Industrial Symbiosis² Hubs 4 Circularity

Funded by the European Union

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FEATURING IS2H4C

H4C COMMUNITY OF PRACTICE WEBINAR

19 MARCH 2025

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Sustainable Circular Economy Transition: From Industrial Symbiosis to Hubs for Circularity

Topic: HORIZON-CL4-2023-TWIN-TRANSITION-01-37 - Hubs for circularity for near zero emissions regions applying industrial symbiosis and cooperative approach to heavy industrialized clusters and surrounding ecosystems (Processes4Planet partnership) (IA)

PROJECT SCALE: 23.5 MILLION EUROS

EU GRANT: 20 MILLION EUROS

34 PARTNERS, 9 COUNTRIES

PROJECT DURATION: 49 MONTHS

PROJECT START-END DATES: JANUARY 2024 – JANUARY 2028

IS2H4C Objectives

IS2H4C's biggest ambition is to promote H4C as Europe's future sustainable regional development models

Objective 1. Deploy and demonstrate near commercial scale industrial symbiosis through innovative technologies

Objective 2: Ensure resilience and sustainability of H4Cs considering planet, people, and profit

Objective 3: Facilitate the market penetration of H4C through novel financial schemes and social innovation approaches unlocking public and private investment

Objective 4: Develop a digital collaboration platform for information-sharing and smart decision-support

Objective 5: Achieve a standardized top-down H4C design methodology, applicable as a reference regional development model

Objective 6: Maximize wider uptake of IS2H4C's results during and after the project's execution

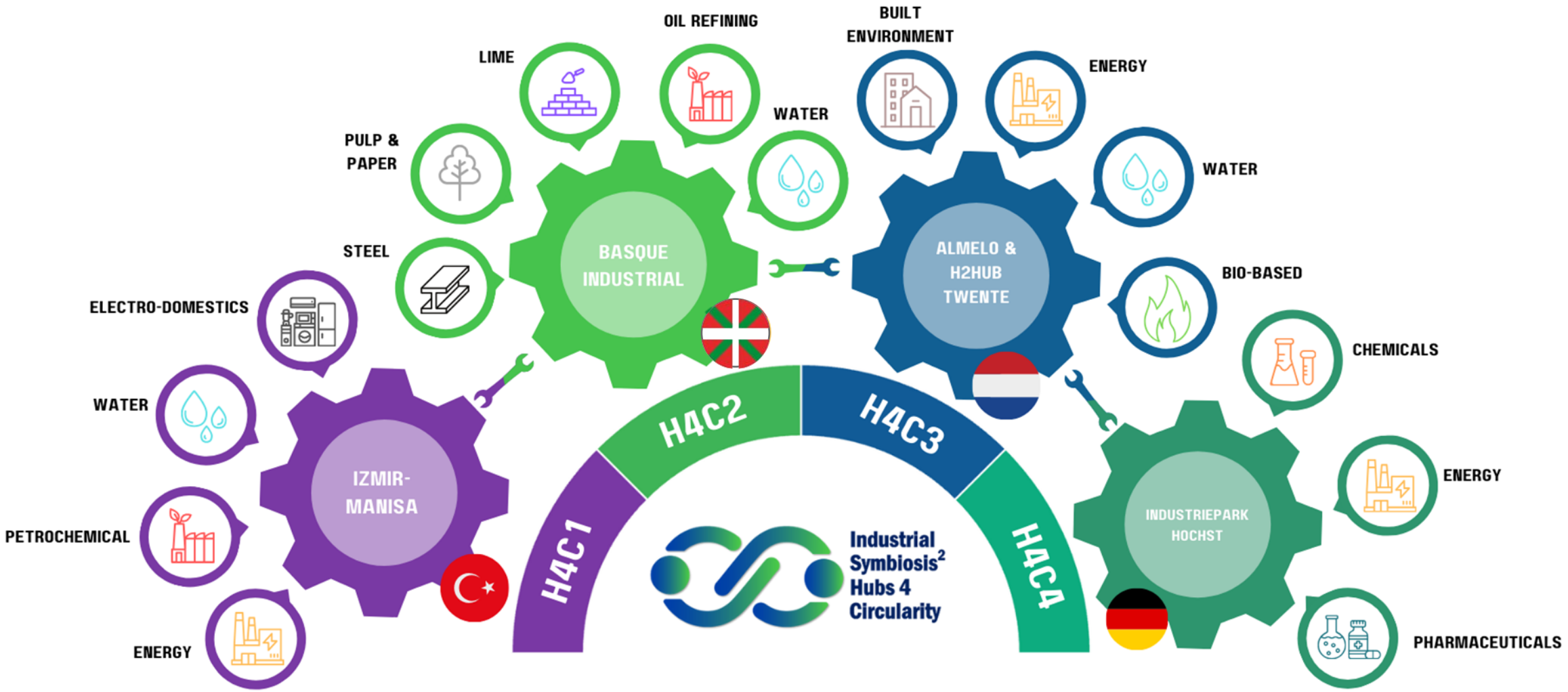
Technology Deployment & Development

17 symbiotic synergies to be demonstrated (scale up from TRL3-6 to TRL 7-9 or directly apply TRL7-9)

24 hub expansion synergies to be researched

11 technologies to be deployed: green H_2, carbon capture and utilization, e-fuels, oxycombustion, wastewater treatment, waste heat recovery, sensing technology

Four Hubs in IS2H4C

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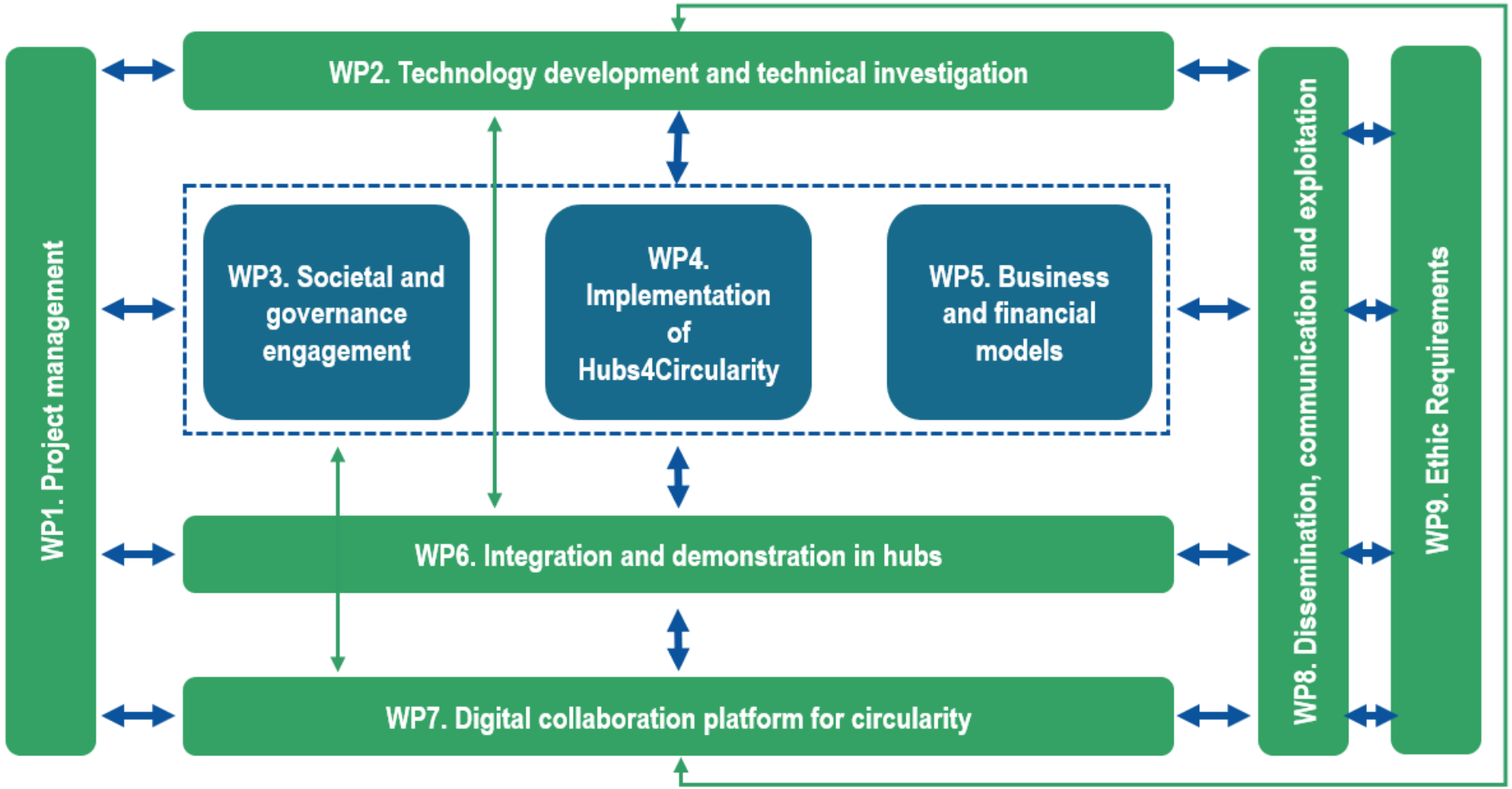
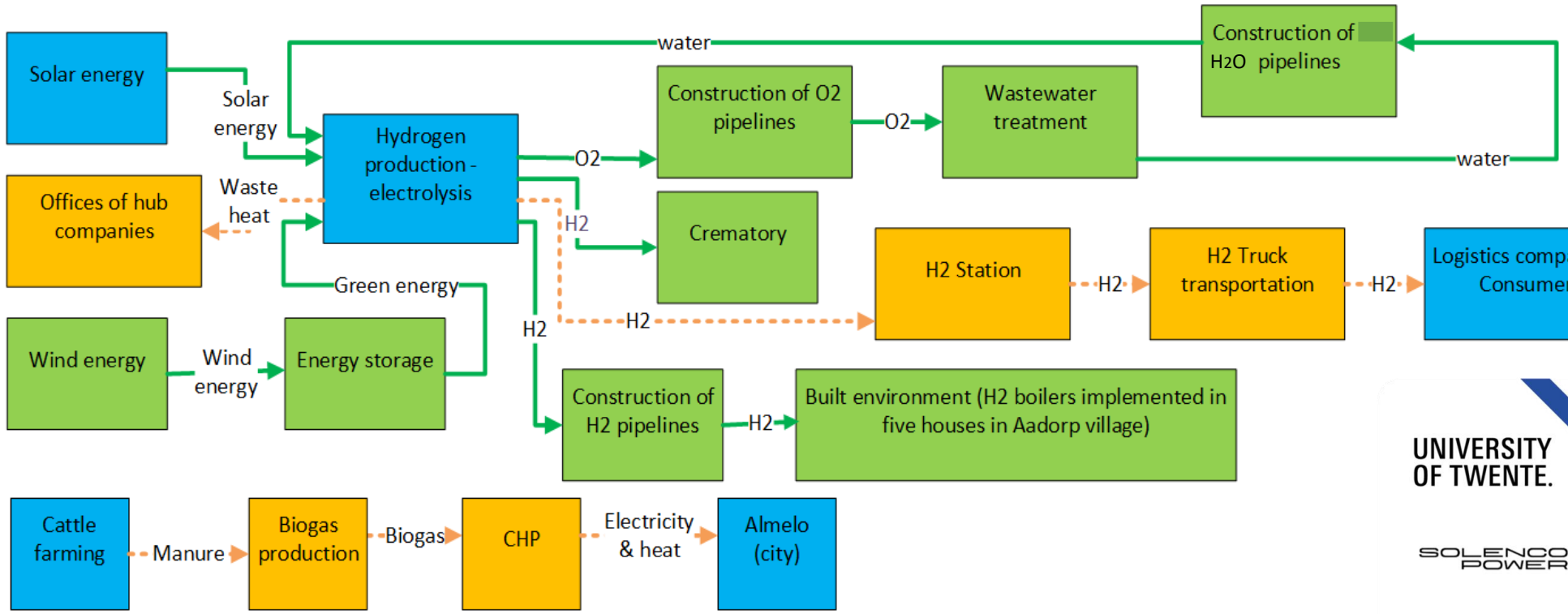
Politecnico di Bari
KPMG

Workplan in IS2H4C



Dutch Hub



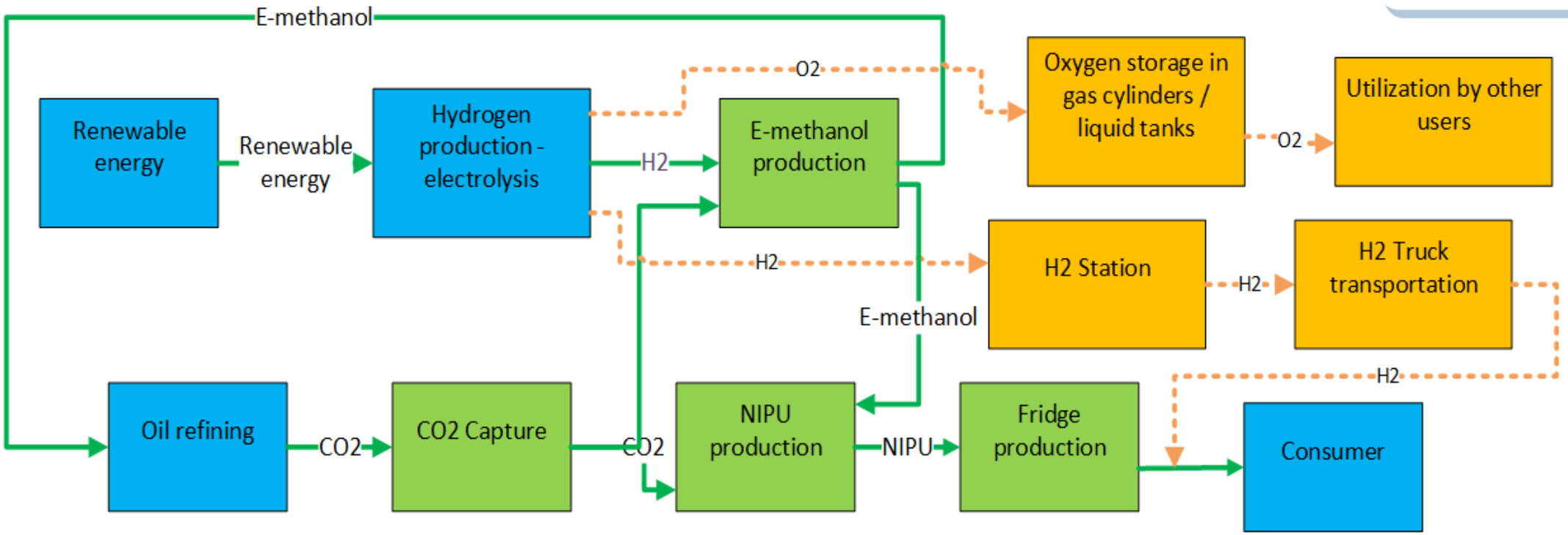
UNIVERSITY OF TWENTE.

SOLENCO POWER

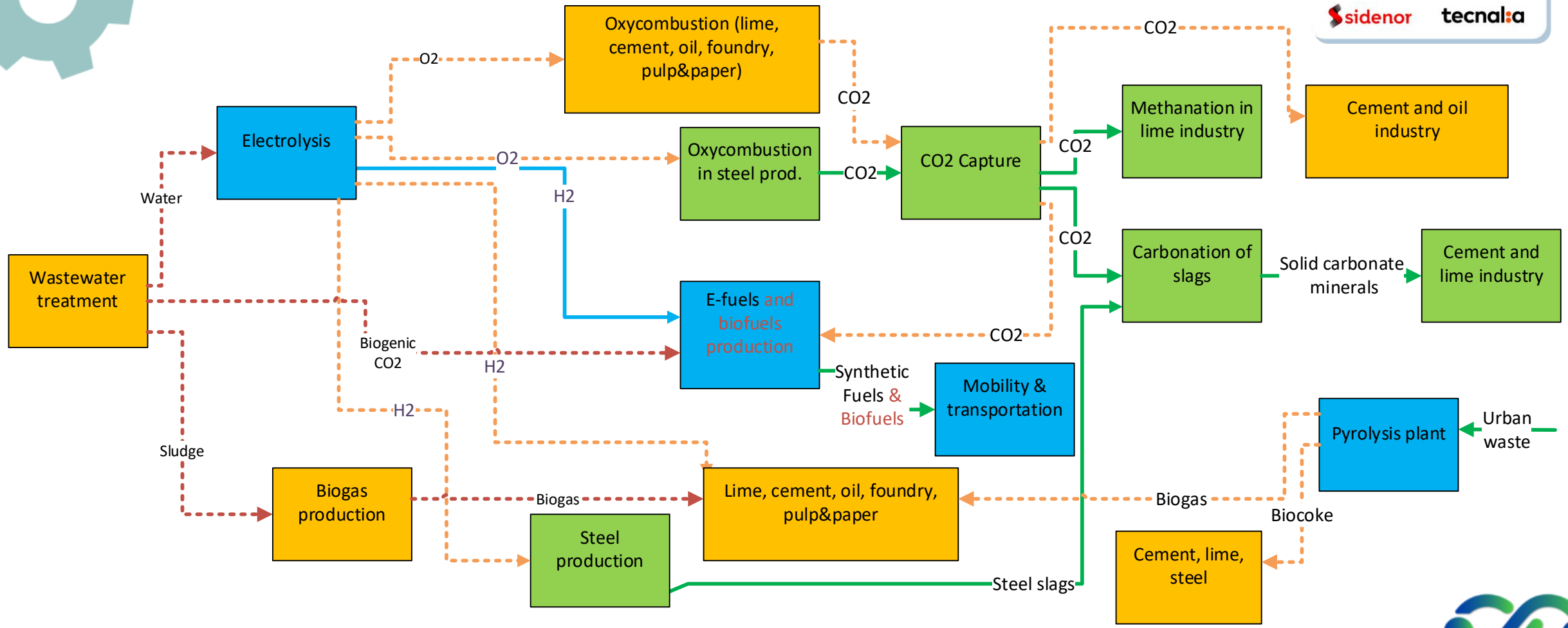
DUURZAAM AADORP | om

H2 Hub Twente
Waterstof Platform

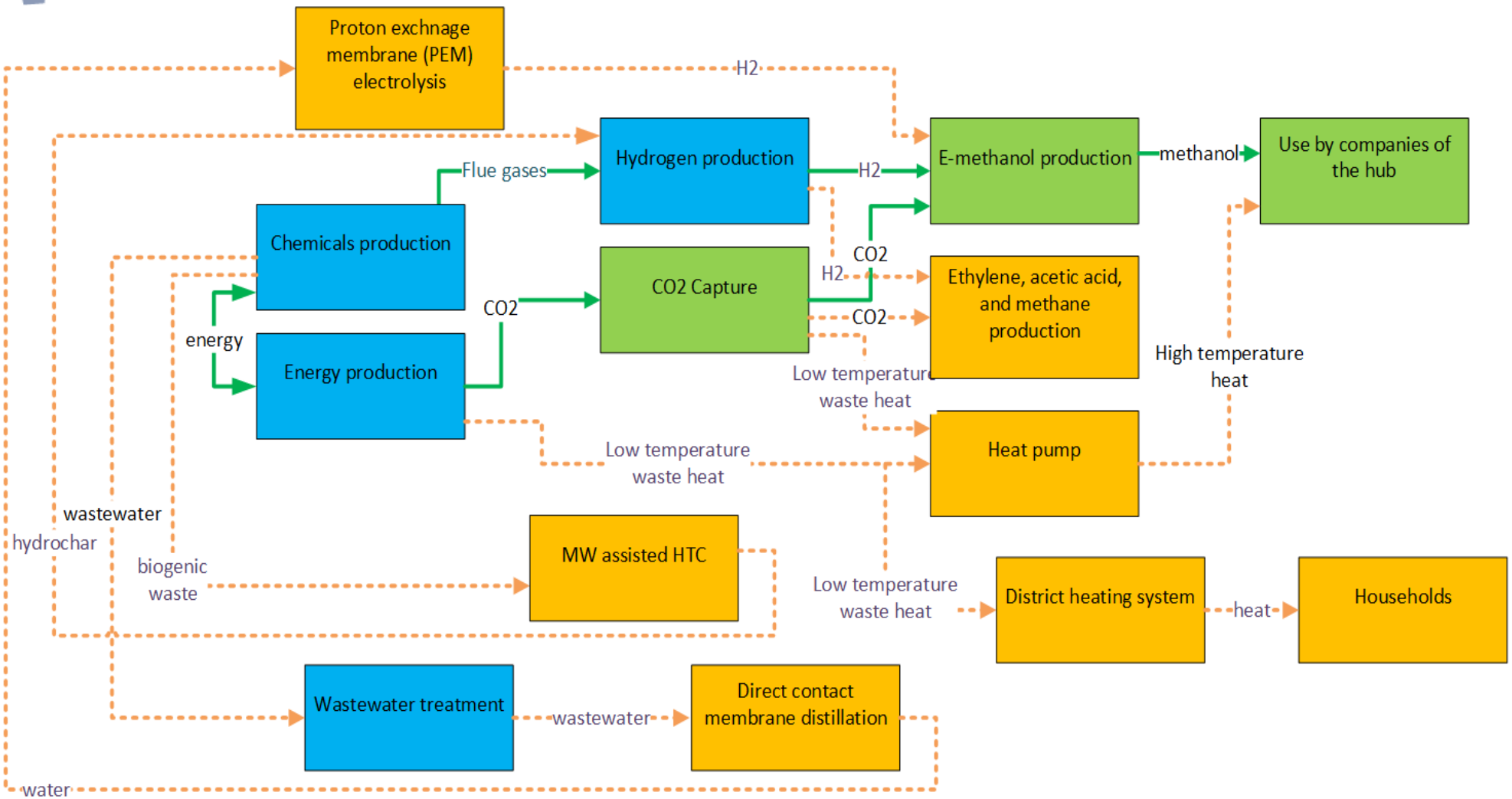
Turkish Hub


E-methanol
Renewable energy
Renewable energy
Hydrogen production - electrolysis
O2
H2
E-methanol production
Oxygen storage in gas cylinders / liquid tanks
O2
Utilization by other users
H2
H2 Station
H2
H2 Truck transportation
E-methanol
H2
Oil refining
CO2
CO2 Capture
CO2
NIPU production
NIPU
Fridge production
Consumer

Basque Hub


Oxycombustion (lime, cement, oil, foundry, pulp&paper)
O2
CO2
Electrolysis
Oxycombustion in steel prod.
CO2 Capture
CO2
Methanation in lime industry
Cement and oil industry
Water
O2
H2
Wastewater treatment
Carbonation of slags
Solid carbonate minerals
Cement and lime industry
E-fuels and biofuels production
Biogenic CO2
H2
Synthetic Fuels & Biofuels
Mobility & transportation
Pyrolysis plant
Urban waste
Sludge
Biogas production
Biogas
Lime, cement, oil, foundry, pulp&paper
Biocoke
Steel production
Steel slags
Cement, lime, steel

German Hub


Proton exchnage membrane (PEM) electrolysis
H2
Hydrogen production
Flue gases
H2
E-methanol production
methanol
Use by companies of the hub
Chemicals production
CO2
H2
CO2 Capture
CO2
Ethylene, acetic acid, and methane production
energy
Energy production
CO2
Low temperature waste heat
High temperature heat
Heat pump
Low temperature waste heat
wastewater
hydrochar
biogenic waste
MW assisted HTC
Low temperature waste heat
District heating system
heat
Households
Wastewater treatment
wastewater
Direct contact membrane distillation
water

WP2 – Technology Development

AEE INTEC

Objectives

- Develop, analyse, and optimise key technologies to maximise industrial synergies (e.g., energy conversion, waste recovery and utilisation, carbon capture and utilization).
- Forecast system behavior and optimize the circularity pathways on a technical level.
- Crucial inputs from desk research/lab work to integration of advanced technologies in the field (in WP6).

WP2 – Technology Development

Direct Contact Membrane Distillation DCMD

AEE

Cascading re-use of waste heat

INEGI

MW-assisted Hydro-thermal Carbonization HTC

CIRCE

Development of CO2 capture & methanation technologies

LTK, TEC, Calcinor

Technology Mapping

MUL

Industrial process 1 Source

Output Stream

Key technology

Linking Stream

Industrial process 2 Sink

Large-scale, multi-vector energy systems incl. H2

UT

Optimizing electricity, heat, fuel, chemical feedstock vectors

UT

CO2 → carbamates → NIPU

FHG

WP 3 - Societal Engagement and Governance

TUDO

Objectives

- Identify relevant stakeholders and their connection process to H4C.
- Investigate non-technical (regulatory, ethical, societal) challenges and barriers for establishing the hub
- Define stakeholder needs and best stakeholder engagement strategies to ensure sustainable development of the H4C
- Establish living labs from the beginning of the project to beyond project's end
- Measure socio-economic regional development impacts of H4C

WP 3 - Societal Engagement and Governance

Stakeholder engagement in hub regions

24 stakeholders from typologies of industry, academia, policy and society

Stakeholder Surveys

28 participants joined the surveys and stakeholder interviews are conducted to understand the interest and influence of stakeholders in Hubs

Survey analysis

Motivation to participate in IS and relevance of diverse topics for a successful IS are analyzed

Work on WP3 will continue with development of methodology for assessment of non-technological topics in H4C, creation of living labs, and measurement of socio-economic regional development impact of H4C

WP4 - Modelling and optimisation for H4C development

UTwente

WP4 ensures H4Cs operate efficiently and sustainably.

H4C analysis: Characterization of resources, processes, energy flows, and industrial symbioses

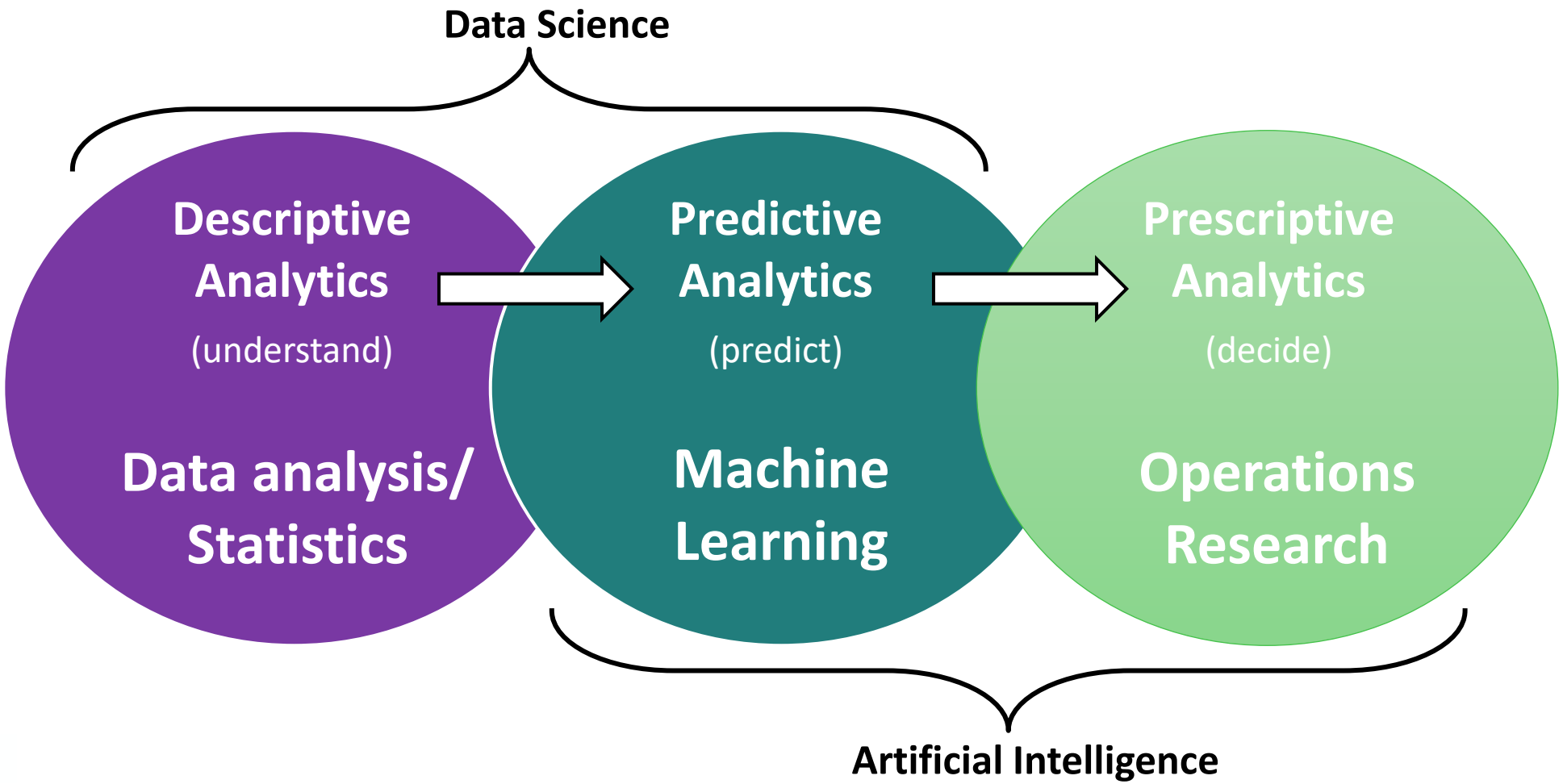
H4C optimization: Quantitative methods for **matchmaking** and **optimizing** logistics, material and energy flows

H4C development: Models for bottom-up and top-down hub development

H4C impact assessment: Long-term environmental impact and economic effects

WP4 - Modelling and optimisation for H4C development

WP4 develops **data-driven tools** for efficient hub operations ➔ **Advanced analytics**



WP4 - Modelling and optimisation for H4C development

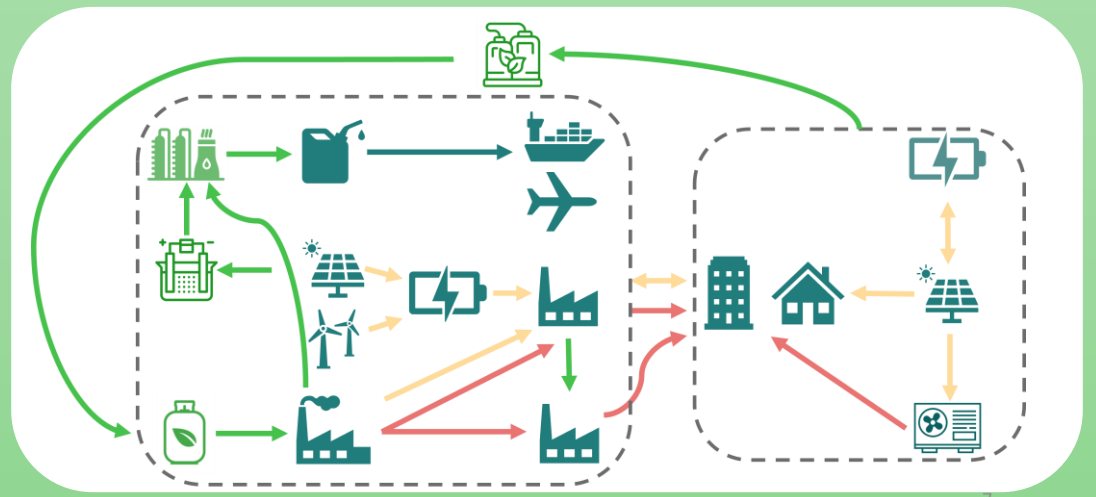
Different stakeholders

Many flows (energy, material)

Uncertainty

Decentralized

H4C are complex systems…



Regulatory framework

Synergies

Dependencies

Economic vs. environmental vs. societal

… with high potential for improving economic, environmental and societal impact

Planning, managing and operating an H4C efficiently is not straightforward and not easily done manually due to the complexity

➔ **Data-driven tools support decision-makers in this complex task**

WP5 - Business and financial models

KPMG

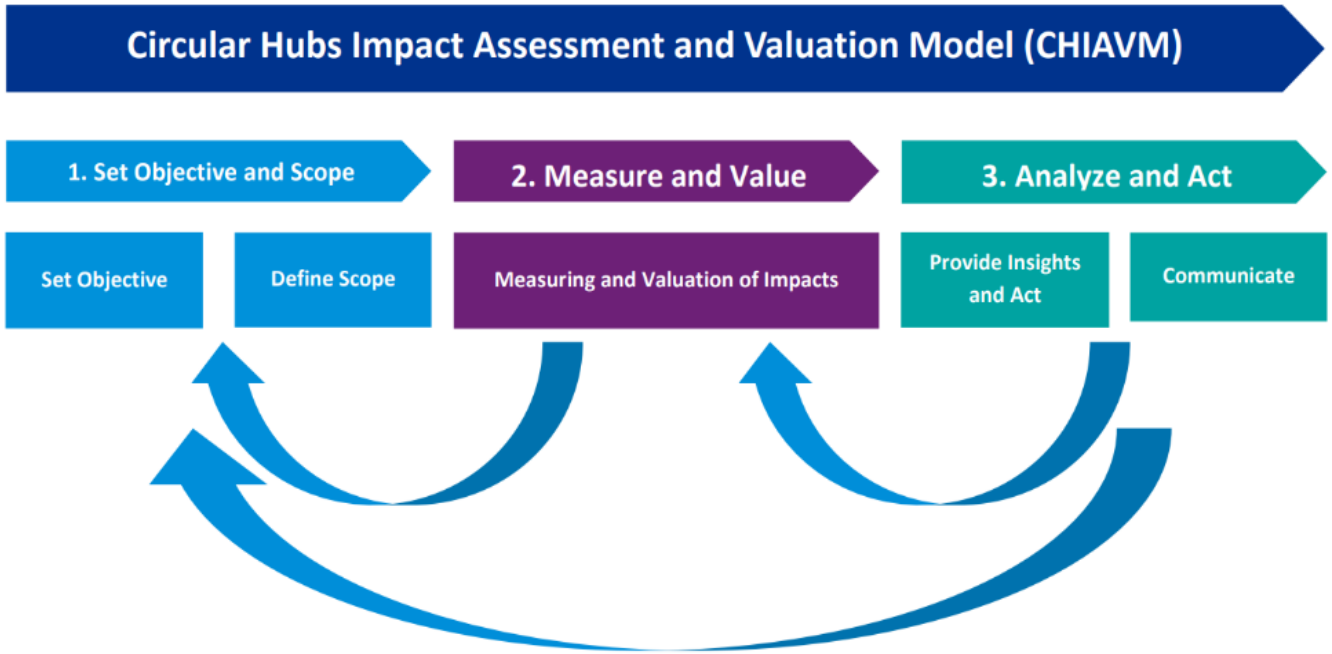
Objectives

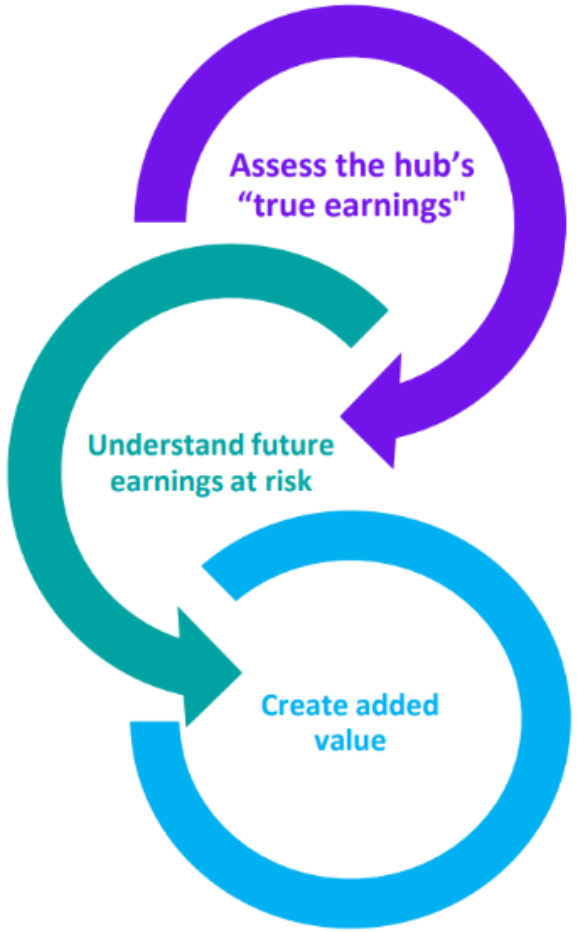
- Design and develop **impact valuation model**, using the “True Value Methodology”
- Assess and monetise the social and environmental externalities as a project screening tool
- Develop business cases for synergies planned in four hubs
- Project further business opportunities within hubs

WP5 - Business and financial models

The aim is to achieve **Economic Sustainability of H4C** and elevate the **commercial attractiveness**

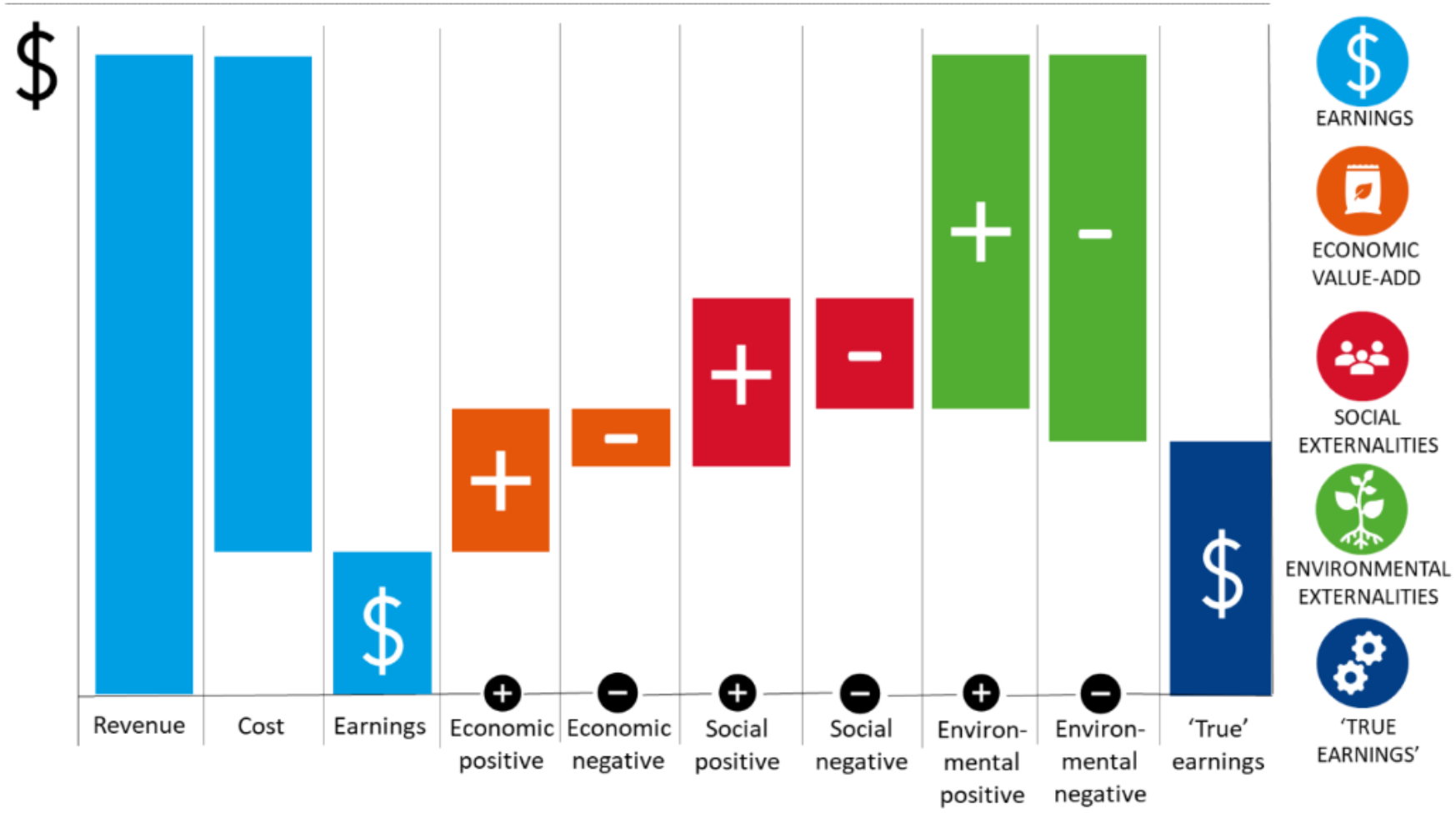
- Business models
- Valuation models
- AI methods for financial assessment
- Investment opportunities





WP5 - Business and financial models

True Value Model developed by KPMG



WP6 - Integration and demonstration in hubs

TECNALIA

Objectives

- Field work takes place in WP6 to deploy the a-priori decided technologies in the hubs.
- WP6 aims at advancing the industrial zones into H4C via applying the technologies in the operational environment under the principals of circularity and IS and integrating the existing and new infrastructure.
- Project’s practical impact occurs in the WP6.

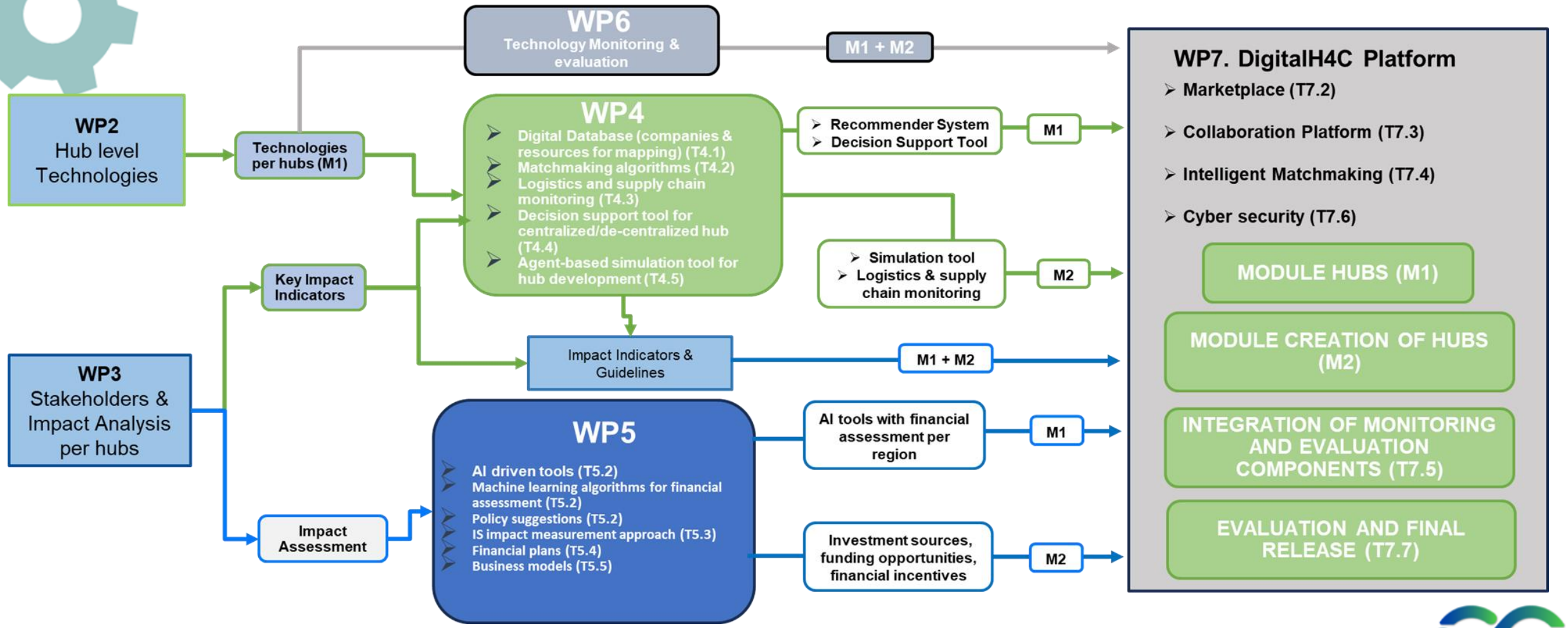
WP7 - Digital Collaboration Platform for H4C

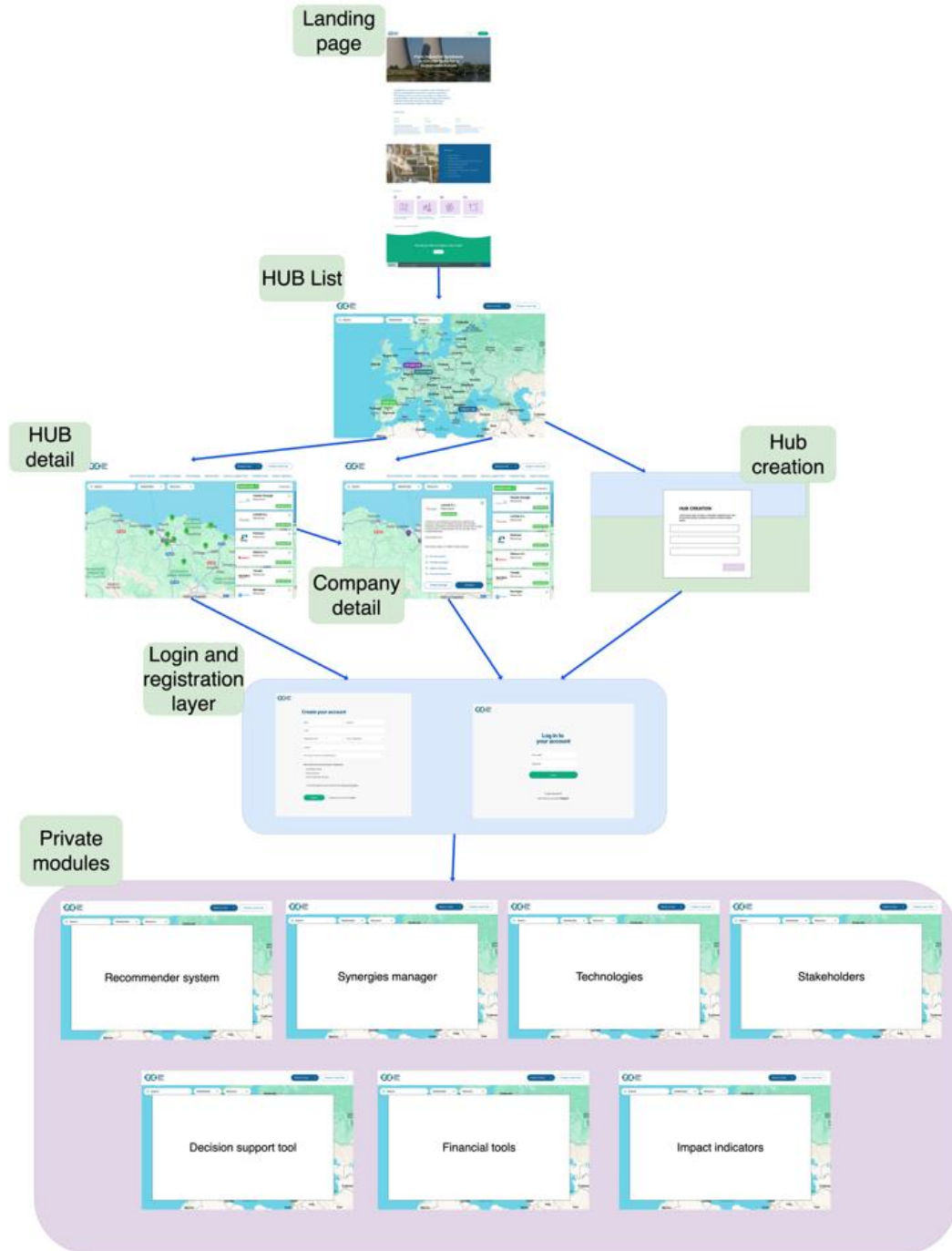
IRIS, UT, ICCS

Objective:

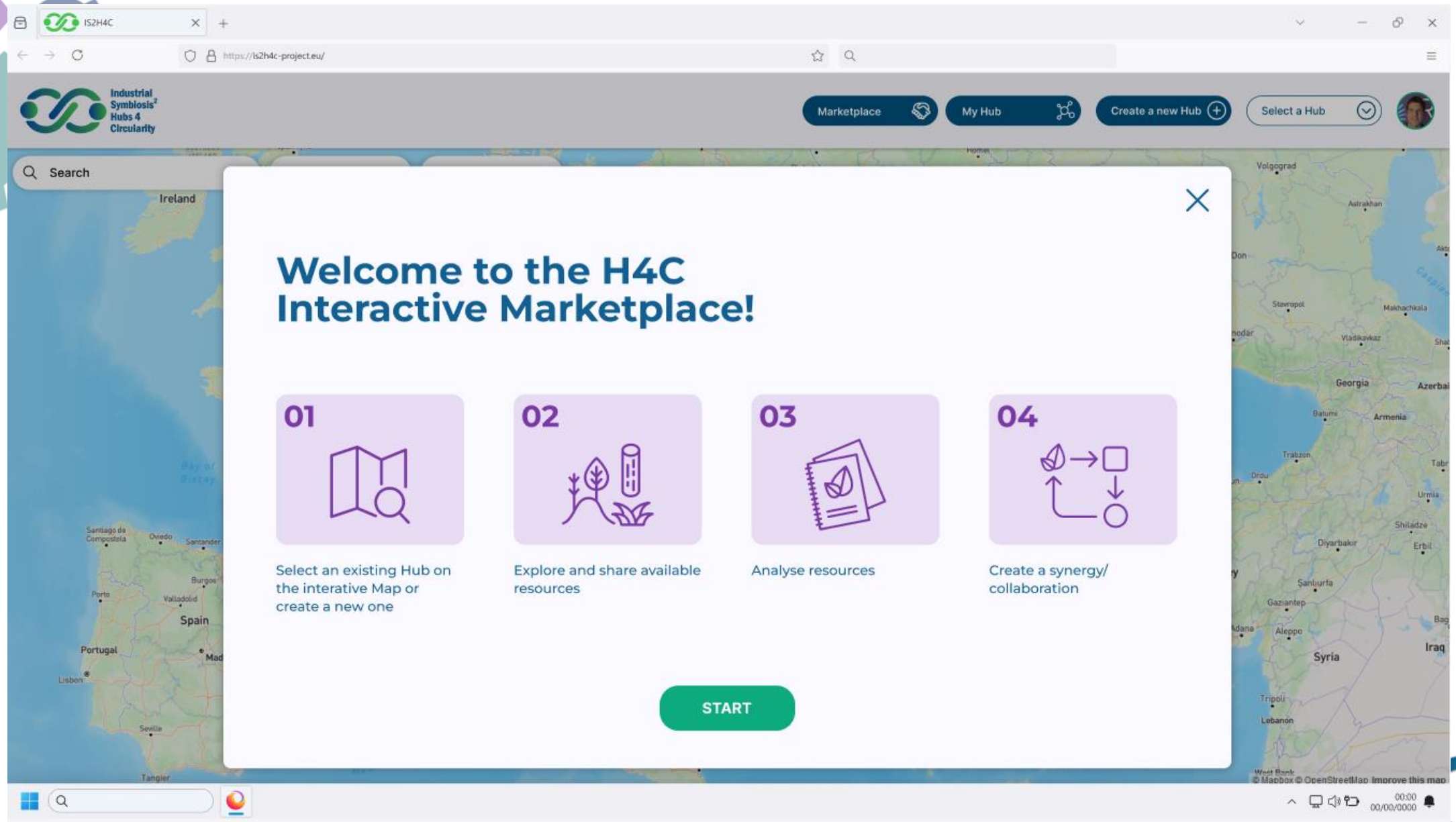
Develop a user-friendly, scalable, and adaptable **digital collaboration platform for H4C (DigitalH4C).** The platform consists of a modular suite of tools, features, and data analytics to facilitate IS identification, assessment, implementation, and monitoring.

WP7 - Digital Collaboration Platform for H4C

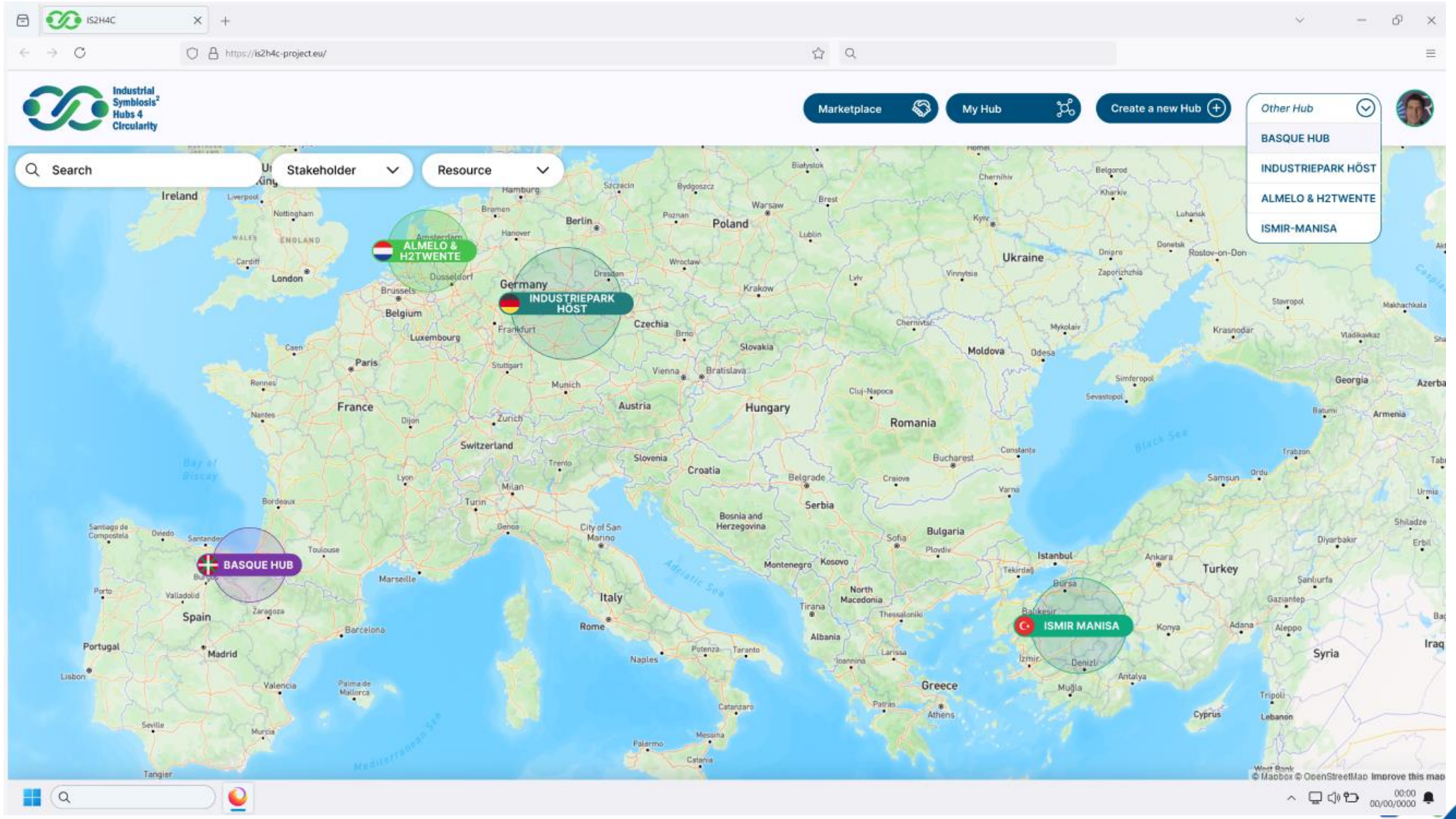



Landing page
HUB List
HUB detail
Hub creation
Company detail
Login and registration layer
Private modules
Recommender system
Synergies manager
Technologies
Stakeholders
Decision support tool
Financial tools
Impact indicators

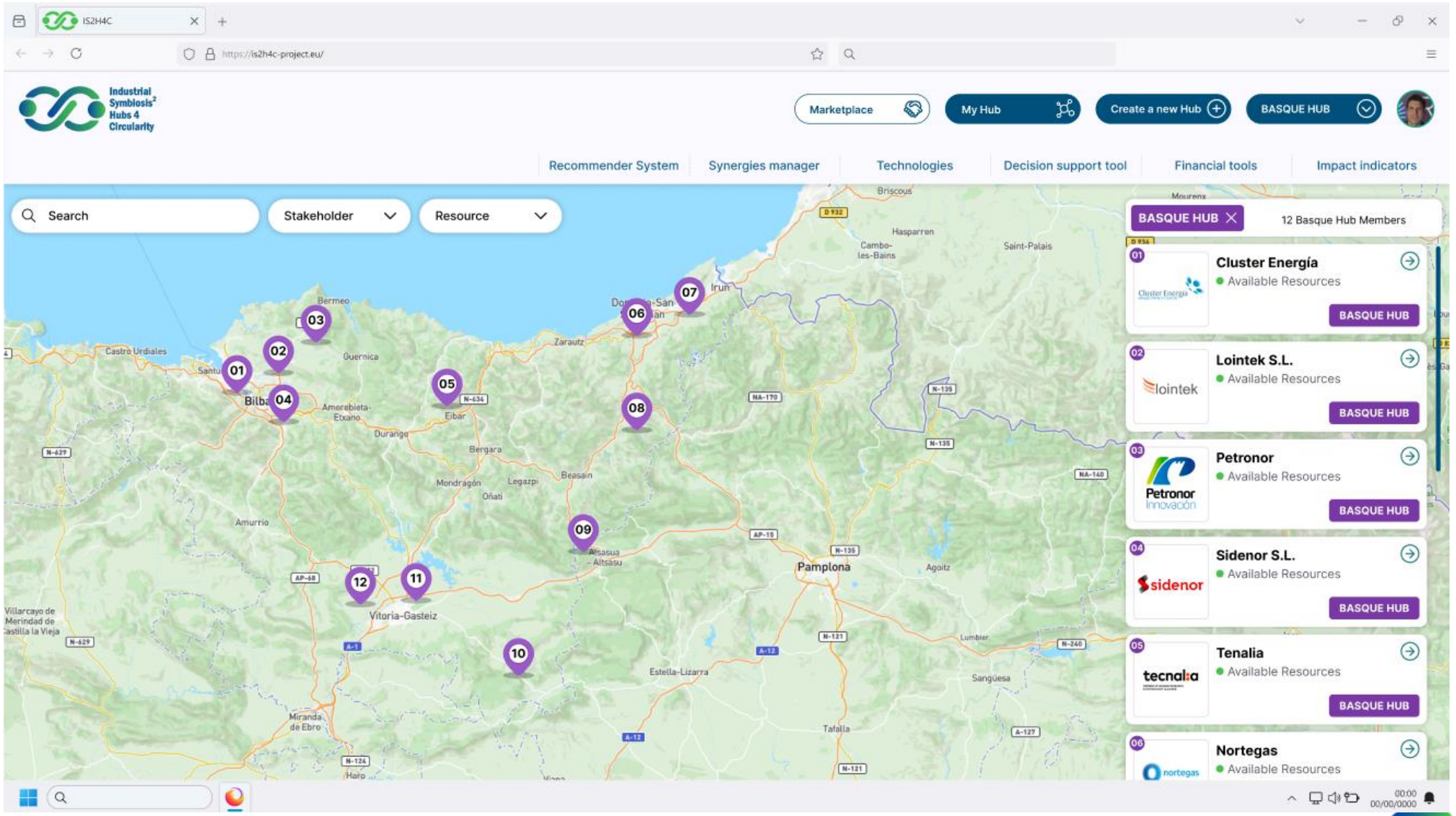
H4C platform: Landing Page



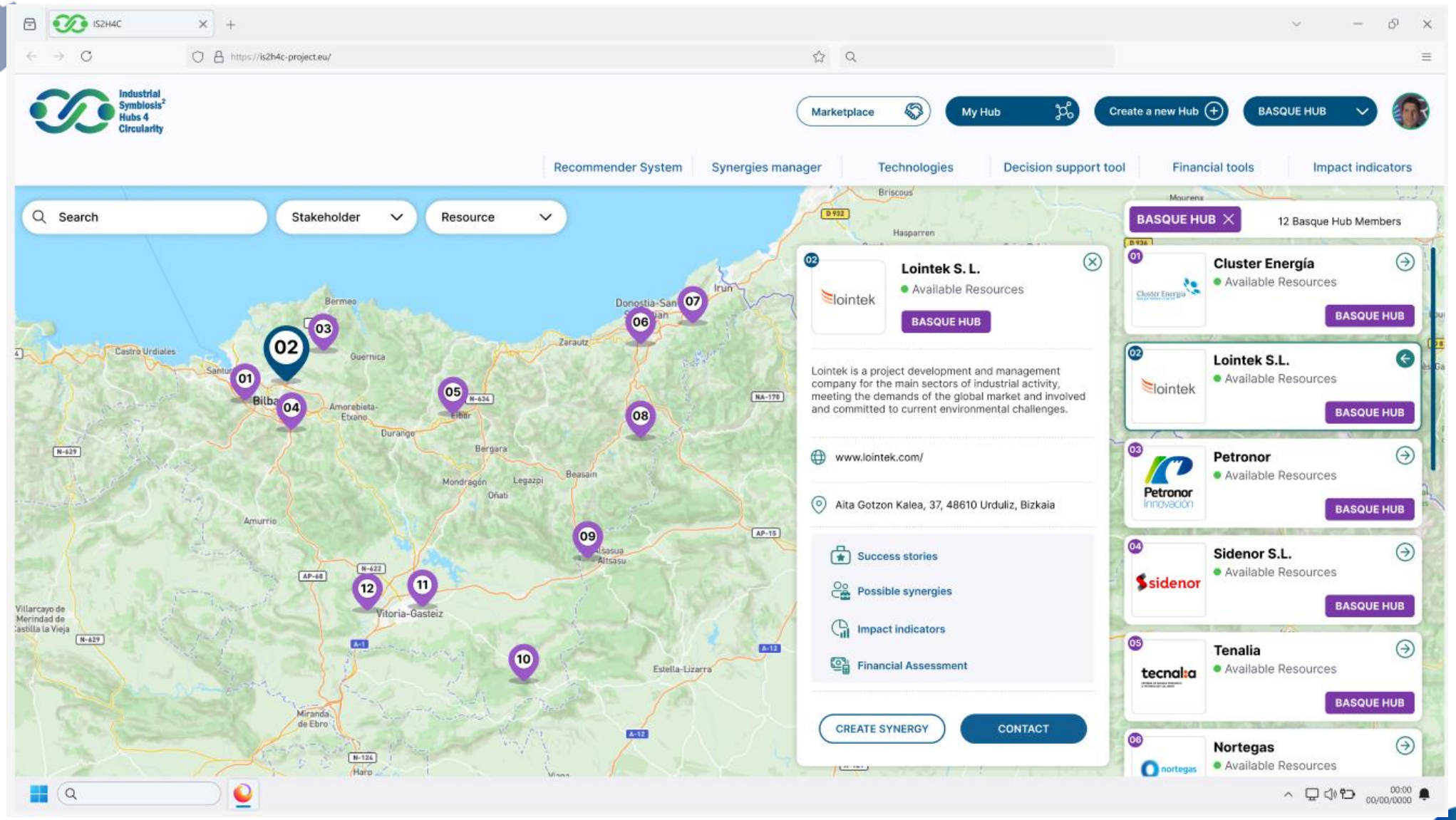
MarketPlace



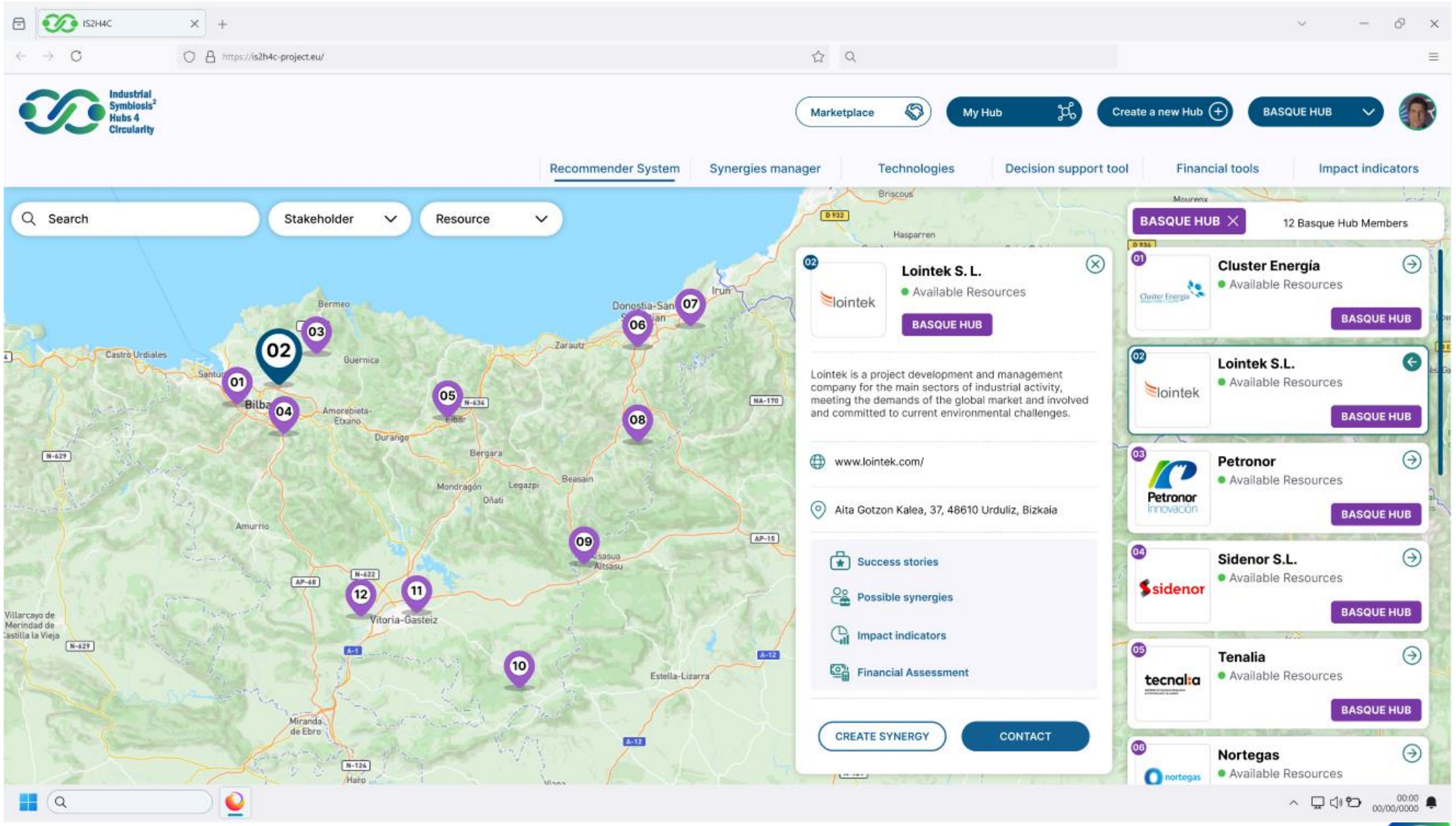
Marketplace: HUB level



Marketplace: HUB level: Company level



Marketplace: Additional modules



WP8- Dissemination, communication & exploitation

Objectives

- Effectively communicate project findings, results, and outcomes to targeted audiences
- Promote the project to a broader audience
- Design and implement strategies to engage stakeholders and pursue collaborations with other pertinent initiatives
- Support the implementation of key exploitable results (KERs) and ensuring their protection through adequate intellectual property rights (IPR) measures

Maximize the IS2H4C's impact and create opportunities for further exploitation and dissemination

Collaborative ecosystem: building the Circular Industry helix

The Circular Industry Helix is an international Open Innovation community of specialists and stakeholders.

Crowdhelix

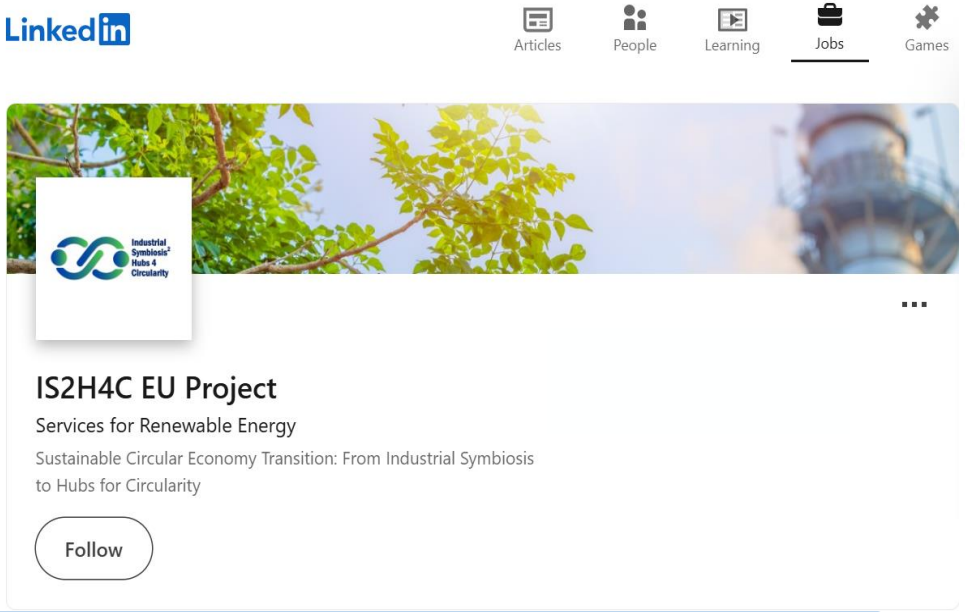
Use the Helix for:

- Sharing Collaboration Opportunities (e.g. funding opportunities)
- Sharing events
- Calls for action (e.g. surveys, participatory processes)
- Sharing results and innovations
- Find relevant stakeholders to support innovation activities

Circular Industry

LinkedIn Overview

01/03/2024 - 10/03/2025



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654	1,949	68,790	2,432	101

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01/09/2024 - 10/03/2025

New Users

1400

Views

3600

Sessions

2500

Newsletter

1st Edition has published

Subscribe to receive our biannual newsletter through our webpage!

is2h4c-project.eu

Dear Readers,

Welcome to the biannual newsletter of the IS2H4C project! Since our kickoff, we've made remarkable progress in advancing industrial symbiosis and sustainability across Europe. Join us as we recap the key milestones and events that have shaped our journey over the past months.

Past Events

5th Symposium on Circular Economy and Sustainability
June 17-19, 2024 | Chania, Greece

German Hub Meeting
November 18–19, 2024 | Germany

2nd European Process Industry Conference (A.SPIRE)
October 25, 2024 | Brussels, Belgium

Basque Hydrogen Corridor Meeting
October 11, 2024 | Basque Country, Spain

European Summit of Industrial Biotechnology (ESIB)
November 12-14 , 2024 | Graz, Austria

Mobile World Congress 2025

March 3-6, 2025 | Barcelona Spain

Upcoming Events

Hubs for Circularity Clustering Webinar Series
March-May, 2025 | Online

6th Symposium on Circular Economy and Sustainability
June 18-20, 2025 | Alexandroupolis, Greece

Consortium Meetings

Kickoff Meeting, Enschede
(February 2024)

2nd GA Meeting, Bilbao
(September 2024)

3rd GA Meeting, Istanbul
(February 2025)

Industrial Symbiosis^2 Hubs 4 Circularity

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MONTAN UNIVERSITÄT LEOBEN

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BASQUE ENERGY CLUSTER

AEE INTEC

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Tüpraş

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Bilbao Bizkaia Ur Partzuergoa
Consorcio de Aguas Bilbao Bizkaia

SBS
Thermal Technologies

inegi driving science & innovation

H$_2$ Hub Twente
Waterstof Platform

SOLENCO POWER

KPMG

Calcinor

Industrial Symbiosis^2 Hubs 4 Circularity

Thank you

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