

Project title: **HyPipeConcept** – Inter-European cooperation to develop a composite pipeline concept for the transport of green hydrogen

Partner:

- Norwegian University of Science and Technology (NTNU)
- Polytechnic University of Milan (PoliMi)

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Mission Statement

The Green Deal adopted by the EU Commission addresses Europe's future energy supply with the major challenge of greenhouse gas neutrality by 2050 - a goal that can only be achieved by consistently phasing out the use of fossil fuels in energy supply. With the help of national hydrogen strategies, the European countries of Germany, Italy and Norway are demonstrating a solution path for achieving the desired goal of net zero CO₂ emissions through the expansion of hydrogen-based energy systems.

Central aspects of these strategies include the development of technologies for H₂ synthesis and energy conversion (power-to-gas processes) as well as the distribution and storage of the hydrogen produced. In order to enable the long-term supply of Europe with so-called green hydrogen, generated from renewable sources, the cooperation of the European nations is essential. The ability to produce green hydrogen depends on two factors: the availability of emission-free energy sources (wind, solar and hydro power) and the unlimited supply of fresh water, which is needed for the synthesis of H₂ by electrolysis. These factors are mainly fulfilled by Northern Europe/Scandinavia and by the southern regions of Northern Italy, Catalonia and Southeastern Europe. These regions have a high potential to secure the future supply of the densely populated and highly industrialized Central and Western Europe. As the regions of H₂ synthesis as well as the main demand of the innovative energy carrier will differ in the future, suitable solutions for the transport of the produced gas have to be worked out. With regard to the strategic transformation of the pan-European energy economy towards a climate-neutral supply system, the cooperation of the European states is indispensable. Within the HyPipeConcept project, a European team of scientists

from Italy, Norway and Germany is working on the development of a fiber composite pipeline concept for the inter-European transport of 100% green hydrogen.

The use of pressure vessel systems for the transport of H₂ currently represents a proven technology for the distribution of the gaseous energy carrier. While tank-based systems can supply decentralized H₂ consumers with small purchase volumes, the use of alternative delivery systems must be investigated for the provision of larger gas volumes. In this context, pipeline networks show a high potential for a secure and constant supply of large H₂ volumes for future energy supply. In addition to the task of gas transport, widely branched pipeline networks have the capability of buffer storage of the transport gas. To enable the distribution of H₂ in existing pipeline networks, solutions to adapt or redesign the distribution system have to be investigated. Thus, the development of new concepts is necessary, which show sufficient resistance against the permeation and embrittlement effects of hydrogen as well as allow a damage-free cyclic loading of the system (e.g. in case of buffer storage operation).

Besides the development of a pipeline concept, the six-month project HyPipeConcept contributes to the networking of the European research institutions ITA, NTNU and PoliMi. The further validation and implementation of the developed concept is planned in the context of the application for a joint research project by the partners. For this purpose, it is planned to apply for research funding from the European Union or the respective national funding agencies with the involvement of industrial partners.

Approach

The goal of the initiation project HyPipeConcept is to establish partnerships that contribute to research solutions for the future European hydrogen economy. Through the cooperation of the three project partners, elementary research fields (materials - NTNU; process technology - RWTH/ITA; system design/modeling - Politecnico di Milano) for the development of pipeline systems will be linked and complemented. Due to the geographical conditions, Norway is expected to become an important European supplier of green hydrogen. The green hydrogen results from the enormous amounts of renewable energy in this country, especially wind and hydro power. The efficient transport of this green hydrogen plays a special role for Germany and Italy due to the high energy demand of these two countries. The conversion of the

industry to the use of hydrogen should help to become a pioneer in the goal of net zero emissions. The consistent application of established scientific methods during the workshops and within the project time frame will ensure the success of this project.

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