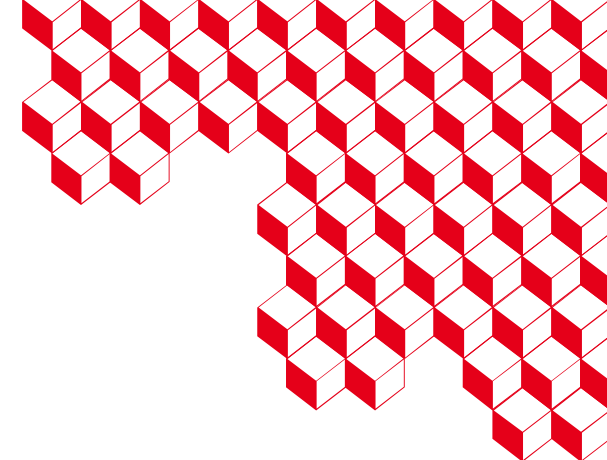




**CC BY 4.0 DEED**  
Attribution 4.0 International



## ***SISYPHE study: how dynamic is the European demand for low carbon electrolytic hydrogen?***

**Guillaume BOISSONNET\*, Ludovic BOURDIN\*, Aymeric CANTON\*, Bertrand CHARMAISON\*, David PROULT\*, Valérie SEGUIN\* \*\***

\*CEA, France

\*\*contact: [valerie.seguin@cea.fr](mailto:valerie.seguin@cea.fr)

*March 25, 2024*

*These slides are shared under a CC-BY-4.0 license. Credit to authors must be given using the above information.*

# Beforehand: CEA technological developments on hydrogen



# Beforehand: I-Tésé, CEA Research Institute in Energy Economics

30 researchers based in Saclay and Grenoble, France

## Our ambition:

Developing a systemic vision of the transition of energy systems to carbon neutrality under economic and sustainability perspective

## Our research themes:

Low-carbon production  
and storage technologies

Key resources of the  
energy transition

Future energy demand  
and consumption patterns

Regulation  
and market design

## Development of a shared knowledge base:

➤ Models, databases, methodologies



# **SISYPHE study: how dynamic is the European demand for low carbon electrolytic hydrogen?**

**Guillaume BOISSONNET, Ludovic BOURDIN, Aymeric CANTON, Bertrand CHARMAISON, David PROULT, Valérie SEGUIN**

March 25, 2024

# SISYPHE study overview

01

## OBJECTIVES

Estimate the demand for electrolytic low-carbon hydrogen and derivatives, for all potential uses **EXCEPT** POWER-to-X-to-POWER (excluded from the analysis)

02

## SCOPE

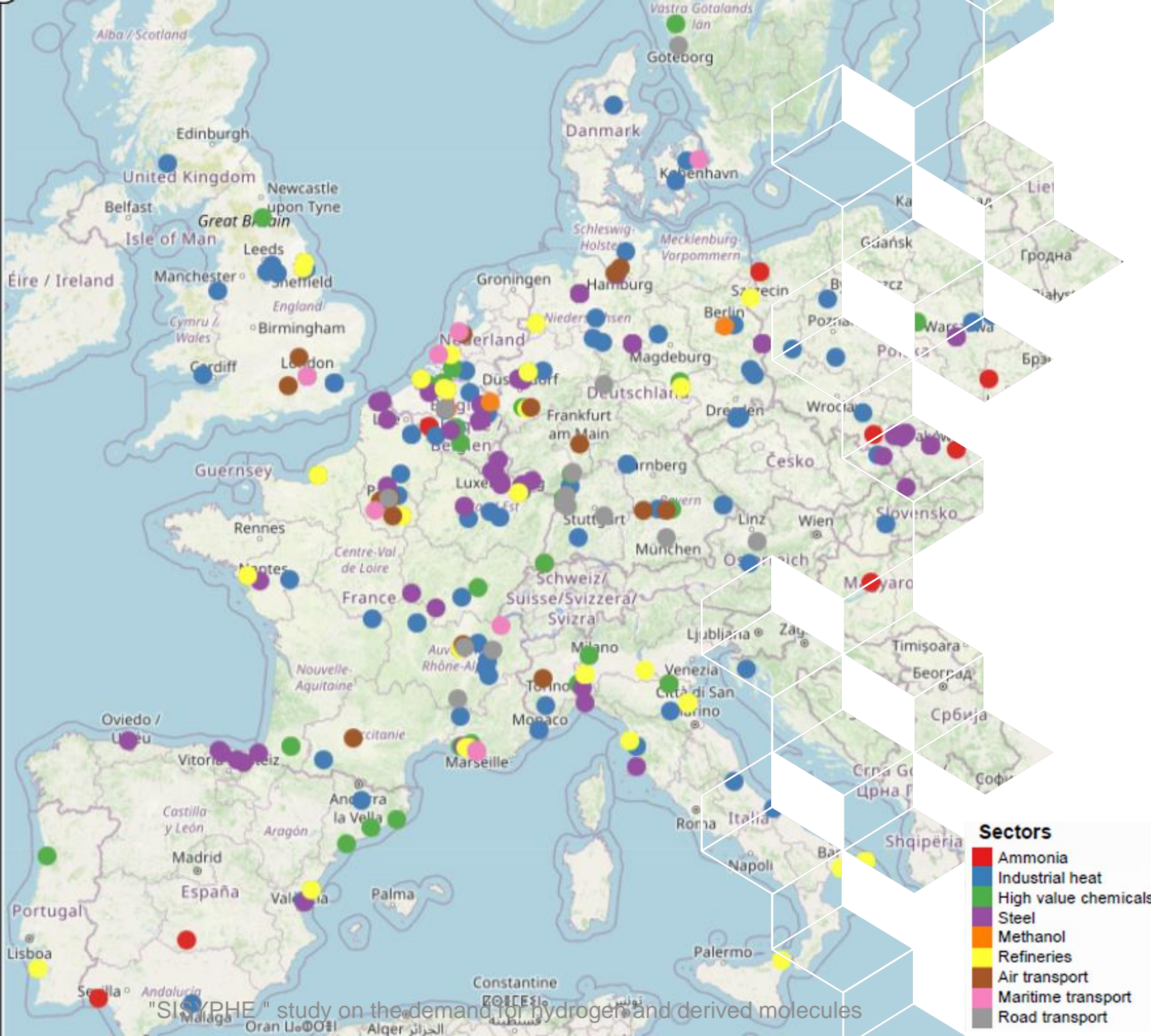
- Sectors:
  - Chemical, petrochemical & refining industry
  - Transport (aviation, maritime and road transport)
  - Steel industry
  - Heavy industry (for industrial heat)
- Time horizon: 2030 to 2040
- Geographical coverage: Europe

03

## METHODOLOGY

- Bibliographical research and analysis of prospective scenarios
- Conducting 70 interviews with industrial users and key stakeholders
- Qualitative and quantitative synthesis by sector, and aggregated synthesis





**SISYPHE study**

**70 interviews**

**9 sectors  
(industry, mobility)**

**European  
coverage**

08/03/2024

# SISYPHE – Qualitative highlights



## 2 decarbonisation pathways to be accommodated :

- Institutional level (France and EU): top-down approach → agenda 2050 NetZero, FitFor55, REPowerEU, REDIII, ...
- **SISYPHE**: bottom-up approach → 70 interviews allowing the aggregation of quantitative needs

### Drivers towards transition for industrials:

- Regulation
- Business opportunities

### Hurdles preventing industrials to meet their decarbonization targets

- Legal : framework too constraining and unstable
- Financial : Lack of financial support for OPEX
- Physical : Insufficient supply expected for 2030-2040, both for low-carbon electricity, hydrogen and CO<sub>2</sub> for derived molecules.

### Risk of increased reliance on imports and relocations of some industries outside the EU:

- Loss in sovereignty and loss of markets
- Insufficient decarbonisation
- 'Carbon leakage'

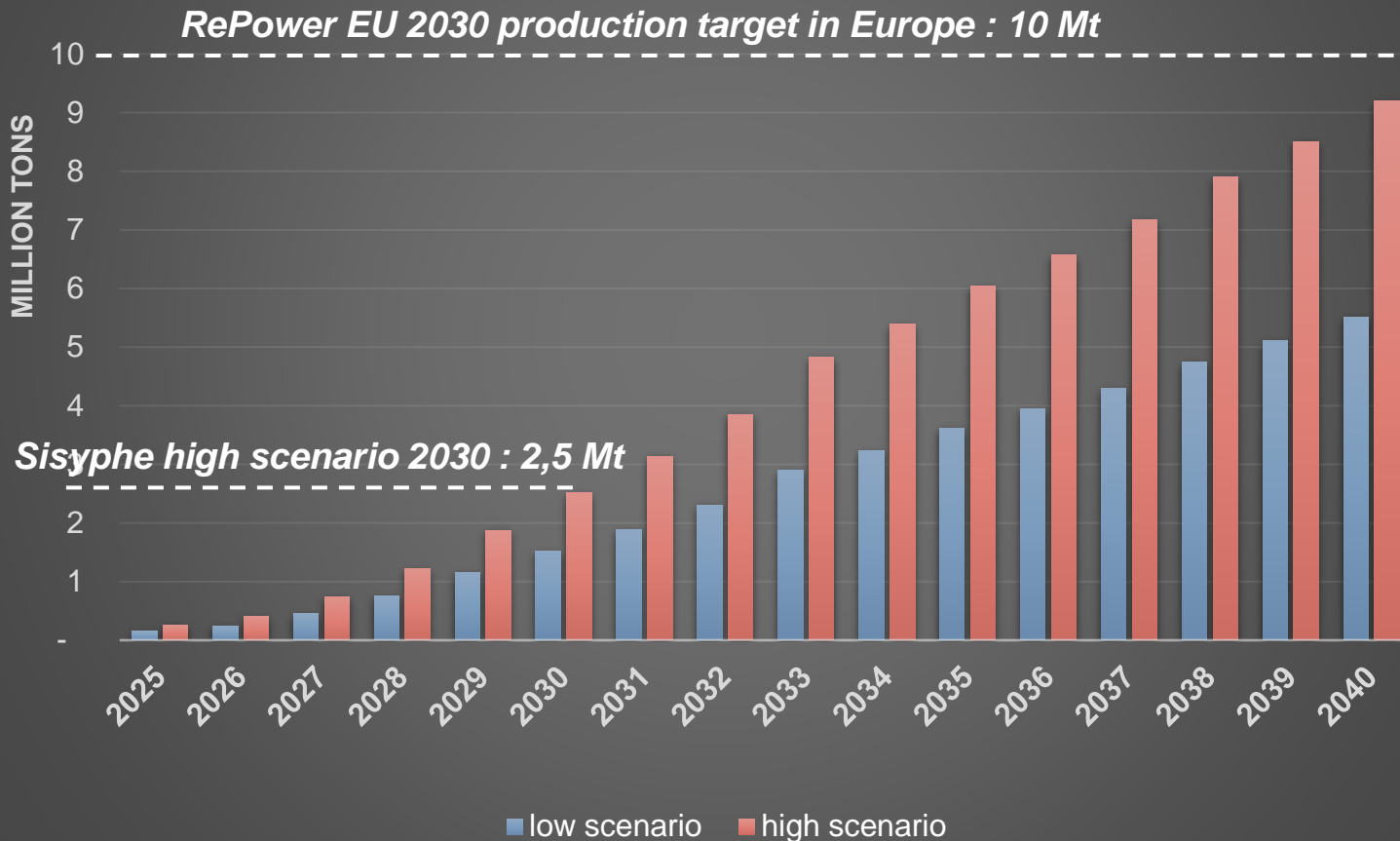
### Levers at hand to address the risks:

- Financial support mechanisms based on more pragmatic rules (e.g. IRA) providing a long-term visibility
- Support for scaling-up and industrial deployment, including R&D
- Channelling resources towards the most demanding sectors, or sectors with no alternatives.

# SISYPHE evaluation of demand in Europe for electrolytic hydrogen



## Demand for electrolytic hydrogen in Europe (all sectors)



## Two scenarios developed:

### SISYPHE « High » scenario:

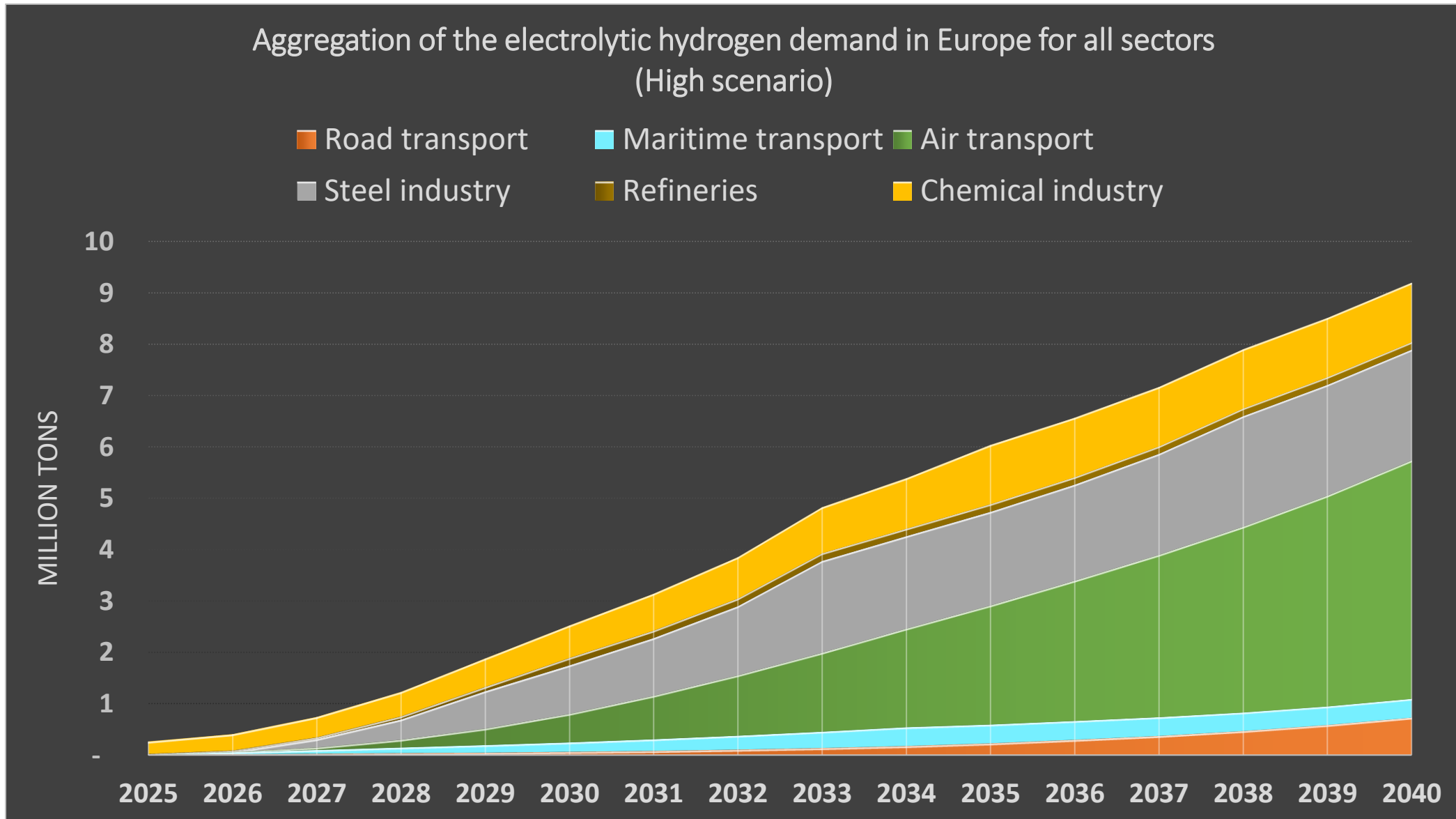
- Achievement of European objectives for the following sectors:
  - Aviation
  - Maritime transport
  - Chemistry (excepted ammonia)
- Road transport in line with roadmaps
- Completion of engaged projects for steelmaking, refineries and ammonia production

### SISYPHE « Low » scenario:

- 60% of the « high » scenario demand
- More conservative approach reflecting possible complications or delays for implementing the projects



# Sectorial insights for « high » scenario





**Thank you**

