international players, some of whom are quoted on the stock exchange, and they have the financial capacity to scale up the testbed projects at operational level) and partly with a series of public funds. Hydrogen investments in the period of project lifetime and afterwards is rapidly growing. Also, in the field of co-funding the projects from national and European funds. In Table 8 possible future co-funding from all three countries is presented.

[20] needed to implement each of the 17 testbeds included in the project/grant agreement

[21] investment planned from the end of the testbed to bring the testbed to operational level/to scale it up after the project end

Table 8: NAHV additional public national and regional sources of funding

Note: the potential resources mentioned below do not represent all the possibilities that will be available in the future and should be taken as indicative at this stage.

Friuli Venezia Giulia Region – Research and Resilience Plan
Measure 2 of the recovery plan 3 "Renewable energy, hydrogen, sustainable infrastructures and mobility" - 3.1 "Production in brownfields" - hydrogen valley; 3.2 "Use of hydrogen in hard-to-abate sectors; 3.3 "testing of hydrogen for road transport"; 3.5 "research and development on hydrogen"
Measure 4 “From research to industry” Creation and strengthening of innovation ecosystems for sustainability building; IPCEI; Research and innovation infrastructures;
Measure 5 "Developing an international, industrial and research and development leadership in the main chains of the transition" - 5.2 "hydrogen" production of electrolysers (IPCEI & other)
Measure 1 "Development of the port system" - 1.1 "interventions for the environmental sustainability of ports
"Strengthening research of innovative models for basic and applied research conducted in synergy between universities and companies
Measure 2 "Support for innovation and technological transfer processes - 2.1 " IPCEI " - 2.2 "partnership - Horizon Europe"
Measure 2 "Support for innovation and technology transfer processes
"Green new deal - research, development and innovation projects for the ecological and circular transition in the areas of the Italian green new deal "
LR 13/2022. paragraph 28 - contributions to purchase and installation of photovoltaic systems, and / or storage green hydrogen energy; paragraph 31 - (SMEs) for interventions with the use of green hydrogen
"LR 23/2021”. paragraph 15 replacement, by 2030, of at least 50 per cent of the diesel fleet with hydrogen
3 "Promoting the production, distribution and end uses of hydrogen" - 3.1 "production in brownfields" - hydrogen valley. mite funds reserved to 5 hydrogen valley regions (FVG region included)
Croatia (nationally)
(RRF) Recovery and Resilience Plan for Croatia - C1.2. R1-I3 – Installation of 10 MW electrolyze (INA oil company); C1.2. R1-I3 – Installation of 6 hydrogen refuelling station (open call); C1.4. R4-I1 – Purchase of clean vehicles (hydrogen)
PKK (ERDF) Programme for Competitiveness and Cohesion - Installation of 20 MW electrolyze (open call); Installation of 4 hydrogen refuelling station (open call); National funding from CO2 allowances (for transport sector)
Slovenia (nationally)
(RRF) Recovery and Resilience Plan for Slovenia - Development area: GREEN PASSAGE; COMPONENT 1: Renewable energy sources and efficient use of energy in the economy (C1 K1)
Cohesion fund 2021-2027 - Specific objective 3.3: Development of smart energy systems, networks and storage outside the pan-European energy network (TEN-E); Specific objective 4.1: Promoting sustainable multimodal urban mobility in the context of the transition to a net-zero carbon economy

JTF - Zasavje: Center for demonstration and training in the field of carbon-free technologies; Zasavje: Transition to renewable fuels in glass production (H2GLASS); SAŠA: Area of promoting the use of renewable energy sources; SAŠA: Dismantling and changing the purpose of facilities related to the use of coal
Modernization fund (expected after 2024)

Moreover, the Commission President Ursula von der Leyen[22] in her State of the Union speech announced the creation of a new European Hydrogen Bank with a first funding basket of **€3bn budget** from the existing Innovation Fund. The president also stated, "we will be working to leverage that amount to ensure we move our hydrogen economy from niche to scale". The above funding will be instrumental for the development of the 2 components (mature ecosystem and core system), each with the same importance. In this sense each element of the NAVH will work following the open innovation paradigm where the output of one of the elements can be the input for another element of the NAHV's ecosystem. Within the NAHV project, the partnership will also work to solve several other non-technical issues and it will contribute to the development of a wider hydrogen ecosystem. The specific design of the NAVH will lead to interlinkages with other hydrogen production locations and/or consumption outside its boundaries, which represents one of the unique selling points of NAVH novelty as the Hydrogen Valley is not confined to a specific geography but will also span across 3 countries and will look for interlinkages with other production/utilization areas going to fill the gap in the current HV geography by contributing to the establishment of a pan European hydrogen market. Going more in detail the NAHV's project is designed around 4 vertical pillars and 5 horizontal pillars which will allow the replication of the NAHV's model.

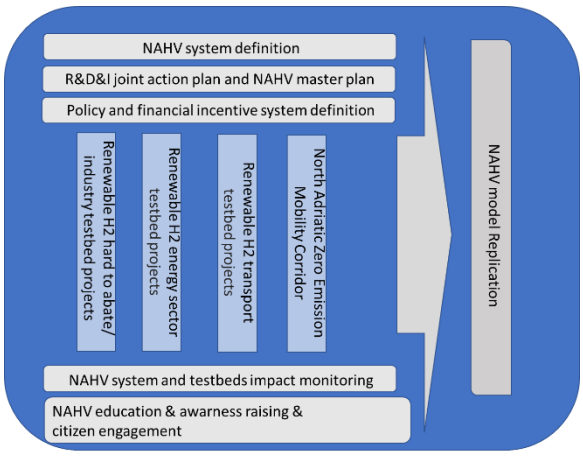


Figure 2: NAHV structure

As shown in figure 2, the horizontal pillars will be focused on building the framework to enable the valley to function. By interviewing the NAHV's stakeholders, we identified the need to define a **systemic vision and the development of a holistic model** of the valley. This heuristic approach will consider plans for production, transport, storage and distribution of hydrogen. Based on the experience tested at Italian level, the NAHV will work following the hub-and-spoke model. The methodology also foresees setting up a multi-sector and multi-scale digital twin for the entire hydrogen valley, which will be based on tools and experiences from previous projects to leverage the impact and boost progress in the NAHV project. Advanced modelling techniques[23] and advanced parametrization methodologies[24] will be combined with advanced methods for assessing degradation phenomena[2526]. To ensure the necessary coordination and management of the ecosystem the NAHV association will be established and registered in Belgium as Association Internationale Sans but Lucratif (**AISBL**). Creating a legal organization will ensure involvement of all actors of the ecosystem and to transfer the legacy of the project's experience. The NAHV AISBL will become the governance body of the valley and it will act as a fair, transparent end equitable body representing the NAHV's

[22] https://hydrogeneurope.eu/historical-day-for-green-hydrogen/

[23] KRAVOS, A, RITZBERGER, D, TAVČAR G, HAMETNER C, JAKUBEK, S, KATRAŠNIK T. Thermodynamically consistent reduced dimensionality electrochemical model for proton exchange membrane fuel cell performance modelling and control. *Journal of power sources*, ISSN 0378-7753, Apr. 2020, vol. 454, str. 1-16

[24] KRAVOS A., RITZBERGER D., HAMETNER,C., JAKUBEK S., KATRAŠNIK T. Methodology for efficient parametrisation of electrochemical PEMFC model for virtual observers : model based optimal design of experiments supported by parameter sensitivity analysis. *International journal of hydrogen energy*, ISSN 0360-3199. [Print ed.], Apr. 2021, vol. 46, iss. 26, str. 13832-13844

[25] KREGAR, Ambrož, FRÜHWIRT, Philipp, RITZBERGER, Daniel, JAKUBEK, Stefan, KATRAŠNIK, Tomaž, GESCHEIDT, Georg. Sensitivity based order reduction of a chemical membrane degradation model for low-temperature proton exchange membrane fuel cells. *Energies*, ISSN 1996-1073, Nov. 2020, vol. 13, 21, 1-16

[26] KRAVOS A., KREGAR A., MAYER K., HACKER V., KATRAŠNIK T. Identifiability analysis of degradation model parameters from transient CO_2 release in low-temperature PEM fuel cell under various AST protocols. *Energies*, ISSN 1996-1073, 2021,vol.14,iss. 14,str.1-16

stakeholders. From evidence gathered by interviewing the NAHV's stakeholders, we identified the need to develop an **R&D&I common development joint action plan** for the NAHV ecosystem itself, which both provides the pathway for collaboration and shows the synergies which can be implemented. The R&D&I common development action plan will be defined by using co-creation and co-design[27] methodologies and by involving stakeholders' representatives of the quadruple helix[28]. The work on **policy and financial scheme definition** will start from the analysis of several studies and from the observation of the experience of other ecosystems[29]. It will proceed toward the definition of new policy measures[30] and incentives schemes[31] to support low carbon and renewable hydrogen in end-use sectors to pave the way for the hydrogen economy and to attract new investors/operators within the NAHV's area. Within NAHV a regulatory sandbox[32] will be studied and proposed for removing excessive regulatory barriers in NAHV's cross border area, including simplifying licensing and permitting processes and removing undue legislative barriers for renewable and low carbon hydrogen production. NAHV Regulatory sandbox has the potential to become an effective tool to test innovative regulations before approving them as new standards. The in-depth study of the regulatory sandbox has already begun (2021) with the activation of a research grant in collaboration between AREA and the University of Trieste. Enabling NAHV's policy will play a key role across all phases of NAHV market development and hydrogen certification schemes (evidence of the origin, carbon footprint and other sustainability) will be defined. The **monitoring activity** will be put in place for at least 2 years from the end of each initiative developed with the NAHV. A two-level monitoring approach is planned: 1) at NAHV's project level and 2) at each testbed project level. Therefore, at level 1 the monitoring of environmental, socio and economic (cost-benefit) impact will be run. In order to evaluate the systemic approach a Life Cycle analysis and Social impact analysis will be executed. At level 2 a massive use of digital technologies will be exploited to gather real time data. System related parameters will be remotely monitored by means of an Internet-of-Things (IoT) based network of sensors and transducers. Devices will be connected following the common communication models used for IoT systems (*e.g.* Device-to-Device, Device-to-Cloud, Device-to-Gateway, and Back-End Data-Sharing). The recorded data will be processed in real time to be fed to the digital twin of the NAHV (task 2.4) and for monitoring the status of the plant. Artificial intelligence algorithms will be developed and employed for the data processing for failure prediction. The ICT will therefore be applied to monitor the main components of the NAHV value chain: the production system, the storage system, the distribution system, the final user hydrogen demand profile and energy efficiency. As for the **public and citizens acceptance & awareness raising:** several studies have pointed out that while the use of hydrogen and the associated technologies is expected to increase in the coming years, the success of hydrogen energy technology (HET) is, however, dependent on public acceptance of the technology[33]. Factors such as sociodemographic, especially the variable age, as well as project-related factors, especially trust in stakeholders, have a high influence on the acceptance of H2 initiatives especially when they are related to large infrastructures[34]. To reduce the risk of a NIMBY effect[35] it is necessary to put in place a **wide citizens awareness** raising campaign to ensure the social acceptance of HET, to increase a positive customer experience by promoting H2 lead-user/evangelist and its social and economic benefits. During the more than 200 face to face interviews with the NAHV's ecosystem the lack of **education and trained** work force to support to the hydrogen wide market introduction emerged. Task 7.3 will realize a set of education related activities to promote the training of future professionals and experts in the field of hydrogen technologies which will also be able to use H2 avoiding hazards.

[27] https://communities.sunlightfoundation.com/action/codesign/

[28] https://cor.europa.eu/en/engage/studies/Documents/quadruple-helix.pdf

[29] In Sweden a tax rate of SEK 40/kg of NOx emitted from any combustion plant producing at least 50 MWh per year has been set.

[30] IRENA. Green hydrogen for industry: A guide to policy making. International Renewable Energy Agency, Abu Dhabi. 2022

[31] Hydrogen council. Policy review. Policy Toolbox for Low Carbon and Renewable Hydrogen Enabling low carbon and renewable hydrogen globally. November 2021

[32] Regulatory sandbox (fca.org.uk)

[33] Scovell D. Explaining hydrogen energy technology acceptance: A critical review. International Journal of Hydrogen Energy, March 2022

[34] Schönauer A-L , Glanz S: Hydrogen in future energy systems: Social acceptance of the technology and its large-scale infrastructure, International Journal of Hydrogen Energy, march 2022

[35] Pal. E et Al. Psychological parameters to understand and manage the NIMBY effect. European Review of Applied Psychology Volume 56, Issue 1, March 2006

The methodology at the base of the **replication** is organized around a policy and capacity building activity which will include and involve at least 5 other hydrogen valleys. The approach is based on the open exchange of experience with labs and peer exchange methods. NAHV can be seen as an open-air distributed laboratory where other organizations will be allowed to get access to NAVH's labs, capacity and tools, following the open lab methodology developed by AREA. In this framework the NAHV ecosystem will benefit from first-class research equipment such as the synchrotron light source managed by Elettra Sincrotrone which allows research and specific tests to be performed on the relation between hydrogen and materials, and AREA's microscopy platform which is under construction, and which is focused on characterization of materials. These research infrastructures will be useful both to the private sector for applied research and to research institutions for pure hydrogen related research.

The vertical pillars are based on a series of testbed projects clustered around 3 main pillars: application of hydrogen in the hard to abate sector, H2 energy production, application of hydrogen in transport. These testbed projects (see tables 4, 5, 6) act as the initial real-life pilot cases in global hydrogen markets and they will demonstrate the full range of benefits from the use of hydrogen as an energy carrier at almost full scale. The testbed projects have been chosen for their capacity to contribute to the creation of a hydrogen economy and market, looking both at hydrogen production and its application in the productive sector. The 18 testbeds foresee a high complementarity with Renewable Energy Sources-RES (mainly photovoltaic panels), which will be installed on existing infrastructures, roofs, or polluted abandoned areas. As shown in fig. 3, NAHV foresees a widespread H2 production and distribution area which will involve 3 countries: 3.658 tonnes/year in Slovenia, 1.002 tonnes/year in Croatia, 1.277 tonnes/year in Italy. The wide geographical distribution of hydrogen producers will allow shared production and distribution reducing the risk associated with a concentration in only a few large producers/distributors.

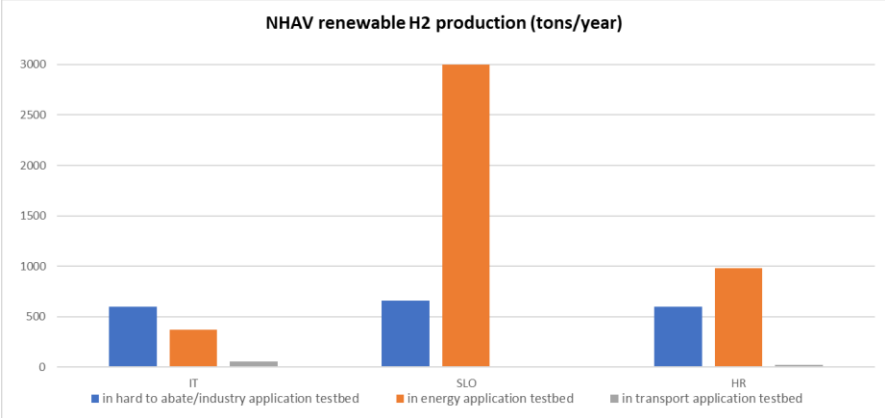


Figure 3: NAHV renewable H2 production (tonnes/year)

The testbed projects are focused on the entire hydrogen value chain from production (including dedicated PV infrastructures) to storage, and its transport and distribution to various off-takers mainly concentrated in the hard-to-abate sector (3.058 tonnes/year), energy (1.157 tonnes/year) and transport (1.684 tonnes/year). The picture below shows the distribution of testbed projects per sector and the related use/production of hydrogen. About 52% of the hydrogen produced will be dedicated to industrial applications, while about 48% of the hydrogen produced will serve other applications. Four fuel cell applications are planned: one in the energy sector and three in the transport sector.

More than 1.200 tonnes/year (+20%) of the produced hydrogen will be exchanged among the 3 countries of the Valley. We have identified two hydrogen corridors: one from Slovenia to Croatia and vice versa; the other one from Croatia to FVG and SLO for maritime off-takers. Other possible corridors from FVG to Slovenia (and vice versa) will be defined in feasibility studies.

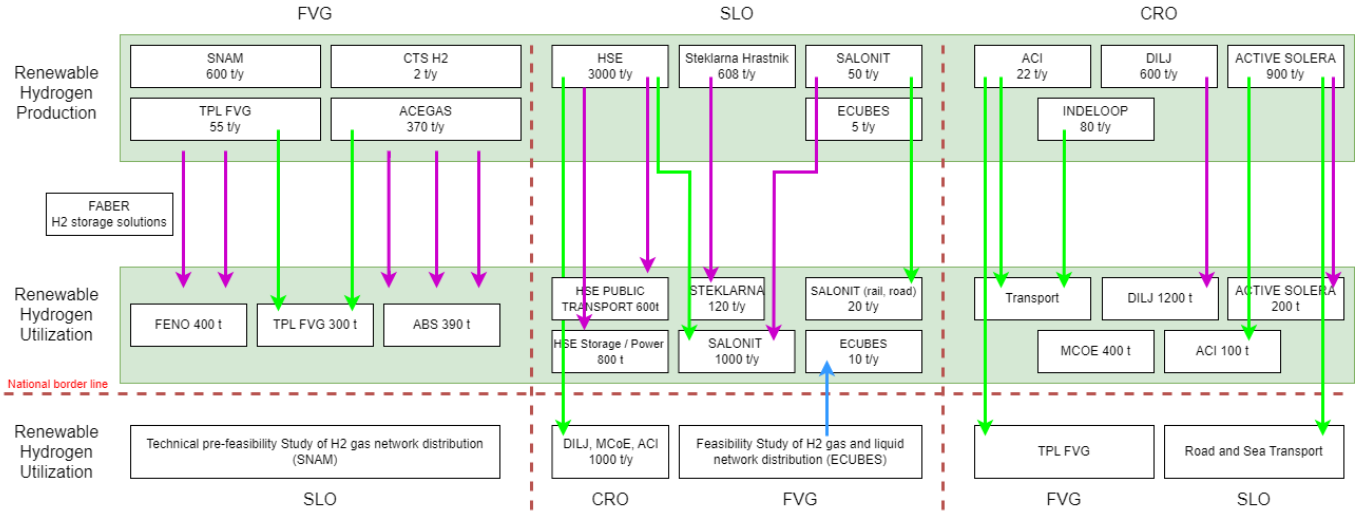


Figure 4 Production of renewable hydrogen, utilization and cross border exchange scheme

The testbed applications planned within the project foresee the installation of 276,5 megawatt PV panels and a related production capacity of about 6.000 tonnes of renewable hydrogen per year at the end of the project duration using new renewable hydrogen production capacity. Based on the data gathered we estimate that at least 4.700 tonnes/year of renewable hydrogen will be exchanged among actors within a single territory (>1.000 H2t/year in Italy, >2.800 in Slovenia, >800 in Croatia) and 1.200 (20%) will cross borders and be exchanged between territories. The hydrogen produced within the NAHV will be dedicated to industrial applications 3.105 tonnes (52%), the energy sector 1.157 tonnes (20%) and transport sector applications 1.684 tonnes (28%).

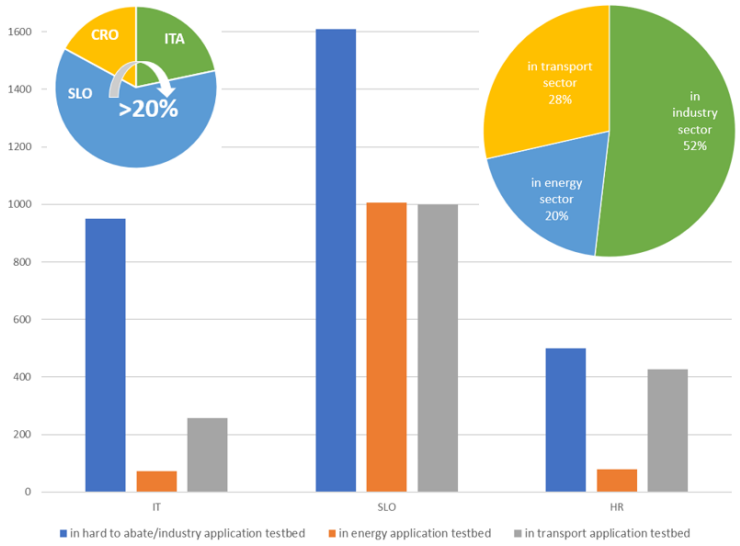


Figure 5 NAHV renewable H2 consumption(tonnes/year)

1.2.2 The North Adriatic Hydrogen Valley compliancy with the Do No Significant Harm (DNSH) principle

The project is compliant with the Do No Significant Harm (DNSH) principle as per Article 17 of the Regulation (EU) 2020/852. The impact on each of the six environmental objectives is assessed in the following.

Does the project significantly harm/impact the environmental objective?	**Project impact and relationship to DNSH principle**
DNSH environmental objective: Climate change mitigation	
Project contributes to the environmental objective climate change mitigation	The contribution of the hydrogen valley to the overall decrease in GHG emissions will be accurately assessed throughout the project, considering not only H2 production but also its distribution, storage and end-use application (this last is the approach used in the KPI's methodology). Moreover, the hydrogen produced and used will be certified by a non-governmental certification scheme (i.e. CertifHy) that will provide evidence of its origin, carbon footprint and sustainability. Projects are in line with the criteria listed under this objective. The project does not lead to significant GHG emissions; indeed, it supports the shift towards a renewable hydrogen economy that mainly involves the production of hydrogen through electrolysis using electricity from renewable energy sources (e.g., PV, waste energy,…). The applications planned within the project will lead to the production of 5.899t/year of renewable H2, corresponding to substituting around 16,85 million Sm3 of natural gas or 19,38 million L of diesel oil relating to the H2 production processes, with a corresponding significant reduction in GHG emissions of 39.600 or 52.200 tonnes of CO2 equivalent respectively[36]
DNSH environmental objective: Climate change adaptation	
Project contributes to the environmental objective climate change adaptation	The project is not expected to be detrimental to climate change adaptation. It contributes to European Green Deal goals of reaching climate neutrality by 2050. Projects are in line with criteria listed under this objective (including storage, production, transmission of H2)
DNSH environmental objective: Sustainable use and protection of water and marine resources	
Project takes into account sustainable use of water and marine resources	The project is not expected to be detrimental to the good environmental status of water bodies. However, since water utilization is expected in development of hydrogen production and utilization sites, the NAHV will assess the true water requirement of innovative H_2 production solutions (e.g. electrolysis technologies), to get a clear idea of the impact hydrogen can have an attempt to minimize water consumption. Assuming a water consumption of 9L of water per kg of H_2 produced via electrolysis, the total amount of water needed to produce 6.000 tonnes/year of hydrogen (project target) would be 54 ML per year. The project also involves the launch of H_2 production testbeds which includes a solution for the use of non-potable water (e.g. recovered from cooling towers of waste-to-energy plants or from rainwater). The analysis of water utilization is considered fundamental and will be included in the environmental impact assessment that will be carried out for each project activity in both the creation and the development phases of the hydrogen valley ecosystem. Data from the testbeds will be collected and made available in real-time on a web-platform, in order to monitor and optimize operation and future developments.
DNSH environmental objective: Circular economy, including waste prevention and recycling	
No	The project does not lead to significant inefficiencies in the use of materials or in the direct/indirect use of natural resources, and it does not cause any harm to the environment in respect to the circular economy. In fact, one of the testbeds foresees the production of

\[36] GHG emission factors from Commission Delegated Regulation (EU) 2018/2066 of 19 December 2018, Annex VI

	renewable hydrogen from non-recyclable waste, and another one uses electricity from a waste-to-energy plant. Both add value to waste materials and support circularity, contributing to the creation of a renewable European H2 economy.
DNSH environmental objective: Pollution prevention and control to air, water or land	
No	The project activities do not cause increased emissions of pollutants in the air, water, or soil. Conversely, by substituting diesel in heavy-duty and passenger transport mobility, the project reduces GHG emissions and air pollutants emissions emitted by the diesel engine exhaust gasses. Indeed, the project has the potential to reduce the pollution emission of about: a) [PM2.5] 1.17 g/kgDIESEL[37]; b) HC (Hydrocarbons) 0.13-0.16 g/kWhDIESEL[38]
DNSH environmental objective: Protection and restoration of biodiversity and ecosystems	
No	The project does not include activities that are significantly detrimental to the good condition and resilience of ecosystems nor to the conservation status of habitats and species (individual projects will consider all relevant EU environmental legislation, including Birds and Habitats Directive, WFD)

When assessing economic activities against the above listed criteria, both the environmental impact of the activity itself and the environmental impact of the products and services provided by that activity throughout their life cycle will be considered, in particular in the production, use and end of life of products and services.

1.2.2 European and national research and innovation initiatives relevant to the NAHV

Project (P). NAHV partner involved (NAHV P). Funding source (F)	**Short description**	**Main outputs to be exploited in NAHV**
P: H2GLASS - Advancing Hydrogen (H2) technologies and smart production systems to decarbonise the glass and Aluminium sectors. **NAHV P:** Steklarna **F:** Horizon Europe	H2GLASS creates the technology stack for glass manufacturers to (a) realize 100% H2 combustion in their production facilities, (b) ensure the required product quality, and (c) manage this safely. H2GLASS will address the challenges related to NOx emissions and high flame propagation speed, process efficiency, and supply of H2 for on-site demonstrations.	Hydrogen supply points at 200 bar. Digital Twin and Tools for dynamic process optimization and real-time production planning (WE and glass furnace). SOTA Hydrogen Safety technology related to hydrogen combustion. Coupling of PV with WE on TRL7
P: HyCOMP NAHV P: FABER **F:** FP7- FCH-JU, 2011-2014	Enhanced design requirements and testing procedures for composite cylinders intended for the safe storage of hydrogen, to improve the full set of existing requirements defined for ensuring the structural integrity of composite cylinders throughout their service life.	Recommendations related to Regulations, Codes and Standards, but also to the composite cylinder industry, to be exploited for the innovative cylinder system prototype demonstration and system qualification

[37] European Environment Agency, 2016, EMEP/EEA air pollutant emission inventory guidebook: technical guidance to prepare national emission inventories, Report n° 21/2016.

[38] EURO VI, European emission standards for heavy-duty diesel vehicles

P: REACT - Renewable energy for self-sustainable island communities **NAHV P:** CTS H2 **F:** H2020-LC-SC3-2018-ES-SCC , 2019-2022	REACT Island demonstrated in the ARAN island (Ireland) for the potential of the storage system up to 170kWh starting from simple rainwater and sun. H2home+ system approved and certified for plugin installation configured for environments with important temperature ranges.	Study on rainwater collection, electrolysers, high pressure storage and fuel cell.
P: DEVH2FOREAF **NAHV P:** FENO **F:** European Union's Research Fund for Coal and Steel	Natural gas (NG) replacement with H2/NG mixture (up to 100% H2) in electric arc furnace burners.	Design & realization of burners, able to work with NG/H2 mixture, up to 100% hydrogen. The burners have been designed and manufactured to work in severe environments, thus ensuring mechanical and thermal resistance.
P: BIG HIT: Building innovative green hydrogen systems in an isolated territory: a pilot for Europe **NAHV P:** FHA **F:** FCH 2 JU, 2016-2022	BIG HIT created a replicable hydrogen territory in Orkney (Scotland) by implementing a fully integrated model of hydrogen production – 1,5MW of PEM electrolysis, storage, transportation and utilization for heat, power and mobility	Lessons learnt from an existing hydrogen valley: management, technical, financing, training, permitting, demonstration period, etc.
P: HEAVENN: Hydrogen Energy Applications for Valley Environments in Northern Netherlands **NAHV P:** FHA **F:** FCH 2 JU, 2020-2025	HEAVENN introduces a sizeable demonstration project aimed at the development of a methodology for and design of a fully integrated and functioning hydrogen valley divided into four clusters: chemical, industrial energy consumption, residential, and mobility; with an expected consumption of 1.500 tonnes H2/year	Implementation of the so-called tool Hydrogen Territories Platform, developed in BIG HIT. Development of a regional hydrogen roadmap to 2050. Transfer of lesson learned
P: GREENHYSLAND: Deployment of an H2 ecosystem on the island of Mallorca **NAHV P:** FHA **F:** FCH 2 JU, 2021-2025	HEAVENN deploys a comprehensive hydrogen network on the island of Mallorca, (SP). The network will consist of infrastructure to produce 300 tonnes H2/year, distribution & end use of hydrogen for transport, heat and power	Lessons learnt on replication after having two comparable experiences (BIG HIT & GREENHYSLAND). Scalable hydrogen hub that could also become the blueprint for the rest of Europe

1.2.3 Inter-disciplinary approach in the NAHV project

NAHV implementation will benefit from a co-design approach taking into consideration the requirements, testing and exploitation conducted by multiple scientific communities from different domains to meet the transversal interdisciplinary NAHV requirements. In the twin green and digital transformations, the disciplines involved will not only be strictly technical such as: mechanics, energy, environmental, chemistry, electronics and computer engineering and physics, but also include economics, law and social sciences (sociology and anthropology), communication, etc. For hydrogen to gain social acceptance it will be necessary to involve sociologists and communication experts to actively involve citizens.

1.2.4 Integration of social sciences and humanities

Social sciences and humanities are crucial disciplines in the implementation of this project and fundamental for its long-term sustainability. Renewable hydrogen adoption and hydrogen valley creation not only come up against technological and economic barriers but also legal and social obstacles[39][40], reflecting a general concern and distrust in this kind of energy. The emergence of a hydrogen market economically stimulates regions where hydrogen is produced, and associated technologies are deployed by creating new jobs and showcasing the regions as environmental forerunners. To promote a long-term sustainable energy transition based on hydrogen, it is necessary to consider the public not just passive as consumers, but as active agents of change. This also means understanding cultures in all their complexities because energy is also a cultural issue that needs to be looked at from a more holistic and comparative viewpoint[41]. Energy transition therefore requires multi-disciplinary research, especially in sociology and anthropology. The effective use of knowledge and practice of social sciences will be employed in WP 7 (communication, education and dissemination) to develop social awareness pathways and innovation agendas guided by values and principles based on sustainability and ethics. Awareness activities targeted at different stakeholders will be crucial for energy transition based on renewable hydrogen. Activities that will be integrated into the NAHV's awareness campaign will include the use of performing and visual arts. FVG has long-standing experience in promoting hybridization activities between traditional industrial sectors and the cultural creative sector, e.g. DIVA[42] project and AREA's artist in residence[43]. This innovative way of communication will contribute to overcome the existing distrust.

1.2.5 Gender dimension in the NAHV project

Transition toward a zero-carbon future is not only technical and economical, but also intrinsically social and linked to gender. The nature of energy transitions' link to gender is often implicit and unexplored. Greater consideration of the role of gender and the value of diversity in energy provides multiple social benefits, including promoting more sustainable practices, accelerating innovation, enhancing women's opportunities, and empowering communities to engage in energy-system change. Thanks to the link established between NAHV project and the Women in Green Hydrogen Network through Impact Hydrogen (LoI subscribing organization), women working in renewable hydrogen will be empowered and will gain visibility during the foreseen activities. T10.7 will be dedicated to investigating the social impact assessment, including gender impact, generated by the creation of the NAHV. NAHV will promote a series of tailored actions aimed at enhancing women's participation. The project will devote specific strategies to stimulate women entrepreneurship (see task 9.6 WP9). Communication and awareness campaigns (WP7) will be gender targeted. The project's goals are in line with the Sustainable Development Goal 5 and the Leave- No-One-Behind Principle by increasing the participation and opportunities for women in taking the lead in crucial decisions concerning energy, climate change adaptation and resilience, granting them the chance to improve their communities' quality of life. NAHV will be implemented respecting the partners' Gender Equality Plan – GEPs and the EC's European Strategy for Gender Equality 2020-2025.

1.2.6 Open science practices

NAHV consortium will empower the adoption of Open Science and Open Data as a mechanism to optimize the societal return of investments. Dataset assets will be published into Zenodo or Open Aire, as well as European Open Science Cloud (EOSC) and into the "data.europa.eu" platform. This data and open knowledge strategy combined with specific data-driven tools will support quadruple helix stakeholders in planning pathways around the different regionalities. Some data will also feed the digital twin model and be made available via this tool. Data and publication strategy will be aligned with the policy and recommendations on "Reproducibility of scientific results in the EU". Nonetheless, having identified exploitable results suitable for patenting or commercial confidentiality protection to enhance business competitiveness, the consortium might need to apply Open Access restrictions derived from IP

[39] Scovell D. *op. cit.*

[40] Schönauer A-L , Glanz S. *op. cit*

[41] The emergence and diffusion of grassroots energy innovations: Building an interdisciplinary approach - ScienceDirect

[42] Il progetto DIVA » Area Science Park

[43] Microplastic pollution: an allegory of art and science by Danish artist Sissel Marie Tonn » Blog Archive » Area Science Park

protection measures or to ensure GDPR and ePrivacy compliance. The assessment of these restrictions will be handled by the IPR & Data Management Board led by the Innovation Manager. Open Science and Open Data will follow up on ethical management concerns such as informed consent, anonymity, and confidentiality.

1.2.7 Data management

NAHV consortium adheres to the FAIR principle: research data that is Findable, Accessible, Interoperable and Re-usable. FAIR-by-design approaches and methods for data and information within the NAHV ecosystem will consider the following points:

- the way in which data and research output will be generated. More specifically, the DMP prepared in task 1.3 by M3 will provide guidelines on how to automatically include appropriate metadata from all instruments.
- guidelines to prepare and store processed data and research output in appropriate and trusted data repositories (Zenodo and other FAIR compliant repositories) will be included in the DMP.
- when data and research output will be made available. Appropriate embargo periods will be decided depending on the nature of the output. Details on clauses regarding embargo periods will be discussed among all the partners and a specific policy will be adopted for all research outputs.
- which are the most appropriate formats to store data and associated metadata schema. This action is important to promote interoperability and reusability of data, software and other research outputs produced by the project.
- the choice of appropriate license schema to be adopted for both data (most likely CREATIVE COMMONS and/or OPEN COMMONS) and software. In the latter case, newly released libraries and modules will be licensed to be compatible with usage by third party codes, including commercial codes (e.g. using LGPL or MIT-BSD licenses).

The NAHV DMP will be a joint effort by all partners. It will combine different points of view and experience that will need to be coordinated and harmonized. In collaboration with the IPR & Data Management Board, appropriate tools, techniques, and best practices on FAIR data will be prepared and shared during short educational events. Because of the involvement of industrial partners and in particular SMEs, the handling of data and especially research outcomes should be managed with care when they are produced in collaboration or where confidentiality is required. Handling of this aspect will be in collaboration with IPR management (see Consortium Agreement in section 3.2). Furthermore, specific Non-Disclosure Agreements (NDA) will be signed with external stakeholders involved in the NAHV ecosystem. All personal and institutional data provided to the project (e.g. web submission forms, event registrations) will be managed according to the GDPR 2016/679 and national laws (where appropriate). Other types of data will be safely stored using the institutional data safety protocols of the responsible institution.

1.2.8 NAHV Hydrogen Safety Plan and Management

A safety plan for the NAHV has been already drafted according to the guidelines provided by the “Safety, planning and management in EU hydrogen and fuel cell projects – Guidance Document” released in September 2021 by the Fuel Cell and Hydrogen 2 Joint Undertaking. The plan includes four sections: 1) project brief 2) project safety 3) operations management 4) checklist and other helpful documents.

The NAHV Project safety plan objectives are: a) to ensure that project outputs in a form of device, system, process and/or infrastructure provide an adequate level of safety and follow or even improve the state-of-the-art; b) to identify and address knowledge gaps and technological bottlenecks that are essential for the project success; c) to formulate activities providing a high level of technical and organisational safety activities in the project delivery; c) to demonstrate that the NAHV is able and willing to do everything possible to prevent or at least mitigate hazards and associated risks during the project delivery and that developed hydrogen system, process and/or infrastructure elements are providing the required level of safety or even improve the state-of-the-art regarding hydrogen safety.
The methodology and structure of the plan has been set and the responsibilities of all the partners involved identified with FBK having the role of coordinating the activities. On this regard a safety manager will be appointed at the beginning of the project which will a) follow the wide set of testbeds to harmonise and create synergies among the interventions; b) will coordinate the safety plan of the whole valley.

At this stage the partners have started to develop the technical basis for the development of the specific plans for the individual test beds that will be completed during the implementation of the project.

For each testbed plant and related processes within NAHV Project the approach below will be followed: 1) description of safety systems and their functions; 2) use of relevant Regulation, Codes and Standards (RCS) and safety policies; 3) adoption of best practices; 4) identification of safety vulnerabilities, hazards and associated risks taking account the state of art; 5) selection of incident scenarios; 6) prevention and mitigation techniques and strategies; 7) personnel training and education plan; 8) reporting results; 9) safety review procedures; 10) emergency response arrangements; 11) management of change procedures; 12) reporting on safety management & lessons learnt. The fact that a common methodology and responsibilities have been already identified at this stage will avoid any delay in the definition of the specific safety plan of each test bed application.

The plan foresees the creation of a safety team composed of two groups of experts, the technical team responsible for solving challenging hydrogen safety issues and the operational management team coordinated by the safety manager, dealing with overall safety arrangements beyond the specific hydrogen safety issue

Safety review procedures are envisaged with the objective of analysing all testbed plants separately on the base of three sorted main pillars: 1) Undertaking of qualitative design review (QDR) like HAZOP to each NAHV testbed application by a dedicated safety team. The team will include project managers, owners, hydrogen safety engineers, architects and designers, representatives of authorities having jurisdiction, e.g. emergency services, and other stakeholders. Each safety team will define incident scenarios, e.g. by undertaking ISV reviews, suggests trial safety designs, and formulates acceptance criteria. 2) Performing a quantitative safety analysis of the selected scenarios and trial designs by means of qualified hydrogen safety engineer(s) using state-of-the-art knowledge in hydrogen safety science and engineering and validated models and tools. 3) Assessment of performance of the hydrogen system under the trial safety designs against predefined acceptance criteria.

The safety report has the following structure: 1) Objectives of the study. 2) Description of the hydrogen system/process/infrastructure. 3) Results of the QDR. 4) Quantitative analysis, including assumptions; engineering judgments; calculation procedures; validation of methodologies; sensitivity analysis, etc. 5) Assessment of analysis results against criteria. 6) Conclusions: hydrogen safety strategy; engineering solutions; management requirements; any limitations on use, etc. 7) References, e.g. drawings, design documentation, technical literature, etc.

The internal procedures for the implementation of the safety plan are described in task 2.3

2 IMPACT

2.1 Project's pathways towards impact

2.1.1 Wider impacts and expected outcomes

NAHV will deploy and develop a large-scale transnational H2 ecosystem, demonstrating an integration of hydrogen production, distribution and consumption across three borders. The exchange of H2 across the 3 territories will exceed 20% of the overall annual production of H2 in the whole NAHV. The **pathway to achieve the impact** is shown below**:**

Developing and validating demand-oriented Expected Key Exploitable Results KERs

In-line with the methodology that has been outlined in 1.2, NAHV will develop the KERs grouped in table 9. The involvement of early adopters to validate and fine-tune the KER Unique Value Proposition, will contribute to paving the way for their **adoption** after the project end.

Table 9 - Expected Key Exploitable Results (KERs) and exploitation path[44]

N°	Key Exploitable Result (KER)	WP	IP owner	Model	Exploitation Route
1	NAHV economic, social & industrial ecosystem created in the framework of the twin green & digital transitions	2	all partners	Open Source	Dissemination at national and EU level
2	17 renewable H2 testbeds in NAHV covering existing markets and creating new fields of application with innovative solutions for production, distribution, storage and end use of H2, showcased to decarbonize the regional economies	3,4,5	all partners	Patent/ Licensing/Know How (KH)	H2 use, storage and cross-border transport and utilization in NAHV/TT to other sectors beyond hard to abate industry, energy and transport/ Technology transfer (TT) to other HVs
3	Production capacity of 6.000 tonnes of renewable H2 by using RES (PV) and at least 20 % cross-border exchange. More than 52% of this H2 production will serve industrial applications, more than 20% transport applications and the rest other energy applications.	3,4,5	all partners	Patent/ Licensing/KH	H2 use, storage and cross-border transport and utilization in NAHV/TT to other sectors beyond hard to abate industry, energy and transport/ TT to other HVs
4	7 testbeds focused on renewable H2 production innovative systems by covering existing markets and creating new field of application	3,4,5	industrial partners	Patent/ Licensing/KH	H2 use and selling in NAHV/TT to other HVs
5	4 testbeds focused on renewable H2 innovative storage and transport by covering existing markets and creating new field of application	3,4,5	industrial partners	Patent/ Licensing/KH	H2 storage and transport in NAHV/TT to other HVs

[44] Please note that the same testbed project might be included several times under different exploitation routes

6	7 testbeds focused on renewable H2 utilization efficient systems by covering existing markets and creating new field of application	3,4 ,5	industrial partners	Patent/ Licensi ng/KH	H2 purchase in NAHV/TT to other HVs
7	6 testbeds for H2 application in hard to abate/industry sector by covering existing markets and creating new field of application	3,4 ,5	industrial partners	Patent/ Licensi ng/KH	H2 use, storage and cross-border transport and utilization in NAHV hard to abate industries /TT to another sectors/ TT to other HVs
8	6 testbeds for renewable H2 application in energy sector by covering existing markets and creating new field of application	3,4 ,5	industrial partners	Patent/ Licensi ng/KH	H2 use, storage and cross-border transport and utilization in NAHV energy applications /TT to another sectors/TT to other HVs
9	6 testbeds for renewable H2 application in storage and transport sector by covering existing markets and creating new field of application	3,4 ,5	industrial partners	Patent/ Licensi ng/KH	H2 use, storage and cross-border transport and utilization in transport sector /TT to another sectors/TT to other HVs
10	4 FCH applications demonstrated in energy and transport sectors	3,4 ,5	Indeloop, MCOE,C TS H2, ECUBE	Open Source	TT to another sectors/TT to other HVs
11	Knowhow on usage of renewable H2 as partial energy source in tile (ceramic industry) production process. New business model creation.	3	DILJ	Patent/ Licensi ng	Industrial implementation of the testbed phase into a fully automated process/co-development with OEM
12	Knowhow on usage of renewable H2 from waste energy system in the glass industry. New business model creation.	3	Steklarna	Patent/ Licensi ng	Industrial implementation of the testbed phase into a fully automated process/ commercial exploitation
13	Industrial development of innovative burners for special steel production and treatment and H2 based steel grade production. New business model creation	3	ABS	KH	Industrial implementation of the testbed phase into a fully automated process/ commercial exploitation
14	Knowhow on optimal renewable H2 blending, mix usage pre-heating furnace for hard to abate industrial application. New business model creation.	3	FENO	KH	Industrial implementation of the testbed phase into a fully automated solution /TT in other plants
15	Usage of renewable H2 in cement plants reducing carbon footprint. New business model creation.	3	Salonit	Patent/ Licensi ng/KH	Industrial implementation of the testbed phase into a fully automated solution /co-development with the OEM/TT to other plants
16	Operating SMO solar process to produce renewable H2 from waste energy. New business model creation.	4	Active Solera	Patent/ Licensi ng	Industrial implementation of the testbed phase into a fully automated process/TT in transport sector application

17	Renewable H2 production modelled through industrial symbiosis and circularity. New business model creation.	4	ACEGAS	Licensing/Patent/KH	Industrial implementation of the testbed phase into a fully standardized solution /co-development with the OEM/TT in other sectors
18	Renewable H2 distribution and storage through existing network assets. New business model creation.	4	ACEGAS	KH	Industrial implementation of the testbed phase/commercial exploitation
19	Industrial implementation of a solar power plant with H2 conversion and transformation into electric grid system	4	HSE	Patent/ Lisensing/KH	Industrial implementation of the testbed phase into a fully automated solution /commercial exploitation/TT to other HV
20	Production of renewable H2 by gasification of organic material for small microgrid in industry. New business model creation.	4	Indeloop	Patent/ Lisensing/KH	Industrial implementation of the testbed phase into a fully automated solution / H2 selling
21	Renewable H2 exchange among NAHV partners	4	ACEAGS/ TPL FVG	Patent/ Lisensing/KH	supply chain integration in NAHV
22	Usage of renewable H2 in propulsion for vessels and maritime infrastructure in the Adriatic. New business model creation.	5	MCoE	Patent/ Lisensing	Green propulsion solutions catalogue/commercial exploitation
23	Mass production of innovative cylinder for H2 transportation. New business model creation.	5	Faber	NDA	Industrial implementation of the testbed phase into a fully automated line to mass produce cylinders for hydrogen transportation/ commercial exploitation
24	Small and distributed H2 refuelling stations produced on site where there are renewable sources that can be used. New business model creation.	5	CTS H2	Patent	Industrial implementation of the testbed phase into a fully automated process/commercial exploitation/ H2 selling
25	H2 production and management models for bus traction and relative replicability in other bus fleets. New business model creation.	5	TPL FVG	KH	Industrial implementation of the testbed phase into a fully automated solution /TT to other sectors
26	Distributed power generation technologies and plants based on FC and thermal energy. New business model creation.	5	ECUBES	Patent	Industrial implementation of the testbed phase into a fully automated plant/ commercial exploitation/TT to other sectors
27	Fuel storage tank for H2 fuelled fleet in marinas. New business model creation.	5	ACI MARINA	Patent /KH	Industrial implementation of the testbed phase into a fully automated process/replication in marinas and transport sector application/TT to other sectors

28	5 feasibility studies for cross-cutting and cross-border transport - Zero Emission Mobility Corridor	6	Snam, Salonit, ACI ECUBE	KH	Renewable H2 cross-border transport in NAHV/ TT to other HVs
29	Joint regulatory framework developed	8	all partners	Open Source	Dissemination at national and EU level
30	Monitoring methodology in line with the KPIs of the Clean Hydrogen JU SRIA 2021-2027 set up, integrated with Digital Twin	10, 2	UniTS, UniRI, UL, FBK	Open Source	Dissemination at national and EU level
31	Replicable model to contribute to the creation of a European H2 economy piloting global H2 markets	11	all partners	Open Source	Dissemination at national and EU level
32	New scheme for certified H2 trading piloted at a transnational-regional/intra-EU hydrogen market	11	FBK	Open Source	Dissemination at national and EU level

Setting the ground for achieving outcomes:

Exploitation, dissemination & communication activities will be crucial for mobilizing outcomes. During the project it will:

- ✓ **facilitate access** to KERs promoting them and creating opportunities for accessing resources and funding needed to scale-up TRL/going to market.
- ✓ **develop tools** (e.g. memorandum of understanding, protocols, implementation guidelines, etc.)
- ✓ **open up dissemination and communication channels** (e.g. events, workshops, seminars).

After the project it will:

- ✓ **make available resources (skills, funding and facilities/tools/demonstrators/data)** to engage with early adopters and key target groups to achieve its **outcomes.**

NAHV will fulfil the following expected outcomes

- ***NAHV will activate a long-lasting hydrogen economy in the north Adriatic region (Friuli Venezia Giulia (IT), Slovenia, Croatia, and beyond the boundaries of the NAHV's target area***

The 3 NAHV's governments are strongly committed to the development of a hydrogen economy in the North Adriatic region. The several letters of intent that have been signed demonstrate the commitment also from the ecosystem's actors. Furthermore, the NAHV will coordinate and establish synergies between the multitude of actors operating in the NAHV region and beyond (WP 2). A coordination organization will be established by month 6 and financially backed by the 3 governments involved in the project. NAHV is the triggering factor which will stimulate the production of new legislative measures and protocols tailored to remove existing barriers (see paragraph below). This interest in hydrogen will activate a flow of new, specialized workplaces and the request for new training courses which will attract at least 600 students, including from neighbouring regions. More than 6000 young people will be informed.

- ***Develop, test and replicate a model for mutualization of hydrogen production, distribution and storage, to pursue the optimization of investments as key parameter for financial viability***

The NAVH will adopt a hub-and-spoke model. To do this, the digital twin of the NAHV will be built. The digital twin (see WP2 & WP10 for details) will receive, in real time, all the main data produced by the testbed projects, and

this will allow monitoring of the parameters related to hydrogen production, distribution, storage and use in the valley. Accessing this data in real time will allow the development of a model for optimization of hydrogen production and usage in the system, also taking into consideration safety plan issues. The infrastructure will be accessible from outside the system for authorized organizations (for safety reasons some data related to H_2 distribution will not be made public). The infrastructure will be built to be easily scalable and replicable. Within WP7, 12 dissemination events and in WP11 20 events (workshops and laboratories) will be organized to promote and replicate the NAHV concept. The digital twin model developed will also be exploited.

- ***Transfer of the NAHV model to at least 5 additional Hydrogen Valleys of at least a similar size and scope in Europe***

In WP11 specific activities will be implemented to transfer the NAHV model. The digital twin system developed in NAHV will be made available in other similar contexts to facilitate the model uptake. Some contacts are already in place with the other EU regions which expressed their interest in the NAHV model (or part of its model) uptake. The NAHV organization which will be set up between Italy, Slovenia and Croatia will be a unique example of a cross-border coordination system which will be transferred to at least 5 other hydrogen valleys in the EU.

- ***Improvement of the public perception of hydrogen ecosystems, contributing towards an EU hydrogen infrastructure backbone***

Hydrogen is seen as a powerful tool for decarbonization, but it is also seen as a dangerous gas, difficult to handle and expensive in economic and environmental terms. The introduction of hydrogen in the EU economy will be achieved through public acceptance of its use and of the related infrastructures which will allow its distribution and production. To improve public perception, NAHV will put in place a widespread awareness campaign (WP7).

- ***Contribution to the system integration of the several elements together to improve overall synergies and facilitate sector coupling & mutualization of production, distribution & storage, decentralization as key parameter***

NAHV was created as a system integrator. The project will lead to one unique cross-border hydrogen valley in which, thanks to the digital twin and use of ICT, all the components of the valley will be fully integrated, and data will be interoperable. Sector coupling will be achieved through the establishment of synergies between several different companies. Integration of the elements in the valley will lead to an ecosystem based on industrial symbiosis. From the testbed projects planned in WP3, WP4, WP5 we expect that at least 10 companies will start to cooperate with each other, and this will lead to at least 3 sectors being coupled following the industrial symbiosis paradigm. WP 9 will define the business model of the valley and the rules for mutualization, and we expect that at least 20% of the hydrogen produced will be exchanged among the partners not only of the present project but of the entire NAHV ecosystem. The mutualization will lay the foundations to ensure the sustainability of decentralized production, distribution and storage. The decentralized production can be observed in fig. 1.

- ***Optimization of system efficiency by improving the energy & economic efficiency of the integrated system***

The NAHV is a bottom-up initiative driven by the companies of the 3 territories. Those companies are calling for an increase in efficiency of the system in terms of flow of resources and regulation. To compete in the international arena, they need to "be different" from their competitors and "to be the frontrunners". To fulfil this need, the NAHV in WP9 will integrate all the requirements expressed by the participants of the valley and will propose a Joint Action Plan for the NAHV's development. Furthermore, the NAHV with the digital twin system developed in WP2 will support a robust activity of data integration and support the development of economies of scale and scope. Hydrogen distribution via trucks will be optimized and via the digital twin control panel, the inefficiencies in the system will be reduced. The NAHV will stimulate the consumption of hydrogen closer to the place of use and this will lead to the reduction of transportation costs and CO_2 emissions and other pollutants as PM10.

- ***Improvement of security and resilience of the energy system, e.g. via hydrogen production using locally available renewable energy sources***

NAHV is triggering investments toward the production of renewable hydrogen in an innovative and flexible way, contributing to decreasing dependence on natural gas (also partly by blending H2 with methane and using the existing natural gas infrastructure and contributing towards development of H2 infrastructure) and increasing flexibility and resilience of the system to external shocks, especially by providing dynamic H2 storage capacities. NAHV is supported by system operators in the three territories (LoIs by Plinovodi, ELES, HOPS, Plinacro, and SNAM being a PP) acknowledging NAHV's contribution to increase energy system resilience, flexibility and security. The H_2 will be produced by using the solar energy available in the NAHV area thank the PV panels distributed in the 3 territories.

- ***Support the market creation and the demonstration of new market for hydrogen***

The analysis conducted by the NAHV partnership (more than 200 interviews with policy makers, researchers and entrepreneurs) showed great interest in the hydrogen market. However, there are several factors that impact on the creation of a hydrogen market: high production costs, complex or non-existent rules and directives, lack of specialized workforce, citizen bias, etc. All those elements hinder the creation of the hydrogen market. To deal with this, we expect: in WP8 to address a proposal for tax incentives/subsidies to reduce the cost of H2 per tonne (taking into consideration state aid regulation); to develop a regulatory sandbox for supporting the use of hydrogen; and in WP7 to train the workforce in safe use of H2.

- ***Complementarity of hydrogen with RES, the integration among different technologies and the exploitation of the existing infrastructure***

NAHV is going to trigger a production of 5.899 tonnes/year of hydrogen by using 276,5MW of installed PV panels. The hydrogen will also be coupled with RES in the production of energy. The hydrogen produced in the NAVH will also be coupled with the technology in use and is being developed by several industrial partners who will use it for the reduction of the CO_2 emissions of their productive processes. The application of hydrogen in industrial plants will contribute to a reduction equivalent to 7.798 tonnes CO_2/year, in the energy sector to a reduction equivalent to 3.919 tonnes CO_2/year and in the transport sector to a reduction equivalent to 19.451 tonnes CO_2/year; the overall application of hydrogen will lead to a cumulative reduction of 31.167 tonnes CO_2/year The work done by SNAM in WP6 and ACEGAS in WP4 will lead to the test and exploitation of the existing gas distribution network.

- ***Put in place a rigorous assessment methodology and procedure of the availability and affordability of clean energy provision for industry and city uses***

WP10 describes the methodology which will be put in place. A set of indicators is expected to be monitored to evaluate the availability and affordability of clean energy production both during and after the project. The indicators will also monitor the request and availability of renewable hydrogen by citizens, cities, and industrial plants. The digital twin mechanism which will be put in place will support the assessment activities.

- ***Help to set and test regulation requirements at national and regional level***

The NAHV has been set up because of the commitment of the Slovenian and Croatian governments and FVG and Italian governments to the hydrogen economy. In WP8 intensive work will be done on policy and regulation by the organizations active in the 3 countries to speed up the uptake and production of H2. Furthermore, the development of a regulatory sandbox is foreseen. This work will lead to the development of policy guidelines. The relevant outcomes at European level will be shared with DG Energy and with the main EU agencies involved in the energy and green transition such as CINEA and the Clean Hydrogen JU.

- ***Increase the knowledge management & assess the socio-economic & environmental impacts, by including the use of digital twin & ensuring an effective monitoring & optimization strategy for the operation & further development of the valley***

The digital twin version of the valley will collect the data coming from the testbed projects and from the main activities linked to the HV. The monitoring of all parameters in real time will allow optimization of the exchange of H2 from producers, storage facilities, distributors and users. A dashboard, which will collect all the socio-economic and environmental impacts, will also be available in real time on the website and in the digital twin. The use of water will be assessed as well as the contribution of the hydrogen valley to the overall reduction of greenhouse gases (GHG). The NAHV expects to assess the true water requirement of electrolysis technology, to get a clear idea of the impact hydrogen can have on a renewable energy future[45].

- ***Develop the public awareness of hydrogen technologies taking stock of the contributions from SSH***

NAHV has foreseen a wide set of awareness raising activities targeted to reach the project's stakeholders. In total about 500.000 people will be reached, 15 awareness events, 5 annual conferences, 10 activities with the schools and universities and about 680 students involved. The H2 STUDENT will involve 6.000 young students. The hydrogen café will attract about 600 stakeholders, including citizens, researchers, students, NGOs. The awareness raising

[45] Does the Green Hydrogen Economy Have a Water Problem? (acs.org)

campaign will involve a wide variety of competences including performing and visual arts to provide new and more effective ways to engage the stakeholders with different tools and languages (i.e. theatre forums).

• ***Support development of Hydrogen Valleys in areas of Europe with no or limited presence of Hydrogen Valleys***

NAHV has an ambitious replication plan. A team will be dedicated to the promotion of the project methodology in other valleys which are currently under development. In doing this our primary target will be the other valleys which have applied for the clean hydrogen call. A specific methodological package will be developed to support uptake of the NAHV's model. The digital twin model will be exploited and made available for the other valleys. The NAHV has been built according to the hub-and-spoke model where the NAHV and the new legal entity which will be created in WP2 are the hub which will liaise with and support the spokes in the other valleys. This modus operandi will speed up the replication process. In total we aim to reach at least 20 potential valleys in Europe and to transfer the NAHV model to at least 5 other valleys. Special attention will be paid to the Balkan areas where now there is a limited presence [46]. Finally, we aim to create a corridor which will link Austria, Italy, Slovenia and Croatia which will be expanded further at East.

Table 10 - Key Exploitable Results (KERs) and outcomes

Ker involved	NAHV MAIN OUTCOME
KER 1, 2, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 19, 20, 21, 23, 24, 25, 26, 28	22 companies (18 partners+4 associate) will introduce hydrogen in their productive process. This interest toward hydrogen will activate a flow of new specialized working places.
KER 32	20 promotional events will be organized to promote the NAHV concept and 10 workshops to replicate the model.
KER 32, 26	at least 5 additional Hydrogen Valleys initiated replicating the NAHV model, 8 workshops for schools, 3 technical workshops, 5 annual conferences, more than 20 initiatives with schools, more than 500.000 citizens reached.
KER 1, 7, 8, 16, 17, 21	at least 10 companies will start to cooperate with each other. This will lead to at least 3 sectors being coupled following the industrial symbiosis paradigm.
KER 3, 5, 22, 29	at least 20% of the hydrogen produced will be exchanged among the organization partners not only of the present project but of the entire NAHV ecosystem.
KER 3, 20, 21, 26, 25	More than 5000 tonnes/year of hydrogen by using PV panels or other renewable energies.
KER 19	at least 1 testbed project will be applied with the function of balancing the energy grid and to reduce the fluctuations given by RES.
KER 5, 9, 18, 24, 29	at least 1.200 tonnes/year of hydrogen transferred cross-border
KER 30, 33	the policy guidelines, designed by the three Governments involved in NAHV and position papers on policy recommendations shared with other EU governments, with DG Energy and with the main EU agencies involved in the energy and green transition such as CINEA and the Clean Hydrogen JU.
KER 31	1 monitoring system integrating digital twin at systemic level to collect data to get a clear idea of the impact hydrogen can have on a renewable energy future. 1 monitoring system integrating digital twin at each testbed level.
KER 10, 27	4 FCH applications demonstrated in energy and transport
KER 31	The digital twin model will be made available for the other hydrogen valleys
KER 1, 30, 33	At least 500.000 people from different target groups reached.

[46] Hydrogen-Valley_Facsheet_18.05.2022.pdf (europa.eu)

Enabling Impact

The outcomes will be exploited as useable assets for enabling impact in the medium-long term. The project will demonstrate its impact potential, thanks to:

- the use of the results will lead to a significant improvement in the integration of the industrial systems of the regions involved as well as to an acceleration of the process of harmonization of the national regulations and standards related to hydrogen production, transportation, distribution and final use.
- the process and the monitoring of results and impact will demonstrate how the concept of hydrogen valleys can be further developed to a transnational European dimension and replicated bringing significant benefits to the environment, economic growth and job creation to the regions involved in this industrial revolution.
- the process of conversion to H2 of "hard to abate" industrial sectors as well as of the heavy transport sectors (one of the most impactful) will contribute to the achievement of the objectives of the European Green Deal.
- building up a hydrogen ecosystem based on renewable hydrogen will benefit the environment and spur a green reindustrialization process to prevent some strategic production processes from moving outside of the EU and lead to a new green industrialization process creating value at local and EU level. The investments and innovation required for this transition will generate as a positive side effect new business opportunities and investments in the supply chain of all the sectors involved in the NAHV.
- The NAHV's high-level objective aims at contributing to the creation of a European Hydrogen Economy piloting global hydrogen markets by creating the conditions for a wider EU replicability. The task 11.5 of the NAVH project, Replication package & laboratories, explains the tools that the consortium is going to use try to replicate the H2V concept in 5 additional territories. The first replicability actions of the project should pursue the objective of:
    - sharing the project and partners experience in the fields of preparation for the deployment of a H2V, deployment and execution of the infrastructure and equipment of a H2V, and the project operation (training, operation, maintenance, etc.);
    - offer a pre-feasibility tool to analyse the financial viability of a H2V concept in a new territory.

The Hydrogen Territories Platform (HTP), developed within the FCH JU project BIG HIT, and more recently supporting FCH JU projects HEAVENN and GREEN HYSLAND, will be the tool to make possible reach these 2 objectives, by using the pre-feasibility model developed in BIG HIT and improved in HEAVENN and GREEN HYSLAND, and promoting different cooperative learning actions like webinars or specialized discussion panels.
In addition to that, and after the M36 of the project, once the project will be able to share lessons learned via the HTP, a set of 10 workshops will be launched to try to replicate the H2V concept in other territories. This will be a more in-depth analysis about how to build a new H2V in other territories working with specific interested stakeholders. It is expected that at least 5 of this case studies will become new H2 valleys.

Additionality, the Replication activity will be fostered by:

- Organisation of NAHV annual conferences, to promote the NAHV results and approach to other existing and would-be HVs and stimulate discussion of future joint activities and networking with relevant actors at the regional, EU, and international levels.
- Dissemination of replication packages, to transfer the lesson learned and NAHV's experience to other target institutions and organizations in the EU and abroad. The replication package will be a mix of tools, developed in NAHV, such as a handbook with NAHV methodology, digital twin model, and monitoring tools, including tools, such as Hydrogen Territories Platform (HTP), developed in a previous project for prefeasibility analysis of replicating HVs.
- Dissemination of joint documents/position papers (at least 5) for Policy Recommendations, on key topics (standards and safety, incentive schemes, H2 industrial symbiosis approach), aiming at sharing the experience gathered during the implementation of the NAHV project.
- Publication of policy guidelines, to promote joint regulatory frameworks to ease the use and distribution of hydrogen, raise awareness among policymakers and enable the formulation of new policies to support the adoption of H2.
- Creation of a special purpose vehicle (SPV) to ensure the continuation of the dissemination and communication activities and support the use of NAHV's key exploitable results after the end of the project. The SPV will also act as a reference point for collaboration with other valleys and joint

policy actions.

Scale-up the pathway to impact leveraging on:

- ***Investments***: EU contribution (25 M) will leverage about 215M of private investments (as initial investments) and about 740M private investments at operational level. Furthermore, NAHV as a public private partnership will potentially compete to 9.4 billion of public investments from national & regional funds as shown in table 8.
- ***Services***: several services will be offered through this project to many companies: those directly involved in the partnership, the new start-ups supported, those targeted by the dissemination activities and other companies indirectly benefiting from project results. These services are: policies revision and update (see deliverables WP8), monitoring activities integrated with digital twin to improve system efficiency and efficacy (WP2 and WP10); training and education (WP7), H2B accelerator services (WP9); exploitation pathways (WP11).
- **Networking**: several networking activities (WP9 and WP11) will be carried out to establish collaborations with some of the most relevant H2 stakeholders and HVs in the EU, to benefit from the lessons learnt, to maximize the collaboration among similar territories and experiences, to accelerate the realization of an optimized action plan.

NAHV will contribute to the European climate neutrality goal and the European Green Deal by producing quantifiable results towards the development and scaling up of hydrogen applications, which is one of the main thrust of the Clean Hydrogen JU SRIA for Hydrogen Valleys.

Table 11 - NAHV contribution to Clean Hydrogen JU SRIA 2021-27 Programme Level Key Performance Indicators

Clean Hydrogen **Strategy map Objective**	**KPI Name**	**Baseline**	**NAHV contribution to Clean Hydrogen JU SRIA 2021-27 KPIs**
Resources (input), processes and activities			
Supporting sustainable solutions	**1.Supporting sustainable solutions**	% of budget:2,5	21 M€ 84 % of NAHV budget (see WP 3, 4, 5)
R&I for hydrogen technologies	**2.Early research projects**	% of budget:10	5 feasibility studies on NAHV cross cutting and cross border transport technologies for Zero Emission Mobility Corridor, 5% of NAHV budget (see WP6)
	3.Demonstration projects	# of projects:43	17 renewable H2 supply-chain testbeds (TRL6-8) in hard to bate, energy and transport sectors (see WP 3, 4, 5)
Supporting market uptake of clean hydrogen applications	**4.Education and training**	# of projects:4	>4 education related activities addressed to promote the training of future professionals and experts in the field of H2 technologies: Vocational training programs, Macro-Regional Competence Center for Hydrogen Research and Education, Training and educational Mentoring programme H2STUDENT – open education for young people, winter/summer school for PhD students (see WP7)
	5.Monitoring technology progress	*Qualitative indicator* N/A	Implementation of a data monitoring system independent from plant owner at least for main performance data. Experimental data process and data set organization for the development of the digital twin (see WP2, 10)

	6.Supporting EC in H2 market uptake	*Qualitative indicator* N/A	Market integration, promotion of the demand and production of H2 as renewable and low-carbon gas enabling the market to decarbonise gas consumption and putting forward policy measures required for supporting the creation of optimum and dedicated infrastructure, as well as efficient markets. Inter-regional hydrogen R&D&I joint action plan and NAHV master plan & business model (see WP2, 8, 9, 11)
Outcomes			
Limiting environmental impacts	**7.Environmental impact and sustainability**	*TBD*	H2 supply-chain testbeds focusing on different elements of sustainability such as LCA, circularity, water re-use. Definition of a methodology for the monitoring of the environmental data and performance of the H2 related testbed/plants: LCA analysis, Cost benefit analysis, Social impact assessment (see WP3, 4, 5, 10)
Improving cost-effectiveness	**8.Capital cost of hydrogen applications**	€/kW: TBD	– 990€/kW (average capex cost for electrolysers from different hydrogen production testbed application projects) – 250 €/kW (average capex cost for hydrogen production technologies from waste heat, like the one in task 5.6) (see WP3, 4, 5)
Synergies with other partnerships	**9.Research and Innovation Synergies**	# of projects:5	- 10 LoI from EU research organizations from Italy, Serbia, Slovenia and Austria (es. Hydrogen Center Austria, Graz University of Technology and University of Modena and Reggio Emilia from Hydrogen Research Europe). -3 LoI from European HVs (Green Hysland, Modena HV and Shamrock HV) + partner FHA involved in other 2 HVs: Big Hit, Heavenn (see WP7, 9, 11)
Increasing Public Awareness	**10.Public perception of hydrogen**	*Qualitative indicator* N/A	Dissemination activities to promote results to early-adopters, users and relevant stakeholders to enable their use, show and raise awareness of general public about project and its findings/success, ensure the most effective and efficient project data publication (see WP7)
Reinforcing EU scientific and industrial ecosystem, including SMEs	**11.Total persons trained**	# of persons: 4163	Almost 7000 future professionals and experts in the field of H2 technologies trained (see WP7)
	12.Patents and publications	#of patents/publications:12/289	#of patents: 10/ #of scientific publications: 10 (see WP3, 4, 5, 6, 7)
	13.Promoting cross-sectoral solutions	# of projects:15	16 out of 17 testbeds covering more than one area of the H2 value chain, 76 % NAHV budget (see WP3, 4, 5, 6, 7, 8, 9, 11)
Impacts			

Reducing GHG emissions	**14.Expected avoided emissions**	Mt of CO2-eq: TBD	31.167 tonnes/year of CO2-eq (within H2 consumption in industry hard to abate sector: 7.798; in energy sector: 3.919; in transport sector: 19.451 CO2-eq t/y) (see WP3, 4, 5, 6)
Energy transition with renewable hydrogen	**15.Deployment of electrolysers**	Gigawatt: 1	49 MW of total capacity of the electrolysers deployed in the NAHV (see WP3, 4, 5)
	16.Market uptake of clean hydrogen	Mt of clean H2 consumed: 0,155	At least 0,006 Mt of clean H2 consumed in NAHV/end-use (see WP3, 4, 5)
Competitive and innovative European hydrogen value chain	**17.Total cost of hydrogen at end-use**	€/kg: 8	Final cost at end-use (including production and distribution): 3€/kg through full techno-economic assessment for the testbed's LCOH (Levelized Cost of Hydrogen), incentives, policy (see WP3, 4, 5, 8, 9, 11)
	18.Size of private hydrogen sector	*Qualitative indicator* N/A	22 companies throughout the renewable H2 supply chain in testbeds (big, SME and 2 start-ups) > 6.8 billion € total turnover, >10k total employees. NAHV Exploitation plan through networking and clustering with existing hydrogen valleys in Europe and Inter-regional hydrogen R&D&I development joint action plan and NAHV master plan & business model (see WP3, 4, 5, 6, 8, 9, 11)

In addition to the contribution of NAHV to the to Clean Hydrogen JU SRIA 2021-27 Programme Level Key Performance Indicators, the monitoring strategy for each of the testbeds will allow to assess compliance with the KPIs of the Clean Hydrogen JU SRIA 2021-2027 for each of the technologies covered. These activities will take place in WP10.

2.1.2 Potential barriers arising from factors beyond the scope and duration of the project

Based on the analysis of the scientific literature[47], policy documents[48][49] and of the interviews with the NAHV stakeholders a PESTEL analysis has been performed (**B**: Barrier; **E**: evolution over time; **M**: Mitigation action)

POLITICAL – Barriers

B1: Contingency energy situation could push back the interest of policy makers toward the green transition. **E1**: Due to clear climate change risk the green transition is not expected to be delayed. **M1**: Raise business and user interest in green transition, and hydrogen as a green energy carrier to shift from methane dependency.
B2: Misunderstanding by the policy makers of the relevance of the hydrogen revolution. **E2**: The Ukrainian crisis makes clear the need to shift toward different energy sources that can be stored. **M2** develop a clear cross-border innovation and policy roadmap and vision on hydrogen as a long term / large quantity energy carrier and storage medium.
B3: Hydrogen technologies not seen as a key driver for acquiring a technological leadership. **E3**: Increase expectation of hydrogen (H2) tech as a tool for decarbonization. **M3**: Organization of policy roundtables/events showing frontrunner examples and release of policy briefs.

ECONOMIC – Barriers

B4: High cost of supply of RES equipment and H2 transport. **E4**: Increasing cost of RES technologies. **M4**: Production and utilization of H2 within the borders of the valley, use in blend in the current pipeline infrastructure. Subsidies for H2 production.
B5: High cost of H2 production due to low electrolyser efficiency: **E5**: Improvement of electrolyser and renewable H2 production technologies. **M5**: Introduction of policy instruments, e.g. subsidies, carbon tax and green certificates to decrease the cost of H2 for users.
B6: Large investment in RES for production of renewable hydrogen. **E6**: Increase of demand of RES equipment and difficulties in the supply chain. **M6**: Coupling hydrogen production with solar/wind electricity to balance the RES production and national commitment toward funding NAHV.
B7: Bottleneck in delivery of hydrogen technologies since demand is increasing and the supply side is slow to react. **E7**: Introduction of measures/incentives to support the scale up of the supply side. **M7**: Support the establishment of new companies and start-ups working in the hydrogen value chain and rapid prototyping

SOCIAL – BARRIERS

B8: Lack of social acceptance of hydrogen (store, use, transport). **E8**: Increased diffidence toward the use of an energy source perceived as dangerous and water consuming. **M8**: Organization of massive social awareness campaign showing the hydrogen economy benefit.
B9: Lack of customer experience/lead user/ of hydrogen. **E9**: Introduction over the time of hydrogen fueled products (cars, trains, etc.). **M9**: involvement of the lead-user/evangelist as promoter of successful hydrogen users and of its social and economic benefit.
B10: Lack of education and trained work force for the application and use of hydrogen. **E10**: Request of workforce trained. **M10**: Organization of training activities to educate the hydrogen users & the workforce to deal with hydrogen

TECHNOLOGICAL - BARRIERS

B11. Scaled-up H2 production systems still require improvements in performance and efficiency. **E11**. Technological advancement and spread of technology are pushed by new hydrogen demand and by the development of an economy of scale. **M11.** Research and development of testbed projects of TRL 6 – 8 will prove the feasibility and applicability of H2 production technologies (Water Electrolysis and Waste to Hydrogen) allowing for an enhancement of their

[47] System approach to natural versus manufactured hydrogen: An interdisciplinary perspective on a new primary energy source

[48] https://h2v.eu/analysis/barriers/regulation

[49] Visions for hydrogen in the Netherlands by 2050

performance and efficiency. Testbeds included in the project involve the production of renewable hydrogen from non-recyclable waste, the production of hydrogen by electrolysis through use of electricity from a waste-to-energy plant, the use of H2 and O2 from a water electrolyzer system in a cutting-edge glass furnace to improve overall energy efficiency. All of these add value to waste materials and support circularity, contributing to an enhancement of H2 production systems efficiency and to the creation of a renewable European H2 economy.
B12. Hydrogen systems need to operate with variable load and adequate flexibility to be coupled with renewable energy. **E12.** The performance evolution of electrolysis systems will favor the integration with RES. The introduction of incentivization mechanisms will favor the diffusion of renewable energy to feed hydrogen production plants. **M12.** Development of dedicated testbeds to leverage the integration between hydrogen production plants and renewable energy sources and improve their flexibility. The integration of different renewable energy sources will be promoted (hydro, PV, floating PV, waste heat) in different testbeds to improve the dynamic operation of the overall system.
B13. Difficulties in exploiting the current gas network for hydrogen distribution. **E13.** Trend to increase the % of H2 in the local distribution net. **M13.** The NAHV project involves testing of solutions for the use of H2 blends in hard-to-abate industrial applications (burners for special steel production and treatments, burners for rolling mills in preheating furnace) exploiting the existing natural gas infrastructure. One testbed will be dedicated to the research and demonstration activities about the transportation of hydrogen through the NG distribution network by blending or via repurposing up to 100% H2.
B14. Lack of logistics infrastructure for hydrogen transportation and distribution. **E14.** Development in research activities about storage and update of existing regulatory framework will permit to improve the logistics infrastructure. **M14.** The NAHV Project aims to boost the logistics infrastructure with research activities on H2 storage solutions. Testbeds will be dedicated to developing innovative H2 storage composite vessels of large water capacity and of very high-pressure at large scale for road, rail and maritime sectors, as well as novel hydrofoil H2 vessels with integrated fuel storage tanks swap (FSTS).
B15. Lack of widespread H2 facilities might hinder the meeting of H2 demand. **E15.** The spreading of H2 technologies and the building of an H2 market is increasing both supply and demand. **M15.** The NAHV project foresees investments in the hydrogen supply chain and in the development of H2 infrastructures (also by blending H2 with methane into the existing natural gas network) for both production and utilization. To fully support this goal, a testbed also foresees the creation of a small microgrid in an industrial area that includes a PEM electrolyzer, a gasification plant for H2 production, and FC application, thus including both supply and demand.
B16. Scaled-up use of hydrogen technologies still requires improvements in performance and efficiency. **E16.** Technological advancement will push new demand and development of economy of scale. **M16.** The project will demonstrate fuel cell applications in energy and transport sectors (e.g., for charging batteries of bicycles and vehicles). Improvements in performance and efficiency will be favored by integration of FC in an industrial microgrid.
B17. Introduction of H2 into hard-to-abate industries to replace natural gas can be challenging because no mature technologies are well established for hydrogen-fired industrial gas appliances. For example, there is no widespread availability of hydrogen burners on the market for industrial applications. **E17.** Technology development will permit a major integration of hydrogen as fuel in hard-to-abate sectors. **M17.** The NAHV Project will provide a boost for process understanding (combustion physics, flame stability, optimal mixture formation) and use of hydrogen as a fuel for industrial machinery in the hard-to-abate sector. One testbed will investigate the introduction of hydrogen in burners for heat treatment furnaces for the steel production industry. Another testbed will be dedicated to partially replacing natural gas inside a kiln with hydrogen for a roof tile factory.

ENVIRONMENTAL – BARRIERS

B18: The need of large surfaces for installation of PV could create a competition with arable land, several constraints exist for wind turbines installation (wind characteristic, landscape regulation, etc). **E18**: Introduction of agri-voltaic fields and liberalization of regulation for PV installation on the roofs of buildings. **M18**: PV panels will be allowed in the valley only when not competing with arable land.
B19: The production of renewable hydrogen requests a large quantity of water. **E19**: New trend on water use and water valorization. **M19**: NAVH includes among its testbed applications (see T5.1) also a solution for the use of rainwater and not drinkable water.

LEGAL – BARRIERS

B20: Regulation and permit applications (missing or inadequate permitting procedures): a) Safety standards (lack of sufficient safety provisions developed at national and EU legislation with regards to H2 creating legal uncertainty); b) Environmental regulation and spatial planning (too strict environmental provisions and complex spatial planning procedures); c) Regulation for H2 blending in grid (uncertainty in legislative provisions); d) taxes/levies/duties on electricity from RES (creating disincentives for investors); e) with regards to RES projects permitting – long permitting procedures and administrative barriers hinder faster deployment, in Slovenia for example PV on artificial lakes is not allowed under the current regulatory framework and the new law on faster RES deployment is in a process of adoption – expected to be adopted by spring 2023 (important for the NAHV project, since floating PV on Družmirje lake is directly linked to H2 production in electrolyzer at TEŠ),
f) additionality rules for hydrogen not adopted yet at EU level, as well as the Gas and Hydrogen market legislative package – both expected to be adopted in 2023;
g) at strategic level - lack of national hydrogen strategy in Slovenia. **E20**: Emerging push toward the development of hydrogen regulation (at EU and national level). **M20**: The work done in WP8 will contribute to overcoming the barriers. The policy documents will be addressed to the 3 parliaments and governments and to the European Commission and Parliament as suggestions for future legislation as well as the revision of the relevant existing legislative provisions.
B21: Lack of experience of permitting authorities (ministries, national regulator) with H2 development and application (generation, distribution, supply, use). **E21**: New Hydrogen Valleys are in the implementation phase. **M21**: The peer learning activities planned by the NAHV will contribute to filling the experience gap by developing best practice examples.

2.2 Measures to maximise impact - Dissemination, exploitation and communication

The NAHV strategy for Communication, Dissemination and Exploitation (C&D&E) aims at supporting the achievement of the Expected Outcomes, within the project lifetime, and facilitating the achievement of the medium-long term wider impacts, beyond the project.

2.2.1 Exploitation of project results

Within the NAHV, a unique value-based approach will be put in place to guide the partners in understanding opportunities, challenges and in identifying steps needed to implement the Exploitation plan, including searching for further financial resources after the project ends. The process will be led by FBK, using methodologies tested in several previous assignments in Europe.
Exploitation strategy: it will follow the main phases of the AIDA model: *Awareness* to attract the attention of the target audience, *Interest* and *Desire* of the target audience to know more about the project, and *Action* to lead the target audience towards involvement in the project and promotion of its results to facilitate exploitation. From month 6 NAHV will start to elaborate a business plan of each testbed and KERs to ensure the use of the NAHV's KERs over the time, the mobilisation of the project outcomes which will enable in the longer time the IMPACTS described in the section 2.1. FBK will supervise and contribute to decision making starting from the KERs. In the execution of WP11, FBK will coordinate the partners and define the exploitation setup and the organizational aspects needed to address the go to market. **Exploitation Strategy** will provide each **Demo-Case (Testbed)** with the opportunity to work on (i) the updating/grouping of the list of **KERs**; (ii) the identification of the related **use model**; (iii) the identification and mapping of **risks** related to the exploitation; (iv) identification of **Early Adopters** and (v) **Follow-up Actions**. The **Business/Use Model Development** (depending on the planned type of use: direct or indirect) of the KERs will result from this process. The main elements to be addressed by partners and exploitation team will be: (i) Novel Solution (Description of the KER, problem solved, Unique Selling Point); (ii) Market (Product/Service Market Size, Market Trends/Public Acceptance, Product/Service Positioning; Competitors/Incumbents, Early adopters/Customers); (iii) External factors (Legal or normative or ethical requirements); (iv) Go to market (Time to market, Cost of Implementation, Estimated Product/Service Price, Adequateness of Consortium Staff, External Partners to be involved); (v) IP Status: Background, Foreground. NAHV will also set up a new legal entity based in Belgium which will represent the NAHV's initiative at international level. NAHV aims at fostering competitiveness and growth and increasing benefits to the partners involved and to the EU economy and citizens. The innovation

activities will produce highly competitive results based on new products/services which will be commercialized by the involved companies. Depending on the project result type, the consortium will develop different exploitation routes customized to the specific testbed strategy. Since the NAHV solutions affect the whole value-chain in the target sectors, the consortium has analysed all the exploitable solutions generated at value-chain level & identified 3 stakeholder groups for exploitation:

- **Technology and B2B-service providers** – **Px - and Design & Engineering groups** – **Py -**, which are interested in selling the solutions and new designs developed or licensing their use to the largest **possible target groups of end-users in different sectors.**
- **Businesses within the value chains** – **Pz -** (Lead-users), companies interested in using the new solutions developed by NAHV for (i) selling components / materials (ii) services to end-users.
- **Product Manufacturers and B2C-service providers** – **Pk -** (End-users): The businesses, which are interested in making a concrete transition towards hydrogen-based new business models to reduce production costs, propose new products to the market, and contribute to the sustainability of their production processes.

Strategy for the management of intellectual property: FBK will support the NAHV ecosystem and in a particular way the testbed projects in identifying the know-how and results to be protected. AREA, which is linked to the European Patent Office with its Patlib Office will do a pre patentability study and it will support the **Innovation Manager** (IM). The IM will be named to coordinate and foster innovation across the project work packages, and to ensure the quality and post-project impact of the exploitation strategy. The NAHV's IM will also assist the consortium in identifying protectable IP and in building on existing IP searches, both from within and outside the consortium. The consortium will follow the EU Guidelines for IPR, keeping up to date with all EU recommendations in this field. Existing know-how (background or pre-existing intellectual property) of a specific partner shall be made available on transfer conditions to the partner(s) within the consortium. The use of such existing know-how is strictly limited to use in the achievement of the project goals and for the duration of the project. An overview of the existing know-how ("background IP") will be included as an annex to the consortium agreement. Foreground shall be owned by the partners who developed these results, individually or jointly. Each partner will be responsible for taking the appropriate steps for securing intellectual property of the knowledge or results created during the project, with the support and advice of the IM. The partners will select for publication those publishers that fit the aims of NAHV strategy, encouraging partners' authors to retain their copyright and to grant adequate licenses to publishers. Through this strategy, NAHV outputs will remain in the hands of providers of research for the global research community and other third parties to access, mine, exploit, reproduce and foster collaboration, to avoid duplication of effort and to accelerate innovation, closing the gap between research and market. Alternative repositories such as the Open Access Infrastructure for Research in Europe (OpenAIRE), Registry of Open Access Repositories (ROAR) and Directory of Open Access Repositories (OpenDOAR) will be exploited.

The Consortium will develop an Exploitation Plan (EXP Plan) to identify potential routes for future exploitation and up scaling of NAHV initiative. Three dedicated exploitation workshops will be organized to focus on exploitation issues. The third workshop will be conducted with the assistance of external stakeholders such as the EU Horizon Result Booster and external stakeholders from the different target groups. The output of the workshop will be used to complete the EXP Plan (at M24, M48 and M72), which will focus on the main KERs and will include the following main contents:

- Exploitation workshops (2 internal and 1 involving external stakeholders) on characterization of the exploitable results, validation of the business opportunities for key results, identification of the main competitors, identification and assessment of the risks and barriers to be overcame to enable the exploitation of the results, development of a feasible risk mitigation plan, fine-tuning and validation of the EXP Plan and IPR management.
- IPR Agreement among the partners, to be ready to exploit the achieve results soon after the project conclusion, IPR protection of NAHV results and identification of ownership, considering possible co-ownerships.
- Market Analysis & Business Case for the scaling up and extension of the NAHV impact as well as enlarging the collaboration network to other hydrogen valleys (including replicators) with the identification of main NAHV stakeholders and their requirements, market barriers to NAHV operations and an overview of the

market potential for the use of hydrogen in the specific Cross Boarder territories on all the identified priority end uses.

- Market Deployment Plan with market expectations, a market introduction strategy, business models for commercialization of solutions with the highest exploitation potential, a business plan with up-scaling and go-to-market strategy, profit-and-loss analysis.

The IPR & knowledge management rules and processes will be described in the data & intellectual property management plan section of the EXP Plan.

FBK will support the NAHV ecosystem and in a particular way the testbed projects in identifying the key exploitable results and the most effective ways to protect the generated IP. AREA, which is linked to the European Patent Office with its Patlib Office, will do a pre patentability study supporting the role of the Innovation Manager (IM). The IM will be nominated to coordinate and foster innovation across the project work packages, and to ensure the quality and post-project impact of the exploitation strategy. The NAHV's IM will also assist the consortium in identifying protectable IP and in building on existing IP searches, both from within and outside the consortium.

Once all KERs are defined, the rules for the distribution of the Intellectual Property Rights (IPR) among partners will be determined, also in accordance with the Consortium Agreement (CA). Nonetheless, partners have already achieved a preliminary agreement on the IP strategy. Each partner owns its IP background and will provide free access to it, to project partners during the implementation of the project. The overall rules are: 1) Participants in the same action will inform each other before their access to the grant agreement of any legal restriction or limit to granting access to their background. 2) Participants will have access rights (on a royalty-free basis) to the results of another participant in the same action if those results are needed by the former to carry out its work under the action. 3) Participants will have access rights to the results of another participant in the same action if those results are needed by the former to exploit its own results, such access shall be granted under fair and reasonable conditions outline the plans for the exploitation of results. 4) Partners keep the ownership of any work contributing to project success. Regarding the foreground, the consortium has identified three levels of IP which will be created from the project: (i) Individual and joint IP, which belongs to individual partners or is jointly owned by partners working in a particular task and is restricted to those partners. Where several partners within the consortium have jointly carried out the work generating the foreground and where their respective share of work cannot be ascertained, they will have joint ownership of such foreground. In this case, partners will jointly apply to obtain and/or maintain the relevant IPRs; (ii) Generic IP, which can be used by all partners of the consortium; (iii) Publicly available IP which will be published on NAHV website and made available with no restrictions. Provisions for use of IP background will be determined during the commercialization strategy. Insights that enhance partners' services or enable the launch of new solutions within partners' strategic go-to-market plan or at the aggregated level of the hydrogen valley will be kept private and protected via non-registered Soft IP measures (confidential information, company know, etc.). IPR will be dealt since the beginning of exploitation activities, starting with a joint exploitation workshop, feeding the Library of Key Exploitable Results. The IPR Clinic, will be (re)done towards the end of the project to do an IP assessment of the project's joint outcomes. It is the policy of the NAHV project that each partner owns the Foreground IP that is solely developed by its developers within the Programme of Innovation and may decide and at its own expense, to register and maintain any protection for the Foreground IP, including filing and prosecuting patent applications for any of the Foreground IP. Once a result is available, the Innovation Manager shall oversee investigating the novelty of the invention and proposing to the consortium the possibility to apply for a patent protecting the generated IP.

Within NAHV several actions will contribute to the implementation of the exploitation strategy and the regulation of the IPRs, among all, the most important for the IP are the following ones.

- D1.3 IPR and Data management plan: a preliminary deliverable on IPR issues will be prepared at M3, identifying the initial list of KERs and related measures to maximize their impact and outreach. The document will describe how the data collected and produced during the NAHV project will be handled and it will be updated at M30 and M72
- D11.1 Exploitation plan: Plan for the exploitation of project activities, data and IPR management, test beds BP, replication

- D11.3 Middle term and final Exploitation plan: The report will describe the exploitation pathway of the solutions developed by NAHV, it will contain an abstract of the testbed projects results and their pathways toward the market

2.2.2 Communication and Dissemination Plan.

The WP7 team, led by META, is specialized in maximizing use of project results. The NAHV communication and dissemination team will be responsible for mobilizing outcomes amongst the early adopters of NAHV KERs, promoting best practices in renewable hydrogen for the benefit of European citizens, governments and industry players and raising general awareness. The **Communication and Dissemination Plan** (C&D Plan) (D7.1) will be discussed by the Executive Board in the kick-off meeting to define communication objectives clearly, ensuring: i) Development of a public awareness campaign on hydrogen technologies; ii) Creation of the public acceptance and public trust in renewable hydrogen and HV; iii)The empowerment of all players & stakeholders, involved in the hydrogen ecosystem to foster a better transfer, adoption and use of results; iv) Identification and involvement of early adopters; v) Use of the most appropriate channels (Demo-sessions, high quality peer-reviewed journals), while safeguarding that IP rights are not trespassed; vi) Collaboration between partnerships and counterparts; vii) Synergies with other projects to increase the impact and reduce overlapping; viii) outreach of multiple audiences. C&D Plan, due at M6, will describe the objectives, target groups, dissemination channels, activities and individual approaches for particular partners to regularly release information on the project. Target groups will be reviewed when characterising the KERs with specific regards to Early adopter/stakeholder analysis/mapping. The C&D Plan-related activities will be implemented thanks to **3 integrated Assets:**
1.A - Toolbox, including: a) Website used as platform for both Communication and Dissemination. It will have multilingual public and a restricted working sections (in English) to ensure an efficient data and information management and content creation/publication (it will also mirror contents from social media). It will ensure High Search Engine Optimization-SEO, Search Engine Marketing-SEM and Search Engine Advertising - SEA functionalities. b) Videos/interviews describing the nature and the goals of the project, addressed to the general audience. c) Pitches Videos of the KERs. d) Electronic Brochure/leaflet.

The toolbox will be designed to ensure an accessible experience also to blind and visually impaired people.

2.A - Media Task Force (MTF): The MTF is a selected network of professionals (not less than 20) in the project domain, with the participations of freelance, External Relations officers/press officers from each partner. They will manage content and implement the plan. The MTF will be updated monthly on the development of the project and its results. MTF will secure a relevant flow of high-quality information to be published on regular bases. MTF will be the "conduit" to secure an enduring visibility of the KERs and the project information. Transparent and continuous internal communication will ensure that partners will be kept fully informed about any developments throughout the course of the project.

3.A - Network of stakeholders. Key stakeholders will be involved within the project implementation also through collaboration with a partners' association and linked initiatives and projects. A detailed list will be developed and updated throughout the project in the C&D Plan.

Communication and dissemination activities: NAHV communication activities will be implemented locally, nationally and at European level. A communication manager (CM) will be identified by META with the role of coordinating the project communication and the MTF. Considering the different kind of stakeholders involved (quadruple helix, i.e. research bodies, businesses, public authorities, civil society), the communication approach will be diversified and at the same time specific. The communication methodology used will be the multi-stakeholder approach, guaranteeing an active involvement of project partners and target groups in the project processes, ensuring they will capitalize on shared experiences and information. An evaluation of communication activities is also foreseen to discuss common methods, sharing tools, learn which ones are a success and which ones should be improved or dropped.
Dissemination of results: Dissemination will target potential adopters across the whole hydrogen value chain, including public authorities, local/national governments, EC, utility companies, industry, SMEs, R&D community. Activities will consider the strict confidentiality clauses for information related to the foreground. Channels for dissemination will include a) demo-sessions at partners sites to showcase technologies in the pilot plants, organisation, b) participation in conferences, workshops and trade fairs where partners will present the KERs and

demonstrators, c) publication in international technical magazines and journals. Dissemination of KERs will consider major milestones and the progress of work

Communication: Communication will be critical for increasing awareness of the public on hydrogen's potential and use, fostering public acceptance of a revolution in the energy sector. The consortium will inform civil society of the benefits and ethical, social and environmental quality of the project and its results using newspapers, radio/TV programmes. Communication will also reach policy makers beyond the partnership and non-profit organizations and foundations.

Communication, dissemination and exploitation activities are summarized in the following table:

Table 12 -: Communication measures targets and values to be reached (to reported in D7.5)

Communication Measures	Target audience - groups	Target audience- target values
Demo-sites/Test beds	▪ SMEs and big companies ▪ policy and decision makers ▪ financial institutions, business associations and ESCOs ▪ research institutions	At least 1 Demo session for each Test bed
Social Media and Project website	▪ national/regional/local authorities' policy & decision makers ▪ SMEs and big companies ▪ financial institutions, business associations & ESCOs thematic agencies ▪ research institutions ▪ citizens & NGOs	At least 50.000 total followers At least 500.000 unique visitors
NAHV video stories (6 videos)	▪ national/regional/local authorities & policy & decision makers ▪ thematic agencies ▪ SMEs and big companies ▪ Citizens & students	At least 2.500 views per video (15.000 views)
NAHV annual conferences (tot 5 conferences)	▪ National/regional/local authorities & policy & decision makers ▪ thematic agencies ▪ SMEs and big companies ▪ NGOs ▪ research institutions ▪ financial institutions, business associations and ESCOs	200 participants to each event (1000 people reached)
NAHV technical workshops (3 workshops)	▪ national/regional/local authorities & policy & decision makers ▪ SMEs and big companies ▪ research institutions ▪ financial institutions, business associations and ESCOs	100 participants (300 participants)
NAHV Hydrogen cafè (4 in each country-tot 12 events)	▪ NGOs ▪ researchers ▪ students & citizens	600 participants
Scientific publications	▪ SMEs and big companies ▪ research institutions ▪ national/regional/local authorities & policy & decision makers	10 open access publications
8 Workshops for High Schools and professional schools	▪ students ▪ teachers	500 participants

H2students training and educational mentoring programme	▪ university students ▪ research institutions	6000 participants
Itinerant summer/winter school	▪ PhD students	180 participants
10 Peer exchange workshops with other HVs in EU	▪ representatives from NAHV partners ▪ representatives from established HVs and arising HVs	250 participants
Participation in EU events and external events/ conferences/ exhibitions	▪ national, regional and local authorities ▪ SMEs and big companies ▪ thematic agencies ▪ research institutions	1 events per year
10 replication workshops	▪ regional and local authorities ▪ SMEs and big companies from arising HVs ▪ thematic agencies from arising HVs ▪ research institutions from arising HVs	4 institutions representing each HV (5 new valleys at least)

2.3 Summary: Key Element of the impact section

SPECIFIC NEEDS	EXPECTED RESULTS	D & E & C MEASURES
NAHV tackles the following needs: **a)** increase cross-border cooperation through a replicable model of hydrogen production, distribution & storage **b)** optimize investments to make renewable hydrogen cost-competitive. **c)** activate a long-lasting hydrogen economy in three countries **d)** update policy & legislation for the use of hydrogen. (***horizontal***) improve public perception of hydrogen ecosystems	*NAHV expects to generate the following results by the end of the project from the KERs produced (table in section 2.1). The KERs complement each other. Clustering by strategic areas:* **a)** Design of a NAHV economic, social and industrial ecosystem model; Energy managing and monitoring system for renewable H2 production and utilization; 5 feasibility studies for cross cutting and cross border transport - Zero Emission Mobility Corridor; 1 Joint regulatory framework developed with a-Monitoring methodology; Set up a Digital Twin in a Replicable model. **b)** implementation of a system of public incentives and financing for the use of green hydrogen; Renewable H2 production modelled through industrial symbiosis and circularity; Industrial implementation of a solar power plant with H2 conversion into electric grid system; Production of renewable H2 by gasification of organic material for small microgrid; Renewable H2 exchange among NAHV partners; H2 production and management models for bus traction; Distributed power generation technologies and plant based on FC and thermal energy. **c)** Renewable H2 testbeds in NAHV: 7 focused on renewable H2 production innovative systems, 4 on renewable H2 innovative storage and transport; 7 on renewable H2 utilization efficient systems; 6 for H2 application in hard to abate/industry; 6 for renewable H2 application in energy sector; 6 for renewable H2 application in storage and transport; 4 FCH application in energy and transport sectors. Production capacity of 6k tons of renewable H2 using RES (PV) (cross border 20%). Knowhow on usage of renewable H2 in tile (ceramic industry) and from waste energy system in glass industry; Industrial development of burners for steel production on h2 based; Knowhow on optimal renewable H2 blending mix usage preheating furnace; Usage of renewable H2 in cement plants; Usage of renewable H2 in propulsion for vessels and maritime infrastructure; Mass production of innovative cylinder for H2 transportation; Small and distributed H2 refuelling stations. Fuel storage tank for H2 fuelled fleet in marinas. **d)** Design and activation of a regulatory sandbox for the use of green hydrogen in NAHV countries; New scheme for certified H2 trading piloted at a transnational-regional/intra-EU hydrogen market.	*NAHV will trigger the following dissemination, exploitation and communication measures*: **Exploitation** - NAHV will address the specific needs, securing the use and the adoption by specific early adopters of the KERs preparing a specific business plan for each of them. **Dissemination**-A set of activities addressing potential adopters of the KERs will be organized. **Communication** - A strategical asset for securing the success of a new energy revolution will pass through a sound awareness and acceptance of the NAHV results.
Target groups	**Outcomes**	**IMPACTS**
Subjects who will benefit and use the results: **Target Groups**: financial institutions, business associations and ESCOs; technical high schools; SMEs and big companies; thematic agencies; EU/national /regional policy makers/local Authorities;	*Changes that NAHV partnership expect to see after successful dissemination/exploitation of project results to the target groups (KERs outcome table in the section 2.1). Changes*: **I.** Companies will introduce H2 in their productive process (KER 1, 2, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 19, 20, 21, 23, 24, 25, 26, 28, 33) including 10 that will cooperate with each other in the 3 sectors (KER 1, 7, 8, 16, 17, 21). **II.** 20% of the hydrogen produced exchanged among the partners (KER 3, 5, 22, 29) with 1200 ton/year of H2 transferred (KER 5, 9, 18, 24, 29) & 5899 ton/year of hydrogen by using PV panels or other RES (KER 3, 20, 21,26,25). **III.** 1 testbed project of balancing the energy grid and to reduce the fluctuations given by RES (KER 19). **IV.** FCH applications demonstrated in energy and transport (KER 10, 27). **V.** NAHV System (tools): Policy guidelines, designed by the three Government involved in NAHV (KER 30, 33); 1 monitoring system integrating digital twin to collect data for the impact (KER 31) available for the other valleys through a new legal entity (KER 1, 30, 33). **VI**. Education & awareness (population, industry, institutions) on hydrogen: 20 promotional events,10 workshops to replicate the model (KER 32); 5	*Scientific, economic and societal effects:* NAHV benefits: environment, society, economic growth and job creation. Testbed applications demonstrate the applicability of hydrogen in the "hard to abate" sectors; energy and transport with 18 new business models. NAHV leverage effect on EU funding (25M) of 8.6 (215M) with 5 HVs replicating the model

Research-Institutions; Standardization bodies; No-funded European HV Projects; Future Italian HV Projects financed within PNRR.	additional Hydrogen Valleys initiated; more than 500.000 citizens reached, 3 technical workshops, 4 educational programmes, more than 20 initiatives for schools (KER 32, 26)	

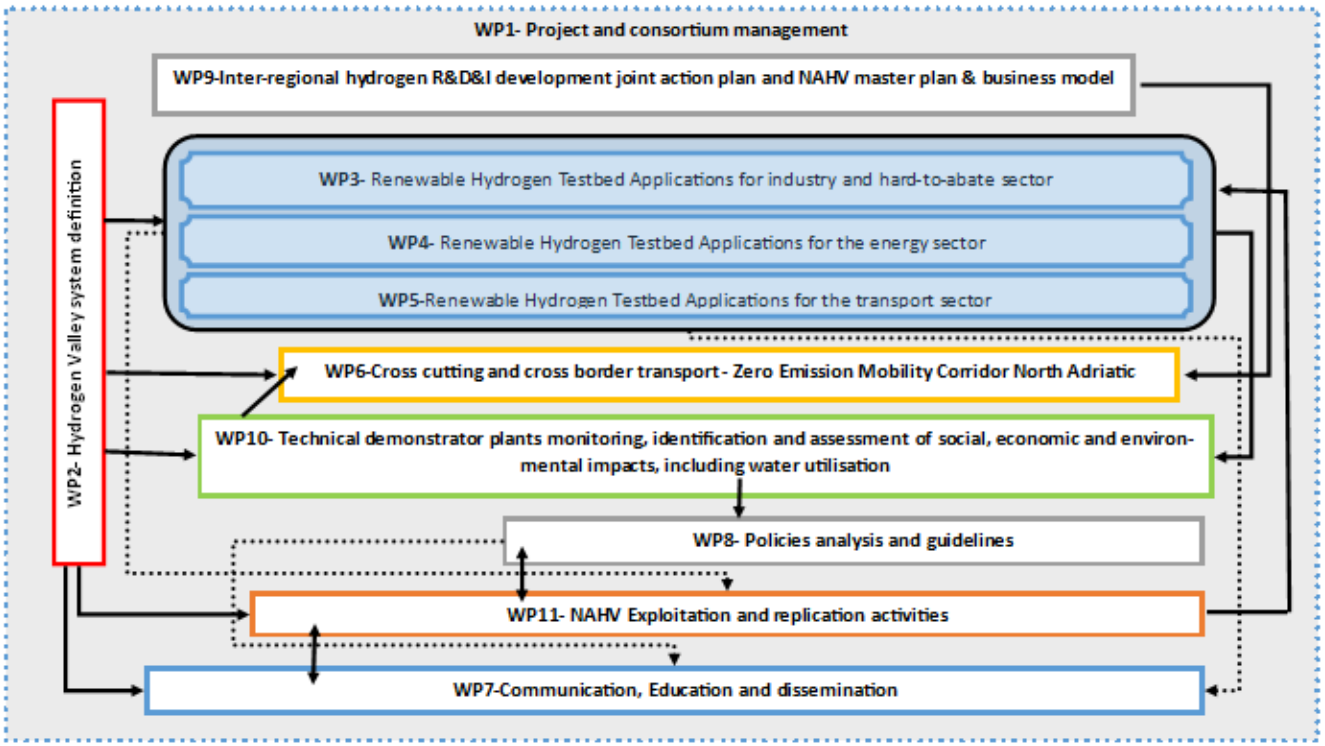
3 QUALITY AND EFFICIENCY OF THE IMPLEMENTATION

3.1 Work plan and resources

3.1.1 Overall structure of the work plan

The NAHV project is organized around 11 work packages. WP1 project management oversees the whole management structure of the project, sets the project boards and scientific and IPR management. WP2 designs the NAHV's system definition and heuristic vision and development model of the valley and the digital twin model of the NAHV. It also aims to ensure the necessary coordination and management of the ecosystem with the setting up of the NAHV AISBL and the NAHV security plan as well as the general monitoring plan of the HV as a whole. WP3, WP4 and WP5 encompass the part of the project related to the testbeds' preparation, set up, testing and monitoring of each single testbed. More in detail: a) WP3 clusters testbed projects focused on the hard to abate sectors such as cement, glass, etc; b) WP4 includes a cluster of testbeds in the renewable hydrogen energy sector and WP5 has testbeds in the H_2 transport sector. WP6 presents a series of feasibility studies which are synergic and pave the way for the NAHV development and scale up. In WP7 a set of actions tailored to ensure the social acceptance of hydrogen energy technology (HET), to get a positive customer experience and launch a wide educational and training programme will be implemented. WP8 will be focused on setting up a normative sandbox, harmonizing legislation and standards in the three countries and a financial incentive scheme tailored to capex and opex and attraction of investments. In WP10 a two-level monitoring approach is planned: 1) at NAHV's project level and 2) at each testbed project level with the scope to provide the NAHV with the necessary data. In WP11, the methodology which we will apply to ensure the successful replication of the NAHV is based on strengthening cooperation with other hydrogen valleys in a mutual learning approach and implementing action aimed at transferring the lessons learned in the project to five other hydrogen valleys across Europe.

Presentation of the components & how they inter-relate



Timing of the different work packages and their components

WP	Leader of WP / Task	Q1	Q2	Q3	Q1	Q2	Q3	Q1	Q2	Q3	Q1	Q2	Q3	Q1	Q2	Q3	Q1	Q2	Q3
WP 1 PROJECT AND CONSORTIUM MANAGEMENT	**HSE**																		
Task 1.1 Project management	HSE																		
Task 1.2 External Stakeholders Advisory Forum	Area																		
Task 1.3 Scientific and IPR Management	UNI TS																		
WP2 Hydrogen Valley System Definition	**HSE**																		
Task 2.1 NAHV approach & methodology	UNI TS																		
Task 2.2. North Adriatic HV AISBL set up	Area																		
Task 2.3 HV Security plan (+ annex)	FBK																		
Task 2.4 Digital twin	FBK																		
Task 2.5 Monitoring	UNI TS																		
Task 2.6 Market integration	Ecubes																		
Task 2.7. Pilot a new scheme for certified hydrogen trading at a transnational-regional/intra-EU hydrogen	FBK																		
WP3 Renewable Hydrogen: testbed applications for industry &	**Steklarna Hrastnik**																		
Task 3.1 Production and usage of Hydrogen as a spatial	Dilj																		
Task 3.2 Hydrogen utilization in special steel production	ABS																		
Task 3.3 Scale-up of a high-efficiency, modular	Snam																		
Task 3.4 Blending mix usage in pre heating system for	FENO																		
Task 3.5 H2 production for cement industry	Salonit																		
Task 3.6 Efficient use of WE system in the glass industry	Steklarna																		
WP4 renewable hydrogen: testbed applications for the energy	**Acegas**																		
Task 4.1 Clean hydrogen from non recyclable waste	Active Solera																		
Task 4.2 H2 production through industrial symbiosis and	Acegas																		
Task 4.3 Assessment of the sustainability of the natural	Acegas																		
Task 4.4 H2 by gasification of organic material for small	Indeloop																		
Task 4.5 H2 ecosystem technology solutions & production for next generation valuable market development	HSE																		
WP5 renewable hydrogen: testbed applications for the transport	**MCoE**																		
Task 5.1 Integrated hydroelectric and HFC power station	CTS H2																		
Task 5.2 H2 storage system for distribution	Faber																		
Task 5.3 H2 propulsion for vessels and maritime	MCoE																		
Task 5.4 Production and management models for the use	TPL FVG																		
Task 5.5 Fuel Storage Tanks Swap (FSTS) solution for	ACI																		
Task 5.6 Energy storage and Distributed power generation	ECUBES																		
WP6 Cross cutting and cross border transport / zero emission	**Ecubes**																		
Task 6.1 P2H2P node hosting capacity in the electric power	Ecubes																		
Task 6.2 Rail transport	Salonit																		
Task 6.3 Heavy Road transport	Salonit																		
Task 6.4 Passenger transport in rural areas	Ecubes																		
Task 6.5 Infrastructure's layout study for the transmission	Snam																		
WP 7 Communication, Education, and dissemination	**Meta Group**																		
Task 7.1 Activating C&D	META																		
Task 7.2 Awarness raising	META																		
Task 7.3 Education	UNIRI																		
WP 8 POLICIES ANALYSIS AND GUIDELINES - Ministries and	**MINGOR**																		
Task 8.1 policies analysis	MINGOR																		
Task 8.2Regulation revision	FVG																		
Task 8.3 Policies Guidelines	MZI																		
Task 8.4 Incentives	FVG																		
WP9 Inter-regional hydrogen R&D&I development joint action	**Area**																		
Task 9.1 JAP methodology	AREA																		
Task 9.2 information gathering and needs' analysis: field	AREA																		
Task 9.3 JAP co-creation	FHA																		
Task 9.4 masterplan methodology definition and	Area																		
Task 9.5 NAHV masterplan, business plan and financing	Area																		
Task 9.6 NAHV hydrogen ecosystem business accelerator –	Area																		
WP10 technical demonstrator plants monitoring, identification,	**UNI TS**																		
Task 10.1 methodology	UNI TS																		
Task 10.2 monitoring Production system	UNI TS																		
Task 10.3 monitoring Storage system	UR																		
Task 10.4 monitoring Distribution system	UL																		
Task 10.5 monitoring Users system	UNI TS																		
Task 10.6 environmental impact assessment, including	UL																		
Task 10.7 social impact analysis	UNIRI																		
Task 10.8 cost-benefit analysis	UNIRI																		
WP11 NAHV exploitation and replication activities	**FBK**																		
Task 11.1 Exploitation plan	FBK																		
TASK 11.2 Peer exchange with other Hydrogen Valleys (HV)	FHA																		
TASK 11.3 Internationalization and Networking of	Active Solera																		
Task 11.4 Nahv clusterization with neighboring hydrogen	FBK																		
Task 11.5 Replication package & laboratories	FHA																		
Task 11.6 Common position papers in cooperation with	FBK																		

Preparation phase
Pilot plant setup phase
Operational scale setup phase
Monitoring phase
Dissemination & replication
Policy & roadmapping
General acivities

Table 3.1g: 'Subcontracting costs' items

The table below describes the several subcontracts foreseen within the NAHV. As a general rule, all Subcontractors and providers of services or equipment or goods, will be selected in observance of the internal procurement rules of the entities and in compliance with the principles of best value for money and No conflict of Interest, and to be properly documented at time of selection.

Subcontracting		
Part. No./ Short name	**Cost (€)**	**Description of tasks and justification**
2 AREA	100.000	WP2 legal assistance for setting up AISBL and translation of the text into national languages (40.000) WP9 technical support for joint action plan definition (60.000)
3 ECUBES	150.000	WP 6 Studies, documentation. This study will be developed in a partnership together with a regional system operator and research institute in the NAHV region and respective authority in Italy. The study will prove feasibility on building a renewable energy harvesting and hydrogen (H2) energy storage capability and to facilitate a cross-border transportation, which will lower CO2 emissions and contribute to energy sustainability in the EU
4 INDELOOP	250.000	WP 4 Preparation of Main Design and other legal requirements within the Law on Construction; Optimisation of the Central Processing Unit (CPU)
6 DILJ	200.000	WP3 Heat distribution analysis, NOx analysis from subcontractors
7 GITONE	230.000	WP 7 Specific technical expertise necessary for the establishment and the work of the Center; Fees for lecturers for education activities
8 ACI	450.000	WP 5, analysis of the fuel cells operation, certification of the vessel -Innovative Electric Hydrogen Hydrofoil Fast Ferry, which will be further enhanced with innovative solution for charging hydrogen based on highly innovative Fuel Storage Tank Swap solution.
9 HRASTNIK	40.000	WP 3 Furnace Monitoring Audit/Benchmarking (25,000€), A third-party company with the necessary certifications will perform a furnace monitoring audit/benchmarking to assess the current state of the furnace and provide recommendations for improvements. The subcontractor possesses the required expertise and certifications to perform the furnace monitoring audit, which is beyond the core competencies of the project team. WP 3: Water Electrolyser Modelling for Operation (15,000€). A specialized company will be subcontracted to develop a model for the operation of the water electrolyser system. This model will help optimize the system performance and identify potential issues. The subcontractor has the necessary expertise in water electrolyser system modelling and can provide valuable insights for the project.
11 ACEGAS	1.990.800	**WP 4: T4.2.** The subcontracted costs concern civil and building works, infrastructure and fire prevention systems, specific project of hydrogen production plant, plant management and control IT systems, development and optimization study of the electrolyser, plant of treatment and demineralization water to be used as input in the electrolyser. These activities require specialist skills which do not fall within the ordinary activities of ACEGAS. In addition, expensive machinery and equipment are required to carry out this activity and for these reasons these activities are entrusted to external companies. Estimated value in T 4.2. is 1.450.000 €

		Task 4.3 Assessment of the sustainability of the natural gas distribution network: The activity intends to start an experimental study to evaluate the use of its methane gas distribution network assets for the injection of increasing % of hydrogen, verify and check the compatibility of the materials used for the hydrogen transport. This activity requires specialist skills and equipment in hydrogen research activity which do not fall within the ordinary activities of ACEGAS and are therefore entrusted to external companies. Estimated values in T4.3. is 540.800 €
12 Active Solera	775.000	WP4 Studies on benefits of system for SMO (Solaire – MicroOndes) solar process, technical documentation preparation for construction, project development assistance from constructor supervisor, construction of the plant
14 ABS	10.000	WP3 Study & engineering of on-site H2 dispatching infrastructure & safety analysis
15 CTS H2	360.000	WP 4: For the definition of the subcontractor, the internal rules of the company will be respected. In any case, given the peculiarity of our non-standard technical requirements and working conditions of the high-pressure system, there are few companies to select. Design of hight pressure engineering part, and commissioning; 90.000€ Design and construction electrolyser assembly in hight pressure stack AES; 90.000€ expense management, purchasing reporting, management of expenses, reporting of purchases, etc., the management of expenses for reporting will be entrusted to an external and expert accountant firm.; 90.000€ Realization of electrical power component projects and software and commissioning. realization of projects of electrical power components and software and commissioning, given the peculiarity of the high-pressure system, the power supplies and many electrical components are not standard for the market, so we have to specially commission them with their management software 90.000€
16 SNAM	300.000	WP3 Detailed Engineering technical documentation preparation for construction (200.000 €), commissioning and start-up of the electrochemical compressor for hydrogen refuelling station (100.000€)
24 META	120.000	WP 7 Expert on dissemination (to increase the targeted distribution of information to a specific public audience, especially in Croatia, where META does not have a representative office)
26 FVG	300.000	WP 8 Technical, legal and financial expertise needed to support WP8 transnational team in standardizing the regulations (also through the institute of regulatory sandboxes) and in proposing a system of incentives and financial lines

Table 3.1h: 'Purchase costs' items (travel and subsistence, equipment and other goods, works and services)

For All "Purchase costs" items and providers of services or equipment or goods, the suppliers will be selected in observance of the internal procurement rules of the entities and in compliance with the principles of best value for money and No conflict of Interest, and to be properly documented at time of selection.

	Cost and justification			
Participant number/short name	**Travel/subsistence (€)**	**Equipment (€)**	**Other goods, works, services (€)**	**Total (€)**
1 HSE	45.000 Project meetings and coordination with partners.	WP4 160.210.000 equipment for hydrogen production (electrolyser, infrastructure, software): Full capitalized costs. **<u>Breakdown</u>** Electrolyzer 2MW 7.510.000 H2 storage 1ton 790.000, Hydrogen refuelling station with infrastructure 2.000.000, Electrolyzer up to 20 MW 72.732.000, H2 storage 14 t 11.060.000, HRS with infrastructure 3.600.000 Additional H2 and battery storages (if applicable) 62.518.000	WP 4 385.000 Design, documentation, consumables, engineering WP 7 200.000 Dissemination, Conference fees, organizational cost of events (demonstration for interested public, meetings)	160.840.000
1.2 HSE INVEST			WP 4 50.000 Environmental impact assessment study	50.000
3 ECUBES	90.000 Project meeting coordination with other partners, conferences and fairs to present project	WP 5: 5.334.000: Full capitalized costs. **<u>Breakdown</u>**	WP1 - Task 1.1 Project management Consumables and office supplies 19.100	5.694.000

		LHC – Energy storage 1 Mwh with liquid H2 carrier (2.554.000) Micro CHP fuel cell systems kx 10 kW (910.000) H2 energy storage in rural environment with HRS charging spots (880.000) One H2 bus (850.000) Two H2 cars (140.000)	WP1 - Task 1.3 Scientific and IPR Management Costs of IPR and patents, Certification of the hydrogen carrier, legal advice, financial guarantees, protection of results 108.000,00 € WP5 - Task 5.6 Energy storage and Distributed power generation based on FC and accounting of carbon credits. Graphical design for promotion, recording and video content capture, documentation of product, translations, publications 115.200 WP 7 - Task 7.3 Education Graphic design of documents, printing and preparation of working and promotional materials, consumables and supplies for classes 25.200 WP 11 - Task 11.1 Exploitation plan Conference fees, organizational cost of events (demonstration for interested public, meetings) 82.500	
4 INDELOOP	7.000 Project meetings and coordination with partners.	WP4: 100.000 Laboratory equipment for analysis of gases, appliances, valves, auxiliary equipment. Depreciated costs (standard depreciation) 100.000 Online monitoring and reporting equipment. Full capitalized costs	WP 4: 50.000 Transportation cost, office materials, communication cost, etc.	257.000
5 MCoE	153.240 Project meetings coordination	WP5: 1.200.000 Equipment for retrofitting of an existing harbour tug (including green	WP 6: 445.000 Testing and validation of the vessel,	1.397.740

	with other partners, conferences and fairs	powertrain, advanced power management & control systems and digital data communication equipment). Full capitalized costs. **<u>Breakdown</u>** Compressed hydrogen storage 70.000 Fuel cells 700.000 Battery pack 30.000 Electromotor package 10,000 Power management system and utilities 120,000.00	consumables, design and documentation Miscellaneous items and contingency 270.000	
6 DILJ	100.000 Travel and logging cost on trips for 3 people for 70 day in 30 months	WP 3: 33.497.000 Gas mixing station, electrolyser, storage and distribution system, H2 ready burners, air liquid H2 system. Full capitalized costs. **<u>Breakdown</u>** Electrolyzer 100 kg/h 15.000.000€ Storage and distribution system 3 bar 300.000€ Gas mixing station design and production 1.000.000 Hydrogen ready burners 140.000 Gas mixing station installation 150.000 Battery system with BMS (battery system management) 16.907.000	WP 3: 500.000 Supply of liquid H2 for testing, 500.000 Mechanical and construction works on the pipelines Usage of oxygen on burners 270.000	34.867.000
7 GITONE	30.000 attendance of project meetings,	WP7: 100.000 Equipment for the work of the Regional Hydrogen	/	130.000

	presentation of the project at conferences	Center - the establishment of a training center on hydrogen in marine applications (computers, VR googles, etc.) Full capitalized costs		
8 ACI	70.000 project meetings, international fairs	WP 5: 12.850.000 Fuel cells, equipment for building a Hydrofoil Hydrogen Electric foot passenger Catamaran Ferry, electrolyzer with capacity of 22 t/ year. Full capitalized costs.	WP 5: 50.000 lawyer providing legal assistance	12.970.000
9 STEKLARNA	12.000 Project meetings, workshops, review and coordination with other partners	WP 3: 5.135.000 Full capitalized costs. **<u>Breakdown</u>** The 3MW PEM Electrolyser has an estimated cost of 3.900.000 The Oxygen Purification System's estimated cost is 220.000 Hydrogen Storage equipment is priced at 300.000 Oxygen Storage equipment costs 185.000 Both Hydrogen and Oxygen Safety/Measuring Skids are priced at 300.000 the Control System for Electrolyser/Furnace is estimated at 230.000	WP 3: 850.000 Test equipment and consumables required to run the pilot: material for piping, wiring, consumable for electrolyser except electricity, transport, installation, and commissioning of equipment	4.098.000
10 SALONIT	30.000 attendance of project meetings, presentation of the project at conferences	WP 3: 3.580.000 Full capitalized costs. **<u>Breakdown –</u>**	WP 3: 600.000 Design and documentation	4.210.000

		H2 equipment at Full capitalized costs 1.200.000 purchase and installation of 0.5MW electrolyser unit - Full capitalized costs 300.000 Upgrade of existing HRS and infrastructure on site of Salonit 1.800.000 H2 transport equipment and infrastructure (including one Fuel Cell Electric Trucks (FCET) and new HRS fuelling station for heavy duty transport)	280.000 large scale electrolyser feasibility study	
11 ACEGAS	-/	WP 4: 7.646.900 2,5 MW prototype electrolyzer, purchase and installation of compressor in electrolyser service (needed to store H2), purchase and installation of storage system Ful capitalized costs WP 4: 6.636.900 2,5 MW prototype electrolyzer. Full capitalized costs. 250.000 Purchase and installation of compressor in electrolyser service (needed to store H2). Full capitalized costs. 760.000 Purchase and installation of storage and distribution system. Full capitalized costs.	/	7.646.900

12 ACTIVE SOLERA	30.000 attendance of project meetings, presentation of the project at conferences	WP 4: 6.353.000 Thermolyser, Gasifier, Hydrogen tanks, engines, ORC, Gas purification. Full capitalized costs.	WP 4: 625.000 Material for unit construction, design and documentation, patents 120.000unit production, innovation market access, H2 market access	7.128.000
13 FABER	12.000 Project meetings, visiting external technological center	WP5: 150.000 Laboratory equipment pieces for testing the cylinder Depreciation methodology: (100% used for the project, 3 years of operation, depreciated over 5 years, usage reported based on log book of project use)	WP 5 : 187.400 Polyamide, carbon fibre, resin, bosses, other consumables 100.000 Sampling of PA cylinders by external technological center	449.400
14 ABS	31.000 Meetings, staff moving across different installations, conferences	WP 4: 4.900.000 Full capitalized costs. **<u>Breakdown</u>** Piping equipment for eighteen 233kW burners (2.200.000) H2 storage infrastructure and station (2.700.000)	WP 4: 700.000 Services for furnace maintenance and update (refractories, structure, chimney) Burners maintenance, H2 for first trial	5.631.000
14.1 Danieli	35.000 Meetings, staff moving across different installations, conferences		WP 3: 810.000 Conception, Engineering, new burners, Installation	846.000
15 CTS H2	17.520 Project meetings, meeting with suppliers and inspections	WP 5: 270.000 Equipment needed to make a suitable AEM electrolyser Full capitalized costs:	WP 5: 570.450 all components, testing	857.970
16 SNAM SPA	/	WP 3: 700.000 Procurement of the electrochemical compressor Full capitalized costs.	WP 6: 150.000 Pre-feasibility, Basic Engineering	850.000
17 FBK	20.000 project meetings, technical project meeting for WP2, 2 meetings with industrial partner /year for safety plan.	/	WP 2: 102.500 including: 6 year license for Modelon impact software (modelica code and optimization tool), H2 GO certification scheme for the NAHV production	122.500

			plants (certifhy), audit, open access.	
18 UNITS	5.000 WP1Meeting with project partners: 5x1 person 12.000 WP7. Participation to conferences – 6x2 people 5.000 WP10. Meeting with suppliers -5x1 persons	12.000: WP2. 4 PC workstations – depreciated over 3 years and used for the project only 50.000 WP10. Sensors and equipment for independent measurements during tests (portable flow meter, pressure and temperature sensors, power analyzers, portable gas sensor)	10.000 WP10 Fittings and other consumable for test rig independent measurements 32.000 WP2 and 10 software for automatic data acquisition and processing (NI Labview) and for process simulation 20.000 WP 10 Installation of instrumentation and development of bespoken systems 12.000 WP7 registration European Fuel Cell conference, Gastech conference, WHEC etc 10.000 WP7 Publication of 5 open access papers on international journal (Elsevier, MDPI…) 15.000 WP 7 Education material, organization of itinerant schools	173.000
19 UL	6400 EUR – Gas: 13 × 2 persons (8 abroad = 8×2×400 EUR; 5 Slovenia 0 EUR) 3600 EUR – WP specific meetings abroad: 6 × 2 persons = 6×2×300 EUR 4800 EUR – 6 EU conferences – travel costs = 6 * 800	WP2, WP 10: 25.800 3 data acquisitions systems for electrochemical devices (electrolysers, fuel cells, batteries): interface hardware, process and storage unit, specific SW for data acquisition and processing, consumables Depreciation methodology: (100% used for the project, 4 years of operation, depreciated over 5 years, usage reported based on log book of project use)	WP 7: 14.200 – Organization of educational events + summer/winter schools; 12.800 Fees of PhD students participating to the schools and other events 14.600 Scholarships and fees for visiting, students, professors and audience 10.800 participation to 6 EU conferences 11.200 Open access fees for 4 peer-reviewed scientific publications 3600 Use of HPC to simulate digital twins	107.800

20 UNIRI	Project meetings 17.775€ Conferences 17.280€ Participation of postdoctoral fellows at summer/winter schools 20.250€		WP10 4200 Organisational material for specific events aiming at popularisation of hydrogen valley - summer/winter schools - Publication of articles fees, Open access fees	59.810
20.1 RiTeh	Project meetings 9.598,5€ Conferences 9.331,2€ Participation of postdoctoral fellows at summer/winter schools 10.854€			30.000
20.2 FESB	Project meetings 8.176,5€ Conferences 7.948,8€ Participation of postdoctoral fellows at summer/winter schools 9.315€			25.000
23.1 TT	/	WP 5 2.500.000 Trieste Transport storage and distribution plant Full purchase costs	/	2.500.000
23.2 APT		WP5 4.500.000 APT hydrogen production plant of 1 MW solar power plant	/	4.500.000
24 META	32.000 attendance of project meetings, presentation of the project at conference	/	WP 7 70.000 participation to fairs, realization of promotional videos and annual conferences	100.000
25 FENO	/	WP 3 407.000 fuel supply regulator system for H2 Full capitalized costs.	WP 3 20.000 Fees for authorization H2 utilization 15.000 laboratory test for stuck emissions during H2 utilization tests (3x5kEuro) 110.000 H2 for test (purchase and transport)	552.000

Table 3.1i: 'Other costs categories' items (e.g. internally invoiced goods and services)

Participant Number/Short Name	**6 DILJ**		**4 Indeloop**	
	Cost (€)	**Justification**	**Cost**	**Justification**
Internally invoiced goods and services	140.000	WP 3 T3.1. Roof tile Products –production of 35.000 pcs/day x 10 days x 0,4 eur/pcs.	25.000	WP 4: T 4.4. Office space, laboratory space, testing, research, self-produced consumables, hosting presentations and consortium meeting
	300.000	WP3 T3.1 Electrical, gas and water during testbed time Gas consumption per day 130.000 kWh * 31 day * 61 €/MWh = 245.830 € Electricity cost 16,29 MWh * 110 €/MWh * 31 = 55.555 €		
	300.000	WP3 T3.1. clay, water and personnel cost during test production with hydrogen. Gas consumption per day 130.000 kWh * 31 day * 61 €/MWh = 245.830 € Electricity cost 16,29 MWh * 110 €/MWh * 31 = 55.555 €		
	740.000	**TOTAL**		

3.2 Capacity of participants and consortium as a whole

NAHV Consortium is composed of 27 main partners and 10 affiliated entity partners from 4 countries, representing at best the quadruple helix and defined to respond to the challenge of developing the first transnational hydrogen valley in Europe. The partnership consists of a well-balanced composition of regional and national governments (3), companies of different sizes and sectors (19) and research and innovation institutions (6) with long-standing expertise in coordinating and participating in large EU projects. The consortium, designed under multi-actor approach, consists of different companies, start-ups, SMEs and big sized enterprises some of which operating at global level (ABS, SNAM, etc) representing the several components of the hard to abate, energy and transport sectors which integrate the H2 value chain and with different complementary expertise

and interests in the hydrogen economy. HSE as a project coordinator has a key role in the implementation of the NAHV project proposal and its deliverables, since it will significantly contribute to achieving 5.000 tonnes of renewable hydrogen with the largest production capacity, with its rich experience in EU projects, HSE is able to lead and manage such multidisciplinary team of more than 30 partners. The different tasks designed within each WP have been assigned to the partners using a co-construction approach for work program development. Thus, the different tasks of the project were assigned to specialists in the corresponding domains. The integration of partners from different complementary backgrounds into a coherent high-profile consortium, provides significant synergetic benefits to the project and ensures the consortium can address the objectives of the project completely and consistently. Partners were also chosen in order to ensure an optimal coverage of all the hydrogen value chain with respect to coverage of a diversity of industrial and R&D&I scenarios. Furthermore, to address such a challenge at best, the experience of the partners of the 3 territories involved will be enriched and complemented by the participation in the partnership of the FHA-Fundación para el Desarrollo de las Nuevas Tecnologías del Hidrógeno en Aragón, a leading organization in the EU in the field of **H2, the coordinator of the consortium implementing Big Hit and partner in Heavenn and Green Hysland** which will guaranty the uptake by NAHV of those HVs experiences and of the developed tool (see T11.5 Hydrogen Territories Platform). FHA contribution will spread across project activities in all main transversal tasks, from methodology development to replication and JAP co-creation, maximizing their consolidated experience in already existing and successful hydrogen valleys across Europe. Thus, the consortium offers several assets for achieving the objectives. For each WP, a reasonable balance between the objectives and the implementation means (critical mass, funding level) has been defined. The consortium is formed by participants of high expertise and recognition in the global scientific community and business with networks with stakeholders, facilitating cooperation with new partners. Hence, NAHV will benefit from such a large panel of potential end-users to fine-tune and sharpen project work activities during the project time, with rapid and efficient enrolment of end-users in our multi-actor platforms. The governments involved are at the forefront of innovation policies in their respective territories and have the required expertise for policies analysis and guidelines development. The **research and innovation** partners have been selected considering the level of expertise and involvement in their respective fields, a proven track record in the domain of reference, a history of effective interdisciplinary international collaboration, and the explicit commitment to building the NAHV as a transnational and transdisciplinary open air distributed laboratory. They include one University in each country (Trieste, Rijeka, Ljubljana), FBK, FHA and Area Science Park, which are specialized in R&D&I activities. Universities and FBK will develop NAHV digital twin. Furthermore, universities will perform monitoring activities, impact assessment and LCA/S-LCA analyses and will work on incorporation of NAHV research results in advanced curricula and other educational and training programmes.

UNITS, FBK and FHA are members of **Hydrogen Europe Research.** Through the Center for Sustainable Energy, FBK is involved in the hydrogen sector on an international scale, with its role in the **EC Clean Hydrogen Partnership**, and the **Italian Hydrogen Association**, among others. FBK has specific expertise in both technology R&D&I in most of the hydrogen value chain and strategic planning and territorial projects, in support of hydrogen end-uses and hydrogen valleys development. Area will use its experience from the project Argo for developing the hub&spoke model for NAHV and ensuring the connection between research and business with its specific technology transfer and innovation exploitation expertise (also in relation to start-ups and acceleration programs), also based on the long-term coordination of all research organisations of the Region FVG.

The **business sector** from the 3 countries is represented by testbed projects implementers, including 2 innovative start-ups (from Italy: CTS H2, and from Croatia: Active Solera), 11 big-sized

companies and 6 micro, small and medium-sized companies, whose fields of activity covers hard to abate sectors (cement, glass packaging, roof tiles and bricks production, steel making industry, metal carpentry), transport operators by including in the partnership TPL FVG which is the organization that coordinates the public transport in the Friuli Venezia Giulia and its two operative companies Trieste Transporti & A.P.T. Azienda Provinciale Transporti which are affiliated entities, and its energy infrastructures, production, distribution and services (including R&D and development of plants for hydrogen production), and transport. 2 industrial partners (SNAM from Italy and Indeloop from Croatia) are members of **Hydrogen Europe**. SNAM is the first Italian gas Transmission System Operator and the leading European operator in the transport and storage of natural gas, with an infrastructure able to ensure hydrogen transition; it's the vice-president of the Italian Hydrogen and Fuel Cells Association (H2IT) and it plays a central role in overseeing the definition of norms and regulations on a national scale. SNAM is also part of the HYREADY network and of the Hydrogen Council. The Croatian companies working on transport related testbed projects represent at best the maritime sector, including Mediterranean's largest marinas chain and leading marina operator nautical tourism company ACI, marine engineering and, maritime affairs and related R&D&I activities (MCOE & Gitone). MCoE has established the Maritime Innovation Cluster (MarInn) in Adriatic Croatia with UNIRI (NAHV partner). Finally, the company Meta Group will lead communication and dissemination activities having a long-time expertise in knowledge to market and valorisation processes, valorisation, patenting and protection of research results, it is also leading the Horizon Results Booster. Meta Group, the Universities, FBK, FHA & Area have a long-time experience in working with innovation stakeholders, companies including start-ups and public authorities, which will ensure at best the development on the NAHV ecosystem and guarantee a true transnational expansion of the exploitation of project results. Finally, the involvement of more than 40 supporting organizations which issued some letters of interest is crucial for the NAHV success & legacy uptake.

Consortium Agreement (CA)

The CA has been already drafted and agreed. The rules for decision-making will be laid down in the CA. The various regulations and standards necessary for project management will be further specified in a project management guide issued by the Management Board. Such CA, based on the DESCA model, together with Horizon Europe regulations will provide legal, administrative and financial management of NAHV. Each partner will have the responsibility to report immediately to their respective WP leader and coordinator any risk situation that may conflict with project objectives or successful completion. Changes in scheduling of deliverables and/or allocated budget, which occur at individual partners' level, are to be reported to respective WP Leader. The CA includes aspects such as i) Organizational provisions (creation of committees, responsibilities, revisions, decision-making structures), ii) IPR and rules for dissemination and use (confidentiality, results ownership, protection of results, pre-existing knowledge of partners), iii) Financial provisions (budget plan, modification procedures, conditions for a reasonable and equitable arrangement on payment of patenting costs and distribution of downstream revenues, in return licenses), iv) Legal provisions (legal cooperation status, penalties, applicable law), v) Rules for communication/interaction within consortium and vi) Specification of rules for publications and conflict management.

4 ETHICS SELF-ASSESSMENT

4.1 Ethical dimension of the objectives, methodology and likely impact

No specific ethical issue was identified in relation to:

- the objectives of NAHV activities;

- the proposed methodology;

- the potential impact of the activities.

NAHV is fully committed to following and upholding the FAIR principles (Findable, Accessible, Interoperable, and Reusable) for data management. This applies not only to data produced by the project as output, but also to data used for the experimentation during the project. For this purpose, the Coordinator will draft the Project Management Handbook and quality plan and the project will develop a Data Management Plan (DMP) as part of the work under WP1. This document will describe in detail how data will be collected and generated both during and after the project. The DMP will evolve during the implementation of the project and will as such serve as a living document defining the main elements of data management policy that will be used by the NAHV consortium regarding the management of data. Updates to the document will be done based on the progress of the project, and whenever significant changes will occur that might affect the FAIR goals.

Due to the distributed nature of data, each NAHV project partner will be responsible to follow the General Data Protection Regulation (GDPR) as well as all necessary measures to ensure the availability, proper storage, management, processing and protection of project data. Each project partner will appoint a Data Manager as a responsible person in their organisation who will participate in defining data policies at the project level, contribute to the DMP and commit to enforce it in their respective organisations.

4.2 Compliance with ethical principles and relevant legislations

Most of data managed in the NAHV project are data from sensors and machines or product data, and as such will not be affected by privacy issues. However, data collection will be performed in full respect of the privacy regulations, starting from the GDPR and also considering specific national legislations, if applicable.

Personal data such as names and email addresses of stakeholders will be collected for the purpose of implementing communication and dissemination activities (for example organisation of events, distribution of newsletters) and social sciences activities (interactions and workshops with stakeholders). Data will be treated in compliance with the GDPR and will be used exclusively for engagement purposes during the project. As already mentioned, a detailed Data Management Plan (DMP) will be developed in the first phase of the project.

Annex A Hydrogen Valley Summary table

Elements of the Hydrogen Valley[1] [2] [3]	Technical		Financial						
	Main technical parameters	**Hydrogen produced / stored, distributed/consumed** **(tonnes H2 per year)**	**Partner incurring/declaring the costs**	**Cost related to each of the equipment/infrastructure items (MEUR)**	**Type of Cost (purchase[4]/subcontract)** **In case of equipment purchase distinguish between depreciation, full capitalised costs, leasing, etc.**	**Costs declared in the JU grant (yes/no)**	***If yes, include the requested grant for the specific item*** ***(MEUR)***	**Main source[5] of funding or co-funding[6] including status *(granted. secured/planned)***	**GAP**
Hydrogen production									
HSE ELECTROLYSER T 4.5.	2 MW	307	HSE	7,51 €	Equipment, full capitalised costs	no		JTF (planned) 6,4 MIO €	0 €
HSE ELECTROLYSER siemens T 4.5.	17.4 MW	2700	HSE	72,73 €	Equipment, full capitalised costs	yes	3,00 €		26 €
DILJ Electrolyzer T 3.1.	2 MW	315	DILJ	15,00 €	Equipment, full capitalised costs	yes	15,00 €	planned	0 €

ACI T 5.5. electrolyzer	0,3 MW	22	ACI	1,10 €	Equipment, full capitalised costs	yes	0,70 €	planned	0,40 €
STEKLARNA T 3.6. PEM electrolyzer	3 MW	608	Steklarna	3,90 €	Equipment, full capitalised costs	yes	0,25 €	planned	3,65 €
SALONIT T 3.5. electrolyzer	1,5 MW	50	Salonit	1,20 €	Equipment, full capitalised costs	yes	0,40 €	planned	0,80 €
ACEGAS T 4.2: ELECTROLYSER	2,5 MW	370	ACEGAS	3,942 €	Equipment, full capitalised costs	no	0 €	planned	3,942 €
ACTIVE SOLERA T 4.1 thermolyzer and gasifier	nd	900	ACTIVE SOLERA	6,35 €	Equipment, full capitalised costs	yes	0,2	planned	
CTSH2 T 5.1 ELECTROLYSER STACK	0,05 MW	4	CTS H2	0,25 €	Equipment, full capitalised costs	yes	0,175 €	Private funding	0,00 €
INDELOOP T 4.4 Electrolyzer	0,43 MW	20	INDELOOP		Equipment, full capitalised costs	no		planned	
SNAM -Task 3.3: ELECTROLYSER	4 MW	80-90 t/y with PV "captive" finacied. Up to ca 400 with PPA compliant to Delegate Act. 600 ton/y full load, but not completely compliant with DA	SNAM	8,126 €	Equipment, full capitalised costs	no		"PNRR or FVG Region (planned) 14 MIO €"	

TPL FVG/ATP T 5. 4 Electrolyzer	1,5 MW	55	TPL FVG/ATP	4,5 €	Equipment, full capitalised costs	yes	0,3	planned	
Hydrogen distribution									
SNAM -Task 3.3: electrochemical compressor		900 bars	SNAM	0,70 €	Equipment, full capitalised costs	yes	0,70 €		0,00 €
Hydrogen storage									
HSE T 4.5. STORAGE	1 ton	1000 kg	HSE	0,79 €	Equipment, full capitalised costs	no	0,79 €	JTF (SECURED) 6,4 MIO €	0,00 €
HSE T 4.5 STORAGE.	14 tons	14 t	HSE	11,06 €	Equipment, full capitalised costs	no		modernization fund (planned)	11,06 €
Storage and distribution system **T 3.1. DILJ**	3 bar	TBD	DILJ	0,30 €	Purchase	yes	0,30 €	planned	0,00 €
MCoE T5.3 Compressed hydrogen storage		TBD	MCoE	0,07 €	Equipment, full capitalised costs	yes	0,07 €		0,00 €
STEKLARNA T 3. 6 Hydrogen storage		TBD	Steklarna	0,30 €	Equipment, full capitalised costs	yes	0,06 €		0,24 €

ACEGAS T 4.2: Compression system		TBD	ACEGAS	1,01 €	Equipment, full capitalised costs	no	€	planned	1,01
ACEGAS T 4.2: Storage System	2,12 t	2,12 t		2.7€	Equipment, full capitalised costs	no	0 €	planned	2,7 €
CTSH2 T5.1 STORAGE, COMPRESSOR AND DISPENSER	0,020 t	4 t/year		0,22 €	Equipment, full capitalised costs	yes	0,15 €	Private funding	0,07
CTSH2 T 5.1 DISPENSER AND CONTROLLER GAS STATION				0,006 €	Equipment, full capitalised costs		0,0042 €	Private funding	0,0018 €
SNAM -T 3.3: STORAGE	buffer 30 bar			0,351 €	Equipment, full capitalised costs	no		"PNRR or FVG Region (planned)	0,351
ABS T 3.2 H2 storage infrastructure and station		TBD	ABS	4,90 €	Equipment, full capitalised costs	yes	0,50 €	planned	4,40 €
End uses: transport									

HSE T4.5 Local public transport Velenje – Šoštanj (Slovenia)		200 t		TBD		no			
HSE T4.5. Ljubljana public transport		400 t		TBD		no			
MCoE T5.3 equipment for retrofitting for harbour tug vessels		400 t	MCoE	1,13	Equipment, full capitalised costs	TBD	yes	Planned	
ACI T 5.5. hydrofoil passenger catamaran ferry		100 t	ACI	11,75	Equipment, full capitalised costs	TBD	yes	Planned	
ECUBES T 5.6 hydrogen truck		20 t	ECUBES	0,85	Equipment, full capitalised costs	Yes 0,5	0,5	planned	
ECUBES T 5.6 hydrogen cars		10 t	ECUBES	0,14	Equipment, full capitalised costs	Yes	0,14		
TPL FVG T 5.4 public transport		300 t	TPL FVG	TBD					
End uses: energy									

HSE T 4. 5 transfer to energy		800 t	HSE	TBD			no	Modernisation fund	
Active Solera T4.1.energy use		200 t	ACTIVE SOLERA	TBD					
End use: hard to abate sector									
STEKLARNA T3.6 Glass industry Steklarna Hrastnik own production		120 t	STEKLARNA	3,90 €	Equipment, full capitalised costs	0,25 €	yes	planned	3,65 €
SALONIT cement industry Slovenia production from HSE		1000 t	SALONIT	TBD after providing business model for H2 in Slovenia and abroad					
DILJ Cement industry Croatia production from HSE		1200 t	DILJ	TBD after providing business model for H2 in Slovenia and abroad					
ABS H2 use from SNAM		390 t	ABS	4,9 €	Equipment, full capitalised costs	0,5	yes		
FENO H2 use from ACEGAS		400 t	FENO	0,41 €	Equipment, full capitalised costs	0,41	yes		

ANNEX 2

ESTIMATED BUDGET FOR THE ACTION

	Estimated eligible[1] costs (per budget category)										Estimated EU contribution[2]			
	Direct costs								Indirect costs	Total costs	EU contribution to eligible costs			Maximum grant amount[6]
	A. Personnel costs			B. Subcontracting costs	C. Purchase costs			D. Other cost categories	E. Indirect costs[3]		Funding rate %[4]	Maximum EU contribution[5]	Requested EU contribution	
	A.1 Employees (or equivalent) A.2 Natural persons under direct contract A.3 Seconded persons		A.4 SME owners and natural person beneficiaries	B. Subcontracting	C.1 Travel and subsistence	C.2 Equipment	C.3 Other goods, works and services	D.2 Internally invoiced goods and services	E. Indirect costs					
Forms of funding	Actual costs	Unit costs (usual accounting practices)	Unit costs[7]	Actual costs	Actual costs	Actual costs	Actual costs	Unit costs (usual accounting practices)	Flat-rate costs[8]					
	a1	a2	a3	b	c1	c2	c3	d2	e = 0,25 * (a1 + a2 + a3 + c1 + c2 + c3)	f = a + b + c + d + e	U	g = f * U%	h	m
1 - HSE	602 000.00	0.00	0.00	0.00	37 000.00	160 210 000.00	585 000.00	0.00	40 358 500.00	201 792 500.00	70	141 254 750.00	4 705 880.93	4 705 880.93
1.1 - TES, d.o.o.	94 225.00	0.00	0.00	0.00	8 000.00	0.00	0.00	0.00	25 556.25	127 781.25	70	89 446.88	89 446.88	89 446.88
1.2 - HSE INVEST	193 500.00	0.00	0.00	0.00	0.00	0.00	50 000.00	0.00	60 875.00	304 375.00	70	213 062.50	213 062.50	213 062.50
2 - AREA	462 000.00	0.00	0.00	100 000.00	40 000.00	0.00	15 000.00	0.00	129 250.00	746 250.00	100	746 250.00	461 060.00	461 060.00
3 - ECUBES	832 500.00	0.00	0.00	150 000.00	90 000.00	5 334 000.00	350 000.00	0.00	1 651 625.00	8 408 125.00	70	5 885 687.50	1 500 000.00	1 500 000.00
4 - INDELOOP LTD	128 000.00	0.00	0.00	250 000.00	7 000.00	200 000.00	50 000.00	25 000.00	96 250.00	756 250.00	70	529 375.00	68 658.29	68 658.29
5 - MCEoE	2 125 830.00	0.00	0.00	0.00	153 240.00	930 000.00	715 000.00	0.00	981 017.50	4 905 087.50	70	3 433 561.25	445 322.20	445 322.20
6 - Dilj d.o.o.	435 000.00	0.00	0.00	200 000.00	100 000.00	33 497 000.00	1 270 000.00	740 000.00	8 825 500.00	45 067 500.00	70	31 547 250.00	3 978 095.26	3 978 095.26
7 - Gitone	250 000.00	0.00	0.00	230 000.00	30 000.00	100 000.00	0.00	0.00	95 000.00	705 000.00	70	493 500.00	64 005.41	64 005.41
8 - ACI d.d.	150 500.00	0.00	0.00	450 000.00	70 000.00	12 850 000.00	50 000.00	0.00	3 280 125.00	16 850 625.00	70	11 795 437.50	1 528 696.65	1 528 696.65
9 - HRASTNIK 1860	405 000.00	0.00	0.00	40 000.00	12 000.00	5 135 000.00	850 000.00	0.00	1 600 500.00	8 042 500.00	70	5 629 750.00	500 000.00	500 000.00
10 - SALONIT	210 000.00	0.00	0.00	0.00	30 000.00	3 580 000.00	600 000.00	0.00	1 105 000.00	5 525 000.00	70	3 867 500.00	500 000.00	500 000.00
11 - ACEGAS	531 156.74	0.00	0.00	1 990 800.00	0.00	7 646 900.00	0.00	0.00	2 044 514.19	12 213 370.93	70	8 549 359.65	1 691 253.00	1 691 253.00
12 - Active Solera	888 000.00	0.00	0.00	775 000.00	30 000.00	6 353 000.00	745 000.00	0.00	2 004 000.00	10 795 000.00	70	7 556 500.00	980 054.51	980 054.51
13 - FABER	440 000.00	0.00	0.00	0.00	12 000.00	150 000.00	287 400.00	0.00	222 350.00	1 111 750.00	70	778 225.00	778 225.00	778 225.00
14 - ABS	265 000.00	0.00	0.00	10 000.00	31 000.00	4 900 000.00	700 000.00	0.00	1 474 000.00	7 380 000.00	70	5 166 000.00	788 710.90	788 710.90
14.1 - DANIELI	159 000.00	0.00	0.00	0.00	35 000.00	0.00	810 000.00	0.00	251 000.00	1 255 000.00	70	878 500.00	134 123.60	134 123.60
15 - CTS H2	360 000.00	0.00	0.00	360 000.00	17 520.00	270 000.00	570 450.00	0.00	304 492.50	1 882 462.50	70	1 317 723.75	922 834.50	922 834.50
16 - SNAM S.P.A.	415 800.00	0.00	0.00	300 000.00	0.00	700 000.00	150 000.00	0.00	316 450.00	1 882 250.00	70	1 317 575.00	952 834.50	952 834.50
17 - FBK	400 200.00	0.00	0.00	0.00	20 000.00	0.00	102 500.00	0.00	130 675.00	653 375.00	100	653 375.00	457 362.50	457 362.50
18 - UNITS	469 800.00	0.00	0.00	0.00	22 000.00	62 000.00	89 000.00	0.00	160 700.00	803 500.00	100	803 500.00	401 750.00	401 750.00
19 - UL	368 550.00	0.00	0.00	0.00	14 800.00	25 800.00	67 200.00	0.00	119 087.50	595 437.50	100	595 437.50	297 718.75	297 718.75
20 - UNIRI	135 000.00	0.00	0.00	0.00	45 358.17	0.00	4 200.00	0.00	46 139.54	230 697.71	100	230 697.71	115 348.86	115 348.86
20.1 - TEHN.FAKULT.	56 250.00	0.00	0.00	0.00	24 469.43	0.00	0.00	0.00	20 179.86	100 899.29	100	100 899.29	50 449.64	50 449.64
20.2 - UNI SPLIT	61 875.00	0.00	0.00	0.00	20 391.20	0.00	0.00	0.00	20 566.55	102 832.75	100	102 832.75	51 416.38	51 416.38
20.3 - UNI ZG FSB	61 875.00	0.00	0.00	0.00	20 391.20	0.00	0.00	0.00	20 566.55	102 832.75	100	102 832.75	51 416.38	51 416.38
21 - MzI	556 625.00	0.00	0.00	0.00	10 000.00	0.00	0.00	0.00	141 656.25	708 281.25	100	708 281.25	354 140.81	354 140.81
22 - FHA	250 000.00	0.00	0.00	0.00	29 600.00	0.00	6 000.00	0.00	71 400.00	357 000.00	100	357 000.00	214 200.00	214 200.00
23 - Tpl Fvg	48 000.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12 000.00	60 000.00	70	42 000.00	6 077.94	6 077.94
23.1 - TRIESTETRASPORT	96 000.00	0.00	0.00	0.00	0.00	2 500 000.00	0.00	0.00	649 000.00	3 245 000.00	70	2 271 500.00	588 041.08	588 041.08
23.2 - A.P.T. S.P.A.	144 000.00	0.00	0.00	0.00	0.00	4 500 000.00	0.00	0.00	1 161 000.00	5 805 000.00	70	4 063 500.00	328 715.47	328 715.47
24 - META	112 000.00	0.00	98 292.80	0.00	12 000.00	0.00	30 000.00	0.00	63 073.20	315 366.00	70	220 756.20	220 756.20	220 756.20

	Estimated eligible[1] costs (per budget category)										Estimated EU contribution[2]			
	Direct costs								Indirect costs	Total costs	EU contribution to eligible costs			Maximum grant amount[6]
	A. Personnel costs			B. Subcontracting costs	C. Purchase costs			D. Other cost categories	E. Indirect costs[3]		Funding rate %[4]	Maximum EU contribution[5]	Requested EU contribution	
	A.1 Employees (or equivalent) A.2 Natural persons under direct contract A.3 Seconded persons		A.4 SME owners and natural person beneficiaries	B. Subcontracting	C.1 Travel and subsistence	C.2 Equipment	C.3 Other goods, works and services	D.2 Internally invoiced goods and services	E. Indirect costs					
Forms of funding	Actual costs	Unit costs (usual accounting practices)	Unit costs[7]	Actual costs	Actual costs	Actual costs	Actual costs	Unit costs (usual accounting practices)	Flat-rate costs[8]					
	a1	a2	a3	b	c1	c2	c3	d2	e = 0,25 * (a1 + a2 + a3 + c1 + c2 + c3)	f = a + b + c + d + e	U	g = f * U%	h	m
24.1 - META SPRL	130 000.00	0.00	0.00	0.00	8 000.00	0.00	0.00	0.00	34 500.00	172 500.00	70	120 750.00	120 750.00	120 750.00
24.2 - META SLO	200 000.00	0.00	0.00	58 000.00	12 000.00	0.00	39 807.20	0.00	62 951.80	372 759.00	70	260 931.30	260 931.30	260 931.30
25 - FENO	249 400.00	0.00	0.00	0.00	0.00	407 000.00	145 000.00	0.00	200 350.00	1 001 750.00	70	701 225.00	701 225.00	701 225.00
26 - REGIONE FVG	345 419.00	0.00	0.00	300 000.00	15 000.00	0.00	0.00	0.00	90 104.75	750 523.75	100	750 523.75	375 262.25	375 262.25
27 - MINGOR	158 400.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	39 600.00	198 000.00	100	198 000.00	99 000.00	99 000.00
Σ consortium	12 790 905.74	0.00	98 292.80	5 213 800.00	956 770.00	249 350 700.00	8 281 557.20	765 000.00	67 869 556.44	345 326 582.18		243 333 496.53	24 996 826.69	24 996 826.69

[1] See Article 6 for the eligibility conditions. All amounts must be expressed in EUR (see Article 21 for the conversion rules).
[2] The consortium remains free to decide on a different internal distribution of the EU funding (via the consortium agreement; see Article 7).
[3] Indirect costs already covered by an operating grant (received under any EU funding programme) are ineligible (see Article 6.3). Therefore, a beneficiary/affiliated entity that receives an operating grant during the action duration cannot declare indirect costs for the year(s)/reporting period(s) covered by the operating grant, unless they can demonstrate that the operating grant does not cover any costs of the action. This requires specific accounting tools. Please immediately contact us via the EU Funding & Tenders Portal for details.
[4] See Data Sheet for the funding rate(s).
[5] This is the theoretical amount of the EU contribution to costs, if the reimbursement rate is applied to all the budgeted costs. This theoretical amount is then capped by the 'maximum grant amount'.
[6] The 'maximum grant amount' is the maximum grant amount decided by the EU. It normally corresponds to the requested grant, but may be lower.
[7] See Annex 2a 'Additional information on the estimated budget' for the details (units, cost per unit).
[8] See Data Sheet for the flat-rate.

ANNEX 2a

ADDITIONAL INFORMATION ON UNIT COSTS AND CONTRIBUTIONS

SME owners/natural person beneficiaries without salary

See Additional information on unit costs and contributions (Annex 2a and 2b)

HE and Euratom Research Infrastructure actions

See Additional information on unit costs and contributions (Annex 2a and 2b)

Euratom staff mobility costs

See Additional information on unit costs and contributions (Annex 2a and 2b)

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

AREA DI RICERCA SCIENTIFICA E TECNOLOGICA DI TRIESTE (AREA), PIC 999549887, established in PADRICIANO 99, TRIESTE 34149, Italy,

hereby agrees

to become beneficiary

in Agreement No 101111927 — NAHV ('the Agreement')

between HOLDING SLOVENSKE ELEKTRARNE DOO (HSE) **and Clean Hydrogen Joint Undertaking** ('granting authority'), under the powers delegated by the European Commission ('European Commission'),

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 39.

By signing this accession form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and terms and conditions it sets out.

SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

ECUBES TEHNOLOGIJE D.O.O. (ECUBES), PIC 891137837, established in ULICA GRADNIKOVE BRIGADE 49, NOVA GORICA 5000, Slovenia,

hereby agrees

to become beneficiary

in Agreement No 101111927 — NAHV ('the Agreement')

between HOLDING SLOVENSKE ELEKTRARNE DOO (HSE) **and Clean Hydrogen Joint Undertaking** ('granting authority'), under the powers delegated by the European Commission ('European Commission'),

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 39.

By signing this accession form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and terms and conditions it sets out.

SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

INDELOOP DOO ZA PROIZVODNJU ELEKTRICE ENERGIJE I GOSPODARENJE (INDELOOP LTD), PIC 889967144, established in SLAVONSKA AVENIJA 22G, ZAGREB 10000, Croatia,

hereby agrees

to become beneficiary

in Agreement No 101111927 — NAHV ('the Agreement')

between HOLDING SLOVENSKE ELEKTRARNE DOO (HSE) **and Clean Hydrogen Joint Undertaking** ('granting authority'), under the powers delegated by the European Commission ('European Commission'),

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 39.

By signing this accession form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and terms and conditions it sets out.

SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

MARITIME CENTER OF EXCELLENCE D.O.O (MCEoE), PIC 890309554, established in MARSALA TITA 198, OPATIJA 51410, Croatia,

hereby agrees

to become beneficiary

in Agreement No 101111927 — NAHV ('the Agreement')

between HOLDING SLOVENSKE ELEKTRARNE DOO (HSE) **and Clean Hydrogen Joint Undertaking** ('granting authority'), under the powers delegated by the European Commission ('European Commission'),

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 39.

By signing this accession form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and terms and conditions it sets out.

SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

DILJ INDUSTRIJA GRADEVINSKOG MATERIJALA D.O.O. (Dilj d.o.o.), PIC 912302752, established in CIGLARSKA 33, VINKOVCI 32100, Croatia,

hereby agrees

to become beneficiary

in Agreement No 101111927 — NAHV ('the Agreement')

between HOLDING SLOVENSKE ELEKTRARNE DOO (HSE) **and Clean Hydrogen Joint Undertaking** ('granting authority'), under the powers delegated by the European Commission ('European Commission'),

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 39.

By signing this accession form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and terms and conditions it sets out.

SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

GITONE KVARNER D.O.O. (Gitone), PIC 885404846, established in ULICA ANDRIJE HEBRANGA 32, ZAGREB 10000, Croatia,

hereby agrees

to become beneficiary

in Agreement No 101111927 — NAHV ('the Agreement')

between HOLDING SLOVENSKE ELEKTRARNE DOO (HSE) **and Clean Hydrogen Joint Undertaking** ('granting authority'), under the powers delegated by the European Commission ('European Commission'),

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 39.

By signing this accession form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and terms and conditions it sets out.

SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

ADRIATIC CROATIA INTERNATIONAL CLUBZA DJELATNOST MARINA D. D. (ACI d.d.), PIC 885416389, established in RUDOLFA STROHALA 2, RIJEKA 51000, Croatia,

hereby agrees

to become beneficiary

in Agreement No 101111927 — NAHV ('the Agreement')

between HOLDING SLOVENSKE ELEKTRARNE DOO (HSE) **and Clean Hydrogen Joint Undertaking** ('granting authority'), under the powers delegated by the European Commission ('European Commission'),

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 39.

By signing this accession form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and terms and conditions it sets out.

SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

STEKLARNA HRASTNIK DRUZBA ZA PROIZVPROIZVODNJO STEKLENIH IZDELKOV DOO (HRASTNIK 1860), PIC 896379523, established in CESTA 1 MAJA 14, HRASTNIK 1430, Slovenia,

hereby agrees

to become beneficiary

in Agreement No 101111927 — NAHV ('the Agreement')

between HOLDING SLOVENSKE ELEKTRARNE DOO (HSE) **and Clean Hydrogen Joint Undertaking** ('granting authority'), under the powers delegated by the European Commission ('European Commission'),

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 39.

By signing this accession form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and terms and conditions it sets out.

SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

SALONIT ANHOVO GRADBENI MATERIALI D.D. (SALONIT), PIC 964288447, established in ANHOVO 1, DESKLE 5210, Slovenia,

hereby agrees

to become beneficiary

in Agreement No 101111927 — NAHV ('the Agreement')

between HOLDING SLOVENSKE ELEKTRARNE DOO (HSE) **and Clean Hydrogen Joint Undertaking** ('granting authority'), under the powers delegated by the European Commission ('European Commission'),

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 39.

By signing this accession form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and terms and conditions it sets out.

SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

ACEGASAPSAMGA S.P.A. (ACEGAS), PIC 904079092, established in VIA DEL TEATRO 5, TRIESTE 34121, Italy,

hereby agrees

to become beneficiary

in Agreement No 101111927 — NAHV ('the Agreement')

between HOLDING SLOVENSKE ELEKTRARNE DOO (HSE) **and Clean Hydrogen Joint Undertaking** ('granting authority'), under the powers delegated by the European Commission ('European Commission'),

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 39.

By signing this accession form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and terms and conditions it sets out.

SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

ACTIVE SOLERA JEDNOSTAVNO DRUSTVO S OGRANICENOM ODGOVORNOSCU ZA USLUGE (Active Solera), PIC 894700065, established in EDE MURTICA 2, ZAGREB 10000, Croatia,

hereby agrees

to become beneficiary

in Agreement No 101111927 — NAHV ('the Agreement')

between HOLDING SLOVENSKE ELEKTRARNE DOO (HSE) **and Clean Hydrogen Joint Undertaking** ('granting authority'), under the powers delegated by the European Commission ('European Commission'),

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 39.

By signing this accession form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and terms and conditions it sets out.

SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

FABER INDUSTRIE SPA (FABER), PIC 986351291, established in VIA DELL INDUSTRIA 23, CIVIDALE DEL FRIULI 33043, Italy,

hereby agrees

to become beneficiary

in Agreement No 101111927 — NAHV ('the Agreement')

between HOLDING SLOVENSKE ELEKTRARNE DOO (HSE) **and** **Clean Hydrogen Joint Undertaking** ('granting authority'), under the powers delegated by the European Commission ('European Commission'),

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 39.

By signing this accession form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and terms and conditions it sets out.

SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

ACCIAIERIE BERTOLI SAFAU SPA (ABS), PIC 888149946, established in VIA BUTTRIO 28, POZZUOLO DEL FRIULI 33050, Italy,

hereby agrees

to become beneficiary

in Agreement No 101111927 — NAHV ('the Agreement')

between HOLDING SLOVENSKE ELEKTRARNE DOO (HSE) **and Clean Hydrogen Joint Undertaking** ('granting authority'), under the powers delegated by the European Commission ('European Commission'),

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 39.

By signing this accession form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and terms and conditions it sets out.

SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

CTS H2 S.R.L. (CTS H2), PIC 894678434, established in VIALE LINO ZANUSSI 1, BRUGNERA 33070, Italy,

hereby agrees

to become beneficiary

in Agreement No 101111927 — NAHV ('the Agreement')

between HOLDING SLOVENSKE ELEKTRARNE DOO (HSE) **and Clean Hydrogen Joint Undertaking** ('granting authority'), under the powers delegated by the European Commission ('European Commission'),

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 39.

By signing this accession form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and terms and conditions it sets out.

SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

SNAM S.P.A. (SNAM S.P.A.), PIC 905331265, established in PIAZZA SANTA BARBARA 7, SAN DONATO MILANESE 20097, Italy,

hereby agrees

to become beneficiary

in Agreement No 101111927 — NAHV ('the Agreement')

between HOLDING SLOVENSKE ELEKTRARNE DOO (HSE) **and Clean Hydrogen Joint Undertaking** ('granting authority'), under the powers delegated by the European Commission ('European Commission'),

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 39.

By signing this accession form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and terms and conditions it sets out.

SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

FONDAZIONE BRUNO KESSLER (FBK), PIC 999625450, established in VIA SANTA CROCE 77, TRENTO 38122, Italy,

hereby agrees

to become beneficiary

in Agreement No 101111927 — NAHV ('the Agreement')

between HOLDING SLOVENSKE ELEKTRARNE DOO (HSE) **and Clean Hydrogen Joint Undertaking** ('granting authority'), under the powers delegated by the European Commission ('European Commission'),

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 39.

By signing this accession form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and terms and conditions it sets out.

SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

UNIVERSITA DEGLI STUDI DI TRIESTE (UNITS), PIC 999842051, established in PIAZZALE EUROPA 1, TRIESTE 34127, Italy,

hereby agrees

to become beneficiary

in Agreement No 101111927 — NAHV ('the Agreement')

between HOLDING SLOVENSKE ELEKTRARNE DOO (HSE) **and Clean Hydrogen Joint Undertaking** ('granting authority'), under the powers delegated by the European Commission ('European Commission'),

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 39.

By signing this accession form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and terms and conditions it sets out.

SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

UNIVERZA V LJUBLJANI (UL), PIC 999923240, established in KONGRESNI TRG 12, LJUBLJANA 1000, Slovenia,

hereby agrees

to become beneficiary

in Agreement No 101111927 — NAHV ('the Agreement')

between HOLDING SLOVENSKE ELEKTRARNE DOO (HSE) **and Clean Hydrogen Joint Undertaking** ('granting authority'), under the powers delegated by the European Commission ('European Commission'),

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 39.

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SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

SVEUCILISTE U RIJECI (UNIRI), PIC 997640733, established in TRG BRACE MAZURANICA 10, RIJEKA 51000, Croatia,

hereby agrees

to become beneficiary

in Agreement No 101111927 — NAHV ('the Agreement')

between HOLDING SLOVENSKE ELEKTRARNE DOO (HSE) **and Clean Hydrogen Joint Undertaking** ('granting authority'), under the powers delegated by the European Commission ('European Commission'),

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 39.

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SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

MINISTRSTVO ZA INFRASTRUKTURO (MzI), PIC 952242696, established in TRZASKA CESTA 19, LJUBLJANA 1000, Slovenia,

hereby agrees

to become beneficiary

in Agreement No 101111927 — NAHV ('the Agreement')

between HOLDING SLOVENSKE ELEKTRARNE DOO (HSE) **and Clean Hydrogen Joint Undertaking** ('granting authority'), under the powers delegated by the European Commission ('European Commission'),

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 39.

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SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

FUNDACION PARA EL DESARROLLO DE LAS NUEVAS TECNOLOGIAS DEL HIDROGENO EN ARAGON (FHA), PIC 997456918, established in CR ZARAGOZA N 330A KM 566 CUARTE, HUESCA 22197, Spain,

hereby agrees

to become beneficiary

in Agreement No 101111927 — NAHV ('the Agreement')

between HOLDING SLOVENSKE ELEKTRARNE DOO (HSE) **and Clean Hydrogen Joint Undertaking** ('granting authority'), under the powers delegated by the European Commission ('European Commission'),

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 39.

By signing this accession form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and terms and conditions it sets out.

SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

TPL FVG S.C. A R.L. (Tpl Fvg), PIC 885121994, established in VIA CADUTI DI AN NASIRIYAH 6, GORIZIA 34170, Italy,

hereby agrees

to become beneficiary

in Agreement No 101111927 — NAHV ('the Agreement')

between HOLDING SLOVENSKE ELEKTRARNE DOO (HSE) **and****Clean Hydrogen Joint Undertaking** ('granting authority'), under the powers delegated by the European Commission ('European Commission'),

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 39.

By signing this accession form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and terms and conditions it sets out.

SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

META GROUP SRL (META), PIC 999735157, established in VIALE UMBERTO TUPINI 116, ROMA 00144, Italy,

hereby agrees

to become beneficiary

in Agreement No 101111927 — NAHV ('the Agreement')

between HOLDING SLOVENSKE ELEKTRARNE DOO (HSE) **and Clean Hydrogen Joint Undertaking** ('granting authority'), under the powers delegated by the European Commission ('European Commission'),

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 39.

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SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

FERRIERE NORD SPA (FENO), PIC 960976479, established in VIA ZONA INDUSTRIALE FRAZ RIVOLI, OSOPPO UD 33010, Italy,

hereby agrees

to become beneficiary

in Agreement No 101111927 — NAHV ('the Agreement')

between HOLDING SLOVENSKE ELEKTRARNE DOO (HSE) **and Clean Hydrogen Joint Undertaking** ('granting authority'), under the powers delegated by the European Commission ('European Commission'),

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 39.

By signing this accession form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and terms and conditions it sets out.

SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

REGIONE AUTONOMA FRIULI-VENEZIA GIULIA (REGIONE FVG), PIC 983174347, established in PIAZZA UNITA D ITALIA 1, TRIESTE 34121, Italy,

hereby agrees

to become beneficiary

in Agreement No 101111927 — NAHV ('the Agreement')

between HOLDING SLOVENSKE ELEKTRARNE DOO (HSE) **and Clean Hydrogen Joint Undertaking** ('granting authority'), under the powers delegated by the European Commission ('European Commission'),

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 39.

By signing this accession form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and terms and conditions it sets out.

SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

MINISTARSTVO GOSPODARSTVA I ODRZIVOG RAZVOJA (MINGOR), PIC 916533310, established in RADNICKA CESTA 80, Zagreb 10000, Croatia,

hereby agrees

to become beneficiary

in Agreement No 101111927 — NAHV ('the Agreement')

between HOLDING SLOVENSKE ELEKTRARNE DOO (HSE) **and Clean Hydrogen Joint Undertaking** ('granting authority'), under the powers delegated by the European Commission ('European Commission'),

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 39.

By signing this accession form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and terms and conditions it sets out.

SIGNATURE

For the beneficiary

FINANCIAL STATEMENT FOR [PARTICIPANT NAME] FOR REPORTING PERIOD [NUMBER]

	Eligible[1] costs (per budget category)																EU contribution[2]				Revenues
	Direct costs															Indirect costs	Total costs	EU contribution to eligible costs			Total requested EU contribution	Income generated by the action
	A. Personnel costs			B. Subcontracting costs	C. Purchase costs			D. Other cost categories								E. Indirect costs[2]		Funding rate %[3]	Maximum EU contribution[4]	Requested EU contribution		
	A.1 Employees (or equivalent) A.2 Natural persons under direct contract A.3 Seconded persons		A.4 SME owners and natural person beneficiaries	B. Subcontracting	C.1 Travel and subsistence	C.2 Equipment	C.3 Other goods, works and services	[D.1 Financial support to third parties]	D.2 Internally invoiced goods and services	[D.3 Transnational access to research infrastructure unit costs]	[D.4 Virtual access to research infrastructure unit costs]	*[OPTION for HE PCP/PPI:* D.5 PCP/PPI procurement costs*]*	*[OPTION for Euratom Programme Cofund Actions:* D.6 Euratom Cofund staff mobility costs*]*	*[OPTION for HE ERC Grants:* D.7 ERC additional funding*]*	*[OPTION for HE ERC Grants:* D.8 ERC additional funding (subcontracting, FSTP and internally invoiced goods and services)*]*	E. Indirect costs						
Forms of funding	Actual costs	Unit costs (usual accounting practices)	Unit costs[5]	Actual costs	Actual costs	Actual costs	Actual costs	[Actual costs]	Unit costs (usual accounting practices)	[Unit costs[5]]	[Unit costs[5]]	[Actual costs]	[Unit costs[5]]	[Actual costs]	[Actual costs]	Flat-rate costs[6]						
	a1	a2	a3	b	c1	c2	c3	[d1a]	d2	[d3]	[d4]	[d5]	[d6]	[d7]	[d8]	e = 0,25 * (a1 + a2 + a3 ~~+b+~~ c1 +c2 + c3 ~~+d1a + d2 + d3 + d4 [+ d5][+ d6]~~ [+d7] ~~[+ d8]~~)	f = a+b+c+d+e	U	g = f*U%	h	m	n
XX – [short name beneficiary/affiliated entity]																						

The beneficiary/affiliated entity hereby confirms that:

The information provided is complete, reliable and true.

The costs and contributions declared are eligible (see Article 6).

The costs and contributions can be substantiated by adequate records and supporting documentation that will be produced upon request or in the context of checks, reviews, audits and investigations (see Articles 19, 20 and 25).

For the last reporting period: that all the revenues have been declared (see Article 22).

① Please declare all eligible costs and contributions, even if they exceed the amounts indicated in the estimated budget (see Annex 2). Only amounts that were declared in your individual financial statements can be taken into account lateron, in order to replace costs/contributions that are found to be ineligible.

[1] See Article 6 for the eligibility conditions. All amounts must be expressed in EUR (see Article 21 for the conversion rules).

[2] If you have also received an EU operating grant during this reporting period, you cannot claim indirect costs - unless you can demonstrate that the operating grant does not cover any costs of the action. This requires specific accounting tools. Please contact us immediately via the Funding & Tenders Portal for details.

[3] See Data Sheet for the reimbursement rate(s).

[4] This is the *theoretical* amount of EU contribution to costs that the system calculates automatically (by multiplying the reimbursement rates by the costs declared). The amount you request (in the column 'requested EU contribution') may be less.

[5] See Annex 2a 'Additional information on the estimated budget' for the details (units, cost per unit).

[6] See Data Sheet for the flat-rate.

ANNEX 5

SPECIFIC RULES

CONFIDENTIALITY AND SECURITY (— ARTICLE 13)

Sensitive information with security recommendation

Sensitive information with a security recommendation must comply with the additional requirements imposed by the granting authority.

Before starting the action tasks concerned, the beneficiaries must have obtained all approvals or other mandatory documents needed for implementing the task. The documents must be kept on file and be submitted upon request by the coordinator to the granting authority. If they are not in English, they must be submitted together with an English summary.

For requirements restricting disclosure or dissemination, the information must be handled in accordance with the recommendation and may be disclosed or disseminated only after written approval from the granting authority.

EU classified information

If EU classified information is used or generated by the action, it must be treated in accordance with the security classification guide (SCG) and security aspect letter (SAL) set out in Annex 1 and Decision 2015/444[1] and its implementing rules — until it is declassified.

Deliverables which contain EU classified information must be submitted according to special procedures agreed with the granting authority.

Action tasks involving EU classified information may be subcontracted only with prior explicit written approval from the granting authority and only to entities established in an EU Member State or in a non-EU country with a security of information agreement with the EU (or an administrative arrangement with the Commission).

EU classified information may not be disclosed to any third party (including participants involved in the action implementation) without prior explicit written approval from the granting authority.

ETHICS (— ARTICLE 14)

Ethics and research integrity

The beneficiaries must carry out the action in compliance with:

[1] Commission Decision 2015/444/EC, Euratom of 13 March 2015 on the security rules for protecting EU classified information (OJ L 72, 17.3.2015, p. 53).

- ethical principles (including the highest standards of research integrity)

and

- applicable EU, international and national law, including the EU Charter of Fundamental Rights and the European Convention for the Protection of Human Rights and Fundamental Freedoms and its Supplementary Protocols.

No funding can be granted, within or outside the EU, for activities that are prohibited in all Member States. No funding can be granted in a Member State for an activity which is forbidden in that Member State.

The beneficiaries must pay particular attention to the principle of proportionality, the right to privacy, the right to the protection of personal data, the right to the physical and mental integrity of persons, the right to non-discrimination, the need to ensure protection of the environment and high levels of human health protection.

The beneficiaries must ensure that the activities under the action have an exclusive focus on civil applications.

The beneficiaries must ensure that the activities under the action do not:

- aim at human cloning for reproductive purposes
- intend to modify the genetic heritage of human beings which could make such modifications heritable (with the exception of research relating to cancer treatment of the gonads, which may be financed)
- intend to create human embryos solely for the purpose of research or for the purpose of stem cell procurement, including by means of somatic cell nuclear transfer, or
- lead to the destruction of human embryos (for example, for obtaining stem cells).

Activities involving research on human embryos or human embryonic stem cells may be carried out only if:

- they are set out in Annex 1 or
- the coordinator has obtained explicit approval (in writing) from the granting authority.

In addition, the beneficiaries must respect the fundamental principle of research integrity — as set out in the European Code of Conduct for Research Integrity[2].

This implies compliance with the following principles:

- reliability in ensuring the quality of research reflected in the design, the methodology, the analysis and the use of resources

[2] European Code of Conduct for Research Integrity of ALLEA (All European Academies).

- honesty in developing, undertaking, reviewing, reporting and communicating research in a transparent, fair and unbiased way

- respect for colleagues, research participants, society, ecosystems, cultural heritage and the environment

- accountability for the research from idea to publication, for its management and organisation, for training, supervision and mentoring, and for its wider impacts

and means that beneficiaries must ensure that persons carrying out research tasks follow the good research practices including ensuring, where possible, openness, reproducibility and traceability and refrain from the research integrity violations described in the Code.

Activities raising ethical issues must comply with the additional requirements formulated by the ethics panels (including after checks, reviews or audits; see Article 25).

Before starting an action task raising ethical issues, the beneficiaries must have obtained all approvals or other mandatory documents needed for implementing the task, notably from any (national or local) ethics committee or other bodies such as data protection authorities.

The documents must be kept on file and be submitted upon request by the coordinator to the granting authority. If they are not in English, they must be submitted together with an English summary, which shows that the documents cover the action tasks in question and includes the conclusions of the committee or authority concerned (if any).

VALUES (— ARTICLE 14)

Gender mainstreaming

The beneficiaries must take all measures to promote equal opportunities between men and women in the implementation of the action and, where applicable, in line with the gender equality plan. They must aim, to the extent possible, for a gender balance at all levels of personnel assigned to the action, including at supervisory and managerial level.

INTELLECTUAL PROPERTY RIGHTS (IPR) — BACKGROUND AND RESULTS — ACCESS RIGHTS AND RIGHTS OF USE (— ARTICLE 16)

Definitions

Access rights — Rights to use results or background.

Dissemination — The public disclosure of the results by appropriate means, other than resulting from protecting or exploiting the results, including by scientific publications in any medium.

Exploit(ation) — The use of results in further research and innovation activities other than those covered by the action concerned, including among other things, commercial exploitation such as developing, creating, manufacturing and marketing a product or process, creating and providing a service, or in standardisation activities.

Fair and reasonable conditions — Appropriate conditions, including possible financial terms or royalty-free conditions, taking into account the specific circumstances of the request for access, for example the actual or potential value of the results or background to which access is requested and/or the scope, duration or other characteristics of the exploitation envisaged.

FAIR principles — 'findability', 'accessibility', 'interoperability' and 'reusability'.

Open access — Online access to research outputs provided free of charge to the end-user.

Open science — An approach to the scientific process based on open cooperative work, tools and diffusing knowledge.

Research data management — The process within the research lifecycle that includes the organisation, storage, preservation, security, quality assurance, allocation of persistent identifiers (PIDs) and rules and procedures for sharing of data including licensing.

Research outputs — Results to which access can be given in the form of scientific publications, data or other engineered results and processes such as software, algorithms, protocols, models, workflows and electronic notebooks.

Scope of the obligations

For this section, references to 'beneficiary' or 'beneficiaries' do not include affiliated entities (if any).

Agreement on background — Background free from restrictions

The beneficiaries must identify in a written agreement the background as needed for implementing the action or for exploiting its results.

Where the call conditions restrict control due to strategic interests reasons, background that is subject to control or other restrictions by a country (or entity from a country) which is not one of the eligible countries or target countries set out in the call conditions and that impact the exploitation of the results (i.e. would make the exploitation of the results subject to control or restrictions) must not be used and must be explicitly excluded in the agreement on background — unless otherwise agreed with the granting authority.

Results free from restrictions

Where the call conditions restrict control due to strategic interests reasons, the beneficiaries must ensure that the results of the action are not subject to control or other restrictions by a country (or entity from a country) which is not one of the eligible countries or target countries set out in the call conditions — unless otherwise agreed with the granting authority.

Ownership of results

Results are owned by the beneficiaries that generate them.

However, two or more beneficiaries own results jointly if:

- they have jointly generated them and
- it is not possible to:
    - establish the respective contribution of each beneficiary, or
    - separate them for the purpose of applying for, obtaining or maintaining their protection.

The joint owners must agree — in writing — on the allocation and terms of exercise of their joint ownership ('joint ownership agreement'), to ensure compliance with their obligations under this Agreement.

Unless otherwise agreed in the joint ownership agreement or consortium agreement, each joint owner may grant non-exclusive licences to third parties to exploit the jointly-owned results (without any right to sub-license), if the other joint owners are given:

- at least 45 days advance notice and
- fair and reasonable compensation.

The joint owners may agree — in writing — to apply another regime than joint ownership.

If third parties (including employees and other personnel) may claim rights to the results, the beneficiary concerned must ensure that those rights can be exercised in a manner compatible with its obligations under the Agreement.

The beneficiaries must indicate the owner(s) of the results (results ownership list) in the final periodic report.

Protection of results

Beneficiaries which have received funding under the grant must adequately protect their results — for an appropriate period and with appropriate territorial coverage — if protection is possible and justified, taking into account all relevant considerations, including the prospects for commercial exploitation, the legitimate interests of the other beneficiaries and any other legitimate interests.

Exploitation of results

Beneficiaries which have received funding under the grant must — up to four years after the end of the action (see Data Sheet, Point 1) — use their best efforts to exploit their results directly or to have them exploited indirectly by another entity, in particular through transfer or licensing.

If, despite a beneficiary's best efforts, the results are not exploited within one year after the end of the action, the beneficiaries must (unless otherwise agreed in writing with the granting authority) use the Horizon Results Platform to find interested parties to exploit the results.

If results are incorporated in a standard, the beneficiaries must (unless otherwise agreed with the granting authority or unless it is impossible) ask the standardisation body to include the funding statement (see Article 17) in (information related to) the standard.

Additional exploitation obligations

Where the call conditions impose additional exploitation obligations (including obligations linked to the restriction of participation or control due to strategic assets, interests, autonomy or security reasons), the beneficiaries must comply with them — up to four years after the end of the action (see Data Sheet, Point 1).

Where the call conditions impose additional exploitation obligations in case of a public emergency, the beneficiaries must (if requested by the granting authority) grant for a limited period of time specified in the request, non-exclusive licences — under fair and reasonable conditions — to their results to legal entities that need the results to address the public emergency and commit to rapidly and broadly exploit the resulting products and services at fair and reasonable conditions. This provision applies up to four years after the end of the action (see Data Sheet, Point 1).

Additional information obligation relating to standards

Where the call conditions impose additional information obligations relating to possible standardisation, the beneficiaries must — up to four years after the end of the action (see Data Sheet, Point 1) — inform the granting authority, if the results could reasonably be expected to contribute to European or international standards.

Transfer and licensing of results

Transfer of ownership

The beneficiaries may transfer ownership of their results, provided this does not affect compliance with their obligations under the Agreement.

The beneficiaries must ensure that their obligations under the Agreement regarding their results are passed on to the new owner and that this new owner has the obligation to pass them on in any subsequent transfer.

Moreover, they must inform the other beneficiaries with access rights of the transfer at least 45 days in advance (or less if agreed in writing), unless agreed otherwise in writing for specifically identified third parties including affiliated entities or unless impossible under the applicable law. This notification must include sufficient information on the new owner to enable the beneficiaries concerned to assess the effects on their access rights. The beneficiaries may object within 30 days of receiving notification (or less if agreed in writing), if they can show that the transfer would adversely affect their access rights. In this case, the transfer may not take place until agreement has been reached between the beneficiaries concerned.

Granting licences

The beneficiaries may grant licences to their results (or otherwise give the right to exploit them), including on an exclusive basis, provided this does not affect compliance with their obligations.

Exclusive licences for results may be granted only if all the other beneficiaries concerned have waived their access rights.

Granting authority right to object to transfers or licensing — Horizon Europe actions

Where the call conditions in Horizon Europe actions provide for the right to object to transfers or licensing, the granting authority may — up to four years after the end of the action (see Data Sheet, Point 1) — object to a transfer of ownership or the exclusive licensing of results, if:

- the beneficiaries which generated the results have received funding under the grant
- it is to a legal entity established in a non-EU country not associated with Horizon Europe, and
- the granting authority considers that the transfer or licence is not in line with EU interests.

Beneficiaries that intend to transfer ownership or grant an exclusive licence must formally notify the granting authority before the intended transfer or licensing takes place and:

- identify the specific results concerned
- describe in detail the new owner or licensee and the planned or potential exploitation of the results, and
- include a reasoned assessment of the likely impact of the transfer or licence on EU interests, in particular regarding competitiveness as well as consistency with ethical principles and security considerations.

The granting authority may request additional information.

If the granting authority decides to object to a transfer or exclusive licence, it must formally notify the beneficiary concerned within 60 days of receiving notification (or any additional information it has requested).

No transfer or licensing may take place in the following cases:

- pending the granting authority decision, within the period set out above
- if the granting authority objects
- until the conditions are complied with, if the granting authority objection comes with conditions.

A beneficiary may formally notify a request to waive the right to object regarding intended transfers or grants to a specifically identified third party, if measures safeguarding EU interests are in place. If the granting authority agrees, it will formally notify the beneficiary concerned within 60 days of receiving notification (or any additional information requested).

Limitations to transfers and licensing due to strategic assets, interests, autonomy or security reasons of the EU and its Member States

Where the call conditions restrict participation or control due to strategic assets, interests, autonomy or security reasons, the beneficiaries may not transfer ownership of their results or grant licences to third parties which are established in countries which are not eligible

countries or target countries set out in the call conditions (or, if applicable, are controlled by such countries or entities from such countries) — unless they have requested and received prior approval by the granting authority.

The request must:

- identify the specific results concerned
- describe in detail the new owner and the planned or potential exploitation of the results, and
- include a reasoned assessment of the likely impact of the transfer or license on the strategic assets, interests, autonomy or security of the EU and its Member States.

The granting authority may request additional information.

Access rights to results and background

Exercise of access rights — Waiving of access rights — No sub-licensing

Requests to exercise access rights and the waiver of access rights must be in writing.

Unless agreed otherwise in writing with the beneficiary granting access, access rights do not include the right to sub-license.

If a beneficiary is no longer involved in the action, this does not affect its obligations to grant access.

If a beneficiary defaults on its obligations, the beneficiaries may agree that that beneficiary no longer has access rights.

Access rights for implementing the action

The beneficiaries must grant each other access — on a royalty-free basis — to background needed to implement their own tasks under the action, unless the beneficiary that holds the background has — before acceding to the Agreement —:

- informed the other beneficiaries that access to its background is subject to restrictions, or
- agreed with the other beneficiaries that access would not be on a royalty-free basis.

The beneficiaries must grant each other access — on a royalty-free basis — to results needed for implementing their own tasks under the action.

Access rights for exploiting the results

The beneficiaries must grant each other access — under fair and reasonable conditions — to results needed for exploiting their results.

The beneficiaries must grant each other access — under fair and reasonable conditions — to background needed for exploiting their results, unless the beneficiary that holds the

background has — before acceding to the Agreement — informed the other beneficiaries that access to its background is subject to restrictions.

Requests for access must be made — unless agreed otherwise in writing — up to one year after the end of the action (see Data Sheet, Point 1).

Access rights for entities under the same control

Unless agreed otherwise in writing by the beneficiaries, access to results and, subject to the restrictions referred to above (if any), background must also be granted — under fair and reasonable conditions — to entities that:

- are established in an EU Member State or Horizon Europe associated country
- are under the direct or indirect control of another beneficiary, or under the same direct or indirect control as that beneficiary, or directly or indirectly controlling that beneficiary and
- need the access to exploit the results of that beneficiary.

Unless agreed otherwise in writing, such requests for access must be made by the entity directly to the beneficiary concerned.

Requests for access must be made — unless agreed otherwise in writing — up to one year after the end of the action (see Data Sheet, Point 1).

Access rights for the granting authority, EU institutions, bodies, offices or agencies and national authorities to results for policy purposes — Horizon Europe actions

In Horizon Europe actions, the beneficiaries which have received funding under the grant must grant access to their results — on a royalty-free basis — to the granting authority, EU institutions, bodies, offices or agencies for developing, implementing and monitoring EU policies or programmes. Such access rights do not extend to beneficiaries' background.

Such access rights are limited to non-commercial and non-competitive use.

For actions under the cluster 'Civil Security for Society', such access rights also extend to national authorities of EU Member States for developing, implementing and monitoring their policies or programmes in this area. In this case, access is subject to a bilateral agreement to define specific conditions ensuring that:

- the access rights will be used only for the intended purpose and
- appropriate confidentiality obligations are in place.

Moreover, the requesting national authority or EU institution, body, office or agency (including the granting authority) must inform all other national authorities of such a request.

Additional access rights

Where the call conditions impose additional access rights, the beneficiaries must comply with them.

COMMUNICATION, DISSEMINATION, OPEN SCIENCE AND VISIBILITY (— ARTICLE 17)

Dissemination

Dissemination of results

The beneficiaries must disseminate their results as soon as feasible, in a publicly available format, subject to any restrictions due to the protection of intellectual property, security rules or legitimate interests.

A beneficiary that intends to disseminate its results must give at least 15 days advance notice to the other beneficiaries (unless agreed otherwise), together with sufficient information on the results it will disseminate.

Any other beneficiary may object within (unless agreed otherwise) 15 days of receiving notification, if it can show that its legitimate interests in relation to the results or background would be significantly harmed. In such cases, the results may not be disseminated unless appropriate steps are taken to safeguard those interests.

Additional dissemination obligations

Where the call conditions impose additional dissemination obligations, the beneficiaries must also comply with those.

Open Science

Open science: open access to scientific publications

The beneficiaries must ensure open access to peer-reviewed scientific publications relating to their results. In particular, they must ensure that:

- at the latest at the time of publication, a machine-readable electronic copy of the published version or the final peer-reviewed manuscript accepted for publication, is deposited in a trusted repository for scientific publications

- immediate open access is provided to the deposited publication via the repository, under the latest available version of the Creative Commons Attribution International Public Licence (CC BY) or a licence with equivalent rights; for monographs and other long-text formats, the licence may exclude commercial uses and derivative works (e.g. CC BY-NC, CC BY-ND) and

- information is given via the repository about any research output or any other tools and instruments needed to validate the conclusions of the scientific publication.

Beneficiaries (or authors) must retain sufficient intellectual property rights to comply with the open access requirements.

Metadata of deposited publications must be open under a Creative Common Public Domain Dedication (CC 0) or equivalent, in line with the FAIR principles (in particular machine-actionable) and provide information at least about the following: publication (author(s), title, date of publication, publication venue); Horizon Europe or Euratom funding; grant project

name, acronym and number; licensing terms; persistent identifiers for the publication, the authors involved in the action and, if possible, for their organisations and the grant. Where applicable, the metadata must include persistent identifiers for any research output or any other tools and instruments needed to validate the conclusions of the publication.

Only publication fees in full open access venues for peer-reviewed scientific publications are eligible for reimbursement.

Open science: research data management

The beneficiaries must manage the digital research data generated in the action ('data') responsibly, in line with the FAIR principles and by taking all of the following actions:

- establish a data management plan ('DMP') (and regularly update it)
- as soon as possible and within the deadlines set out in the DMP, deposit the data in a trusted repository; if required in the call conditions, this repository must be federated in the EOSC in compliance with EOSC requirements
- as soon as possible and within the deadlines set out in the DMP, ensure open access — via the repository — to the deposited data, under the latest available version of the Creative Commons Attribution International Public License (CC BY) or Creative Commons Public Domain Dedication (CC 0) or a licence with equivalent rights, following the principle 'as open as possible as closed as necessary', unless providing open access would in particular:
    - be against the beneficiary's legitimate interests, including regarding commercial exploitation, or
    - be contrary to any other constraints, in particular the EU competitive interests or the beneficiary's obligations under this Agreement; if open access is not provided (to some or all data), this must be justified in the DMP
- provide information via the repository about any research output or any other tools and instruments needed to re-use or validate the data.

Metadata of deposited data must be open under a Creative Common Public Domain Dedication (CC 0) or equivalent (to the extent legitimate interests or constraints are safeguarded), in line with the FAIR principles (in particular machine-actionable) and provide information at least about the following: datasets (description, date of deposit, author(s), venue and embargo); Horizon Europe or Euratom funding; grant project name, acronym and number; licensing terms; persistent identifiers for the dataset, the authors involved in the action, and, if possible, for their organisations and the grant. Where applicable, the metadata must include persistent identifiers for related publications and other research outputs.

Open science: additional practices

Where the call conditions impose additional obligations regarding open science practices, the beneficiaries must also comply with those.

Where the call conditions impose additional obligations regarding the validation of scientific publications, the beneficiaries must provide (digital or physical) access to data or other results

needed for validation of the conclusions of scientific publications, to the extent that their legitimate interests or constraints are safeguarded (and unless they already provided the (open) access at publication).

Where the call conditions impose additional open science obligations in case of a public emergency, the beneficiaries must (if requested by the granting authority) immediately deposit any research output in a repository and provide open access to it under a CC BY licence, a Public Domain Dedication (CC 0) or equivalent. As an exception, if the access would be against the beneficiaries' legitimate interests, the beneficiaries must grant non-exclusive licenses — under fair and reasonable conditions — to legal entities that need the research output to address the public emergency and commit to rapidly and broadly exploit the resulting products and services at fair and reasonable conditions. This provision applies up to four years after the end of the action (see Data Sheet, Point 1).

Plan for the exploitation and dissemination of results including communication activities

Unless excluded by the call conditions, the beneficiaries must provide and regularly update a plan for the exploitation and dissemination of results including communication activities.

SPECIFIC RULES FOR CARRYING OUT THE ACTION (— ARTICLE 18)

Implementation in case of restrictions due to strategic assets, interests, autonomy or security of the EU and its Member States

Where the call conditions restrict participation or control due to strategic assets, interests, autonomy or security, the beneficiaries must ensure that none of the entities that participate as affiliated entities, associated partners, third parties giving in-kind contributions, subcontractors or recipients of financial support to third parties are established in countries which are not eligible countries or target countries set out in the call conditions (or, if applicable, are controlled by such countries or entities from such countries) — unless otherwise agreed with the granting authority.

The beneficiaries must moreover ensure that any cooperation with entities established in countries which are not eligible countries or target countries set out in the call conditions (or, if applicable, are controlled by such countries or entities from such countries) does not affect the strategic assets, interests, autonomy or security of the EU and its Member States.

Recruitment and working conditions for researchers

The beneficiaries must take all measures to implement the principles set out in the Commission Recommendation on the European Charter for Researchers and the Code of Conduct for the Recruitment of Researchers[3], in particular regarding:

- working conditions
- transparent recruitment processes based on merit, and

[3] Commission Recommendation 2005/251/EC of 11 March 2005 on the European Charter for Researchers and on a Code of Conduct for the Recruitment of Researchers (OJ L 75, 22.3.2005, p. 67).

- career development.

The beneficiaries must ensure that researchers and all participants involved in the action are aware of them.

Specific rules for access to research infrastructure activities

Definitions

Research Infrastructures — Facilities that provide resources and services for the research communities to conduct research and foster innovation in their fields. This definition includes the associated human resources, and it covers major equipment or sets of instruments; knowledge-related facilities such as collections, archives or scientific data infrastructures; computing systems, communication networks, and any other infrastructure, of a unique nature and open to external users, essential to achieve excellence in research and innovation. Where relevant, they may be used beyond research, for example for education or public services, and they may be 'single-sited', 'virtual' or 'distributed'[4]:

When implementing access to research infrastructure activities, the beneficiaries must respect the following conditions:

- for transnational access:
  - access which must be provided:

    The access must be free of charge, transnational access to research infrastructure or installations for selected user-groups.

    The access must include the logistical, technological and scientific support and the specific training that is usually provided to external researchers using the infrastructure. Transnational access can be either in person (hands-on), provided to selected users that visit the installation to make use of it, or remote, through the provision to selected user-groups of remote scientific services (e.g. provision of reference materials or samples, remote access to a high-performance computing facility).

  - categories of users that may have access:

    Transnational access must be provided to selected user-groups, i.e. teams of one or more researchers (users).

    The majority of the users must work in a country other than the country(ies) where the installation is located (unless access is provided by an international organisation, the Joint Research Centre (JRC), an ERIC or similar legal entity).

[4] See Article 2(1) of the Horizon Europe Framework Programme Regulation 2021/695.

Only user groups that are allowed to disseminate the results they have generated under the action may benefit from the access (unless the users are working for SMEs).

Access for user groups with a majority of users not working in a EU Member State or Horizon Europe associated country is limited to 20% of the total amount of units of access provided under the grant (unless a higher percentage is foreseen in Annex 1).

- procedure and criteria for selecting user groups:

  The user groups must request access by submitting (in writing) a description of the work that they wish to carry out and the names, nationalities and home institutions of the users.

  The user groups must be selected by (one or more) selection panels set up by the consortium.

  The selection panels must be composed of international experts in the field, at least half of them independent from the consortium (unless otherwise specified in Annex 1).

  The selection panels must assess all proposals received and recommend a short-list of the user groups that should benefit from access.

  The selection panels must base their selection on scientific merit, taking into account that priority should be given to user groups composed of users who:

  - have not previously used the installation and
  - are working in countries where no equivalent research infrastructure exist.

  It will apply the principles of transparency, fairness and impartiality.

  Where the call conditions impose additional rules for the selection of user groups, the beneficiaries must also comply with those.

- other conditions:

  The beneficiaries must request written approval from the granting authority for the selection of user groups requiring visits to the installations exceeding 3 months (unless such visits are foreseen in Annex 1).

  In addition, the beneficiaries must:

  - advertise widely, including on a their websites, the access offered under the Agreement
  - promote equal opportunities in advertising the access and take into account the gender dimension when defining the support provided to users
  - ensure that users comply with the terms and conditions of the Agreement

- ensure that its obligations under Articles 12, 13, 17 and 33 also apply to the users

- keep records of the names, nationalities, and home institutions of users, as well as the nature and quantity of access provided to them

- for virtual access:

  - access which must be provided:

    The access must be free of charge, virtual access to research infrastructure or installations.

    'Virtual access' means open and free access through communication networks to digital resources and services needed for research, without selecting the users to whom access is provided.

    The access must include the support that is usually provided to external users.

    Where allowed by the call conditions, beneficiaries may in justified cases define objective eligibility criteria (e.g. affiliation to a research or academic institution) for specific users.

  - other conditions:

    The beneficiaries must have the virtual access services assessed periodically by a board composed of international experts in the field, at least half of whom must be independent from the consortium (unless otherwise specified in Annex 1). For this purpose, information and statistics on the users and the nature and quantity of the access provided, must be made available to the board.

    The beneficiaries must advertise widely, including on a dedicated website, the access offered under the grant and the eligibility criteria, if any.

    Where the call conditions impose additional traceability[5] obligations, information on the traceability of the users and the nature and quantity of access must be provided by the beneficiaries.

These obligations apply regardless of the form of funding or budget categories used to declare the costs (unit costs or actual costs or a combination of the two).

Specific rules for JU actions

JU actions must contribute to the long-term implementation of the JU partnership, including the JU Strategic Research and Innovation Agenda, the JU objectives and the exploitation of research and innovation results.

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[5] According to the definition given in ISO 9000, i.e.: "Traceability is the ability to trace the history, application, use and location of an item or its characteristics through recorded identification data." The users can be traced, for example, by authentication and/or by authorization or by other means that allows for analysis of the type of users and the nature and quantity of access provided.

Moreover, when implementing JU actions, the members and contributing partners of the Joint Undertaking must fulfil their obligations regarding contributions to the Joint Undertaking:

- the description of the action in Annex 1 must include, for beneficiaries, affiliated entities, associated partners or other participants or third parties which are members or contributing partners, the estimated contributions to the action, i.e.:
    - in-kind contributions to operational activities ('IKOP'; if applicable)
    - in-kind contributions to additional activities linked to the action ('IKAA'; if applicable)
    - financial contributions ('FC'; if applicable)
- the contributions must be reported during the implementation of the action in the Portal Continuous Reporting tool
- at the end of the action, the members and contributing partners that have not received funding under the grant must ensure that financial and in-kind contributions of EUR 430 000 or more (see Article 21) are supported by statements of contributions (CS) and certificates on the statements of contributions (CCS) which fulfil the following conditions:
    - be provided by a qualified approved external auditor which is independent and complies with Directive 2006/43/EC (or for public bodies: by a competent independent public officer)
    - the verification must be carried out according to the highest professional standards to ensure that the statements of contributions comply with the provisions under the Agreement and the applicable JU Regulation, that the contributions cover activities that are part of the action and that they have not been reimbursed by the grant
- contributions must comply with the following conditions:
    - costs covered by financial contributions cannot be claimed for reimbursement under the JU grant
    - for Clean Aviation JU, SNS JU, Europe's Rail JU, CBE JU grants: if provided in the call conditions, a certain percentage of the total costs of the action must be covered by contributions (IKOP, IKAA or FC)
    - for IHI JU grants: at least 45% (or another amount set out in the call conditions) of the total costs of the action and of the related IKAA must be covered by contributions (IKOP, IKAA or FC)
    - for IHI JU grants: non-EU costs must not exceed 20% (or other percentage set out in the call conditions) of IKOP provided by members and contributing partners.

The beneficiaries must comply with the additional IPR, dissemination and exploitation obligations set out in the call conditions (Article 16 and Annex 5), in particular:

- for all JU grants: the granting authority right to object to transfers or licensing also applies to results generated by beneficiaries not having received funding under the grant

- for SESAR 3 JU and Clean Aviation JU grants: in view of the long innovation cycles:

    - the granting authority right to object to transfers or licensing (if any) can be exercised for up to 10 years after the end of the action (see Data Sheet, Point 1)

    - the beneficiaries must comply with their best effort obligation to exploit the results and any additional exploitation obligations imposed by the call conditions for up to 10 years after the end of the action (see Data Sheet, Point 1)

- for IHI JU and Global Health EDCTP3 JU grants (if applicable): the beneficiaries must ensure that the products and services that they develop based or partially based on the results of clinical studies undertaken as part of the grant are affordable, available and accessible to the public at fair and reasonable conditions.

In addition to the obligations set out in Article 17, communication and dissemination activities as well as infrastructure, equipment or major results funded under JU actions must moreover display the Joint Undertaking's special logo:

and the following text:

> "The project is supported by the [insert JU name] and its members *[OPTION for actions with national contribution top-ups:* (including top-up funding by [name of the national funding authority])*]*."

For EuroHPC JU and KDT JU grants, the beneficiaries must respect the following conditions when implementing actions with national contribution top-ups from Participating States:

- the beneficiaries must ensure visibility of the national contributions (see below)
- the payment deadlines for prefinancing, interim or final payments are automatically suspended if a national funding authority is late with its payments to the Joint Undertaking for the national contribution top-up
- the European Anti-Fraud Office (OLAF), European Public Prosecutor's Office (EPPO), European Court of Auditors (ECA), the National Court of Auditors and other national authorities can exercise their control rights on the project implementation and costs declared, including for the national contribution top-up.

For SNS JU grants, where imposed by the call conditions for digital infrastructure projects the beneficiaries must ensure that the network technologies and equipment (including software and services) funded by the action comply with the security requirements and assessments as reflected in the applicable EU, international and national law on cybersecurity and on data protection.

Moreover, where the call conditions impose wholesale access obligations, the beneficiaries must provide wholesale access to the digital infrastructure funded by the action, under fair and reasonable conditions, in a non-discriminatory manner and in accordance with the call conditions.

For Global Health EDCTP3 JU fellowship grants, the beneficiaries must respect the following conditions when implementing them through financial support to third parties:

- avoid any conflict of interest and comply with the principles of transparency, non-discrimination and sound financial management
- take all measures to implement the principles set out in the Commission Recommendation on the European Charter for Researchers and the Code of Conduct for the Recruitment of Researchers[6] and ensure that the researchers and all participants involved in the action are aware of them
- ensure that the researchers enjoy at the place of the implementation at least the same standards and working conditions as those applicable to local researchers holding a similar position
- ensure that the other direct contract or fixed-amount-fellowship agreement specifies:
    - the name of the supervisor(s) and/or mentor(s) for the research and training activities
    - the starting date and duration of the research and training activities
    - the monthly support for the researcher under this Agreement (in euro and, if relevant, in the currency in which the remuneration is paid)
    - the obligation of the researcher to work exclusively for the action, unless part-time has been approved and not to receive, for activities carried out in the frame of the action, other incomes than those received from the beneficiary or other entities mentioned in Annex 1)
    - the working pattern of the researcher
    - the arrangements related to the intellectual property rights (during implementation of the action and afterwards), in particular full access — on a royalty-free basis — for the researcher to background and results needed for their activities under the action
    - the obligation of the researcher to inform as soon as possible about events or circumstances likely to affect the implementation of the action or the compliance with requirements under the Agreement (see Article 19)
    - the obligation of the researcher to maintain confidentiality (see Article 13)
    - the obligation of the researcher to ensure the visibility of the EDCTP Association and EU funding in communications or publications and in applications for the protection of results (see Articles 17)

[6] Commission Recommendation 2005/251/EC of 11 March 2005 on the European Charter for Researchers and on a Code of Conduct for the Recruitment of Researchers (OJ L 75, 22.3.2005, p. 67).

    - where set out in the call conditions, the obligation of the researcher to carry out a mandatory return period of 12 months

- assist the researchers in the administrative procedures related to the recruitment
- inform the researchers about:
    - the description, conditions, location and timetable for the implementation of the research and training activities
    - the rights and obligations toward the researchers under this Agreement
    - the obligation of the researchers to complete and submit — at the end of the research training activities — the evaluation questionnaire and — two years later — follow-up questionnaire provided by the granting authority
- ensure full access — on a royalty-free basis — for the researchers to background and results needed for their activities under the action
- ensure that the researchers do not have to bear any costs for the implementation of the action as described in Annex 1
- provide training, infrastructure and the necessary means for implementing the action (or ensure that such training and means are provided by other participants in the action)
- ensure that the researchers are adequately supervised and receive appropriate career guidance
- ensure that personalised career development plans are established, support their implementation and update in view of the needs of the researchers
- ensure an appropriate exposure to the non-academic sector (if applicable)
- respect the maximum limit for secondments set out in the call conditions (if applicable)
- respect the conditions for the outgoing and return phases set out in the call conditions (if any)
- ensure that the researchers are informed that they are ‘Global Health EDCTP3 JU fellows’
- ensure that the researchers do not receive, for activities carried out in the frame of the action, other incomes than those received from the beneficiaries (or other entities mentioned in Annex 1)
- host the researchers at their premises (or at the premises of other participants in the action).

Consortium Agreement

DESCA
MODEL CONSORTIUM
AGREEMENT

[NAHV]

Version [1] – [06/09/2022]

(Based on DESCA – Model Consortium Agreement for Horizon Europe, version 1, December 2021)

Table of Contents

[Change Records]

Version	Date	Changes
Version 1.0	06/09/2022	First draft provided by HSE and AREA
Version 1.1	28/09/2022	Integration of the comments
Version 1.2	31/03/2023	Integration of the comments
Version 2.0		

REMARKS

To be completed (tbc).

CONSORTIUM AGREEMENT

THIS CONSORTIUM AGREEMENT is based upon Regulation (EU) No 2021/695 of the European Parliament and of the Council of 28 April 2021 establishing Horizon Europe – the Framework Programme for Research and Innovation (2021-2027), laying down its rules for participation and dissemination (hereinafter referred to as "Horizon Europe Regulation"), and on the European Commission's General Model Grant Agreement and its Annexes, and is made on Project start date, hereinafter referred to as the Effective Date

BETWEEN:

HOLDING SLOVENSKE ELEKTRARNE D.O.O. (HSE), Koprska ulica 92, 1000 Ljubljana Slovenia, the Coordinator

AREA DI RICERCA SCIENTIFICA E TECNOLOGICA DI TRIESTE (AREA SCIENCE PARK), Padriciano 99, 34149 Trieste, Italy. The Co-coordinator

ECUBES TEHNOLOGIJE, d.o.o (ECUBES), Ulica Gradnikove Brigade 49, 5000 Nova Gorica, Slovenia

INDELOOP d.o.o, za proizvodnju električne energij I gospodarjenje (INDELOOP), Slavonska avenija 22G, 10000 Zagreb, Croatia,

MARITIME CENTER OF EXCELLENCE, D.O.O. (MCOE), Maršala Tita 198, 51410 Opatija, Croatia

DILJ INDUSTRIJA GRADEVNISKOG MATERIJALA D.O.O. (Dilj d.o.o.), Ciglarska 33, 32100 Vinkovci, Croatia

GITONE KVARNER, D.O.O., (GITONE), Ulica Andrije Hebranga 32, 10000 Zagreb, Croatia

ADRIATIC CROATIA INTERNATIONAL CLUB ZA DJELATNOST MARINA D.D. (ACI D.D.), Rudolfa Strohala 2, 51000 Rijeka, Croatia

STEKLARNA HRASTNIK DRUŽBA ZA PROIZVODNJO STEKLENIH IZDELKOV D.O.O., (STEKLARNA HRASTNIK), Cesta 1. Maja 14, 1430 Hrastnik, Slovenia

SALONIT ANHOVO GRADBENI MATERIALI D.D. (SALONIT), Anhovo 1, 5210 Deskle, Slovenia

ACEGASAPSAMGA S.P.A., (ACEGAS), Via del Teatro 5, 34121 Trieste, Italy

ACTIVE SOLERA JEDNOSTAVNO DRUŠTVO S OGRANIČENOM ODGOVORNOŠČU ZA USLUGE, (ACTIVE SOLERA), Ede Murtiča 2, 10000 Zagreb, Croatia

CIMOLAI SPA (CIMOLAI), Viale Pasteur 49, 00144 Roma, Italy

FABER INDUSTRI SPA (FABER), Via dell industria 23, 33043 Cividale del Friuli, Italy

ACCIAIERIE BERTOLI SAFAU SPA (ABS), Via Buttrio 28, 33050 Pozzuolo del Friuli, Italy

CTS H2 S.R.L., (CTS H2), Viale Lino Zanussi 1, 33070 Brugnera, Italy

SNAM S.P.A. (SNAM), Piazza Santa Barbra 7, 20097 San Donato Milanese, Italy

FUNDAZIONE BRUNO KESSLER (FBK), Via Santa Croce 77, 38122 Trento, Italy

UNIVERSITA DEGLI STUDI DI TRIESTE (UNITS), Piazzale Europa 1, 34127 Trieste, Italy

UNIVERZA V LJUBLJANI, (UL), Kongresni trg 12, 1000 Ljubljana, Slovenia

SVEUČILIŠTE U RIJECI (UNIRI), Trg Brače Mažuranica 10, 51000 Rijeka, Croatia

MINISTRSTVO ZA INFRASTRUKTURO (MZI), Langusova ulica 4, 1000 Ljubljana, Slovenia

FUNACION PARA EL DESARROLLO DE LAS NUEVAS TECHNOLOGIAS DEL HIDROGENO EN ARAGON (FHA), Cr Zaragoza N 330A KM 566 Cuarte, 22197 Huesca Espania

TPL FVG S.C. A.R.L., (TPL FVG), Vai Caduti di An Narisyah 6, 34170 Gorizia, Italy

META GROUP SRL (META), Viale Umberto Tupini 116, 00144 Roma, Italy

FERRIERE NORD SPA (FENO), Via zona industrial Fraz Rivoli, 33010, Osoppo Udine, Italy

REGIONE AUTONOMA FRIULI-VENEZIA GIULIA (REGIONE FVG), Piazza Unita d Italia 1, 34121 Trieste, Italy

MINISTARSTVO GOSPODARSTVA I ODRŽIVOG RAZVOJA (MINGOR), Radnička cesta 80, 10000 Zagreb, Croatia

hereinafter, jointly or individually, referred to as "Parties" or "Party"

relating to the Action entitled

North Adriatic Hydrogen Valley

in short

NAHV

hereinafter referred to as "Project"

WHEREAS:

The Parties, having considerable experience in the field concerned, have submitted a proposal for the Project to the Granting Authority as part of Horizon Europe – the Framework Programme for Research and Innovation (2021-2027).

The Parties wish to specify or supplement binding commitments among themselves in addition to the provisions of the specific Grant Agreement to be signed by the Parties and the Granting Authority (hereinafter "Grant Agreement").

The Parties are aware that this Consortium Agreement is based upon the DESCA model consortium agreement that has been adapted to the specific needs of the NAHV Project.

NOW, THEREFORE, IT IS HEREBY AGREED AS FOLLOWS:

1 Definitions

1.1 Definitions

Words beginning with a capital letter shall have the meaning defined either herein or in the Horizon Europe Regulation or in the Grant Agreement including its Annexes.

1.2 Additional Definitions

"Consortium Body"

Consortium Body means any management body described in Section 6 (Governance Structure) of this Consortium Agreement.

"Consortium Plan"

Consortium Plan means the description of the Action and the related agreed budget as first defined in the Grant Agreement and which may be updated by the Project Management Board.

"Granting Authority"

means the body awarding the grant for the Project.

"Defaulting Party"

Defaulting Party means a Party which the Project Management Board has identified to be in breach of this Consortium Agreement and/or the Grant Agreement as specified in Section 4.3 of this Consortium Agreement.

"Non Performing Party"

Non Performing Party means:

- a Party which has not reached the amount of expenditure due for the given reporting period at the time of the end of such reporting period, and/or
- a Party which has not deliver the deliverables and/or reach the milestones foreseen for the given party at the time of the end of such reporting period, and/or
- a Party which has not reached the phase of advanced payment foreseen at art. 7.3.2 of this Consortium Agreement.

"Needed"

means:

For the implementation of the Project:

Access Rights are Needed if, without the grant of such Access Rights, carrying out the tasks assigned to the recipient Party would be technically or legally impossible, significantly delayed, or require significant additional financial or human resources.

For Exploitation of own Results:

Access Rights are Needed if, without the grant of such Access Rights, the Exploitation of own Results would be technically or legally impossible.

"Software"

Software means sequences of instructions to carry out a process in, or convertible into, a form executable by a computer and fixed in any tangible medium of expression.

2 Purpose

The purpose of this Consortium Agreement is to specify with respect to the Project the relationship among the Parties, in particular concerning the organisation of the work between the Parties, the management of the Project and the rights and obligations of the Parties concerning inter alia liability, Access Rights and dispute resolution.

3 Entry into force, duration and termination

3.1 Entry into force

An entity becomes a Party to this Consortium Agreement upon signature of this Consortium Agreement by a duly authorised representative.

This Consortium Agreement shall have effect from the Effective Date identified at the beginning of this Consortium Agreement.

An entity becomes a new Party to the Consortium Agreement upon signature of the accession document (Attachment 2) by the new Party and the Coordinator. Such accession shall have effect from the date identified in the accession document.

3.2 Duration and termination

This Consortium Agreement shall continue in full force and effect until complete fulfilment of all obligations undertaken by the Parties under the Grant Agreement and under this Consortium Agreement.

However, this Consortium Agreement or the participation of one or more Parties to it may be terminated in accordance with the terms of this Consortium Agreement.

If

- the Grant Agreement is not signed by the Granting Authority or a Party, or
- the Grant Agreement is terminated, or
- a Party's participation in the Grant Agreement is terminated,

this Consortium Agreement shall automatically terminate in respect of the affected Party/ies, subject to the provisions surviving the expiration or termination under Section 3.3 of this Consortium Agreement.

3.3 Survival of rights and obligations

The provisions relating to Access Rights, Dissemination and confidentiality, for the time period mentioned therein, as well as for liability, applicable law and settlement of disputes shall survive the expiration or termination of this Consortium Agreement.

Termination shall not affect any rights or obligations of a Party leaving the Project incurred prior to the date of termination, unless otherwise agreed between the Project Management Board and the leaving Party. This includes the obligation to provide all necessary input, deliverables and documents for the period of its participation.

4 Responsibilities of Parties

4.1 General principles

Each Party undertakes to take part in the efficient implementation of the Project, and to cooperate, perform and fulfil, promptly and on time, all of its obligations under the Grant Agreement and this Consortium Agreement as may be reasonably required from it and in a manner of good faith as prescribed by Belgian law.

Each Party undertakes to notify promptly the Granting Authority and the other Parties, in accordance with the governance structure of the Project, of any significant information, fact, problem or delay likely to affect the Project.

Each Party has to obey with the obligation to keep information up to date and to inform about events and circumstances likely to affect the Grant Agreement according to Article 19.2 of the Grant Agreement.

Each Party is obliged to keep records and other supporting documentation according to Article 20 of the Grant Agreement.

Each Party must submit to the Coordinator reports regarding their participation in the Project according to Article 21 of the Grant Agreement.

Each Party must inform the Coordinator about any IPR that is held by the Party and is needed to implement the Action or exploit the Results.

Each Party shall promptly provide all information reasonably required by a Consortium Body or by the Coordinator to carry out its tasks and shall responsibly manage the access of its employees to the EU Funding & Tenders Portal.

Each Party shall take reasonable measures to ensure the accuracy of any information or materials it supplies to the other Parties.

4.2 Internal reporting

Every 9 months the parties have to submit to the coordinator for internal project advancement monitoring purposes an internal reporting on progress of the expenditures of the project done in the form of the financial statement and of the activities implemented in the period (including internal deliverables performed as stated in art.4.2.1). A template for this financial and technical report will be included in the Project Management handbook (D1.1). The release of the advanced payment will be subject to the actual incurred expenditure as recorded in the internal reporting.

4.2.1 Internal deliverable

For the sake of a swift project's implementation and reporting, a series of "internal" deliverables and milestones to be reached are planned. Those "internal" deliverables aim to set up a tracking mechanism to measure the implementation process of the test beds and studies foreseen in WP 3-4-5. The tables in attachment 2 encompass the delivery day, the description, and the format of the expected deliverables. Amendments to the below tables are possible only if adequately explained and requested before the delivery date. All the planned deliverables must be of adequate quality and must provide a clear reporting of the state of advancement of the project and they must send to the coordinator 1 month after the delivery date. By signing this document, the Parties authorize the Coordinator to submit these documents to the funding agency also for reporting purposes.

4.3 Breach

In the event that the Project Management Board identifies a breach by a Party of its obligations under this Consortium Agreement or the Grant Agreement (e.g. improper implementation of the Project), the Coordinator or, if the Coordinator is in breach of its obligations, the Party appointed by the Project Management Board, will give formal notice to such Party requiring that such breach will be remedied within 30 calendar days from the date of receipt of the written notice by the Party.

If such breach is substantial and is not remedied within that period or is not capable of remedy, the Project Management Board may decide to declare the Party to be a Defaulting Party and to decide on the consequences thereof which may include termination of its participation.

In case of non-compliance of a Party with the obligations stipulated in the Grant Agreement, the consequences set out by the Funding Authority shall be borne by the relevant Party.

A Party aiming to terminate unilaterally the Consortium Agreement should be considered as a Defaulting Party, unless the terms and conditions of this termination has been accepted by a unanimous vote of the General Assembly.

This does not prevent the Party, which is in breach, to submit a dispute to resolution in accordance with the provisions of Settlement of disputes in Section 11.8. of this Consortium Agreement.

4.4 Involvement of third parties

A Party that enters into a subcontract or otherwise involves third parties (including but not limited to Affiliated Entities or other Participants) in the Project remains the sole responsible for carrying out its relevant part of the Project and for such third party's compliance with the provisions of this Consortium Agreement and of the Grant Agreement. Such Party has to ensure that the involvement of third parties does not affect the rights and obligations of the other Parties under this Consortium Agreement and the Grant Agreement. Any third party who has access to confidential Project documentation, attends Project meetings or is otherwise involved in the Project will be required to sign a Non-Disclosure Agreement with the Coordinator.

4.5 Specific responsibilities regarding data protection

Where necessary, the Parties shall cooperate in order to enable one another to fulfil legal obligations arising under applicable data protection laws (the *Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data* and relevant national data protection law applicable to said Party) within the scope of the performance and administration of the Project and of this Consortium Agreement.

In particular, the Parties shall, where necessary, conclude a separate data processing, data sharing and/or joint controller agreement before any data processing or data sharing takes place.

5 Liability towards each other

5.1 No warranties

In respect of any information or materials (incl. Results and Background) supplied by one Party to another under the Project, no warranty or representation of any kind is made, given or implied as to the sufficiency or fitness for purpose nor as to the absence of any infringement of any proprietary rights of third parties.

Therefore,

- the recipient Party shall in all cases be entirely and solely liable for the use to which it puts such information and materials, and
- no Party granting Access Rights shall be liable in case of infringement of proprietary rights of a third party resulting from any other Party (or its entities under the same control) exercising its Access Rights.

5.2 Limitations of contractual liability

No Party shall be responsible to any other Party for any indirect or consequential loss or similar damage such as, but not limited to, loss of profit, loss of revenue or loss of contracts, except in case of breach of confidentiality.

A Party's aggregate liability towards the other Parties collectively shall be limited to once the Party's share of the total costs of the Project as identified in Annex 2 of the Grant Agreement.

A Party's liability shall not be limited under either of the two foregoing paragraphs to the extent such damage was caused by a willful act or gross negligence or to the extent that such limitation is not permitted by law.

The terms of this Consortium Agreement shall not be construed to amend or limit any Party's statutory liability.

5.3 Damage caused to third parties

Each Party shall be solely liable for any loss, damage or injury to third parties resulting from the performance of the said Party's obligations by it or on its behalf under this Consortium Agreement or from its use of Results or Background.

5.4 Force Majeure

No Party shall be considered to be in breach of this Consortium Agreement if it is prevented from fulfilling its obligations under the Consortium Agreement by Force Majeure.

Each Party will notify, in writing, the Project Management Board of any Force Majeure without undue delay. If the consequences of Force Majeure for the Project are not overcome within 6 weeks after such notice, the transfer of tasks - if any - shall be decided by the Project Management Board.

The Parties shall take the necessary measures to limit any damage due to force majeure. They shall do their best to resume the implementation of the action as soon as possible.

6 Governance structure

6.1 General structure

The organisational structure of the consortium shall comprise the following Consortium Bodies:

- The Project Management Board (PMB) as the ultimate decision-making body of the consortium for all matters going beyond the ordinary management of the project and implying amendments to the GA (such as major budget changes, modifications in the workplan, termination of a defaulting partner, etc.). It is composed of 1 representative of each project partner. They will meet virtually every 3 months and physically twice per year to discuss the advancement of the project. Affiliated partners can appoint a representative to the Project Management Board that can participate to all the meetings without voting rights
- The Executive Board (EB) as the supervisory body for the execution of the Project, which shall report to and be accountable to the Project Management Board. The EB is responsible for the overall management and implementation of the project. It is the decision-making body of the project for all ordinary matters and it is composed by 12 members appointed by the coordinator, the 9 WP leaders, the Region Friuli Venezia Giulia and the Ministry of Infrastructure of Slovenia. Those people will be in charge of supporting the coordinator for the day-to-day management of the project.
- the Steering Group (SG), is the external steering body of the project composed by high-level external policy and scientific representatives. Up to five independent international experts will be invited. One of the invited experts will be the chairman of the Stakeholders Advisory Forum.
- The IPR and Data Management Board is responsible for IPR & Data Management Plan first release and updates and for managing all issues related to data management and IPR. The Board is coordinated by the Innovation Manager appointed by the task 1.3 leader University of Trieste, members are appointed from FBK, AREA, the Universities of Ljubljana, Rijeka and Split and META. This Board will meet upon request of partners and at least once a year.
- The Coordinator as the legal entity acting as the intermediary between the Parties and the Granting Authority. The Coordinator shall, in addition to its responsibilities as a Party, perform the tasks assigned to it as described in the Grant Agreement and this Consortium Agreement. The Project Coordinator will be nominated by HSE.
- The co-coordinator as the legal entity which will support the coordinator in the management of the project and in the representation of the project in front of the Granting Authority. The co -coordinator shall, in addition to its responsibilities as a Party, perform the tasks assigned to it as described in the Grant Agreement and this Consortium Agreement. The Project Co-Coordinator will be nominated by Area Science Park.
- The **Work Package Leaders** will each manage a work package in coordination with the Coordinator and ensure smooth and timely delivery of all work package deliverables.

6.2 General operational procedures for all Consortium Bodies

6.2.1 Representation in meetings

Any Party which is appointed to take part in a Consortium Body shall designate one representative (hereinafter referred to as "Member").

Any Member:

- should be present or represented at any meeting;
- may appoint a substitute or a proxy to attend and vote at any meeting; shall participate in a cooperative manner in the meetings,
- May replace its representative and/ or appoint a substitute or a proxy to attend and vote at any meeting though each Party shall use reasonable endeavors to ensure continuity of its representation. If such a replacement, substitute or proxy becomes necessary, the chairperson must be informed in writing. The chairperson will inform the other Parties of any such replacement of a representative and/or appointment of a substitute or proxy

6.2.2 Preparation and organisation of meetings

6.2.2.1 Convening meetings:

The chairperson of a Consortium Body shall convene meetings of that Consortium Body.

	Ordinary meeting	Extraordinary meeting
Project Management Board	Virtually every 3 months, physically twice per year	At any time upon request of the Executive Board or 1/3 of the Members of the Project Management Board
Executive Board	Virtually every 3 months	At any time upon request of any Member of the Executive Board

6.2.2.2 Notice of a meeting

The chairperson of a Consortium Body shall give written notice of a meeting to each Member of that Consortium Body as soon as possible and no later than the minimum number of days preceding the meeting as indicated below.

	Ordinary meeting	Extraordinary meeting

Project Management Board	30 calendar days	15 calendar days
Executive Board	14 calendar days	7 calendar days

6.2.2.3 Sending the agenda

The chairperson of a Consortium Body shall prepare and send each Member of that Consortium Body an agenda no later than the minimum number of days preceding the meeting as indicated below.

Project Management Board	14 calendar days, 7 calendar days for an extraordinary meeting
Executive Board	7 calendar days

6.2.2.4 Adding agenda items:

Any agenda item requiring a decision by the Members of a Consortium Body must be identified as such on the agenda.

Any Member of a Consortium Body may add an item to the original agenda by written notice to all of the other Members of that Consortium Body up to the minimum number of days preceding the meeting as indicated below.

Project Management Board	12 calendar days, 6 calendar days for an extraordinary meeting
Executive Board	4 calendar days

6.2.2.5

During a meeting the Members of a Consortium Body present or represented can unanimously agree to add a new item to the original agenda.

6.2.2.6

Meetings of each Consortium Body may also be held by tele- or videoconference, or other telecommunication means as well as in hybrid format.

6.2.2.7

As general principle the decisions will only be binding once the relevant part of the minutes has been accepted according to Section 6.2.5.2.

In case of urgent issues or when the coordinator will inform the parties in advance in the agenda, the minutes shall be taken of the course of the Consortium Body for evidentiary purposes (not as a condition of its validity).

6.2.2.8

Decisions without a meeting

Any decision may also be taken without a meeting if

a) the Coordinator circulates to all Members of the Project Management Board a suggested decision with a deadline for responses of at least 10 calendar days after receipt by a Party and

b) the decision is agreed by 51 % of all Parties.

The Coordinator shall inform all the Parties of the outcome of the vote.

A veto according to Section 6.2.5 may be submitted up to 15 calendar days after receipt of this information.

The decision will be binding after the Coordinator sends a notification to all Members. The Coordinator will keep records of the votes and make them available to the Parties on request.

6.2.3 Voting rules and quorum

6.2.3.1

Each Consortium Body shall not deliberate and decide validly in meetings unless two-thirds (2/3) of its Members are present or represented (quorum).

If the quorum is not reached, the chairperson of the Consortium Body shall convene another ordinary meeting within 15 calendar days. If in this meeting the quorum is not reached once more, the chairperson shall convene an extraordinary meeting which shall be entitled to decide even if less than the quorum of Members is present or represented.

6.2.3.2

Each Member of a Consortium Body present or represented in the meeting shall have one vote.

6.2.3.3

A Party which the Project Management Board has declared according to Section 4.3 to be a Defaulting Party may not vote.

6.2.3.4

Decisions shall be taken by a majority of 51% of the votes cast. In case of parity the vote of the coordinator will be count twice.

6.2.4 Veto rights

6.2.4.1

A Party which can show that its own work, time for performance, costs, liabilities, intellectual property rights or other legitimate interests would be severely affected by a decision of a Consortium Body may exercise a veto with respect to the corresponding decision or relevant part of the decision.

6.2.4.2

When the decision is not foreseen on the original agenda, a Party may only veto such a decision during the meeting.

6.2.4.3

When a decision has been taken on a new item added to the agenda before or during the meeting, a Party may veto such decision during the meeting or within 15 calendar days after receipt of the draft minutes of the meeting.

A Party that is not appointed to participate to a particular Consortium Body may veto a decision within the same number of calendar days after receipt of the draft minutes of the meeting.

6.2.4.4

When a decision has been taken without a meeting a Party may veto such decision within 15 calendar days after written notice by the chairperson of the outcome of the vote.

6.2.4.5

In case of exercise of veto, the Members of the related Consortium Body shall make every effort to resolve the matter which occasioned the veto to the general satisfaction of all the Parties.

6.2.4.6

A Party may neither veto decisions relating to its identification to be in breach of its obligations nor to its identification as a Defaulting Party. The Defaulting Party may not veto decisions relating to its participation and termination in the consortium or the consequences of them.

6.2.4.7

A Party requesting to leave the consortium may not veto decisions relating thereto.

6.2.5 Minutes of meetings

6.2.5.1

The chairperson of a Consortium Body shall produce minutes of each meeting which shall be the formal record of all decisions taken. He/she shall send the draft minutes to all Members within 10 calendar days of the meeting.

The minutes shall be signed by the person chairing the meeting and the person taking the minutes. The person taking the minutes shall be appointed by the chairperson of the meeting; a non-member may also be appointed to take the minutes. The minutes shall contain the following: place, type and time of the meeting, the person chairing the meeting and the person taking the minutes, the number of participants, indicating the type of participation (present or virtual) and the total number of voting rights represented by the participants, the agenda, the statement by the chairperson of the meeting on the formalities of convening the meeting and constituting a quorum, all motions, the individual voting results (with the voting results yes/no/abstention), the type of voting and the resolutions passed.

6.2.5.2

The minutes shall be considered as accepted if, within 15 calendar days from receipt, no Member has sent an objection by written notice to the chairperson with respect to the accuracy of the draft of the minutes by written notice.

6.2.5.3

The chairperson shall send the accepted minutes to all the Parties and to the Coordinator, who shall retain copies of them.

6.3 Specific operational procedures for the Consortium Bodies

6.3.1 Project Management Board

In addition to the rules described in Section 6.2, the following rules apply:

6.3.1.1 Members

6.3.1.1.1

The Project Management Board shall consist of one representative of each Party (hereinafter Project Management Board Member).

6.3.1.1.2

Each Project Management Board Member shall be deemed to be duly authorised to deliberate, negotiate and decide on all matters listed in Section 6.3.1.2 of this Consortium Agreement. In case, the representative cannot participate in person, the Party which has appointed the representative shall make its best efforts to ensure, that a substitute or proxy with similar qualifications shall always be entitled to replace such person . This also applies if the representative is replaced. Affiliated partners can appoint a representative to the Project Management Board that can participate to all the meetings without voting rights. These members should sign a Non Disclosure Agreement with the Coordinator.

6.3.1.1.3

The Coordinator shall chair all meetings of the Project Management Board, unless decided otherwise in a meeting of the Project Management Board.

6.3.1.1.4

The Parties agree to abide by all decisions of the Project Management Board. This does not prevent the Parties from exercising their veto rights, according to Section 6.2.4.1, or from submitting a dispute to resolution in accordance with the provisions of Settlement of disputes in Section 11.8.

6.3.1.2 Decisions

The Project Management Board shall be free to act on its own initiative to formulate proposals and take decisions in accordance with the procedures set out herein.

In addition, all proposals made by the Executive Board shall also be considered and decided upon by the Project Management Board.

The following decisions shall be taken by the Project Management Board:

- Content and finances Proposals for changes to Annexes 1 and 2 of the Grant Agreement to be agreed by the Granting Authority
- Changes to the Consortium Plan
- Modifications or withdrawal of Background in Attachment 1 (Background Included)

- Additions to Attachment 3 (List of Third Parties for simplified transfer according to Section 8.3.2)
- Additions to Attachment 4 (Identified Affiliated Entities)

Evolution of the consortium

- Amendment to the Consortium Agreement
- Entry of a new Party to the Project and approval of the settlement on the conditions of the accession of such a new Party
- Withdrawal of a Party from the Project and the approval of the settlement on the conditions of the withdrawal
- Identification of a breach by a Party of its obligations under this Consortium Agreement or the Grant Agreement
- Declaration of a Party to be a Defaulting Party
- Remedies to be performed by a Defaulting Party
- Termination of a Defaulting Party's participation in the Project and measures relating thereto
- Proposal to the Granting Authority for a change of the Coordinator
- Proposal to the Granting Authority for suspension of all or part of the Project
- Proposal to the Granting Authority for termination of the Project and the Consortium Agreement

6.3.2 Executive Board

In addition to the rules in Section 6.2, the following rules shall apply:

6.3.2.1 Members

The Executive Board shall consist of the Coordinator and the representatives of the WP leaders, the Region Friuli Venezia Giulia and the Ministry of Infrastructure of Slovenia. The Executive Board will approve the organizations to be invited to participate in the external Stakeholders Advisory Forum.

The Executive Board will be in charge of the appointment of the Steering Group members, proposed by the coordinator and by the co-coordinator.

The Coordinator shall chair all meetings of the Executive Board, unless decided otherwise by a majority of two-thirds.

6.3.2.2 Minutes of meetings

Minutes of Executive Board meetings, once accepted, shall be sent by the Coordinator to the Project Management Board Members for information.

6.3.2.3 Tasks

6.3.2.3.1

The Executive Board shall prepare the meetings, propose decisions and prepare the agenda of the Project Management Board according to Section 6.3.1.2.

6.3.2.3.2

The Executive Board shall seek a consensus among the Parties.

The Executive Board shall be responsible for the proper execution and implementation of the decisions of the Project Management Board for all extraordinary matters and shall be responsible for the overall day-to-day management and implementation of the project for all ordinary matters.

6.3.2.3.3

The Executive Board shall monitor the effective and efficient implementation of the Project as the responsible body for the overall management and implementation of the project

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6.3.2.3.4

In addition, the Executive Board shall collect information at least every 9 months on the progress of the Project, examine that information to assess the compliance of the Project with the Consortium Plan and, if necessary, propose modifications of the Consortium Plan to the Project Management Board.

6.3.2.3.5

The Executive Board shall:

- support the Coordinator in preparing meetings with the Granting Authority and in preparing related data and deliverables
- prepare the content and timing of press releases and joint publications by the consortium or proposed by the Granting Authority in respect of the procedures of the Grant Agreement Article 17 and Annex 5 Section "Communication, Dissemination, Open Science and Visibility" and of Section 8 of this Consortium Agreement.

6.3.2.3.6

In the case of abolished tasks as a result of a decision of the Project Management Board, the Executive Board shall advise the Project Management Board on ways to rearrange tasks and budgets of the Parties concerned. Such rearrangement shall take into consideration any prior legitimate commitments which cannot be cancelled.

6.4 Coordinator

6.4.1

The Coordinator shall be the intermediary between the Parties and the Granting Authority and shall perform all tasks assigned to it as described in the Grant Agreement and in this Consortium Agreement.

The Project Coordinator will liaise with the co-coordinator, the executive board and each Work Package Leaders on a regular basis to monitor progress and quality across all work packages.

The Project Coordinator will have an overview of the entire project and has the role of identifying any potential problems early on and resolving them quickly. The Project Coordinator will concentrate his attention on all critical and any lagging activities and will visit with the co-coordinator and the WP leader those undertaking/underperforming such activities to ensure that all possible action is being taken to keep these activities on course.

6.4.2

In particular, the Coordinator shall be responsible for:

- overall management and coordination of the Project, including planning, execution and controlling of the Project at aggregated level
- monitoring compliance by the Parties with their obligations under this Consortium Agreement and the Grant Agreement
- keeping the address list of Members and other contact persons updated and available
- collecting, reviewing to verify consistency and submitting reports, other deliverables (including financial statements and related certifications) and specific requested documents to the Granting Authority
- transmitting documents and information connected with the Project to any other Parties concerned
- administering the financial contribution of the Granting Authority/ Funding Authority and fulfilling the financial tasks described in Section 7
- providing, upon request, the Parties with official copies or originals of documents that are in the sole possession of the Coordinator when such copies or originals are necessary for the Parties to present claims.
- forwarding to the Funding/Granting Authority the audit certificates provided by the Parties as per the requirements of the Grant Agreement
- delivering in due time the cost justifications provided by the Parties, as per the requirements of the Grant Agreement
- receiving the funds from the Funding Authority on behalf of the Parties and distribute them according to the Grant Agreement and the Consortium Agreement.
- ensuring the timely preparation of administrative progress reports.
- signing the Grant Agreement in the name and on behalf of the Parties (subject to the prior express approval of the Parties).

If one or more of the Parties is late in submission of any Project deliverable, the Coordinator may nevertheless submit the other 'Parties' Project deliverables and all other documents required by the Grant Agreement to the Granting Authority/Funding Authority in time.

6.4.3

If the Coordinator fails in its coordination tasks, the Project Management Board may propose to the Granting Authority/Funding Authority to change the Coordinator.

6.4.4

The Coordinator shall not be entitled to act or to make legally binding declarations on behalf of any other Party or of the consortium, unless explicitly stated otherwise in the Grant Agreement or this Consortium Agreement.

6.4.5

The Coordinator shall not enlarge its role beyond the tasks specified in this Consortium Agreement and in the Grant Agreement.

6.5 Co-Coordinator

6.5.1 AREA Science Park shall take the role of co-coordinator. The Co-Coordinator shall support the Coordinator in the relationship with all the involved legal entities having legal seat in Italy. Considering that the nature of some of the activities in which AREA Science Park is involved have a strong international character, the Co-Coordinator will support the Coordinator in the activities to be held to facilitate the visibility, the expansion and the replication of the NAHV, in particular participating in meetings having an international character.

6.5.2

In particular, the Co-Coordinator shall be responsible for:

- supporting the Italian Parties in fulfilling with their administrative obligations under this Consortium Agreement and the Grant Agreement
- supporting, via capacity building activities, the Italian organizations in ensuring the timely preparation of administrative progress reports.
- representing the Nord Adriatic Hydrogen Valley at the international level.

6.5.3

If the Coordinator fails in its coordination tasks, the Co-coordinator may replace temporally the Coordinator under appointment of the executive board for the time necessary to implement what foreseen in art, 6.4.3.

6.5.4

The Co-Coordinator shall not be entitled to act or to make legally binding declarations on behalf of any other Party or of the consortium, unless explicitly stated otherwise in the Grant Agreement or this Consortium Agreement.

6.5.5

The Co-Coordinator shall not enlarge its role beyond the tasks specified in this Consortium Agreement and in the Grant Agreement.

6.6 Steering Group (SG)

A Steering Group (SG) will be appointed as the external steering body of the project. In total, 7 independent (independence has to be read as not belonging/employ to any of the consortium Parties) experts including the chairman of the Stakeholders Advisory Forum will be invited to participate by the Project Management Board upon suggestions from the Executive Board. The project coordinator will be in charge of covering the cost for travel and accommodation of those experts.

The Coordinator will ensure that a non-disclosure agreement is executed between all Parties and each SG member.

By way of exception to Section 6.4.4 above, the Parties mandate the Coordinator to execute, in their name and on their behalf, a non-disclosure agreement (hereafter "NDA") with each member of the SG, in order to protect Confidential Information disclosed by any of the Parties to any member of the SG, either directly or through the Coordinator in the case where the concerned Party gave to the Coordinator its prior written approval for such disclosure. The NDA for the SG members is enclosed in Attachment 5. The mandate of the Coordinator comprises solely the execution of the NDA in Attachment 5.

Its terms shall be not less stringent than those stipulated in this Consortium Agreement, and it shall be concluded no later than 30 calendar days after their nomination or before any confidential information will be exchanged/disclosed, whichever date is earlier. The Coordinator shall write the minutes of the SG meetings and submit them to the Project Management Board. The SG members shall be allowed to participate in Project Management Board meetings upon invitation but have not any voting rights.

The SG meets at least twice per year.

6.7 Work Packages

The main tasks of the Project are split up in eleven Work Packages (WP). The Parties shall deliver the work in accordance with the Grand Agreement.

6.8 WP Leaders

For each WP a WP Leader has been identified in the list of Work Packages to which the respective WP is assigned. At least one representative of each WP Leader shall attend Executive Board meetings.

The area of responsibility of the WP Leaders are as follows:

- define, in coordination with the Parties involved in a WP the detailed planning of the subtasks and activities to be performed;
- coordinate the work performed within a WP according to the time schedule, agreed by the parties, and to be responsible for the daily management of that WP;
- assess and monitor the activities conducted within a WP in order to assure the quality of the work, to achieve the objectives defined, and to meet budget and time lines;
- coordinate with other WP Leaders the information flow required by WP inter-dependencies;
- prepare the progress reports summarizing the work performed according to the Grant Agreement;
- inform the EB and the Coordinator about the progress achieved, results obtained, problems encountered and possible risks, before every EB and PMB meeting;
- assure the quality, coordinate, preliminary approve and forward the deliverables prepared in the WP to the EB;
- - participate in the preparation of the expert review meetings with the Funding Authority.

7 Financial provisions

7.1 General Principles

7.1.1 Distribution of Financial Contribution

The financial contribution of the Granting Authority to the Project shall be distributed by the Coordinator according to:

- the Consortium Plan and in accordance with the Grant Agreement
- the approval of reports by the Granting Authority,
- the fulfilment of each partner obligation,
- the provisions of payment in Section 7.2.

A Party shall be funded only for its tasks carried out in accordance with the Consortium Plan.

Participants must have sufficient financial capacity to implement their project.

7.1.2 Justifying Costs

In accordance with its own usual accounting and management principles and practices, each Party shall be solely responsible for justifying its costs (and those of its Affiliated Entities, if any) with respect to the Project towards the Granting Authority. Neither the Coordinator nor any of the other Parties shall be in any way liable or responsible for such justification of costs towards the Granting Authority.

Each Party shall act according to the rules of economy and in accordance with national legislations regarding the justifying costs.

7.1.3 Funding Principles

A Party that spends less than its allocated share of the budget as set out in the Consortium Plan or – in case of reimbursement via unit costs - implements less units than foreseen in the Consortium Plan will be funded in accordance with its units/actual duly justified eligible costs only.

A Party that spends more than its allocated share of the budget as set out in the Consortium Plan will be funded only in respect of duly justified eligible costs up to an amount which follow these rules:

- If the grant has been fully consumed, the maximum amount granted by Party is the same as the amount initially granted.
- If the total amount of grant has not been fully consumed (some Parties spend less), then the overall unused part of the Grant is allocated to the other Parties which spend more, pro rata among the excess of Grant claimed by each Party spending more than initially allocated.

7.1.4 Excess payments

7.1.4.1 In any case of a Party having received excess payments, the Party has to return the relevant amount to the Coordinator without undue delay.

7.1.4.2 In case a Party earns any receipt that is deductible from the total funding as set out in the Project Plan, the deduction is only directed toward the Party earning such income. The other Parties' financial share of the budget shall not be affected by one Party's receipt. In case the relevant receipt is more than the allocated share of the Party as set out in the Project Plan, the Party shall reimburse the funding reduction suffered by other Parties.

In case a Party has received excess payment, the Party has to inform the Coordinator and return the relevant amount to the Coordinator without undue delay. In case no refund takes place within 60 days upon request for return of excess payment from the Coordinator, the Party is in substantial breach of the Consortium Agreement.

Amounts which are not refunded by a breaching Party and which are not due to the Granting Authority, shall be apportioned by the Coordinator to the remaining Parties pro rata according to their share of total costs of the Project as identified in the Consortium Budget, until recovery from the breaching Party is possible.

7.1.5 Revenue

In case a Party earns any revenue that is deductible from the total funding as set out in the Consortium Plan, the deduction is only directed toward the Party earning such revenue. The other Parties' financial share of the budget shall not be affected by one Party's revenue. In case the relevant revenue is more than the allocated share of the Party as set out in the Consortium Plan, the Party shall reimburse the funding reduction suffered by other Parties.

7.1.6 Financial Consequences of the termination of the participation of a Party

A Party leaving the consortium shall refund to the Coordinator any payments it has received except the amount of contribution accepted by the Granting Authority or another contributor.

In addition, a Defaulting Party shall, within the limits specified in Section 5.2 of this Consortium Agreement, bear any reasonable and justifiable additional costs occurring to the other Parties in order to perform the leaving Party´s task and necessary additional efforts to fulfil them as a consequence of the Party leaving the consortium. The Project Management Board should agree on a procedure regarding additional costs which are not covered by the Defaulting Party or the Mutual Insurance Mechanism.

7.2 Budgeting

The budget set out in the Consortium Plan shall be valued in accordance with the usual accounting and management principles and practices of the respective Parties and countries.

7.3 Payments

7.3.1 Payments to Parties are the exclusive task of the Coordinator.

In particular, the Coordinator shall:

- notify the Party concerned promptly of the date and composition of the amount transferred to its bank account, giving the relevant references
- perform diligently its tasks in the proper administration of any funds and in maintaining financial accounts
- undertake to keep the Granting Authority's financial contribution to the Project separated from its normal business accounts, its own assets and property, except if the Coordinator is a Public Body or is not entitled to do so due to statutory legislation.

With reference to Article 22 of the Grant Agreement, no Party shall before the end of the Project receive more than its allocated share of the maximum grant amount less the amounts retained by the Granting Authority for the Mutual Insurance Mechanism and for the final payment.

7.3.2 Pre-financing and advanced payment

The transfer of the initial pre-financing, the advanced payment and interim payments to Parties will be handled in accordance with provisions of the Grant Agreement and of this consortium agreement.

For the sake of clarity, the advanced payment is the second tranche of the prefinancing.

The Coordinator will transfer to the Parties the 50% of the prefinancing after receipt from the Funding Authority within a maximum period of 30 calendar days.

The transfer of the prefinancing will be performed only to those Parties that have signed the Accession Form to the Grant Agreement and the present Consortium Agreement.

The remaining part of the pre financing –will be transferred pro quota to those parties which

- have used and reported to the coordinator expenses for at least the 70% of their quota of prefinancing as assessed in the internal reporting as foreseen in art. 4.2.
- have subscribed a bank guaranty in favour of the Coordinator for an amount equal to the amount to be received, or

- have proven to be able to spend all the received amount by the end of the said reporting period.

If at the time of the reporting period, a party is underspending for the sake to guarantee the advancement of the project's expenditure the unspent amount will be transferred pro quota to the parties which could guarantee to reaching the ceiling of the 70% as stated in article 22.3.1. of the grant agreement - additional prefinancings.

In any moment a Party that has spent all the prefinancing can report and request to the coordinator all the advance payment.

7.3.3 Interim payment

Within a maximum period of 30 calendar days after receipt from the Funding Authority the Coordinator will transfer the interim payment to those parties that have delivered all the deliverables and milestones that were expected to be finalized within that reporting period. The coordinator will transfer the payment to the Parties within 30 days from the finalization of their deliverables.

In case a partner did not finalize by that time all the expected deliverables, milestones and reporting, it will be considered as a non performing partner therefore the interim payment will not be transferred to that part until when the partner will fulfil its obligations.

If a partner can demonstrate that the delay in the finalization of the deliverables was due to another partner missing contribution it can ask the Executive Board to authorize the Coordinator to transfer the prefinancing/advanced payment/interim payment.

The Parties should communicate to the coordinator the bank account details to which the transfer should be performed and should communicate without delay any change that might occur.

Funding for costs accepted by the Granting Authority will be paid by the Coordinator to the Party concerned.

The Coordinator is entitled to withhold any payments due to a Party identified by the Project Management Board to be in breach or non performing of its obligations under this Consortium Agreement or the Grant Agreement or to a Beneficiary which has not yet signed this Consortium Agreement.

Apart from the first tranche of the pre-financing and advanced payment all the other tranches of payment will be released under the condition of pro-quota reimbursement of the eligible expenses effectively incurred in the given reporting period. If at the time of the reporting period, a party is underspending for the sake to guarantee the advancement of the project's expenditure the unspent amount will be transferred pro quota to the parties which could guarantee to reaching the ceiling of the 70% of expenditure as stated in article 22.3.1. of the grant agreement.

The Coordinator is entitled to recover any payments already paid to a Defaulting Party except the costs already claimed by the Defaulting Party and accepted by the Granting Authority. The Coordinator is equally entitled to withhold payments to a Party when this is suggested by or agreed with the Granting Authority.

8 Results

Strategy for the management of intellectual property

IPR & Data management Board (leaded by the Innovation Manager-IM named by UNITS) will coordinate and foster innovation across the project work packages, and to ensure the quality and post-project impact of the exploitation strategy. The IPR &Data management Board will also assist the consortium in identifying protectable IP and in building on existing IP searches, both within and outside the consortium. IPR &Data management Board will support the NAHV ecosystem and in a particular way the testbed projects (see WP3, WP 4, WP 5) in identifying the know-how and results to be protected. The consortium will follow the EU Guidelines for IPR, keeping up to date with all EU recommendations in this field. Existing know-how (background or pre-existing intellectual property) of a specific partner shall be made available on transfer conditions to the partner(s) within the consortium. The use of such existing know-how is strictly limited to use in the achievement of the project goals and for the duration of the project. An overview of the existing know-how ("background IP") is included in the annex 1. Foreground shall be owned by the partners who developed these results, individually or jointly. Each partner will be responsible for taking the appropriate steps for securing intellectual property of the knowledge or results created during the project, with the support and advice of the IPR &Data management Board .

The overall rules are: 1) Participants in the same action will inform each other before their access to the grant agreement of any legal restriction or limit to granting access to their background. 2) Participants will have access rights (on a royalty-free basis) to the results of another participant in the same action if those results are needed by the former to carry out its work under the action. 3) Participants will have access rights to the results of another participant in the same action if those results are needed by the former to exploit its own results, such access shall be granted under fair and reasonable conditions to outline the plans for the exploitation of results. 4) Partners keep the ownership of any work contributing to project success.

Regarding the foreground, the consortium has identified three levels of IP which will be created from the project: (i) Individual and joint IP, which belongs to individual partners or is jointly owned by partners working in a particular task and is restricted to those partners. Where several partners within the consortium have jointly carried out the work generating the foreground and where their respective share of work cannot be ascertained, they will have joint ownership of such foreground. In this case, partners will jointly apply to obtain and/or maintain the relevant IPRs; (ii) Generic IP, which can be used by all partners of the consortium; (iii) Publicly available IP which will be published on NAHV website and made available with no restrictions. Provisions for use of IP background will be determined during the commercialization strategy. Insights that enhance partners' services or enable the launch of new solutions within partners' strategic go-to-market plan or at the aggregated level of the hydrogen valley will be kept private and protected via non-registered Soft IP measures (confidential information, company knowhow, etc.). It is the policy of the NAHV project that each partner owns the Foreground IP that is solely developed by its developers within the Programme of Innovation and may decide and at its own expense, to register and maintain

any protection for the Foreground IP, including filing and prosecuting patent applications for any of the Foreground IP. Once a result is available, the IPR & Data management Board shall be in charge of investigating the novelty of the invention and proposing to the consortium the possibility to apply for a patent protecting the generated IP.

The partners will select for publication those publishers that fit the aims of NAHV strategy, encouraging partners' authors to retain their copyright and to grant adequate licenses to publishers. Through this strategy, NAHV outputs will remain in the hands of providers of research for the global research community and other third parties to access, mine, exploit, reproduce and foster collaboration, to avoid duplication of effort and to accelerate innovation, closing the gap between research and market. Alternative repositories such as the Open Access Infrastructure for Research in Europe (OpenAIRE), Registry of Open Access Repositories (ROAR) and Directory of Open Access Repositories (OpenDOAR) will be exploited.

For the sake of clarity, the IP generated within each testbed and feasibility study (see WP3, WP 4, WP 5, WP6) will remain in the ownership of the developer, if not different bilateral written agreement are taken.

8.1 Ownership of Results

Results are owned by the Party that generates them.

8.2 Joint ownership

Joint ownership is governed by Grant Agreement Article 16 and its Annex 5, Section Ownership of results, with the following additions:

In case of joint ownership, each of the joint owners shall be entitled to Exploit the joint Results as it sees fit, and to grant non-exclusive licenses, without obtaining any consent from, paying compensation to, or otherwise accounting to any other joint owner, unless otherwise agreed between the joint owners.

The joint owners shall agree on all protection measures and the division of related cost in advance.

The results of activities implemented under WP 3, WP4, WP5, WP6 cannot be considered as joint ownership.

8.3 Transfer of Results

8.3.1

Each Party may transfer ownership of its own Results, including its share in jointly owned Results, following the procedures of the Grant Agreement Article 16 and its Annex 5, Section Transfer and licensing of results, sub-section "Transfer of ownership".

8.3.2

Each Party may identify specific third parties it intends to transfer the ownership of its Results to in Attachment (3) of this Consortium Agreement. The other Parties hereby waive their right to prior notice and their right to object to such a transfer to listed third parties according to the Grant Agreement Article 16 and its Annex 5, Section Transfer of licensing of results, sub-section "Transfer of ownership", 3rd paragraph.

8.3.3

The transferring Party shall, however, at the time of the transfer, inform the other Parties of such transfer and shall ensure that the rights of the other Parties under the Consortium Agreement and the Grant Agreement will not be affected by such transfer. Any addition to Attachment (3) after signature of this Consortium Agreement requires a decision of the Project Management Board.

Clean Hydrogen JU have the right to object to transfers of ownership of results, or to grants of an exclusive licence regarding results, if: (a) the beneficiaries which generated the results have received Union funding; (b) the transfer or licensing is to a legal entity established in a non-associated third country; and (c) the transfer or licensing is not in line with Union interests.

The Parties recognise that in the framework of a merger or an acquisition of an important part of its assets, it may be impossible under applicable EU and national laws on mergers and acquisitions for a Party to give at least 45 calendar days prior notice for the transfer as foreseen in the Grant Agreement.

8.3.4

The obligations above apply only for as long as other Parties still have - or still may request - Access Rights to the Results.

8.4 Dissemination

8.4.1

For the avoidance of doubt, the confidentiality obligations set out in Section 10 apply to all dissemination activities described in this Section 8.4 as far as Confidential Information is involved.

8.4.2 Dissemination of own (including jointly owned) Results

8.4.2.1

During the Project and for a period of 1 year after the end of the Project, the dissemination of own Results by one or several Parties including but not restricted to publications and presentations, shall be governed by the procedure of Article 17 of the Grant Agreement and its Annex 5, Section Dissemination, subject to the following provisions.

Prior notice of any planned publication shall be given to the other Parties at least 45 calendar days before the publication. Any objection to the planned publication shall be made in accordance with the Grant Agreement by written notice to the Coordinator and to the Party or Parties proposing the dissemination within 30 calendar days after receipt of the notice. If no objection is made within the time limit stated above, the publication is permitted.

8.4.2.2

An objection is justified if

a) the protection of the objecting Party's Results or Background would be adversely affected, or

b) the objecting Party's legitimate interests in relation to its Results or Background would be significantly harmed, or

c) the proposed publication includes Confidential Information of the objecting Party.

The objection has to include a precise request for necessary modifications.

8.4.2.3

If an objection has been raised the involved Parties shall discuss how to overcome the justified grounds for the objection on a timely basis (for example by amendment to the planned publication and/or by protecting information before publication) and the objecting Party shall not unreasonably continue the opposition if appropriate measures are taken following the discussion.

8.4.2.4

The objecting Party can request a publication delay of not more than 90 calendar days from the time it raises such an objection. After 90 calendar days the publication is permitted, provided that the objections of the objecting Party have been addressed.

8.4.3 Dissemination of another Party's unpublished Results or Background

A Party shall not include in any dissemination activity another Party's Results or Background without obtaining the owning Party's prior written approval, unless they are already published.

8.4.4 Cooperation obligations

The Parties undertake to cooperate to allow the timely submission, examination, publication and defense of any dissertation or thesis for a degree that includes their Results or Background subject to the confidentiality and publication provisions agreed in this Consortium Agreement.

8.4.5 Use of names, logos or trademarks

Nothing in this Consortium Agreement shall be construed as conferring rights to use in advertising, publicity or otherwise the name of the Parties or any of their logos or trademarks without their prior written approval.

9 Access Rights

9.1 Background included

9.1.1

In Attachment 1, the Parties have identified and agreed on the Background for the Project and have also, where relevant, informed each other that Access to specific Background is subject to legal restrictions or limits. Especially, If Background includes all or part of a commercially available product of a Party or of a third party, the terms and provisions governing the access to and use of such commercially available product, which are established in Attachment 1, shall be the prevailing terms

Anything not identified in Attachment 1 shall not be the object of Access Right obligations regarding Background.

9.1.2

Any Party may add additional Background to Attachment 1 during the Project provided they give written notice to the other Parties. However, approval of the Project Management Board is needed should a Party wish to modify or withdraw its Background in Attachment 1.

9.2 General Principles

9.2.1

Each Party shall implement its tasks in accordance with the Consortium Plan and shall bear sole responsibility for ensuring that its acts within the Project do not knowingly infringe third party property rights.

9.2.2

Any Access Rights granted exclude any rights to sublicense unless expressly stated otherwise.

9.2.3

Access Rights shall be free of any administrative transfer costs.

9.2.4

Access Rights are granted on a non-exclusive basis.

9.2.5

Results and Background shall be used only for the purposes for which Access Rights to it have been granted.

9.2.6

All requests for Access Rights shall be made in writing. The granting of Access Rights may be made conditional on the acceptance of specific conditions aimed at ensuring that these rights will be used only for the intended purpose and that appropriate confidentiality obligations are in place.

9.2.7

The requesting Party must show that the Access Rights are Needed.

9.3 Access Rights for implementation

Access Rights to Results and Background Needed for the performance of the own work of a Party under the Project shall be granted on a royalty-free basis, unless otherwise agreed for Background in Attachment 1.

9.4 Access Rights for Exploitation

9.4.1 Access Rights to Results

Access Rights to Results if Needed for Exploitation of a Party's own Results shall be granted on a royalty-free basis.

9.4.2

Access Rights to Background if Needed for Exploitation of a Party's own Results, shall be granted on Fair and Reasonable conditions.

9.4.3

A request for Access Rights may be made up to twelve months after the end of the Project or, in the case of Section 9.7.2.1.2, after the termination of the requesting Party's participation in the Project.

9.5 Access Rights for Affiliated Entities

Affiliated Entities have Access Rights under the conditions of the Grant Agreement Article 16 and its Annex 5, Section "INTELLECTUAL PROPERTY RIGHTS (IPR) —BACKGROUND AND RESULTS —ACCESS RIGHTS AND RIGHTS OF USE", sub-section "Access rights for entities under the same control" if they are identified in [Attachment 4 (Identified entities under the same control) to this Consortium Agreement].

Such Access Rights must be requested by the entity under the same control from the Party that holds the Background or Results. Alternatively, the Party granting the Access Rights may individually agree with the Party requesting the Access Rights to have the Access Rights include the right to sublicense to the latter's entity under the same control [listed in Attachment 4]. Access Rights to an entity under the same control shall be granted on Fair and Reasonable conditions and upon written bilateral agreement.

Affiliated Entities under the same control which obtain Access Rights in return fulfil all confidentiality obligations accepted by the Parties under the Grant Agreement or this Consortium Agreement as if such Affiliated Entities were Parties.

Access Rights may be refused to Affiliated Entities under the same control if such granting is contrary to the legitimate interests of the Party which owns the Background or the Results.

Access Rights granted to any Affiliated Entity under the same control are subject to the continuation of the Access Rights of the Party with whom it is under the same control, and shall automatically terminate upon termination of the Access Rights granted to such Party.

Upon cessation of the status as an Affiliated Entity under the same control, any Access Rights granted to such former entity under the same control shall lapse.

Further arrangements with Affiliated Entities under the same control may be negotiated in separate agreements.

9.6 Additional Access Rights

For the avoidance of doubt any grant of Access Rights not covered by the Grant Agreement or this Consortium Agreement shall be at the absolute discretion of the owning Party and subject to such terms and conditions as may be agreed between the owning and receiving Parties.

9.7 Access Rights for Parties entering or leaving the consortium

9.7.1 New Parties entering the consortium

As regards Results developed before the accession of the new Party, the new Party will be granted Access Rights on the conditions applying for Access Rights to Background.

9.7.2 Parties leaving the consortium

9.7.2.1 Access Rights granted to a leaving Party

9.7.2.1.1 Defaulting Party

Access Rights granted to a Defaulting Party and such Party's right to request Access Rights shall cease immediately upon receipt by the Defaulting Party of the formal notice of the decision of the Project Management Board to terminate its participation in the consortium.

9.7.2.1.2 Non-defaulting Party

A non-defaulting Party leaving voluntarily and with the other Parties' consent shall have Access Rights to the Results developed until the date of the termination of its participation.

It may request Access Rights within the period of time specified in Section 9.4.3.

9.7.2.2 Access Rights to be granted by any leaving Party

Any Party leaving the Project shall continue to grant Access Rights pursuant to the Grant Agreement and this Consortium Agreement as if it had remained a Party for the whole duration of the Project.

9.8 Specific provisions for Access Rights to Software

9.8.1 Definitions relating to Software

"Application Programming Interface" or "API"

means the application programming interface materials and related documentation containing all data and information to allow skilled Software developers to create Software interfaces that interface or interact with other specified Software.

"Controlled License Terms" means terms in any license that require that the use, copying, modification and/or distribution of Software or another work ("Work") and/or of any work that is a modified version of or is a derivative work of such Work (in each case, "Derivative Work") be subject, in whole or in part, to one or more of the following:

(where the Work or Derivative Work is Software) that the Source Code or other formats preferred for modification be made available as of right to any third party on request, whether royalty-free or not;

that permission to create modified versions or derivative works of the Work or Derivative Work be granted to any third party;

that a royalty-free license relating to the Work or Derivative Work be granted to any third party.

For the avoidance of doubt, any Software license that merely permits (but does not require any of the things mentioned in (a) to (c) is not under Controlled License Terms.

"Object Code" means Software in machine-readable, compiled and/or executable form including, but not limited to, byte code form and in form of machine-readable libraries used for linking procedures and functions to other software.

"Software Documentation" means Software information, being technical information used, or useful in, or relating to the design, development, use or maintenance of any version of a Software programme.

"Source Code" means Software in human readable form normally used to make modifications to it including, but not limited to, comments and procedural code such as job control language and scripts to control compilation and installation.

9.8.2 General principles

For the avoidance of doubt, the general provisions for Access Rights provided for in this Section 9 are applicable also to Software as far as not modified by this Section 9.8.

Parties' Access Rights to Software do not include any right to receive Source Code or Object Code ported to a certain hardware platform or any right to receive Source Code, Object Code or respective Software Documentation in any particular form or detail, but only as available from the Party granting the Access Rights.

The introduction of Software under Controlled License Terms in the Project requires the prior approval of the Project Management Board to implement such introduction into the Consortium Plan.

9.8.3 Access to Software

Access Rights to Software that is Results shall comprise:

- Access Rights to the Object Code; and,
- where normal use of such an Object Code requires an API, Access Rights to the Object Code and such an API; and,

Background shall only be provided in Object Code unless otherwise agreed between the Parties concerned.

9.8.4 Software license and sublicensing rights

9.8.4.1 Object Code

9.8.4.1.1 Results - Rights of a Party

Where a Party has Access Rights to Object Code and/or API that is Results for Exploitation, such Access shall, in addition to the Access for Exploitation foreseen in Section 9.4, as far as Needed for the Exploitation of the Party's own Results, comprise the right:

- to make an agreed number of copies of Object Code and API; and
- to distribute, make available, market, sell and offer for sale such Object Code and API alone or as part of or in connection with products or services of the Party having the Access Rights;

provided however that any product, process or service has been developed by the Party having the Access Rights in accordance with its rights to exploit Object Code and API for its own Results.

If it is intended to use the services of a third party for the purposes of this Section 9.8.4.1.1, the Parties concerned shall agree on the terms thereof with due observance of the interests of the Party granting the Access Rights as set out in Section 9 of this Consortium Agreement.

9.8.4.1.2 Results - Rights to grant sublicenses to end-users

In addition, Access Rights to Object Code shall, as far as Needed for the Exploitation of the Party's own Results, comprise the right to grant in the normal course of the relevant trade to end-user customers buying/using the product/services, a sublicense to the extent as necessary for the normal use of the relevant product or service to use the Object Code alone or as part of or in connection with or integrated into products and services of the Party having the Access Rights and, as far as technically essential:

- to maintain such product/service;
- to create for its own end-use interacting interoperable Software in accordance with the Directive 2009/24/EC of the European Parliament and of the Council of 23 April 2009 on the legal protection of computer programs.

9.8.4.1.3 Background

For the avoidance of doubt, where a Party has Access Rights to Object Code and/or API that is Background for Exploitation, Access Rights exclude the right to sublicense. Such sublicensing rights may, however, be negotiated between the Parties.

9.8.4.2 Source Code

9.8.4.2.1 Results - Rights of a Party

Where, in accordance with Section 9.8.3, a Party has Access Rights to Source Code that is Results for Exploitation, Access Rights to such Source Code, as far as Needed for the Exploitation of the Party's own Results, shall comprise a worldwide right to use, to make copies, to modify, to develop, to adapt Source Code for research, to create/market a product/process and to create/provide a service.

If it is intended to use the services of a third party for the purposes of this Section 9.8.4.2.1, the Parties shall agree on the terms thereof, with due observance of the interests of the Party granting the Access Rights as set out in Section 9.2 of this Consortium Agreement.

9.8.4.2.2 Results – Rights to grant sublicenses to end-users

In addition, Access Rights, as far as Needed for the Exploitation of the Party's own Results, shall comprise the right to sublicense such Source Code, but solely for purpose of adaptation, error correction, maintenance and/or support of the Software.

Further sublicensing of Source Code is explicitly excluded.

9.8.4.2.3 Background

For the avoidance of doubt, where a Party has Access Rights to Source Code that is Background for Exploitation, Access Rights exclude the right to sublicense. Such sublicensing rights may, however, be negotiated between the Parties.

9.8.5 Specific formalities

Each sublicense granted according to the provisions of Section 9.8.4 shall be made by a traceable agreement specifying and protecting the proprietary rights of the Party or Parties concerned.

10 Non-disclosure of information

10.1

All information in whatever form or mode of communication, which is disclosed by a Party (the "Disclosing Party") to any other Party (the "Recipient") in connection with the Project during its implementation and which has been explicitly marked as "confidential" at the time of disclosure, or when disclosed orally has been identified as confidential at the time of disclosure and has been confirmed and designated in writing within 15 calendar days from oral disclosure at the latest as confidential information by the Disclosing Party, is "Confidential Information".

10.2

The Recipients hereby undertake in addition and without prejudice to any commitment on non-disclosure under the Grant Agreement, for a period of 5 years after the end of the Project:

- not to use Confidential Information otherwise than for the purpose for which it was disclosed;
- not to disclose Confidential Information without the prior written consent by the Disclosing Party;
- to ensure that internal distribution of Confidential Information by a Recipient shall take place on a strict need-to-know basis; and
- to return to the Disclosing Party, or destroy, on request all Confidential Information that has been disclosed to the Recipients including all copies thereof and to delete all information stored in a machine-readable form to the extent practically possible. The Recipients may keep a copy to the extent it is required to keep, archive or store such Confidential Information because of compliance with applicable laws and regulations or for the proof of on-going obligations provided that the Recipient complies with the confidentiality obligations herein contained with respect to such copy.

10.3

The Recipients shall be responsible for the fulfilment of the above obligations on the part of their employees, or third parties involved in the Project and shall ensure that they remain so obliged, as far as legally possible, during and after the end of the Project and/or after the termination of the contractual relationship with the employee or third party. Therefore, for the sake of clarity by signing the present Consortium Agreement the Parties assume the obligation for themselves and for their employees to non-disclosure any confidential information, the present Consortium Agreement it has to be considered itself by its signature a Non disclosure Agreement for the signatories and for their employees.

10.4

The above shall not apply for disclosure or use of Confidential Information, if and in so far as the Recipient can show that:

- the Confidential Information has become or becomes publicly available by means other than a breach of the Recipient's confidentiality obligations;
- the Disclosing Party subsequently informs the Recipient that the Confidential Information is no longer confidential;
- the Confidential Information is communicated to the Recipient without any obligation of confidentiality by a third party who is to the best knowledge of the Recipient in lawful possession thereof and under no obligation of confidentiality to the Disclosing Party;
- the disclosure or communication of the Confidential Information is foreseen by provisions of the Grant Agreement;

- the Confidential Information, at any time, was developed by the Recipient completely independently of any such disclosure by the Disclosing Party;
- the Confidential Information was already known to the Recipient prior to disclosure, or
- the Recipient is required to disclose the Confidential Information in order to comply with applicable laws or regulations or with a court or administrative order, subject to the provision Section 10.7 hereunder.

10.5

The Recipient shall apply the same degree of care with regard to the Confidential Information disclosed within the scope of the Project as with its own confidential and/or proprietary information, but in no case less than reasonable care.

10.6

Each Recipient shall promptly inform the relevant Disclosing Party by written notice of any unauthorised disclosure, misappropriation or misuse of Confidential Information after it becomes aware of such unauthorised disclosure, misappropriation or misuse.

10.7

If any Recipient becomes aware that it will be required, or is likely to be required, to disclose Confidential Information in order to comply with applicable laws or regulations or with a court or administrative order, it shall, to the extent it is lawfully able to do so, prior to any such disclosure

- notify the Disclosing Party, and
- comply with the Disclosing Party's reasonable instructions to protect the confidentiality of the information.

11 Miscellaneous

11.1 Attachments, inconsistencies and severability

This Consortium Agreement consists of this core text and:

- Attachment 1 (Background included)
- Attachment 2 (Accession document)
- Attachment 3 (List of third parties for simplified transfer according to Section 8.3.2)
- Attachment 4 (Identified entities under the same control)
- Attachment 5 (NDA for External Expert Advisory Board agreed under Section 6)

In case the terms of this Consortium Agreement are in conflict with the terms of the Grant Agreement, the terms of the latter shall prevail. In case of conflicts between the attachments and the core text of this Consortium Agreement, the latter shall prevail.

Should any provision of this Consortium Agreement become invalid, illegal or unenforceable, it shall not affect the validity of the remaining provisions of this Consortium Agreement. In such a case, the Parties concerned shall be entitled to request that a valid and practicable provision be negotiated that fulfils the purpose of the original provision.

11.2 No representation, partnership or agency

Except as otherwise provided in Section Pogreška! Izvor reference nije pronađen.~~Errore. L'origine riferimento non è stata trovata.~~, no Party shall be entitled to act or to make legally binding declarations on behalf of any other Party or of the consortium. Nothing in this Consortium Agreement shall be deemed to constitute a joint venture, agency, partnership, interest grouping or any other kind of formal business grouping or entity between the Parties.

11.3 Formal and written notices

Any notice to be given under this Consortium Agreement shall be addressed to the recipients as listed in the most current address list kept by the Coordinator.

Any change of persons or contact details shall be immediately communicated to the Coordinator by written notice. The updated address list shall be accessible to all Parties.

Formal notices:

If it is required in this Consortium Agreement (Sections 4.3, 9.7.2.1.1, and 11.4) that a formal notice, consent or approval shall be given, such notice shall be signed by an authorised representative of a Party and shall either be served personally or sent by mail with recorded delivery with acknowledgement of receipt.

Written notice:

Where written notice is required by this Consortium Agreement, this is fulfilled also by other means of communication such as e-mail with acknowledgement of receipt.

11.4 Assignment and amendments

Except as set out in Section 8.3, no rights or obligations of the Parties arising from this Consortium Agreement may be assigned or transferred, in whole or in part, to any third party without the other Parties' prior formal approval.

Amendments and modifications to the text of this Consortium Agreement not explicitly listed in Section 6.3.1.2 require a separate written agreement to be signed between all Parties.

11.5 Mandatory national law

Nothing in this Consortium Agreement shall be deemed to require a Party to breach any mandatory statutory law under which the Party is operating.

11.6 Language

This Consortium Agreement is drawn up in English, which language shall govern all documents, notices, meetings, arbitral proceedings and processes relative thereto.

11.7 Applicable law

This Consortium Agreement shall be construed in accordance with and governed by the laws of Belgium excluding its conflict of law provisions.

11.8 Settlement of disputes

The Parties shall endeavour to settle their disputes amicably.

Any dispute, controversy or claim arising under, out of or relating to this contract and any subsequent amendments of this contract, including, without limitation, its formation, validity, binding effect, interpretation, performance, breach or termination, as well as non-contractual claims, shall be submitted to mediation in accordance with the WIPO Mediation Rules. The place of mediation shall be Brussels unless otherwise agreed upon. The language to be used in the mediation shall be English unless otherwise agreed upon.

If, and to the extent that, any such dispute, controversy or claim has not been settled pursuant to the mediation within 60 calendar days of the commencement of the mediation, the courts of Brussels shall have exclusive jurisdiction.

12 Signatures

AS WITNESS:

The Parties have caused this Consortium Agreement to be duly signed by the undersigned authorised representatives in separate signature pages the day and year first above written.

[INSERT NAME OF PARTY]

Signature(s)

Name(s)

Title(s)

Date

[It is recommended to insert a new page for each signature.]

[INSERT NAME OF PARTY]

Signature(s)

Name(s)

Title(s)

Date

[INSERT NAME OF PARTY]

Signature(s)

Name(s)

Title(s)

Date

Attachment 1: Background included

According to the Grant Agreement (Article 16.1) Background is defined as "data, know-how or information (...) that is (...) needed to implement the Action or exploit the results". Because of this need, Access Rights have to be granted in principle, but Parties must identify and agree amongst them on the Background for the Project. This is the purpose of this attachment.

PARTY 1

As to [NAME OF THE PARTY], it is agreed between the Parties that, to the best of their knowledge, [insert the relevant option here].

[Option 1 start]

the following Background is hereby identified and agreed upon for the Project. Specific limitations and/or conditions, shall be as mentioned hereunder:

Describe Background	**Specific restrictions and/or conditions for implementation (Article 16.4 Grant Agreement and its Annex 5, Section "Access rights to results and background", sub-section "Access rights to background and results for implementing the Action")**	**Specific restrictions and/or conditions for Exploitation (Article 16.4 Grant Agreement and its Annex 5, Section "Access rights to results and background", sub-section "Access rights for exploiting the results")**

[Option 1 end]

[Option 2 start]

Option 2: No data, know-how or information of [NAME OF THE PARTY] is Needed by another Party for implementation of the Project (Article 16.1 and its Annex 5 Grant Agreement, Section "Access rights to results and background", sub-section "Access rights to background and results for implementing the action") or Exploitation of that other Party's Results (Article 16.1 and its Annex 5 Grant Agreement, Section "Access rights to results and background", sub-section "Access rights for exploiting the results").

[Option 2 end]

This represents the status at the time of signature of this Consortium Agreement.

[Same for PARTY 2, PARTY 3, etc]

Attachment 2: Internal deliverables

Table with internal deliverables related to WP3-WP4-WP5 to be reported

Attachment 3: List of third parties for simplified transfer according to Section 8.3.2.

[Attachment 4: Identified Affiliated Entities under the same control according to Section 9.5]

[Attachment 5: NDA for External Expert Advisory Board agreed under Section 6]

TBD

[