Issue #1 | February 2025

Newsletter

Pre-normative research on integrity assessment protocols of gas pipes repurposed to hydrogen and mitigation guidelines

As we reflect on the progress made in the PilgrHYm project this past year, we are inspired by the efforts and involvement of each pilgrHYmer. We appreciate your contributions and encourage you to stay involved!

Please find below recent updates, highlights and activities of the PilgrHYm project.

Look out for updates in our bi-yearly Newsletters.

This issue

Co-funded by the European Union

Clean Hydrogen Partnership

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WP1 nears its finalization

In the PilgrHYm project, WP1 work consisted in providing in a comprehensive manner a detailed description of the European natural gas transmission network of steel pipelines, both in terms of infrastructure properties and in terms of current operating conditions with natural gas. First, before any detailed analysis of the EU natural gas transmission pipeline grid, experts of the WP had to select 2 reference materials (base metals) for round robin tests with H_2: L415 (X60) and L450 (X65) steel grades. These were chosen due to their known use in Europe and there are less published results on these in comparison with L360 (X52) and L485 (X70).

As a second step, a questionnaire intended for all European TSOs was prepared in order to collect as much information as possible on their pipelines. The questionnaire was sent out to all TSOs and various associations (GERG, ENTSOG, EPRG & CEN TC234) representing EU TSOs in April 2024. Several reminders and 1-to-1 discussions occurred to increase the response rate. A total of 23 onshore TSO replies were finally received, accounting for a global length of 182469 km of steel pipelines (above the proposal target of 156054 km). Figure 1 shows a map of extended Europe with red colour depicting countries from where at least a response has been received. All TSOs that are either project partners or members of the Advisory Board have replied to this questionnaire.

We then carried out a detailed analysis of the questionnaire answers and prepared a comprehensive report about the characteristics of pipeline steels currently used for natural gas transmission in Europe and their potential reuse for hydrogen transport. Following this analysis, we prepared a list of steels interesting to be tested in PilgrHYm, accommodating conclusions from the analysis of questionnaires and knowledge gaps in the field.

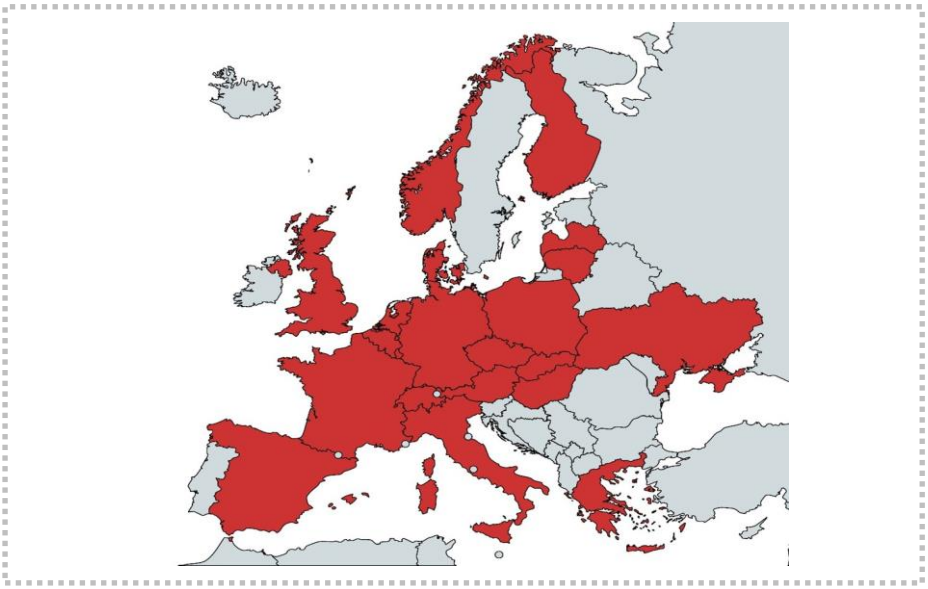


Fig 1. Map of extended Europe with red colour where at least an answer has been received.

> "PilgrHYm's TSO inventory covers a total length of 182469 km of steel pipelines"

Both the analysis of questionnaires and the list of steels to be tested resulted in public deliverables:
Deliverable 1.1: TSO Inventory
Deliverable 1.2: List of steel grades.

After the preparation of this list, we contacted selected TSOs to precisely identify material samples corresponding to the requirements and that could be donated. We prepared a list with material candidates and a few deviations from the wish list were discussed and approved during the 3rd project consortium meeting in December 2024. An updated list of all materials to be received and their dispatch testing laboratory was therefore produced after discussions with testing laboratories.

Last task of WP1 is now to supervise the preparation of material samples at the different TSOs and their dispatch to the project testing laboratories. Once all samples will be delivered, WP1 work will be completed. It is foreseen to do so before end of March 2025 as cutting and transport of all samples are already in preparation.

WP2 continues its course through 2025

During the first year of the PilgrHYm project, WP2 "Review of experimental methods and proposition of a harmonized test matrix" focused on the critical assessment of the standardized method for characterization of the relevant mechanical properties of metallic materials within the operational envelop of pipelines for hydrogen transport.

As results of Task 2.1, Slow Strain Rete Tensile (SSRT) testing, Fracture Toughness (FT) and Fatigue Crack Growth Rate (FCGR) standardized experimental methods have been systematically reviewed and the outcome in terms of standards incongruencies and research gaps have been summarized in a report (deliverables) and presented in the EPRI International Workshop on Hydrogen Embrittlement in Oxford in June 2024 (2024 - 06 - Oxford-EPRI Workshop on hydrogen Embrittlement).

The study also included the hollow specimens method as potential experimental technique for assessing the deleterious effect of gaseous hydrogen on pipeline steel mechanical properties. This constituted the bases for the definition of the experimental procedures for the interlaboratory proficiency testing which will include SSRT testing, FT and hollow specimen testing.

In an interactive process in tandem with the activities in WP3 and WP4, and throughout 2025 the definition for the baseline characterization of the relevant mechanical properties of pipeline steels in pressurized hydrogen

[Partners from SINTEF, TECNALIA and the University of Burgos at the Oxford EPRI International Workshop on Hydrogen Embrittlement]

environment will be delivered by the end of this week as part of task 2. 3.

Experimental lab tests have begun within WP3

The WP3 "Experimental lab tests on selected steels grades representative of EU gas network" includes all the experimental tests that will be performed within the PilgrHYm project. This large number of tests will be carried out by several partners, listed by decreasing order of experimental involvement: TECNALIA, CEA Liten, UBU, SINTEF, OCAS, NaTran, IWM, FHA.

WP3 began at Month 6, in strong collaboration with WP1 and WP2. Two tasks are currently running. Task 3.1 is dedicated to checking the materials supply and the tests coordination. The materials to be tested have been previously identified in WP1, while dispatching between the different labs has also been clarified. Task 3.2 is dedicated to the experimental intercomparison and to the development of a data base.

In addition, the protocols for the experimental lab intercomparison, concerning Slow Strain Rate Tensile tests, tensile tests on hollow specimen and fracture toughness, have been discussed with WP2 and are now ready. Moreover, templates to collect the experimental data on a common basis have also been provided. The samples for Slow Strain Rate Tensile tests have been machined by a single tool workshop and sent to the different concerned partners. Similarly, the first SSRT tests have been performed and the samples for fracture toughness are currently being machined. At last, the end of the intercomparison step is foreseen for mid-2025 as expected.

WP4 launched with literature review of numerical models

WP4 began in March 2024 (M3) with a kick-off meeting on 15 March 2024, with coordination meetings scheduled on a bi-monthly basis. The first deliverable of WP4 is a literature review of numerical modelling frameworks, developed over 6 months.

Four model frameworks were included in the literature review as selected in the initial application phase, divided by topic among the partners based on interest. A template for reviewing applicable papers was created by IWM and distributed to partners, who completed the templates. Over 30 papers are included in the literature review, covering state-of-the-art modelling for fracture and fatigue applications. The literature review

was iterated through by all partners of the WP in July and August, with the final draft approved and submitted by the deadline of 30 September as deliverable D4.1 Literature review.

For Task 4.2, the four possible model frameworks were discussed in terms of strengths, limitations, and interest, utilizing the results of the literature review and expertise from consortium partners. UBU will lead the fracture Task 4.3 applying Phase Field Modelling, with support from CEA and SINTEF.

IWM will lead the fatigue Task 4.4 applying Cohesive Zone Modelling, with support from OCAS and SINTEF, resulting in Milestone 6: Numerical model selection. Two documents were drafted by UBU and IWM to propose initial experimental inputs needed for each model, including inputs required for both models. The documents will be updated, as necessary, following discussions with WP2 and WP3 planned for January 2025. The developed models will be calibrated to one of the reference materials and validated using the other reference material.

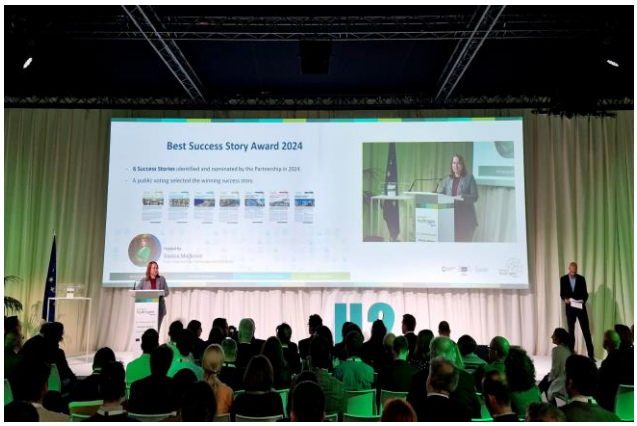
The Project at the EU forefront

The PilgrHYm project's scientific poster was exhibited at the European Gas Technology Conference 2024 (EGATEC 2024) held in Hamburg on June 18th–19th 2024. EGATEC is a conference, co-organised by MARCOGAZ and GERG, which brings together high-level representatives from the European gas industry, universities, companies, and other stakeholders.

This opportunity underscored PilgrHYm's contribution to the successful decarbonization of the European gas industry.

[Partners from GERG at EGATEC 2024]

Furthermore, it is customary to hold awards during the annual European Hydrogen Week for recognized achievements in the following categories: Best Success Story, Best Innovation, Best Outreach, European Hydrogen Valleys and the Women in Science which has been introduced this year.



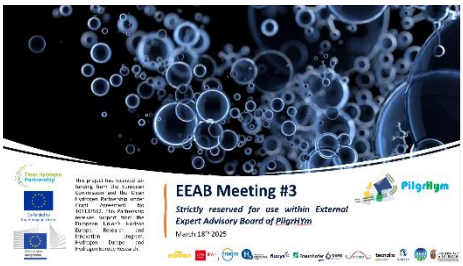
[Awards ceremony at the European Hydrogen Week (2024)]

For this year's edition, thus the European Hydrogen Week 2024, PilgrHYm was shortlisted for the Best success story awards. Although the project was not among the top 6 finalists, its selection highlights the importance of its work in the deployment of hydrogen in the energy transition.

Likewise, many of the PilgrHYm project's partners held a booth at the European Hydrogen Week 2024, amongst others Fluxys, Fraunhofer, SNAM, etc. SNAM and GERG had the opportunity to hand out flyers of the project in increase the visibility of the project through the distribution of customized flyers for the project.

[The GERG team at the European Hydrogen Week (2024)]

Upcoming events



PilgrHYm International Advisory Board (IAB) Meeting

Tuesday 18th March 2025
10:00-12:00 CET

Stay tuned!

Thank you for your interest in the PilgrHYm activities!

Follow us on social media !

You want more information? Visit our website.

Interested in joining PilgrHYm's IAB? Contact the project coordinator → magali.polo@natrangroupe.com

Project Partners

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