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INERIS
maîtriser le risque pour un développement durable

6th Research and Development RD20 Conference

Technical Session: Addressing Technical Barriers to Hydrogen Implementation

Decision analysis and support for the development and uptake of hydrogen technologies

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Introduction

Topics presented today

1. Presentation of INERIS
2. INERIS, hydrogen & risks
3. Decision analysis and support:
   A. Principles
   B. Application to hydrogen
4. Challenges

About Ineris…

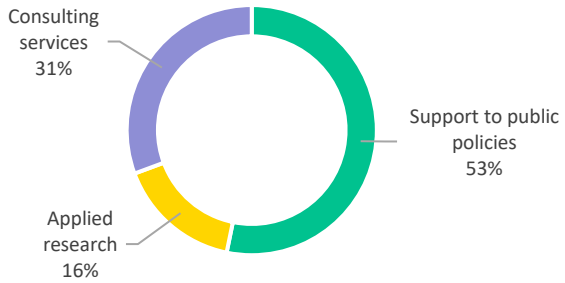
French public institute under the supervision of the Ministry of Environment

Created in 1990 - 530 people (350 engineers & researchers)

Area of expertise : Prevention and management of risks associated with economic activities

- Risks for the people, the environment and assets
- Accidental risks (undesired events) and chronic risks (long-term)

Activities



Organized in 3 operational Divisions + 1 cross-cutting Strategy department

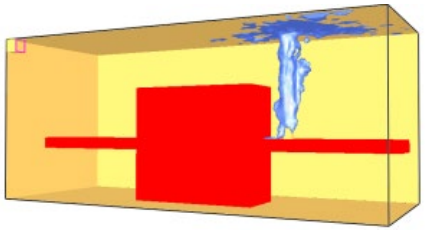
Located in Verneuil-en-Halatte (Oise), 60 km North of Paris, with regional offices

INERIS, hydrogen & risks

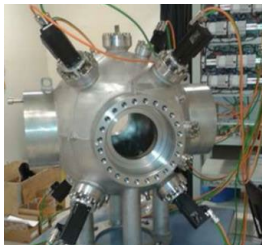
INERIS, with its **30 years of experience in hydrogen → 3 complementary approaches**:

1. **Risks assessment and reduction:**
   - **Accidentology** (probabilities, impacts)
   - **Safety plan and evaluation** (e.g. risk indexes, analysis of safety barriers, for new regulations)
   - **Phenomenology of hazardous incidents**: modelling and experiments (large platforms)
   - **Tools development** for risks management (MIRA) or impact prediction (EXPLO JET)…
   - Example: Report on *risks governance in territories in the context of energy transition* in October 2022, which led to the *creation of safety days by France Hydrogen*

Modelling



Lab



Experimental platform

INERIS, hydrogen & risks

3 complementary approaches (continued):

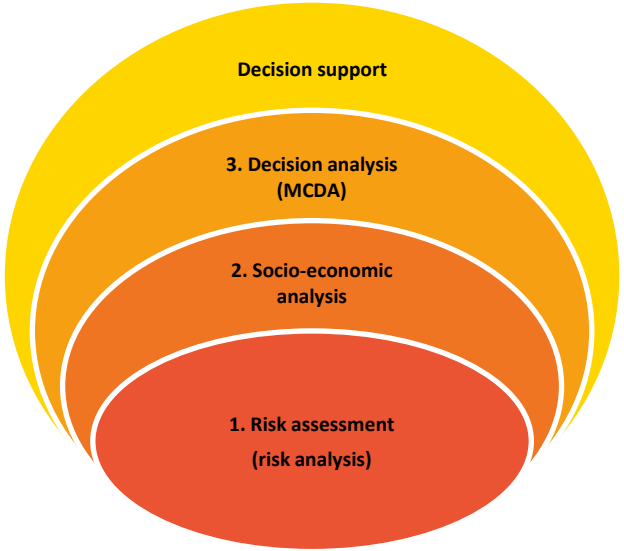
2. **Socio-economic assessment**: social cost-benefit analysis of hydrogen mobility in Europe, monetisation of environmental impacts for hydrogen storage…
3. **Decisions analysis and support:** multicriteria decision analysis, development scenarios analysis, and governance and stakeholders analysis

Additionally:

- Not separated assessments but **complementary** and nested parts of evaluations
- Expertise deployed in multiple **(European and national) projects and networks**
- Working **all along the hydrogen value chain** either on specific parts (e.g. FRHYDGE for storage, ALRIGH2T for aircraft refuelling) or for the whole chain (IMAGHYNE, AIDHY)

Decision analysis and support: principles

- **Decision support: interconnectedness between risk analysis, SEA and MCDA**
- **Objective:** providing tools and methods to *rationalise choices between options*
- **Criteria: reference** for comparison of options; wide variety of indicators possible
- Sensitivity analysis



Decision support	Risk index	CBA	CEA	MCDA
Composition	**hazard and exposition**	**costs and benefits**	costs & **efficiency index**	**aggregation** (ELECTRE)
Category	risk analysis	socioeconomic analysis		decision analysis
Coverage	health, environment	socioeconomic, health and environment (→risks)		adaptable
Data needs	small to moderate	moderate to large	moderate	moderate to large

Decision analysis and support: hydrogen

Application: IMAGHYNE European project with the AURA French region

- IMAGHYNE: to accelerate the deployment of *hydrogen technologies in the region*
- **Context: scenarios** developed by the CEA based on *multi-objective optimisation*
- Different scenarios: minimisation of costs, minimisation of CO2 emissions…
- However, regarding multi-objective optimisation:
  - **Only criteria directly linked to the energy system** (equipment costs and dimensions etc.)
  - **Lack of method for comparison**
- **Advantage** of decision analysis and support: providing **other criteria**, integrating them in the scenarios **comparison**, and bringing a **structured method → weights & scores → ranking**
- **Other criteria:** safety, regulatory difficulties, additional health and environmental criteria, social perceptions…
- Additional advantages: interactivity, control for incoherent/implicit choices, results discussion

Challenges

1. **Lack of data on risks/incidents** (feedback from past experiences, tests, lab experiments) → **data collection, experimentation and modelling needed**, especially for new use
   - For instance, to estimate more accurate incidents probabilities
2. For **hydrogen development** at the scale of a territory: **lack of decision analysis and support considering safety and all environmental impacts**
3. **Including safety into decision-making:**

   A. **Light mobility & safety**: question of new users (individuals) and safety → decision analysis

   B. **Infrastructure & safety**: influence planning and infrastructure choice (e.g. ammonia)

Conclusion

- INERIS: public expert on **industrial and environmental risks** with long **experience in hydrogen**
- **Complementary approaches: risks assessment, socio-economic analysis and decision support**
- **Decision analysis and support**:
  - Use of socio-economic assessment and risks assessment, with additional criteria, and MCDA aggregation
  - Example of **IMAGHYNE**: using decision analysis to enrich the analysis of hydrogen development scenarios

- **Challenges**:
  - **Lack of data on risks** → data collection, experimentation and modelling needed
  - **Taking safety and all environment impacts into decision making** → improve development and prevent change in social perceptions

End of the presentation

Thank you for listening !