Research Fund for Coal & Steel

European Commission

Mine toH2
RFCS JT PROJECT

MINE-TO-H2

Repurposing a former coal mine: Green hydrogen for the transport sector using the circular economy and coupled with the heating sector

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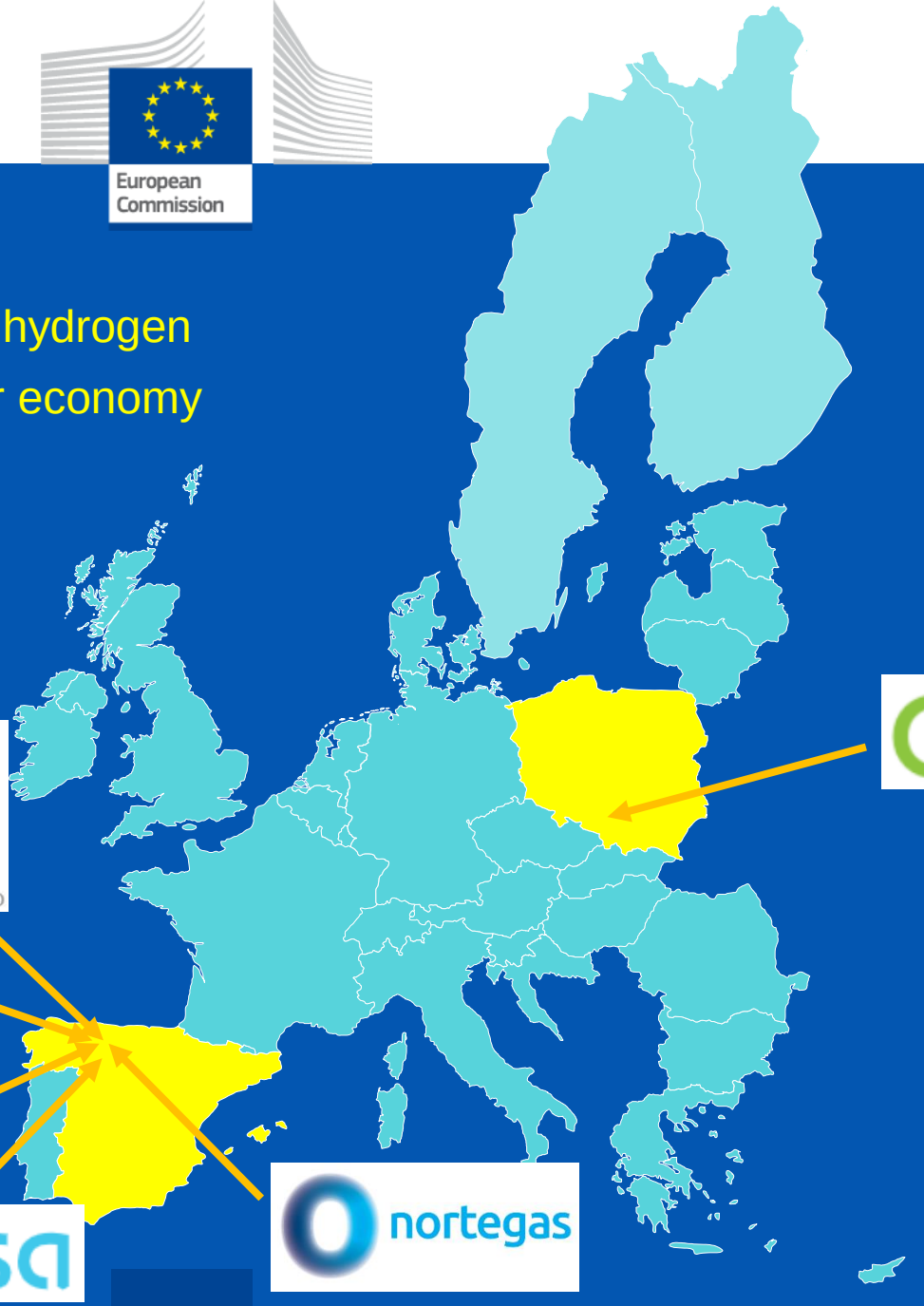
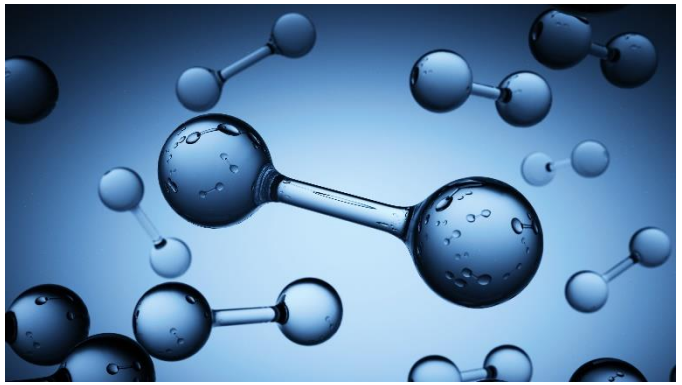


Call: *RFCS-2023-JT*
Instrument: *PDR*
Start date: 01/04/2024
End date: 30/09/2028
Budget: 18 052 926 €

Problem tackled by MINE-TO-H2

- The European Green Deal is supported by the Fit for 55 package, which states that all Union actions and policies, including the RFCS, should pull together to help the Union achieve a successful and just transition towards a sustainable future.

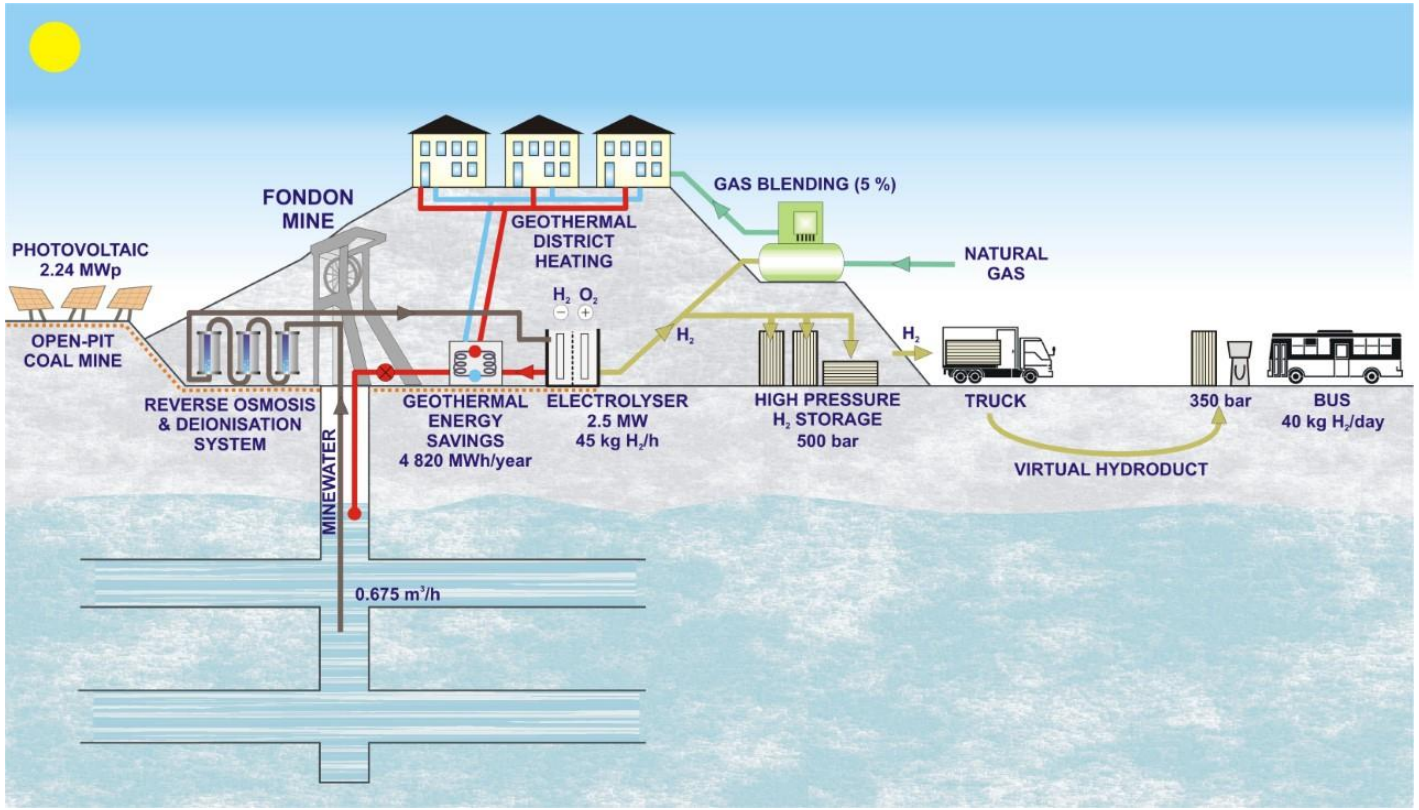


- Hydrogen production and its coupling with the heating sector is an excellent option to support the just transition of the coal sector and regions most affected by the transition by repurposing end-of-life coal mines and developing a power sector based mainly on renewable energies.

- Hydrogen can be used as a fuel, an energy carrier or a feedstock and could reduce emissions in hard-to-abate sectors, particularly in industry and transport.

Main objectives

- The use of mine water for electrolysis to save water from the population supply.
- H_2 injection into natural gas grids, refueling and storage.
- Demonstrating the economics of green hydrogen plants.
- Training and re-skilling of former coal miners.



- Achieving energy savings in geothermal district heating through heat recovery by electrolyser cooling.

Main expected results

- An operating green hydrogen plant.
- Hybridization with an existing geothermal plant.
- Installation of a photovoltaic plant in a former coal open-pit mine.
- An operating storage and distribution facility for hydrogen at 500 bar.
- An operating virtual hydroduct and hydrogen refueling station (HRS), and a prototype of intercity hydrogen bus (Fuel Cell Electric Vehicle).
- Injection of hydrogen to the natural gas network.
- Training and reskilling programs to address the skill gaps of former coal mining workers.

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Main industrial and/or socio-economic outcome/ impact

- Hydrogen and its coupling with the heating sector will support the just transition of the coal sector and regions promoting sustainable local economic growth and maximising the number of green and quality jobs.
- Depending on the downstream natural gas customers, demonstrating the hydrogen admissibility level of the different equipment.
- Lower climate impact in passenger transport.

Communication & dissemination

- Reaching multiple audiences to maximise stakeholders' involvement: coal mining companies, EURACOAL, UNECE, & associations related with H_2.
- With the help of adequate initiatives: a friendly website; annual newsletters; promotional videos; presentations at relevant forums; publications; etc.
- Benchmarking of coal mining companies focusing on the feasibility of building green hydrogen plants to undergo their repurposing.
- Training managers from coal mines on this business plan.
- And taking further steps once the project is completed: feeding back new policy-making, scaling up production if feasible, etc.

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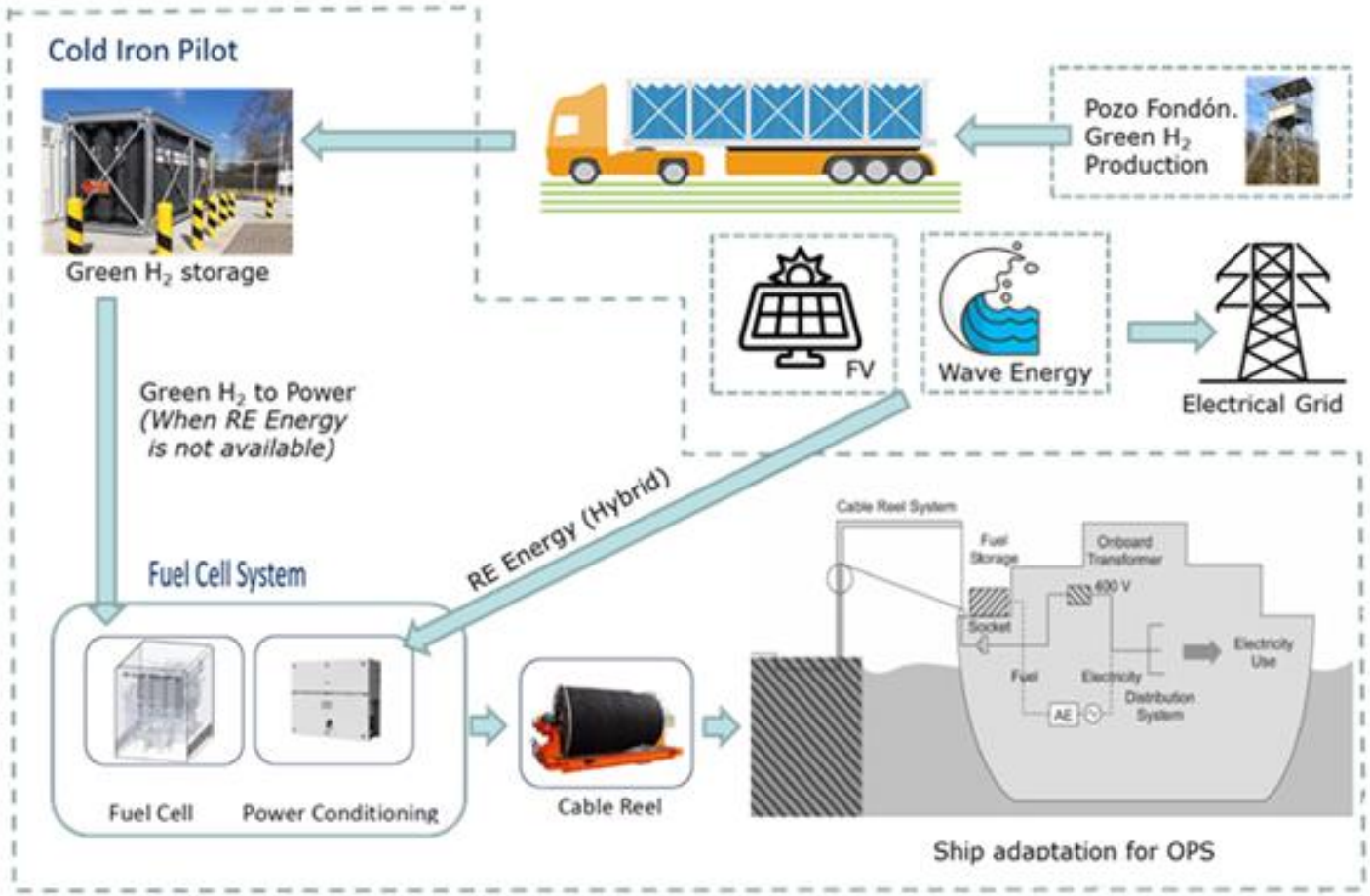
Exploitation

- Contacting potential off-takers: regional and national bus fleets, urban bus fleets, waste management fleets, retail and logistic fleets, industrial plants and others.
- Exploring further pilots trying to involve other possible stakeholders, e.g., Onshore power supply (OPS).



Economics behind the project

Capital expense (CAPEX)

Description	Estimated cost (€)
2.24 MWp Photovoltaic plant	2,020,000
Electrolyser system	3,200,000
Mine water feeding and treatment systems	220,000
Blending installation	330,650
Hydrogen storage and refuelling systems	4,623,220
Electrical system connection	324,000
Mechanical & electrical balance of plants (BOP)	1,870,000
Digital Twin and Artificial Intelligence software	110,000
Rental of equipment	187,850
TOTAL	**12,885,720**

Economics behind the project

Technical and economic parameters

Description	Value
Functioning hours of the installation for one year	6,000 h
Hourly production of hydrogen	45 kg/h
Annual hydrogen production	270,000 kg/year
Annual photovoltaic functioning hours	1,200 h/year
Photovoltaic energy production	3,600 MWh/year
Tolls and charges for electricity supply	15 €/MWh
Operating expenses (personnel, maintenance, repairs)	250,000 €
Electrical consumption of the plant	3 MWh

Challenges

- Beneficiaries
- New use for mine water
- Synergies with other European Projects
- Heat recovery and integration into DH networks
- Recovery of mining areas
- Development of new technologies

Beneficiaries

- Extensive experience in RFCS projects
- (Coordinator in Potentials, RECOVERY, GreenJOBS, etc.)

- Already experienced in green H2
- Large Companies but strong link to this coal region

GIG National Research Institute

Universidad de Oviedo

grupohunosa

alsa

nortegas

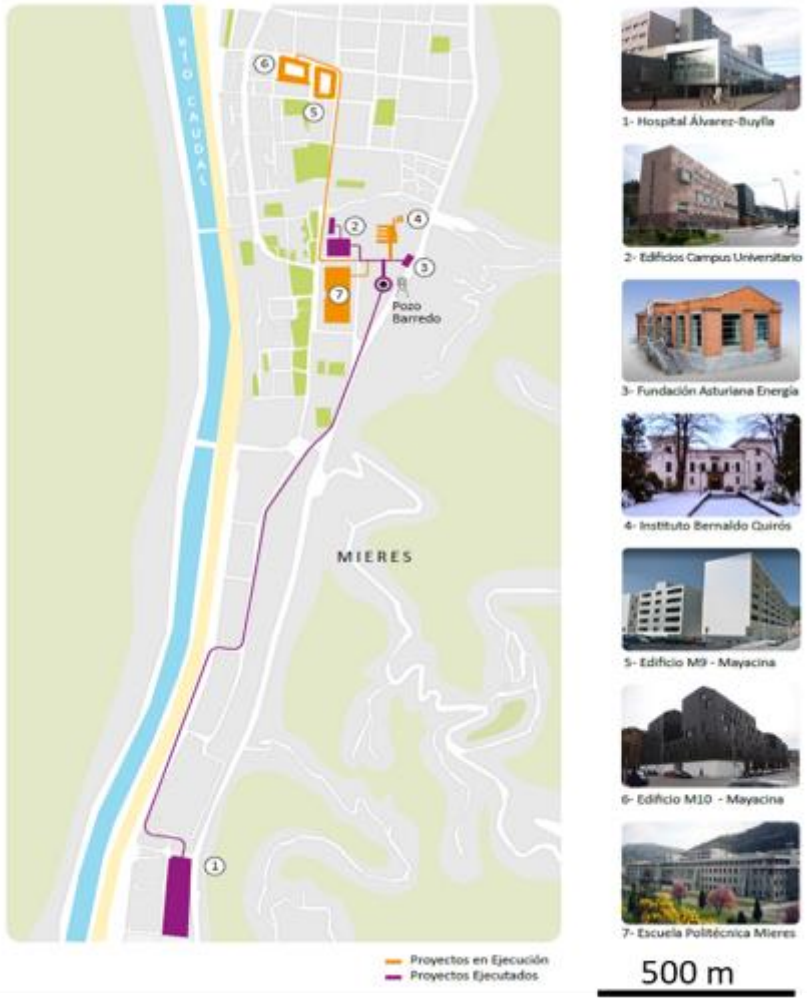
New use for mine water

- Mine water pumped yearly: 35 Hm3/y (1 m3/s)
- Temperature: 23ºC
- Used to generate heating and cooling service with the help of chillers and heat pumps.

1. **BARREDO COLLIERY** (**6,6 +3,6 MWth**) in Mieres

First geotermal facilities (2014): 4,6 MWth + 3,6 MWth (heating + cooling)

New Barredo District Heating Network (2020): 2 MWth (Heating)



New use for mine water

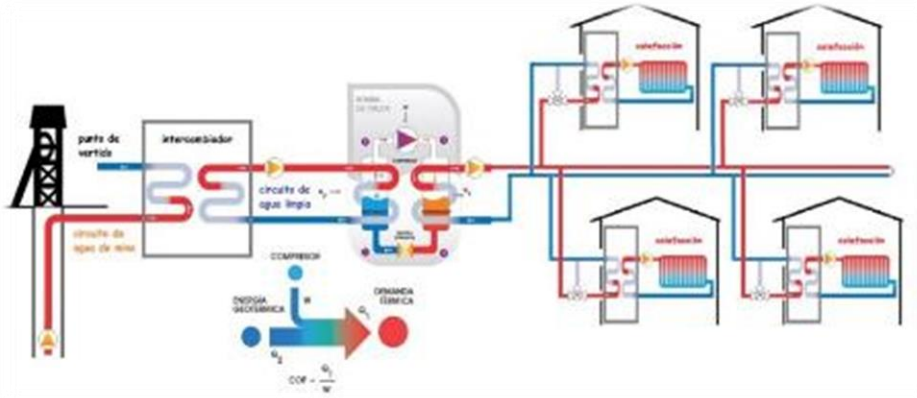
1. FONDÓN COLLIERY (1,5 +1,5 MWth) (Langreo)

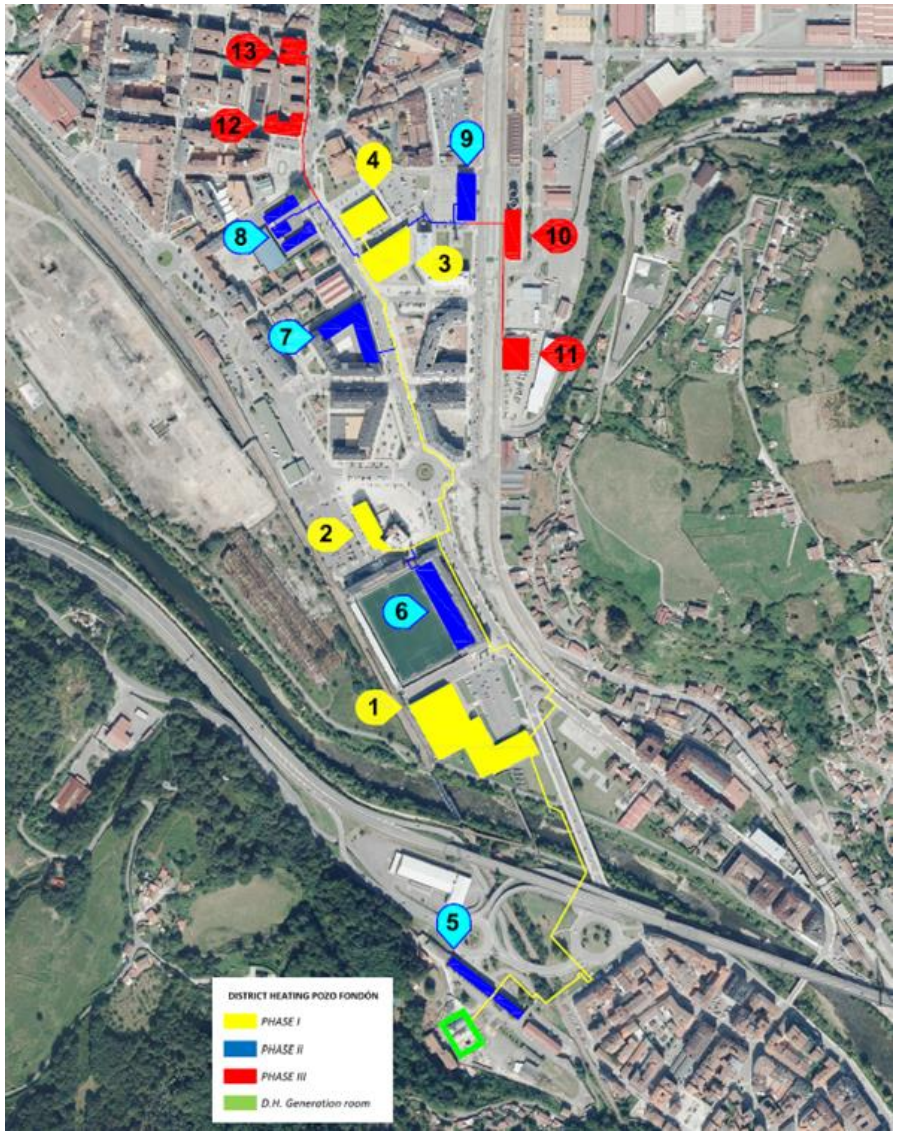
DH Fondón Phase I (2022):

1,5 MWth

DH Fondón Phase II: (hybridization with biomass - under construction)

1,5 MWth





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Synergies with other European projects

- Recent case studies in R&D European projects.

REWARDHeat (2019-2024)

REWARDHeat

Horizon 2020 European Union Funding for Research & Innovation

GreenJOBS (2022-2025)

GreenJOBS RFCS RESEARCH PROJECT

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- Recovery of waste heat from electrolyzers for use in district heating networks.
- Assessment of the feasibility of implementing green hydrogen generation plants, mainly in mining areas.

- Opportunity: - Efficiency of PEM electrolysis is approximately 70%

  - Heat losses usable in our District heating Networks

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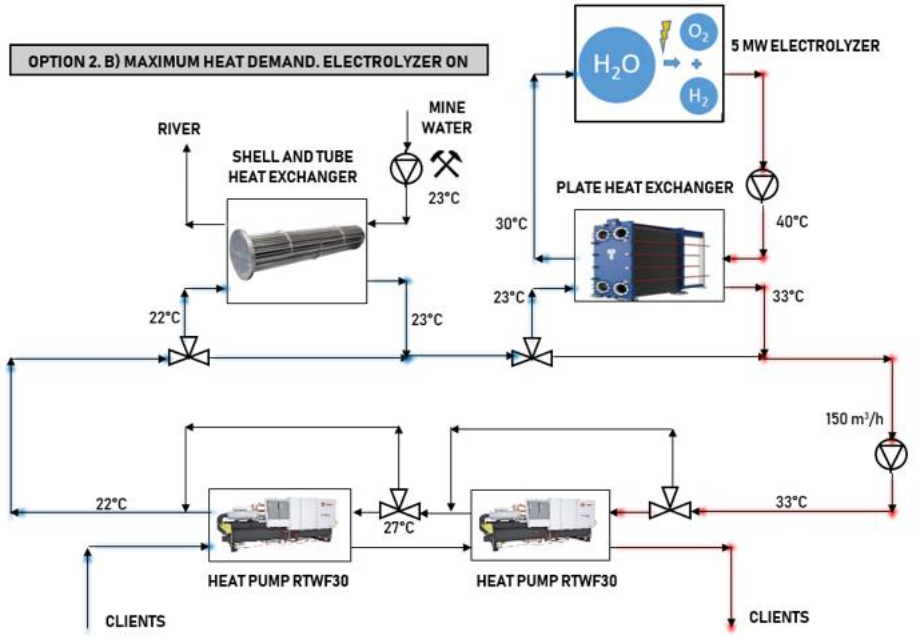
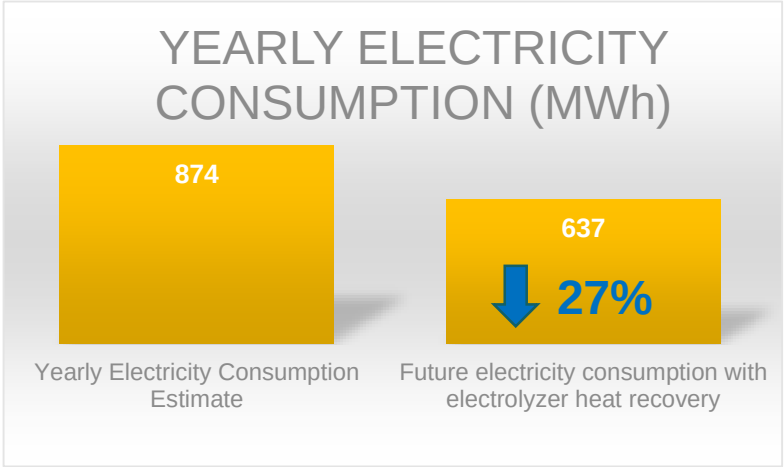
Heat recovery

- Cooling temperatures up to 30-40°.
- Very high efficiency for space heating and DHW through the use of water-to-water chillers or heat pumps.



	BT	AT	**On average**
Increase in theoretical COP	1,12	0,70	**0,83**
Electricity consumtion	626	1.336	

Yearly Heat Production estimate	1.962	MWht
Yearly Electricity Consumption Estimate	**874**	**MWh**
Yearly COP estimate	2,25	
Future COP with electrolyzer heat recovery	3,08	
Future electricity consumption with electrolyzer heat recovery	**637**	**MWh**



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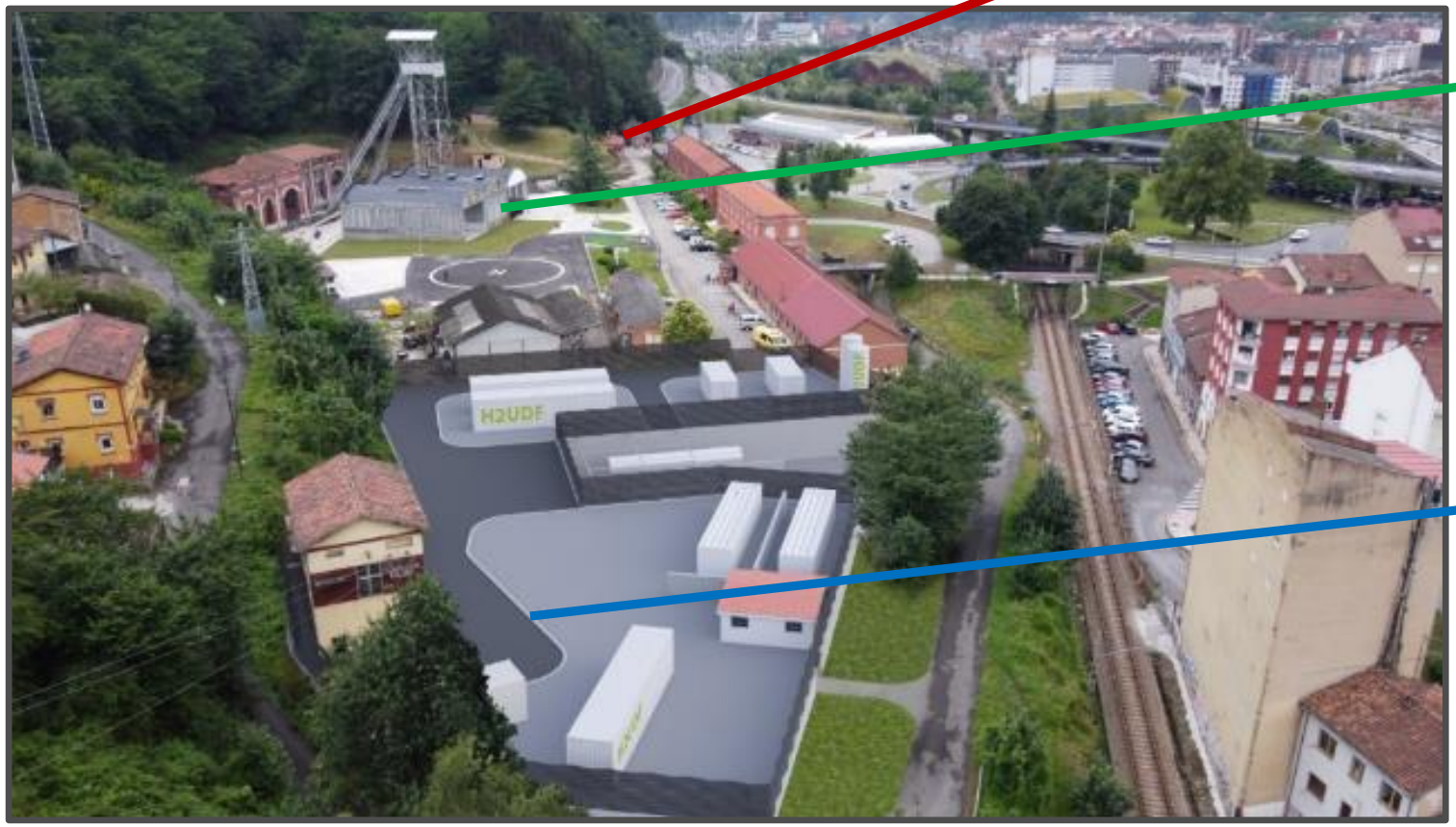
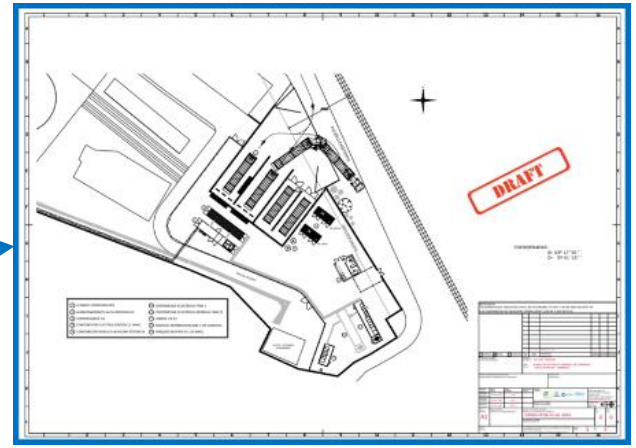
Recovery of mining areas

- Water from La Nalona (former coal mine)
- 2.5 MW electrolyzer stack





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Recovery of mining areas

From Colliery to Industrial Plant

Open Pit or Waste Dump to PV Plant

Restoration + Resource utilization

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Development of technologies

H2 STORAGE

500 bar

GREEN MOBILITY:

First FCEV Intercity

DIGITAL TWIN

BLENDING

- Testing
- Limits ¿?

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Conclusions

SYNERGIES:
Other EU projects
Beneficiaries

RECOVERY OF MINING AREAS:
Collieries
Open Pit Mines

CIRCULAR ECONOMY:
Mine water
Heat recovery

NEW TECHNOLOGY DEVELOPMENTS:
Intercity bus
Blending
H2 Storage
Digital Twin

Thank you very much for your attention

www.minetoh2project.eu

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