Webinar: Achieving industrial decarbonisation through affordable low-carbon hydrogen

Monday 22 February 2021 – 15.00 – 16.30

Affordable hydrogen produced with a continuous supply of low-carbon electricity can be used to decarbonise energy intensive industries which require energy around the clock. This panel will therefore focus on:

- The affordable low-carbon hydrogen solutions which can help meet the challenges that industries are facing
- Identification of financing needs
- Discussion on the best policies to leverage these solutions

This event falls under the umbrella of the European Commission's EU Industry Week

Draft programme:

- Welcome: **Andrei Goicea**, Policy Director – FORATOM
- Short introduction: **Yves Desbazeille**, Director General - FORATOM
- Producing low-carbon hydrogen: **Jean-Maurice Gimet**, Operation & Maintenance Manager – Hynamics
- Hydrogen as a decarbonisation solution: **Nicola Rega**, Energy Director – European Chemical Industry Council (Cefic)
- Government support for hydrogen perspective from Hungary: **dr. József Szuper**, Innovation Director at PIP Nonprofit Kft.
- Q&A session moderated by **Andrei Goicea**

Nuclear Hydrogen Production – a key low-carbon technology in a decarbonised Europe

Andrei Goicea

Policy Director

Achieving industrial decarbonisation through affordable low-carbon hydrogen webinar – 22/02/2021

FORATOM

FORATOM - the voice of the European nuclear industry in energy policy discussions with EU Institutions & other key stakeholders.

Key topics:

EU Energy Policy:
- Economics of nuclear
- EU energy mix
- Euratom Treaty
- Security of energy supply
- Sustainability
- Special projects - Brexit

Nuclear technology:
- Innovation, R&D
- Nuclear safety*
- Nuclear transport
- Supply chain
- Waste disposal

Communication:
- Nuclear advocacy
- Perception of nuclear energy
- Promotion of nuclear energy
- Public opinion

* Topic overseen by ENISS

Legal aspects

Membership

The membership of FORATOM is made up of 15 national nuclear associations representing more than 3,000 companies.

Belgium

Bulgaria

Finland

France

Hungary

Italy

Netherlands

Romania

Slovakia

Slovenia

Spain

Sweden

Switzerland

Ukraine

United Kingdom

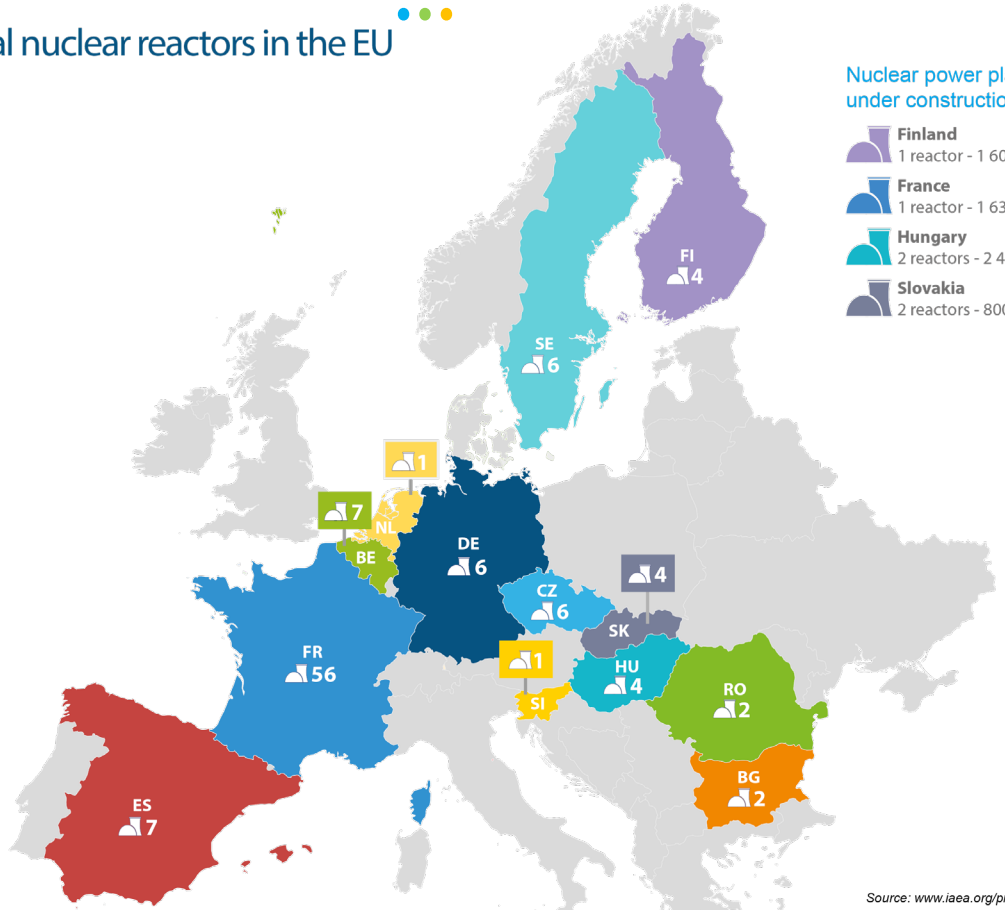
CEZ (Czech Republic), Fermi Energia (Estonia), NUVIA (France),
PGE EJ 1 (Poland) and Urenco Ltd (Global) are Corporate Members

Nuclear energy in EU27

106 Operational nuclear reactors in the EU

Nuclear share of electricity

- **71% France** 56 reactors - 61 370 MW
- **55% Slovakia** 4 reactors - 1 814 MW
- **49% Hungary** 4 reactors - 1 902 MW
- **42% Sweden** 6 reactors - 6 869 MW
- **38% Belgium** 7 reactors - 5 918 MW
- **36% Slovenia** 1 reactor - 688 MW
- **34% Bulgaria** 2 reactors - 1 966 MW
- **34% Czech Republic** 6 reactors - 3 932 MW
- **33% Finland** 4 reactors - 2 764 MW
- **20% Spain** 7 reactors - 7 121 MW
- **18% Romania** 2 reactors - 1 300 MW
- **12% Germany** 6 reactors - 8 113 MW
- **3% Netherlands** 1 reactor - 482 MW

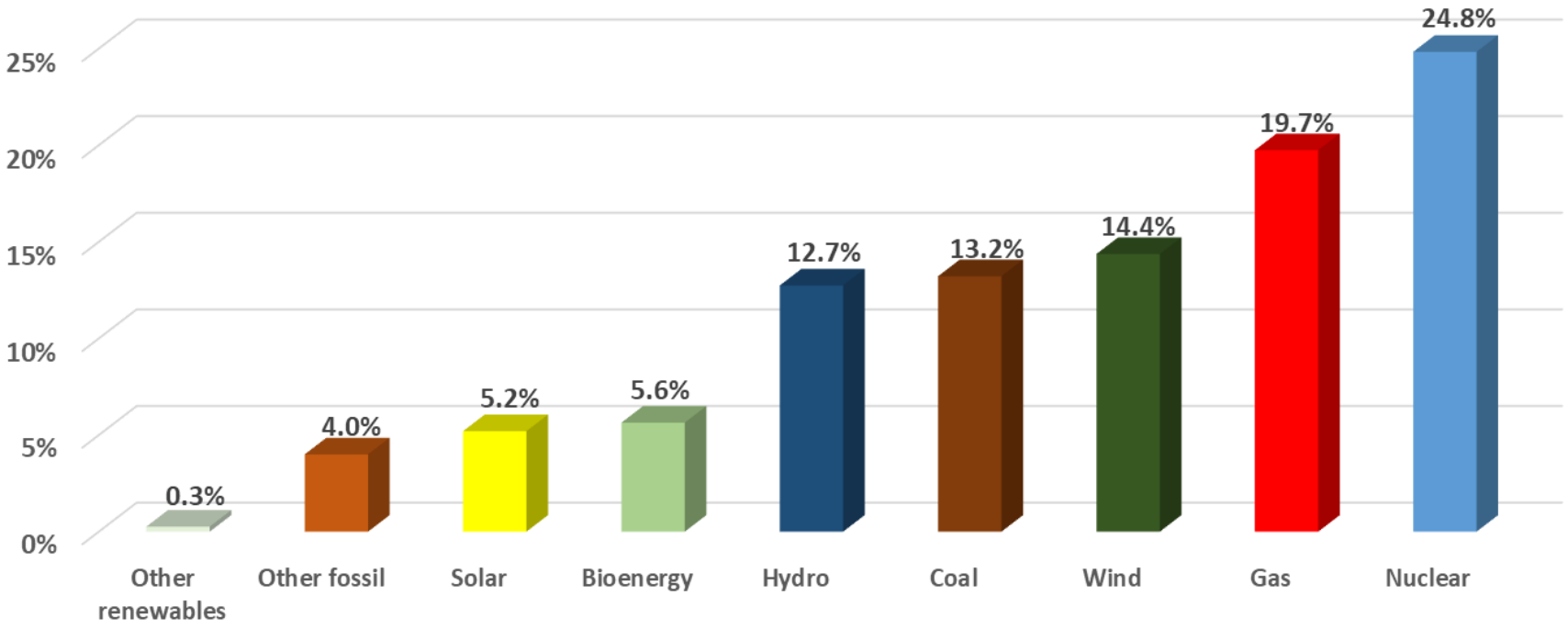


Nuclear power plants under construction

- **Finland** 1 reactor - 1 600 MW
- **France** 1 reactor - 1 630 MW
- **Hungary** 2 reactors - 2 400 MW
- **Slovakia** 2 reactors - 800 MW

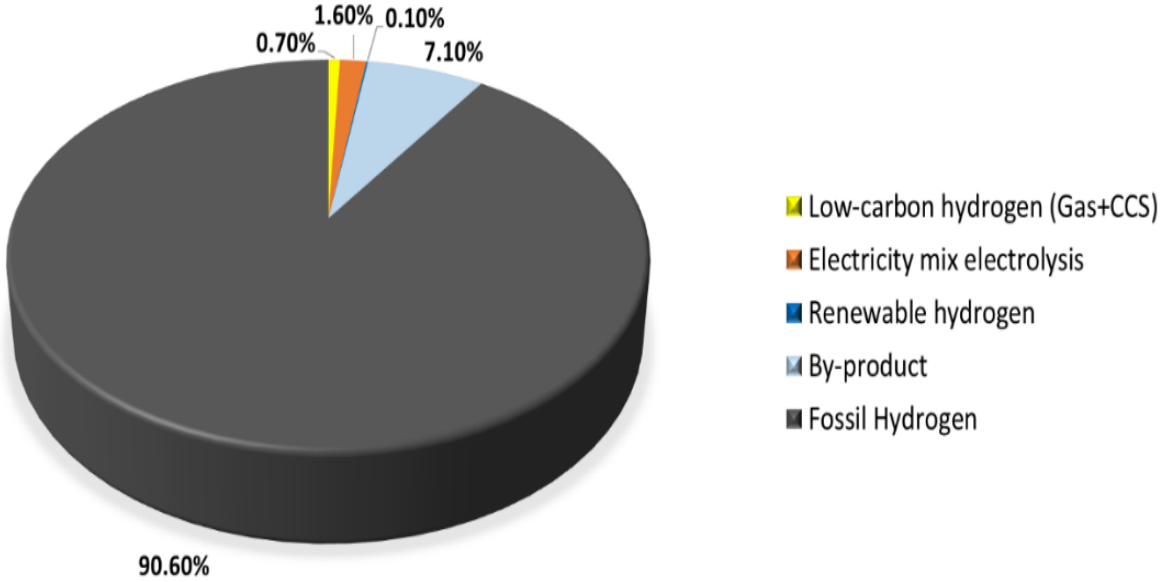
Source: www.iaea.org/pris, 2020

EU’s power sector in 2020



Source: "Europe's Power Sector in 2020", published by Ember and Agora Energiewende on 25th January 2021

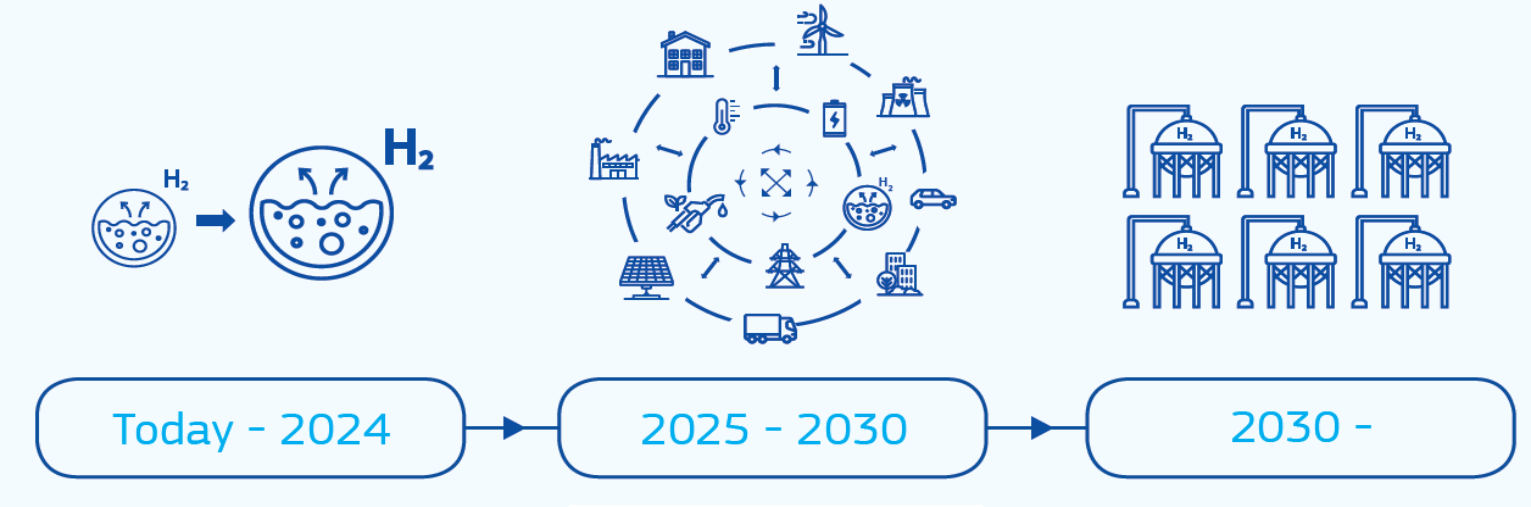
Current EU hydrogen production status



The current EU hydrogen is mostly produced through emissions-intensive natural gas reforming and coal gasification

Chart made based on Hydrogen Europe 2020 monitor, HydrogenEurope data

EU hydrogen production perspective



From now to 2024, we will support the **installation of at least 6GW of renewable hydrogen electrolysers in the EU**, and the production of **up to 1 million tonnes** of renewable hydrogen.

From 2025 to 2030, hydrogen needs to **become an intrinsic part of our integrated energy system**, with at least 40GW of renewable hydrogen electrolysers and the production of **up to 10 million tonnes** of renewable hydrogen in the EU.

From 2030 onwards, **renewable hydrogen will be deployed at a large scale** across all hard-to-decarbonise sectors.

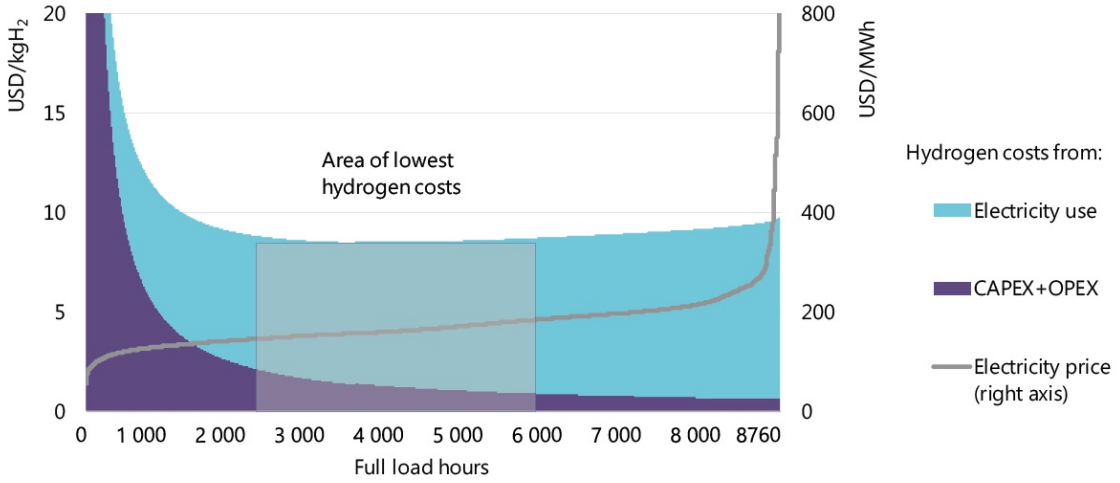
EU hydrogen production perspective (2)

…but can those targets be achieved only with renewable hydrogen?

In FORATOM's opinion, an **economic and sustainable** hydrogen ambitious production cannot be set without considering the electrolysis with **nuclear produced base load low-carbon electricity**.

Economics of low carbon hydrogen

Different sources of information are confirming the IEA statement in its 2019 report*:
"*With increasing full load hours, the impact of CAPEX on hydrogen costs declines and the electricity becomes the main cost component for water electrolysis*"

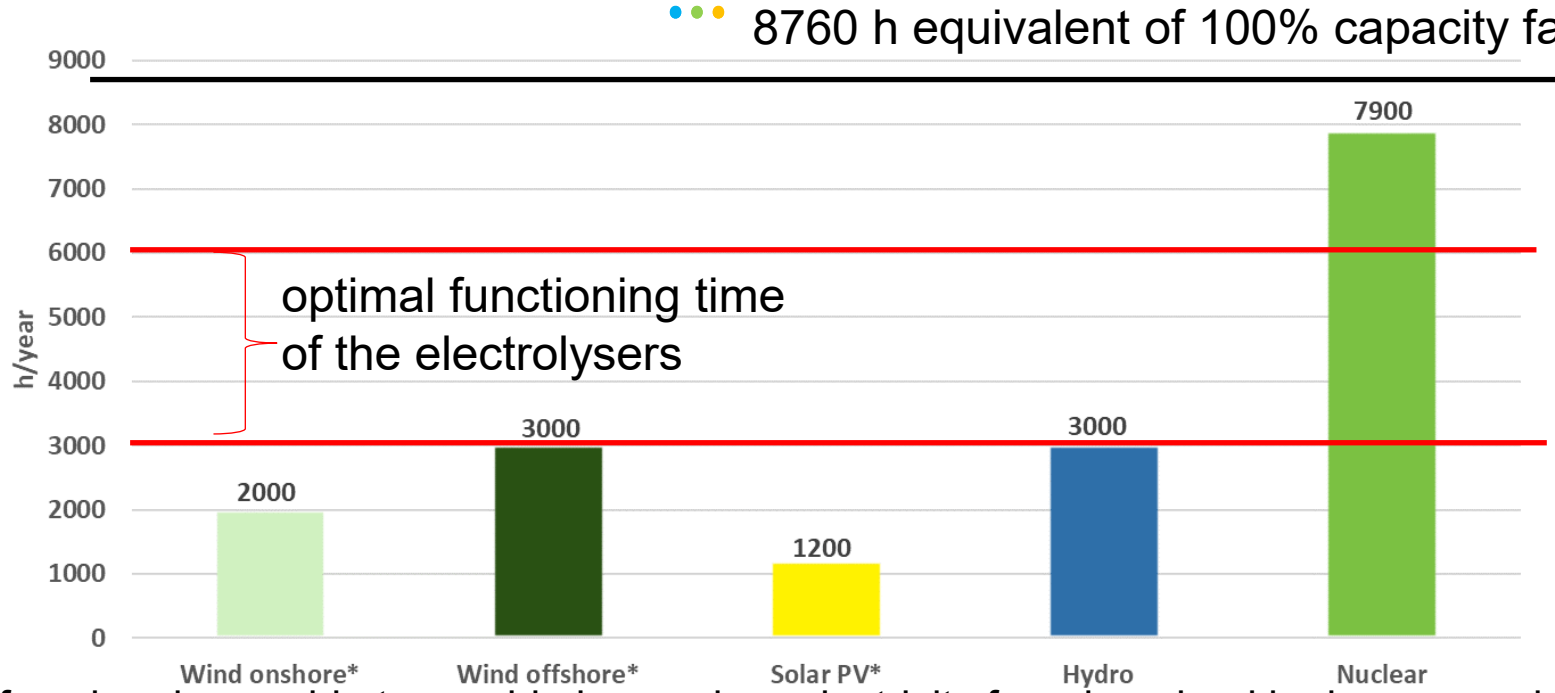


Notes: CAPEX = USD 800/kW$_e$; efficiency (LHV) = 64%; discount rate = 8%.
Source: IEA analysis based on Japanese electricity spot prices in 2018, JEPX (2019), *Intraday Market Trading Results 2018*.

Considering also the electricity costs, the figure confirms that somewhere between **3000h-6000h** could be an optimal functioning time from economic perspective of the electrolysers

*The future of hydrogen report IEA 2019

Low-carbon generations capacity factors



Even if nuclear is capable to provide low-carbon electricity for a baseload hydrogen production we consider that the most economic path would be a combination of nuclear and renewables, considering for the later one the curtailments

*ASSET report for EC on "Technology pathways in decarbonisation scenarios", July 2018

Note: medium capacity factors for 2030 has been considered for the selected technologies

Sustainability of low-carbon hydrogen

- In order to be considered sustainable, the hydrogen should have a certain **carbon intensity**.

- This is why **FORATOM consider that classification and guarantee of origin should be done based on a detailed life-cycle assessment of the carbon intensity of the source used to produce hydrogen** and the future hydrogen legislation should **adopt a low-carbon technology neutral approach** and review process

- Depending on the carbon intensity of the national grid, the production of the sustainable hydrogen can be done either by
  - direct connection of the electrolyser to the low-carbon power production source (nuclear, renewables)
  - using electricity from the power grid

Sustainability of low-carbon hydrogen

- Hydrogen production with direct connection of the electrolyser to the low-carbon power production source - nuclear
  - UK - Hydrogen 2 Heysham Project: feasibility assessment carried out on the viability of low-carbon hydrogen production by electrolysis using nuclear generated electricity at the Heysham nuclear power station.

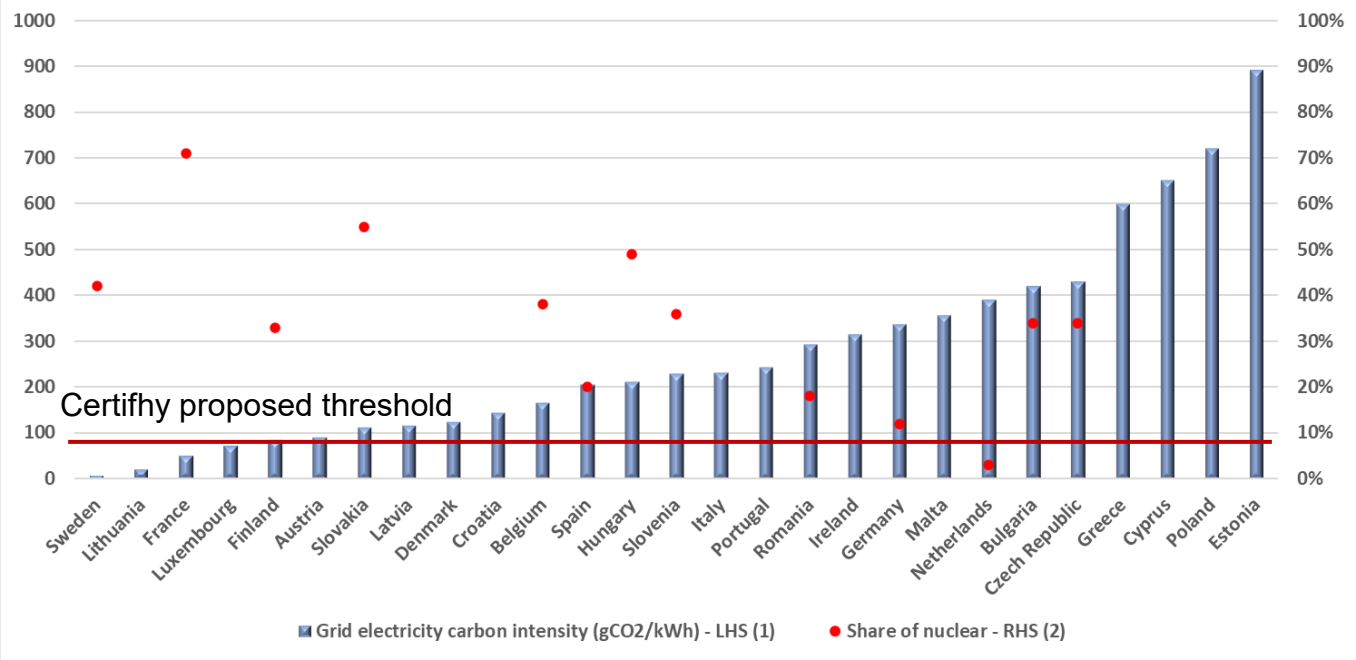
  - US – Exelon and partners will install a 1MW PEM electrolyzer at one of Exelon's operating nuclear plants to demonstrate dynamic production of hydrogen from nuclear electricity (source)

- Main advantage of this solution is the electricity costs reduction by avoiding the transport network costs

Sustainability of low-carbon hydrogen

- Using electricity from the power grid – where the grid meet the carbon intensity requirements

Considering the Certifhy, the project dedicated to set hydrogen carbon intensity thresholds, there are only few countries able to fulfill the requirements – out of them, the ones with larger power grids relies on nuclear



1. Greenhouse gas emission intensity of electricity generation in 2019 – European Environmental Agency – left hand side
2. FORATOM calculations based on IAEA PRIS data 2020 – right hand side

Conclusions

Key policy recommendations

- EU policy should aim to support all **low-carbon hydrogen projects**, regardless of the technology.
- EU initiatives, such as the **Clean Hydrogen Alliance**, must recognise the validity of **nuclear -based hydrogen projects**.
- **Support Innovation, Research and Development into all low-carbon hydrogen projects**.
- Studies to identify the cost and economic viability of projects must take into consideration full system costs.
- The implementation of support schemes such as carbon contracts for difference should be encouraged in order to trigger the scale-up of low-carbon hydrogen projects.

Thank you

The upcoming position paper on nuclear hydrogen production will be available soon here: https://www.foratom.org/publications/#position_papers