



Exploring the Mechanical Challenges of an Offshore Hydrogen Pipeline System

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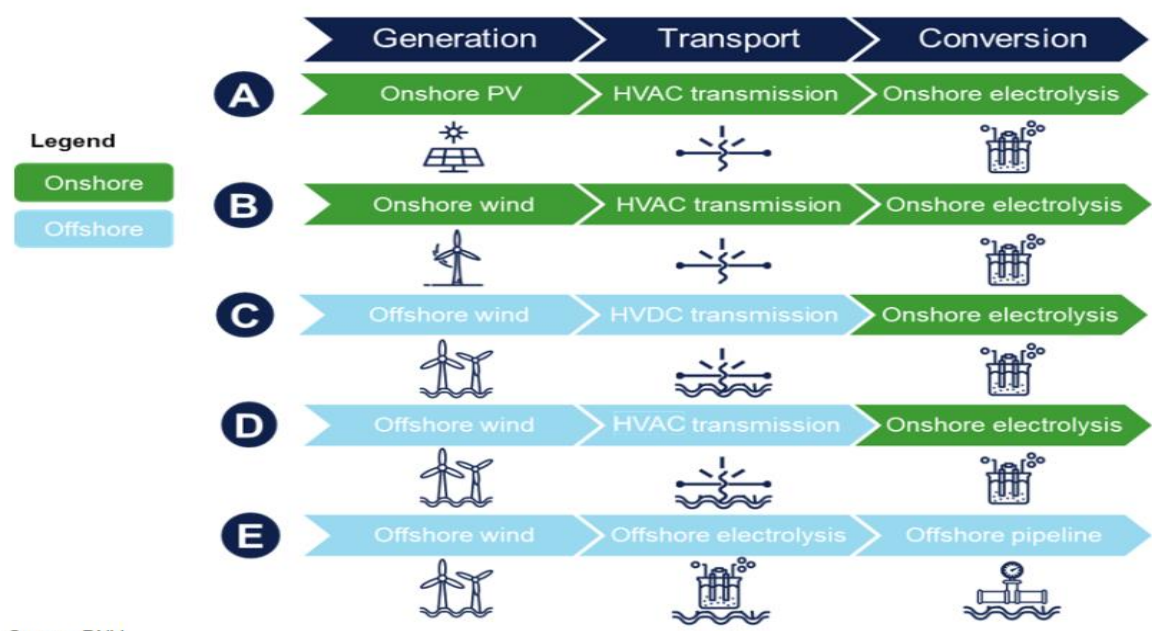
BEng (Hons) Mechanical Engineering

Introduction

Hydrogen is pivotal to achieving net-zero emissions, with demand projected to rise 600% by 2030 (IEA, 2024).

Offshore green hydrogen production offers scalable potential, leveraging abundant wind energy.

Offshore hydrogen pipelines provide an efficient transport solution but pose significant mechanical challenges.



Source: DNV
DNV Hydrogen Value Chains (DNV, 2023).

Project Aims

To explore the mechanical challenges associated with transporting offshore green hydrogen via subsea pipelines.

- Analyse the chemical properties of hydrogen and their impact on pipeline materials.
- Define a base case for an offshore hydrogen pipeline.
- Review existing standards and codes.
- Evaluate suitable installation techniques.

Methodology

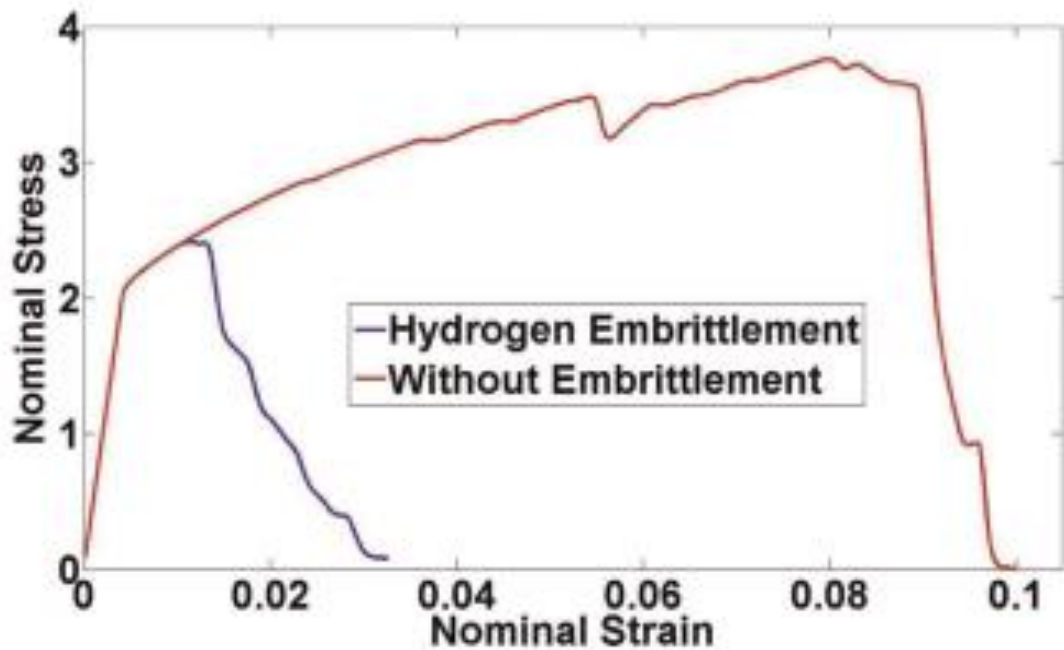
A qualitative research approach was used to explore the mechanical challenges.

Including a comprehensive literature review, research into real word use cases and advancements.

Results

Hydrogen's unique properties create significant mechanical and material challenges for offshore pipelines:

- Hydrogen embrittlement reduces ductility and fracture toughness in steels.
- High permeability.
- Wide flammability range and low ignition energy.



Stress-strain curves for Hydrogen embrittlement cases (Wu & Zirky, 2015).

Realistic offshore hydrogen base case was developed to assess mechanical challenges, based on the location of SEN 1 zone in the German North Sea.

