

PIPELIFE – Opportunities and Challenges to develop a generic model for prescriptive maintenance in the energy sector

Summary

The bilateral initiative PIPELIFE promotes collaboration between IST-ID, SINTEF, EQUINOR and the University of Stavanger, for the creation of a universal framework for pipeline risk-based maintenance.

Despite the attempts made to predict the degradation patterns of gas pipelines, the relevant interdependency between different degradation mechanisms was not considered, and the “uncertainty” of mechanisms’ severity weights were not addressed simultaneously. In this sense, none of the previous studies developed models that can predict the deterioration rate of gas pipelines and, consequently, none of the existing studies are able to define their respective deterioration curve or propose accurate maintenance policies. The PIPELIFE Bilateral initiative (BI) fills the existing gap in several aspects: a) Propose more comprehensive condition assessment model that allows pipeline operators to take the necessary actions to prevent future failures or accidents, considering factors as: third party; corrosion; mechanical actions; operational errors; natural events, as natural weathering and erosion, extreme events and climate change effects; b) The possibility of creating a risk assessment model will be studied, using historical data, intending to predict the failure caused by third party activity. The main objective is to identify sabotage risks and propose the

adoption of measures to mitigate these risks; c) Using machine learning techniques for pattern recognition to distinguish the presence of defects, their type, size and location on pipeline system; d) Propose a degradation condition index to encompass the effects and severity of different degradation mechanisms, in order to define a degradation curve and to assess the remaining service life of a pressurized pipeline; e) Propose a universal framework for opportunistic condition-based maintenance to optimise the interval and condition monitoring strategies. The framework proposed in this BI can be scaled up to different types of pipelines and to other systems in energy transformation (wind turbines, hydropower, and offshore components).

This initiative promotes international technological collaboration that is expected to have a significant impact on the definition of innovative models in the field of security, efficiency and sustainability of energy supply (Goals 7, 12 and 13, UN Agenda 2030).

The bilateral PIPELIFE initiative promotes a more comprehensive condition assessment model, and a risk-based maintenance model will be developed that allows pipeline operators to take the necessary measures to prevent future failures that can cause catastrophic environmental damage as well as economic losses due to distribution interruption.

Project Reference

FBR_OC2_71

Leading Institution

IST-ID – Associação do Instituto Superior Técnico para a Investigação e Desenvolvimento (Portugal)

Partners

SINTEF (Norway), EQUINOR (Norway), UIS – University of Stavanger (Norway)

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Funding

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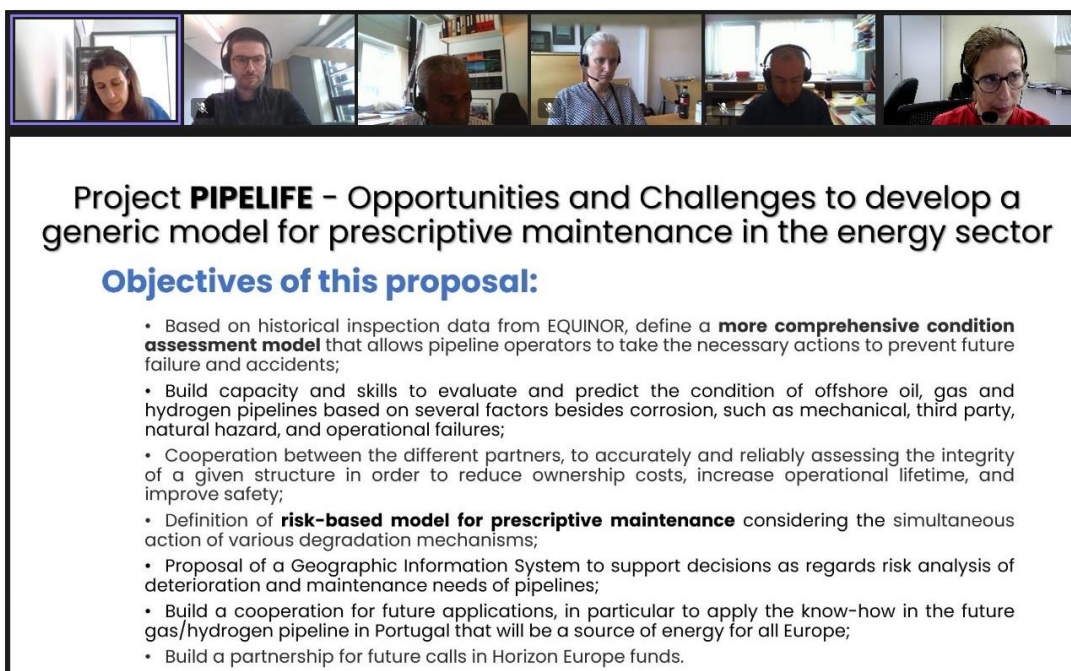
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Project Website

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Objectives of this proposal:

- Based on historical inspection data from EQUINOR, define a **more comprehensive condition assessment model** that allows pipeline operators to take the necessary actions to prevent future failure and accidents;
- Build capacity and skills to evaluate and predict the condition of offshore oil, gas and hydrogen pipelines based on several factors besides corrosion, such as mechanical, third party, natural hazard, and operational failures;
- Cooperation between the different partners, to accurately and reliably assessing the integrity of a given structure in order to reduce ownership costs, increase operational lifetime, and improve safety;
- Definition of **risk-based model for prescriptive maintenance** considering the simultaneous action of various degradation mechanisms;
- Proposal of a Geographic Information System to support decisions as regards risk analysis of deterioration and maintenance needs of pipelines;
- Build a cooperation for future applications, in particular to apply the know-how in the future gas/hydrogen pipeline in Portugal that will be a source of energy for all Europe;
- Build a partnership for future calls in Horizon Europe funds.

Figure 1. Technologic international collaboration between IST-ID, SINTEF, EQUINOR and the University of Stavanger.