

Hydrogen for Europe study

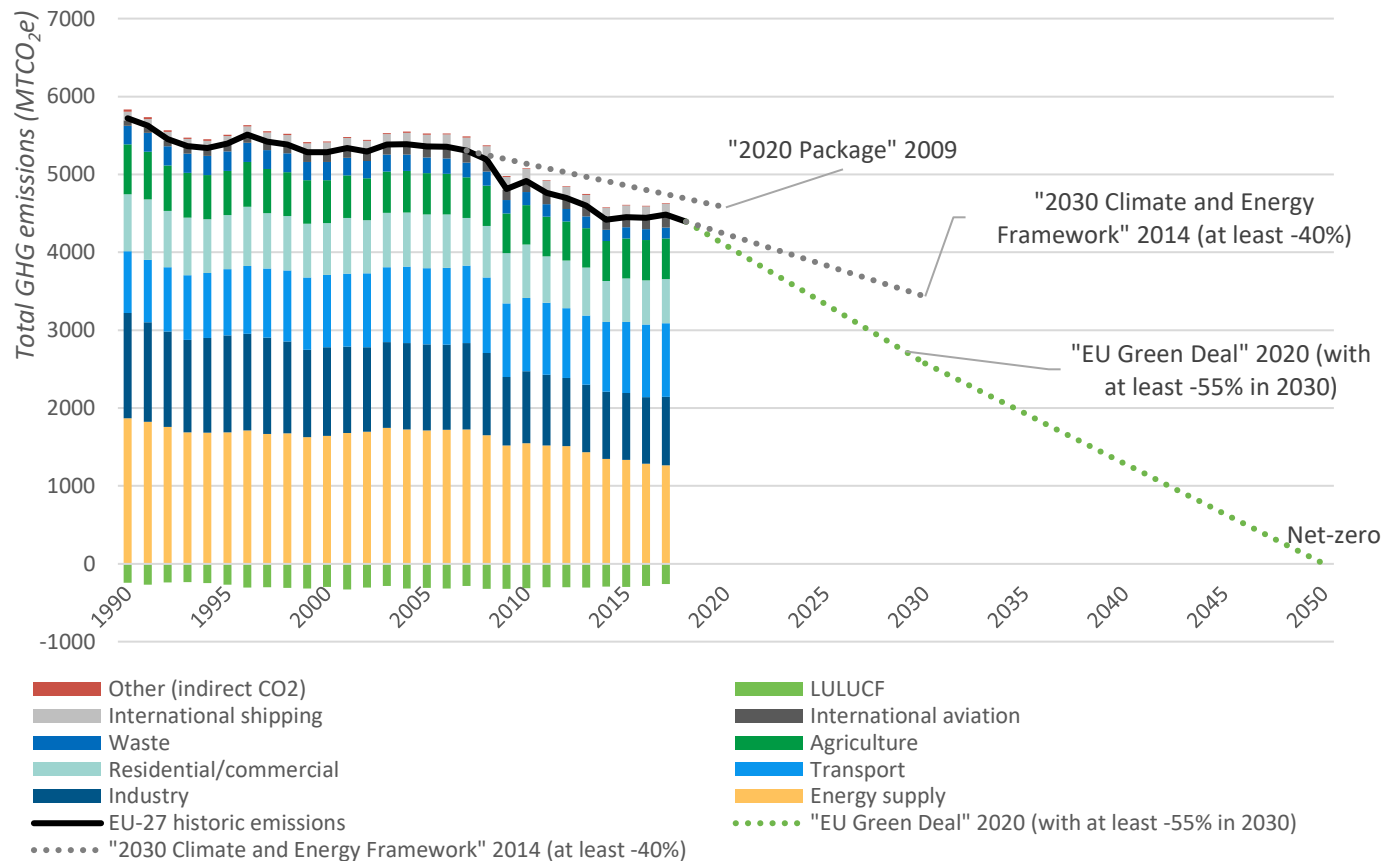
Available at: <https://www.hydrogen4eu.com>

Dr. Manuel Villavicencio

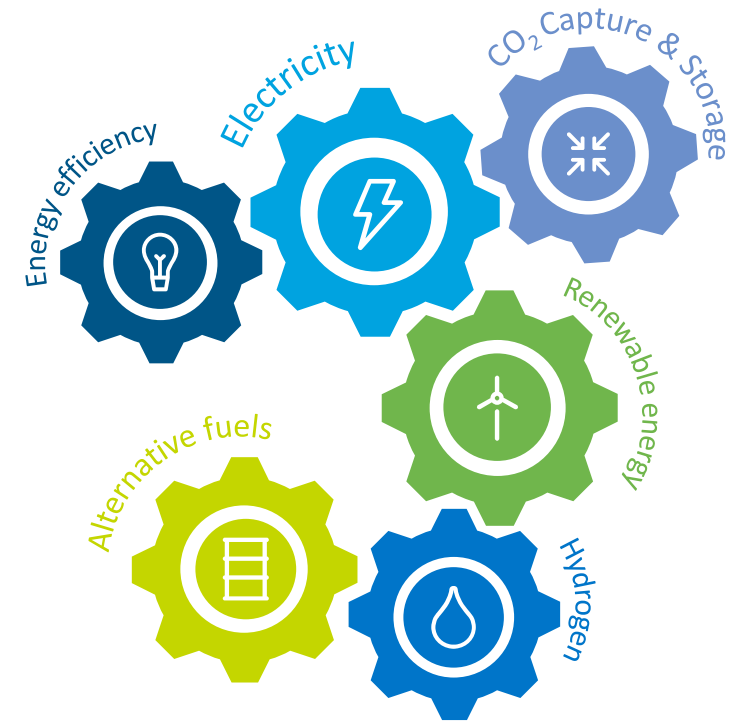
Economic Advisory – Deloitte France

Reaching net-zero emissions in the EU by 2050 is a formidable challenge

The European Union has reduced its carbon emissions during the last decade but the path towards net-zero requires a step change in efforts



Integrated energy system for the Net-Zero target



The design of the Hydrogen for Europe study in a nutshell

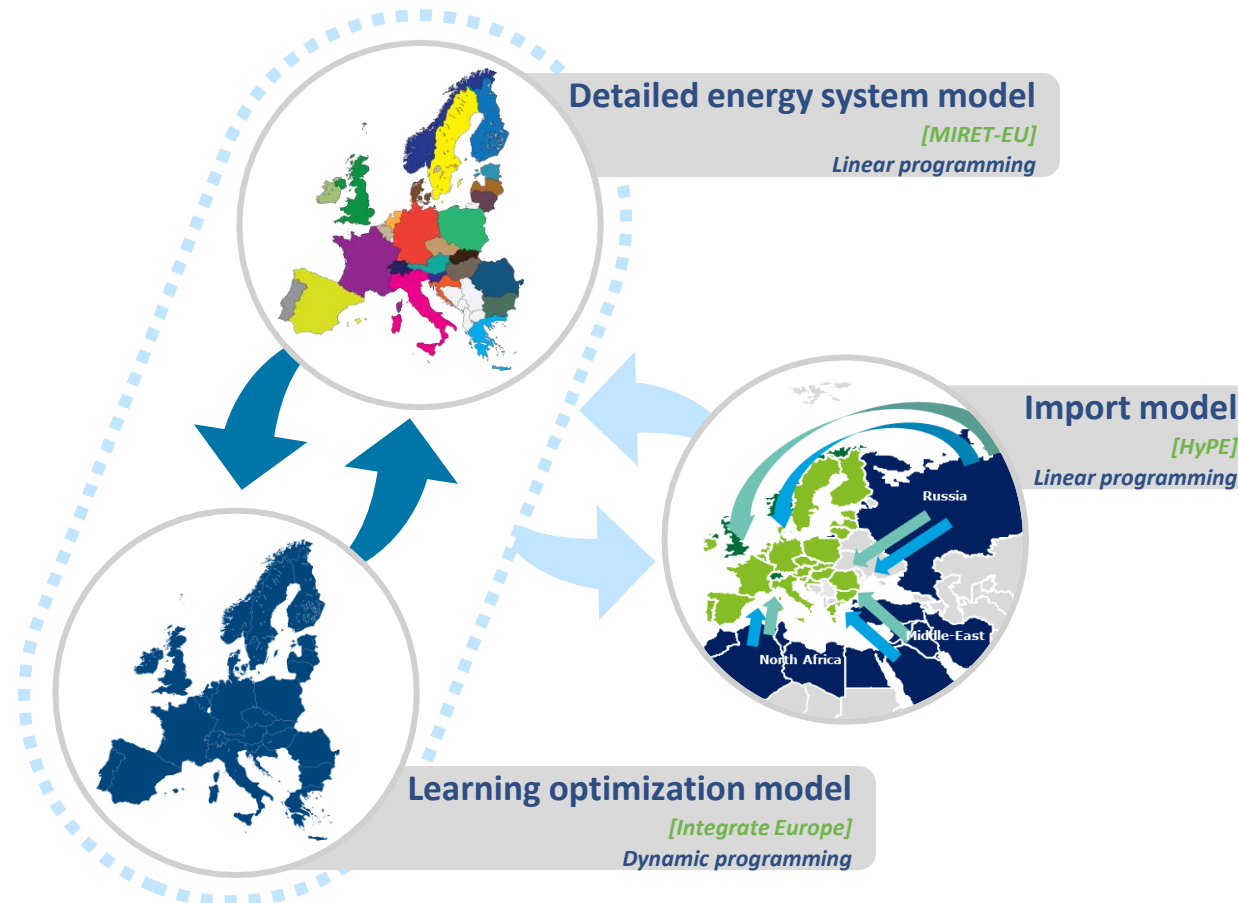


Hydrogen for Europe is a new research study that comprehensively looks at the **European energy system** to assess the **role of hydrogen** in the energy transition.

Addressed issues



- How can **renewable and low-carbon hydrogen** contribute to the energy transition?
- What decisions and pathways help to **bring down the technology cost**?
- What is needed at **policy and regulatory level** ?



The study rests on a quantitative analysis, relying on three models and their interaction: MIRET, Integrate Europe and HyPE.
Led by Deloitte, research centers SINTEF and IFPEN implemented an innovative and original modelling approach

Two main pathways are analysed:

Technology Diversification pathway

→ Illustrates how an inclusive approach helps minimize the cost of the transition

Renewable Push pathway

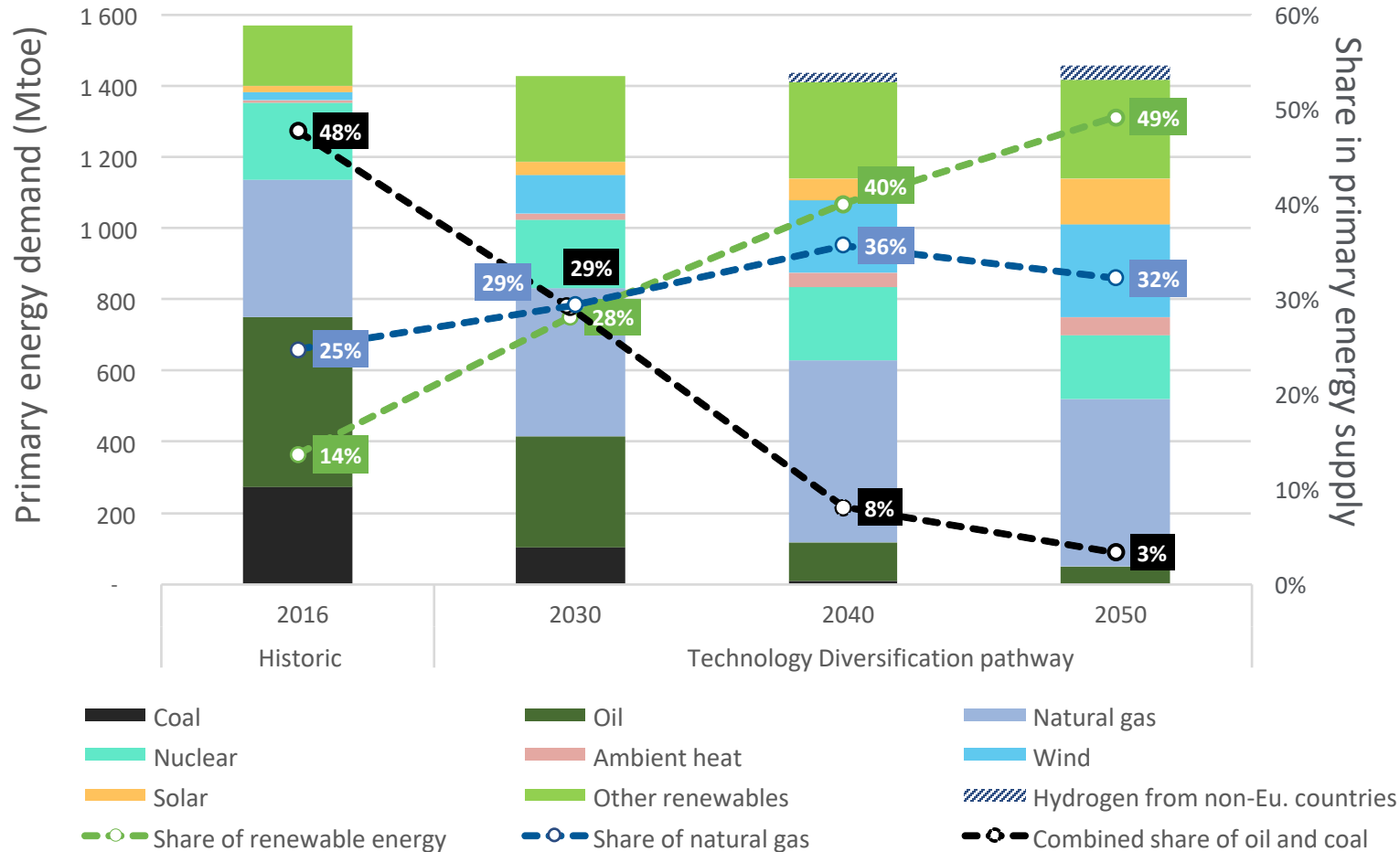
→ Shows the implications of a deliberate focus on renewables

Both are aligned with key EU policy goals:

- 55% reduction in GHG by 2030,
- Net-zero by 2050

The primary energy mix is fundamentally reshaped in the two pathways

Evolution of primary energy demand in Europe



- **x3.5 in 30 years**
- Meets almost **half** of primary energy by 2050

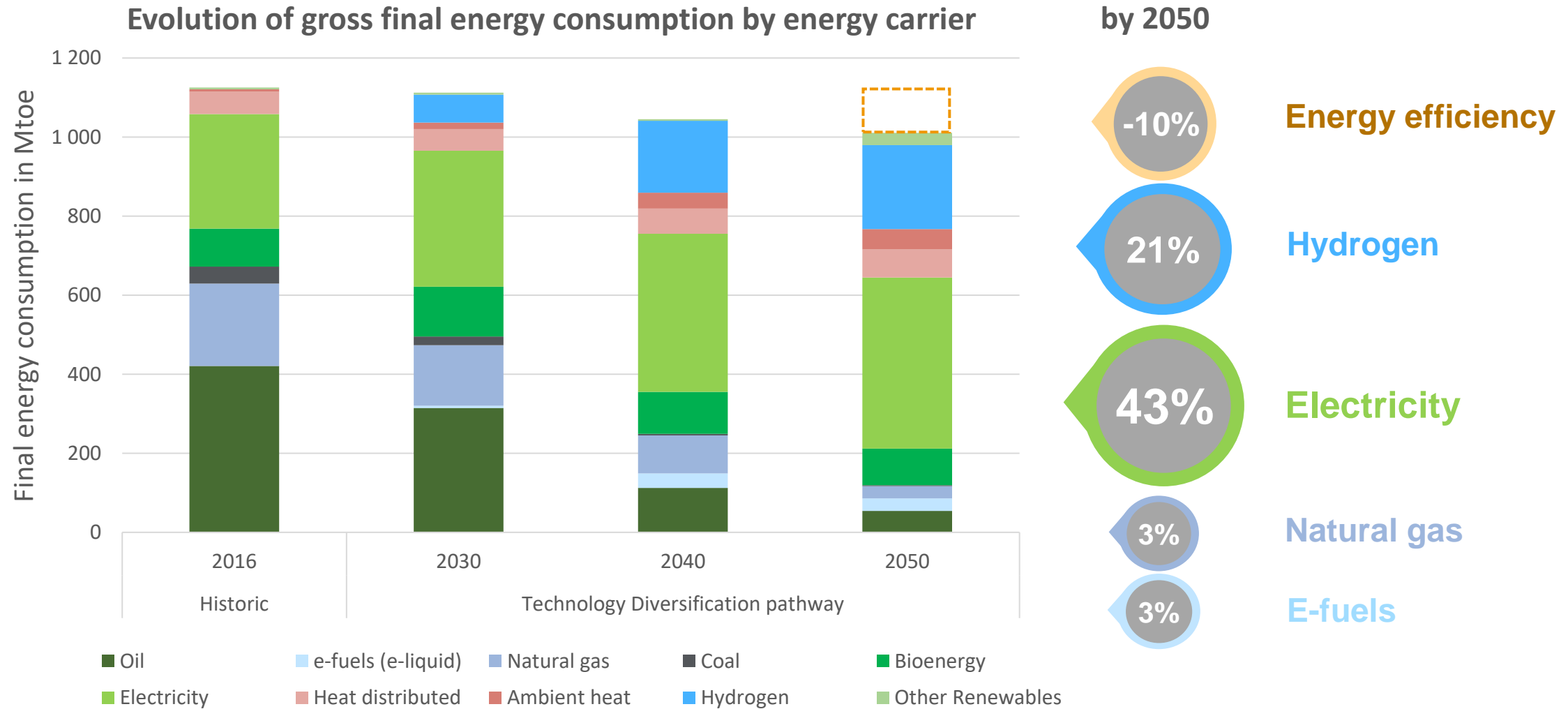


- **32% share by 2050**
- Resilient during the transition



- Dwindling role of coal and oil
- **3% share by 2050**

Electricity and hydrogen combine forces to decarbonise energy end-use

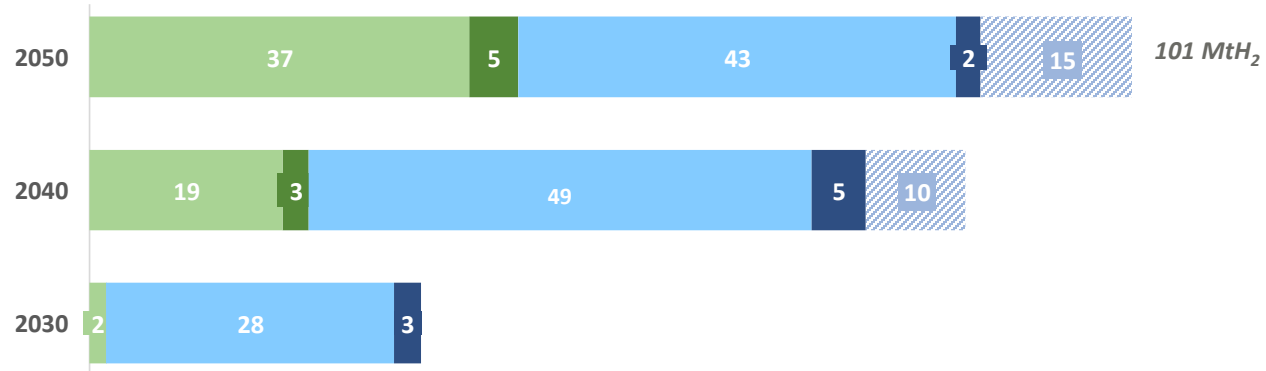


**~ 100 million tonnes
of H₂ consumed by
2050**

Diversity and complementarity between hydrogen supply options

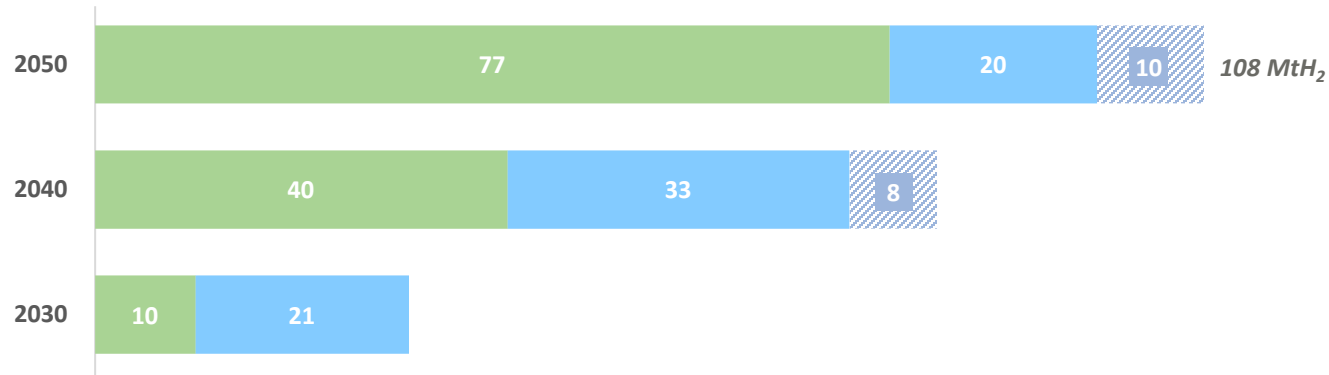
Technology Diversification pathway

Supply in MtH₂



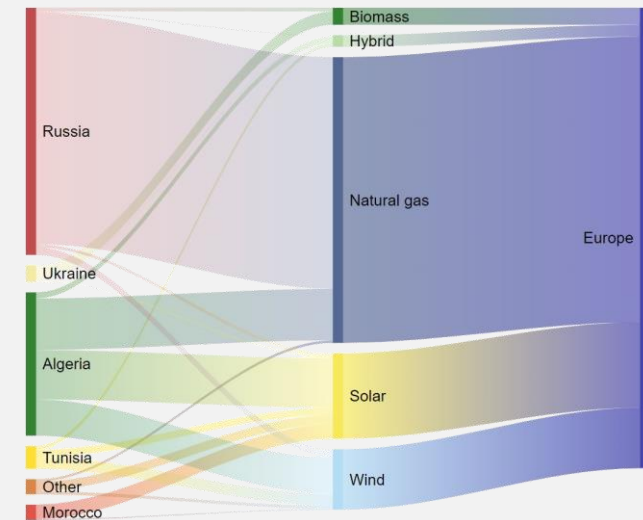
Renewable Push pathway

Supply in MtH₂

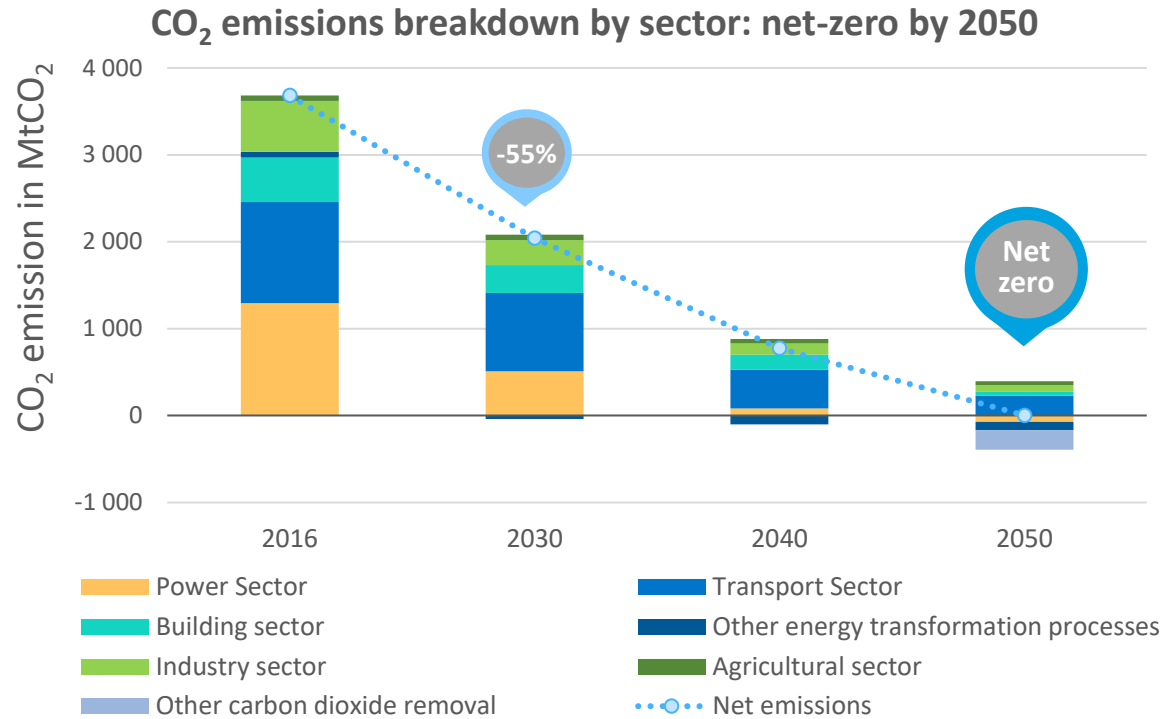


- Electrolyzer
- Biomass / biomass with CCS
- Reformer with CCS
- Methane pyrolysis
- Imports from non-European countries

Imports from non-European countries



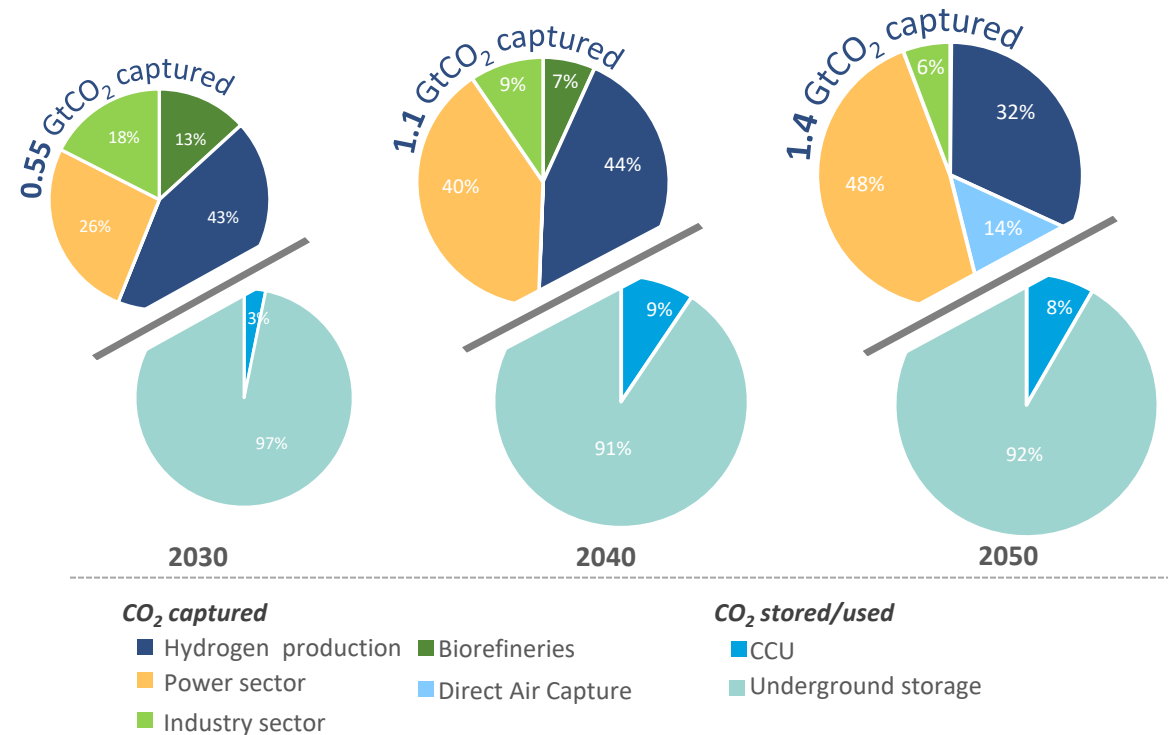
Zooming in on CO₂ emissions and the net-zero objective



Carbon capture and storage technology is indispensable:

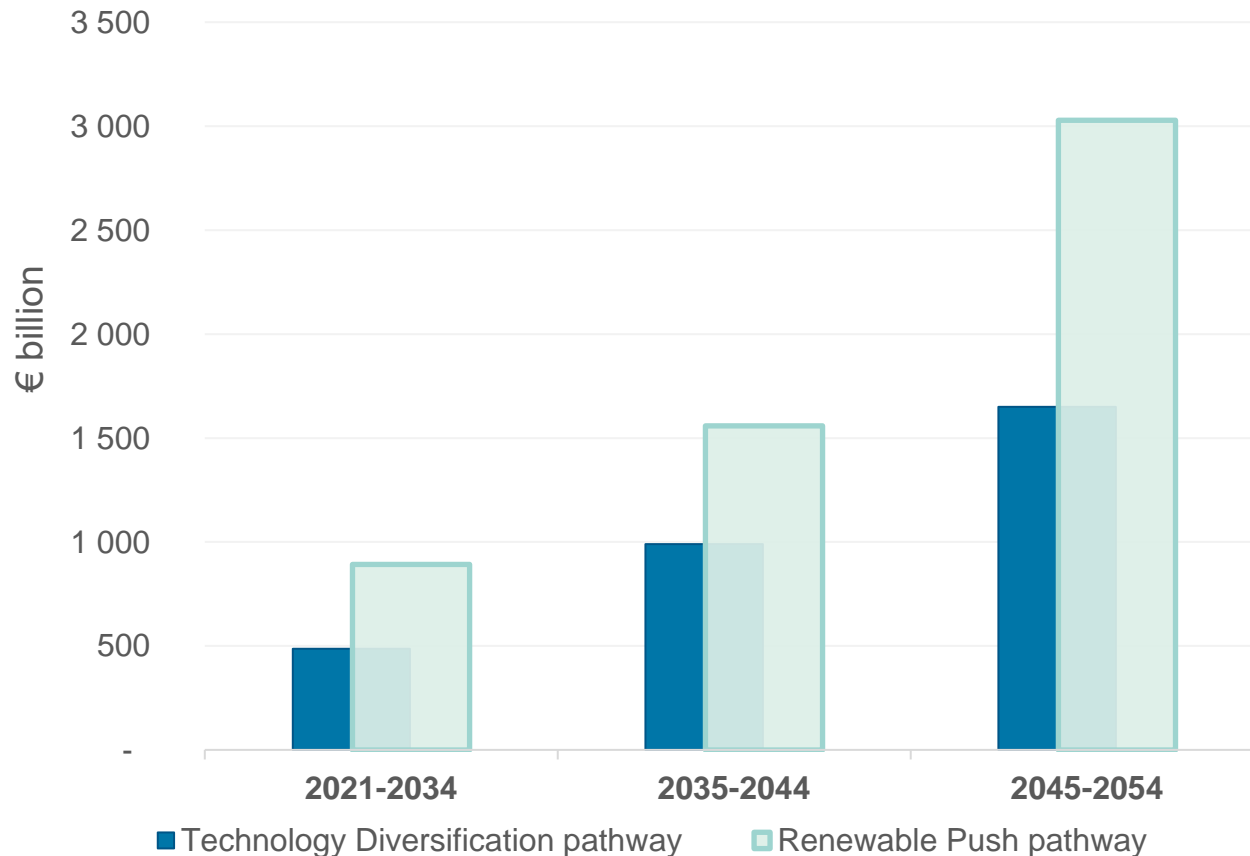
- Unlock the potential of low-carbon solutions
- Enabling negative emissions

Some 400 Mt of CO₂ are removed in 2050
 In some applications the cost of full decarbonization is grater than compensating emissions with CO₂ removal.



Investment, investment, investment...

Investment pathways in the hydrogen value chain
(including offgrid electricity)



Trillions of euros are needed in both scenarios to finance the hydrogen value chain.

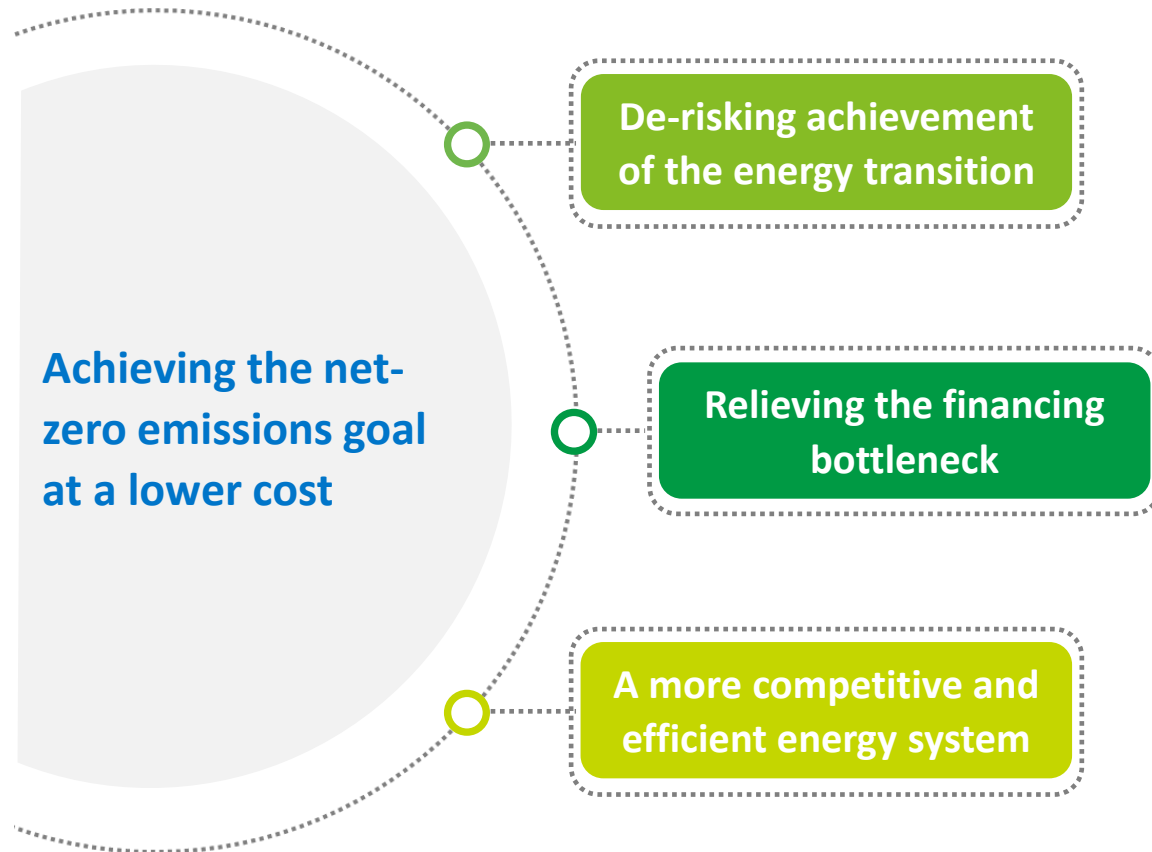
Temporality and level of necessary investment differ between the scenarios: more money needs to be mobilized earlier in the Renewable Push pathway

5.5 trillion euros
Renewable Push

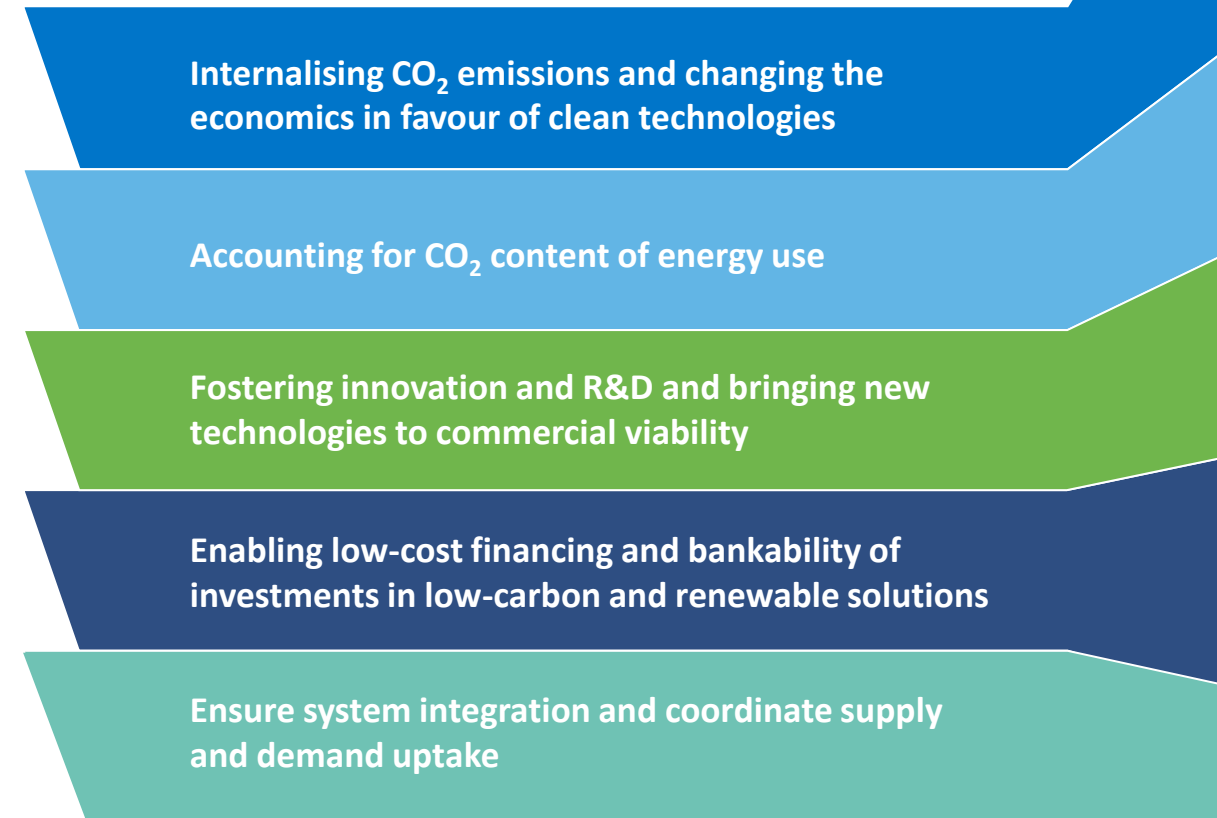
3.1 trillion euros
Technology Diversification



The Technology Diversification pathway offers to European society several advantages that policy-makers should trade-off against other criteria



Five main guidelines to inform the design of next policy packages and measures



Thanks for your attention

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