pre-Normative Research on Hydrogen Releases Assessment

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Sharing is encouraged

About the project

Duration: Jan 2024 - Dec 2026

Budget: 3,5 M€

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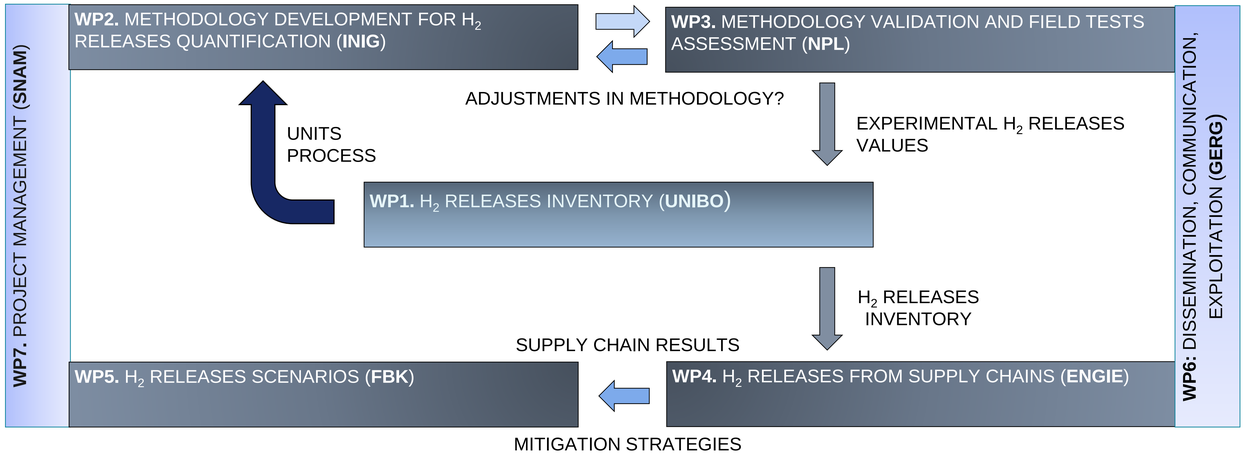
Introduction and Objective

Hydrogen (H_2) will play a pivotal role in achieving the European Union (EU) **Green Deal**'s goal of climate neutrality by 2050. However, without technical countermeasures, venting, depressurization, and fugitive emissions of H_2 could raise atmospheric H_2 levels. Since H_2 can react with hydroxyl radicals in the atmosphere, extending methane's lifetime and increasing ozone and water vapor production, it can be qualified as an **indirect greenhouse gas** [1]. To date, there is still uncertainty regarding the amount of the H_2 releases expected along the future H_2 value chain and the associated environmental impact [2,3]. A dedicated **normative framework**, including testing methodologies for hydrogen releases, does not exist.

The aim of the **NHyRA** project is to address these critical knowledge gaps by assessing potential H_2 releases along the entire H_2 value chain and its measurement to contribute to H_2 value chain development with least climate impact.

Methods

- ❑ WP1 identifies the H_2 supply chains and units process to design a H_2 releases inventory.
- ❑ WP2 develops the protocols and methodologies for quantification of H_2 releases in most critical elements of H_2 value chain.
- ❑ WP3 validates the methodology and quantification of H_2 releases through experimental testing.
- ❑ WP4 defines the H2 releases mitigation strategy and estimates H2 releases along the supply chain.
- ❑ WP5 assesses total H_2 releases scenarios.
- ❑ WP6 develops and implements activities related to dissemination, communication and exploitation.
- ❑ WP7 ensures the smooth and timely project implementation.



Expected Outcomes

- Identification, quantification, and preparation of an **inventory** of the types of **anthropogenic H_2 releases** expected throughout the H_2 value chain.
- Development and validation of **reliable detection and quantification methods**, new data and rigorous calculation-based models to measure **H_2 releases** from the H_2 value chain in the middle (2030) and long term (2050).
- Provide **recommendations for** interested stakeholders, including **industrial and academic researchers** involved in the assessment of H_2 release and its impact on the atmosphere, but also to policy makers.
- Deliver a complete and detailed report about **H_2 economy scenarios** with a focus on possible benefits of **potential** H_2 release **mitigation strategies**.

References

[1] Ocko, I. B. and Hamburg, S. P., *Climate consequences of hydrogen emissions*, Atmos. Chem. Phys., 22, 9349–9368, 2022

[2] Arrigoni, A. and Bravo Diaz, L., *Hydrogen emissions from a hydrogen economy and their potential global warming impact*, EUR 31188 EN, Publications Office of the European Union, Luxembourg, 2022, JRC130362

[3] Cooper J. et al., *Hydrogen emissions from the hydrogen value chain-emissions profile and impact to global warming*, Science of The Total Environment, Volume 830,2022, 154624

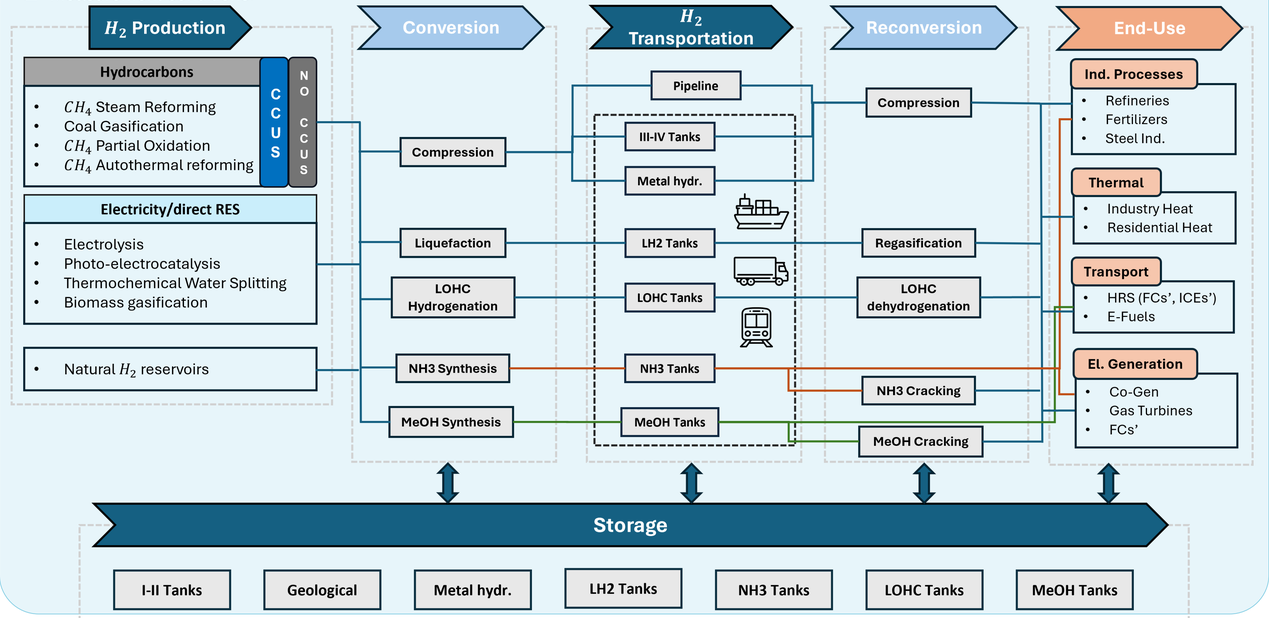
Work Package 1

First version of database:

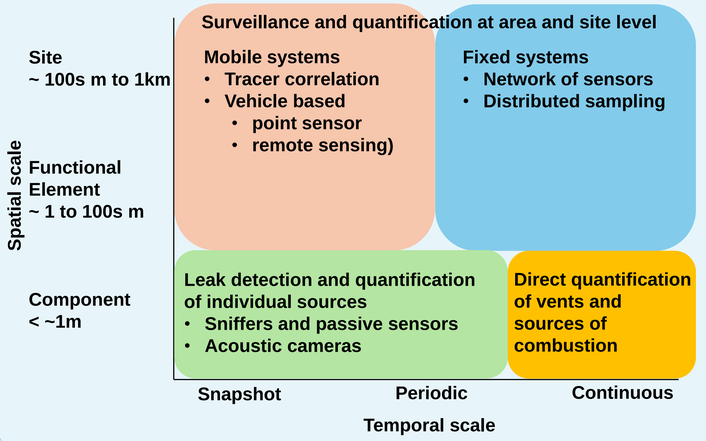
- ❑ Type of emission: fugitive, vented and incomplete combustion.
- ❑ Sub-categories of emissions : e.g. leaks, permeation, vents…
- ❑ Emission characteristics: e.g. Temporal profile, H_2 concentration…
- ❑ Value of emission or emission factor.
- ❑ Measurement conditions.

Ongoing and future work:

- ❑ Identify and develop priority list of critical elements.
- ❑ Update database using validated data:
  - To be obtained by direct measurements.
  - Evidences from literature review.



Work Package 2 and 3



On going and future work: Method development (WP2):

- ❑ Identification of techniques for detecting and quantifying hydrogen emissions over a wide range of temporal and spatial scales: a state-of-the-art review.
- ❑ Development of a draft method for detecting leaks at component level.
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- ❑ Review of methods based on validation (WP3).
- ❑ Development of analytical methods for quantifying vented emissions.
- ❑ Development of methods for quantification at area scale.

Ongoing and future work: test and validation (WP3):

- ❑ Laboratory testing of selected instruments – response time, linearity, drift; identification of influence factors on instrument response (interferent gases, temperature, pressure, humidity).
- ❑ Testing utilising controlled release capability – to assess method performance against traceable emission rates (identification of sampling effects).
- ❑ Validation of the practical application of the methods under real world scenarios on industrial sites. Develop QA/QC procedures.

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Clean Hydrogen Partnership

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