

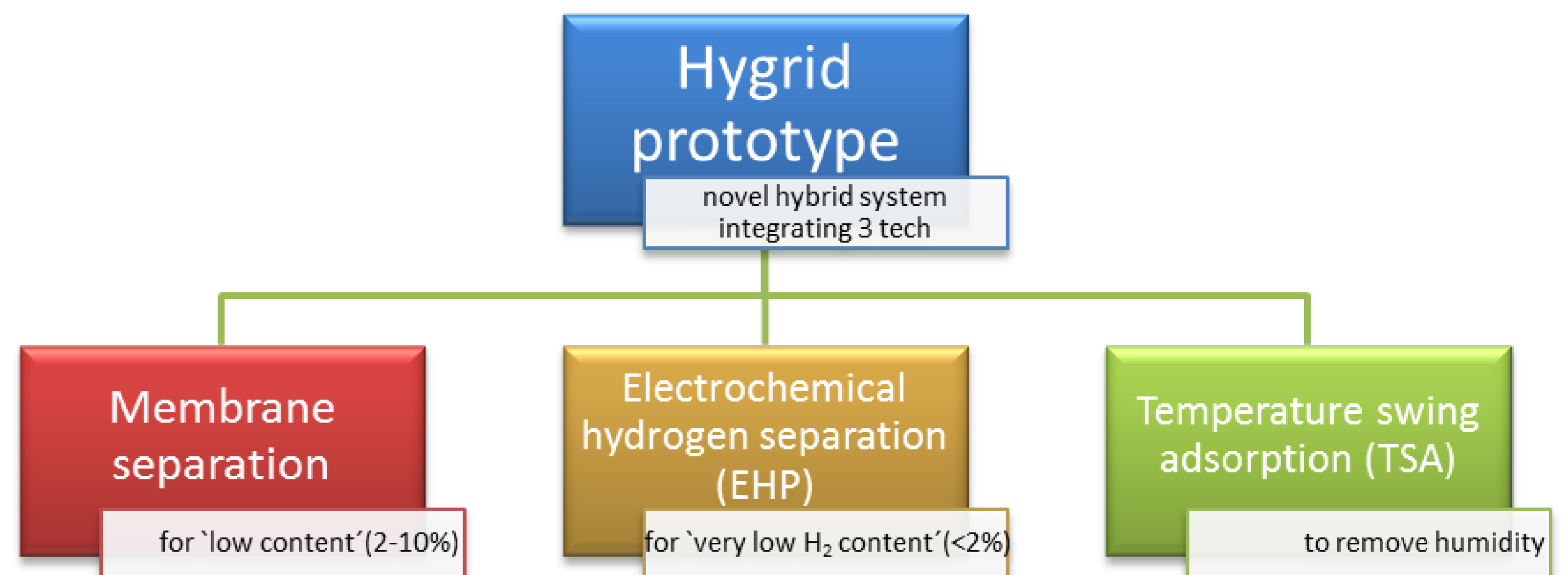
Summary and Concept

One of the main problems for the implementation of the hydrogen based economy is the transportation from production centres to the end user both industries and population. To solve this problem, besides the in-situ production of hydrogen, the use of the existing Natural Gas network has been proposed for storing and distributing hydrogen. However, cost effective separation technologies for direct separation of hydrogen from the natural network should be developed for separating and purifying the hydrogen to match the end user requirements.

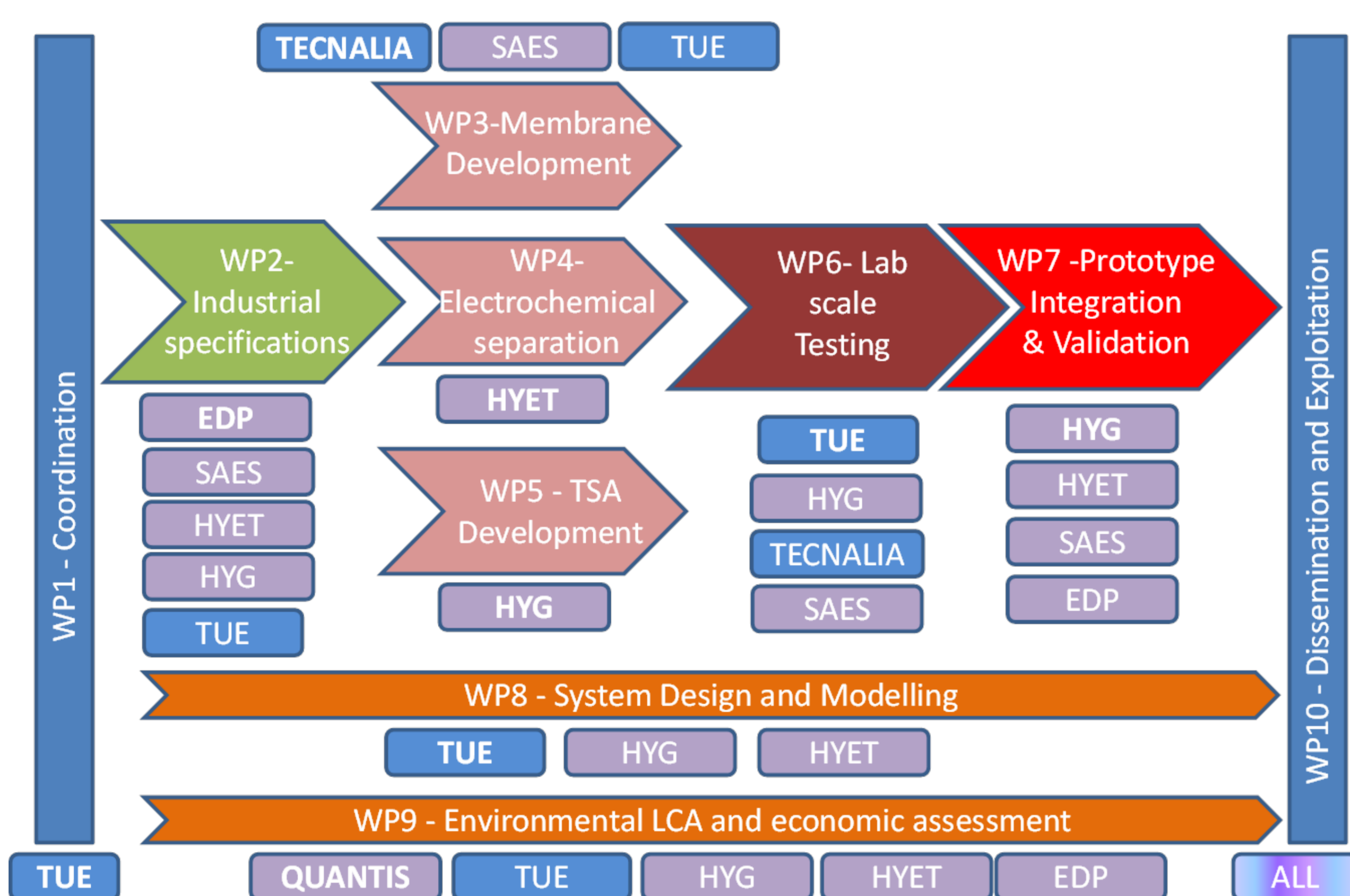
The HyGrid project (www.hygrid-h2.eu) proposes an integral solution for developing of an advanced high performance, cost effective separation technology for direct separation of hydrogen from natural gas networks. By using a novel membrane based hybrid technology combining three technologies integrated in a way that enhances the strengths of each of them: membrane separation technology is employed for removing H₂ from the "low H₂ content" (e.g. 2-10 %) followed by electrochemical hydrogen separation (EHP) optimal for the "very low H₂ content" (e.g. <2 %) and finally temperature swing adsorption (TSA) technology to purify from humidity produced in both systems upstream, pure hydrogen production (ISO 14687) will be obtained. The project targets a pure hydrogen separation system with power and cost of < 5 kWh/kg_{H₂} and < 1.5 €/kg_{H₂}. The pilot will be designed for the separation and purification of >25 kg/day of hydrogen (ISO 14687).

The new separation & purification system will increase the value of hydrogen blended into the natural gas grid, improving the economics of central hydrogen production from excess renewable energy couples with natural gas grid injection. In addition, it will reduce cost, and therefore increase the use of hydrogen from very dilute hydrogen streams in energy and transport applications. On the other side, further applications could be found in separating hydrogen from mixtures produced in chemical or biological processes, where it otherwise would be used to generate heat or even be vented.

HyGrid concept



Project Objectives



- Design, develop, demonstrate and optimise an advanced hydrogen separation system for the production of at least 25 kg/day of hydrogen as per ISO 14687 from low (2-10%) and very low (<2%) H₂ blends in natural gas grids.
- Development of stable, high performance and long durability membranes for hydrogen recovery from low (2-10%) hydrogen content streams.
- Development of more stable sealing methods for the membranes at moderate temperatures and reductive atmospheres.
- The further development of EHP for hydrogen recovery from very low (<2%) concentration streams.
- The further development of TSA for water removal from hydrogen/water streams.
- The integration of the new membranes, TSA and EHP in novel hybrid system to achieve high recoveries with low energy penalties.
- Energy analysis of the new HyGrid technology on different scenarios:
 - recovery of H₂ from low concentration streams (2% -10%) up to 99.97% H₂ purity (ISO14687) in the whole range of pressures of the NG grid.
 - Different configurations/combinations of the three separation technologies.
- The validation of the novel hybrid system at prototype scale (TLR 5).
- The environmental analysis through a Life Cycle Assessment of the complete chain.
- Dissemination and exploitation of the results.

Project details

Project details

Start Date: 1 May 2016
Duration: 36 months
Project Cost: 2,847,710 Euro
Project Funding: 2,527,710 Euro

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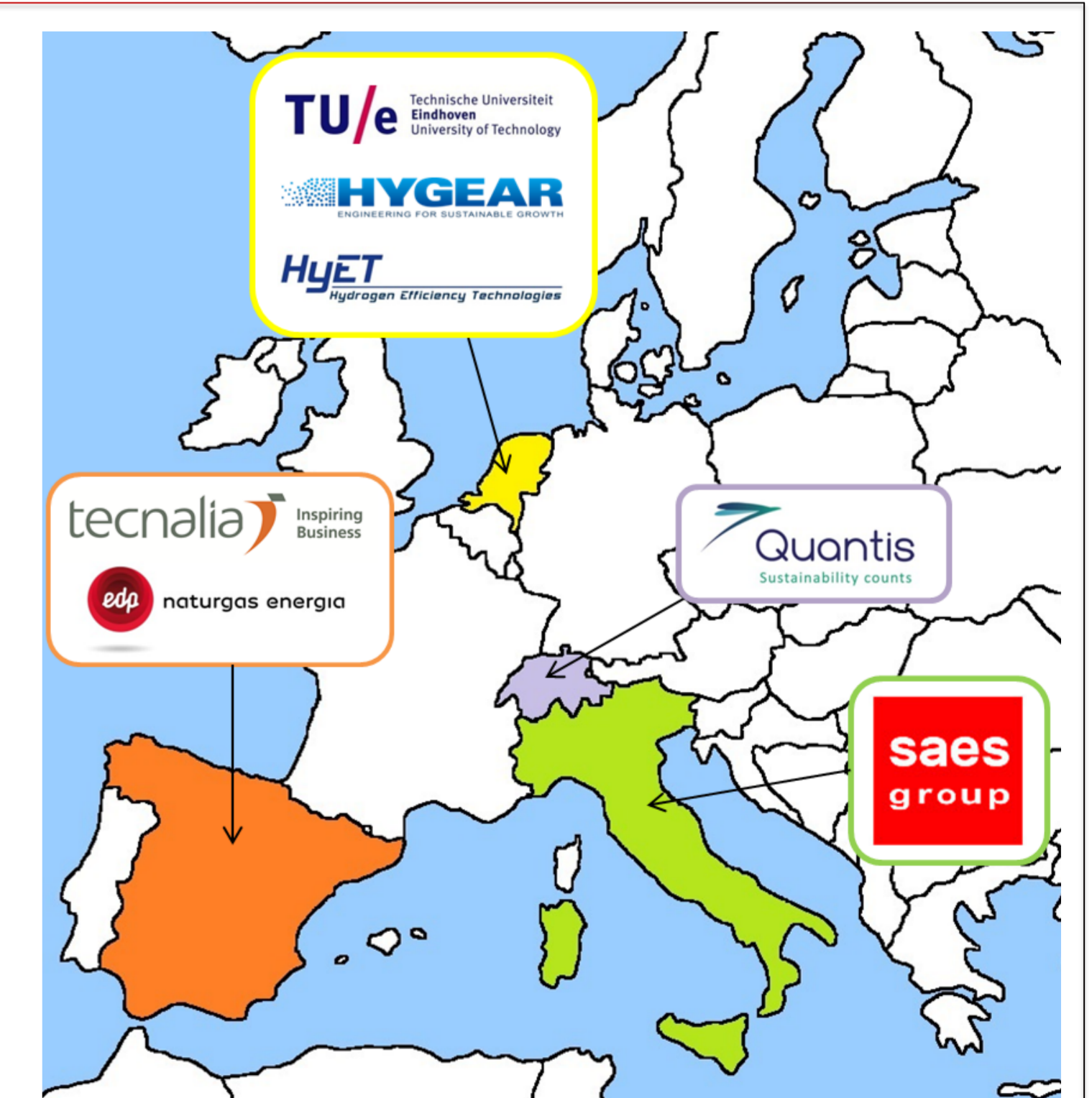
More information at: <http://www.hygrid-h2.eu>

Consortium

The consortium brings together multidisciplinary expertise on material development (electrochemical separation, sorption and membranes), chemical and process engineering, modelling (from thermodynamics to unit operation modelling to system integration), membranes modules and reactors development, LCA and industrial study, innovation management and exploitation.

- 7 Partners from 4 different countries
- 2 Research Centres and Universities;
- 3 SMEs;
- 2 Large Enterprises.

- 1 TU/e, Netherlands
- 2 TECNALIA, Spain
- 3 HYG, Netherlands
- 4 SAES, Italy
- 5 HYET, Netherlands
- 6 QUANTIS, Switzerland
- 7 EDP, Spain



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