In collaboration with:

Towards climate neutrality

Role of green hydrogen in future decarbonised and optimised European energy systems

Andrzej Ceglarz, Alexandros Fakas Kakouris, Léa Hayez

Renewables Grid Initiative

Contributing to:

With support from:

13:30 – 17:30 - 12.07.2023

Brussels, European Environmental Bureau's premises

Who is RGI?

RGI is a unique **collaboration of NGOs and TSOs** from across Europe engaging in an ‘energy transition ecosystem-of-actors’. We foster knowledge exchange, discussions on the grid infrastructure needs, and the implementation of best practices within **three dimensions**:

Technical

We enable discussions on **how to model, plan and implement** decarbonised and optimised clean energy systems, including different voices in the process.

Environmental

We ensure energy systems both onshore and offshore are developed in **coherence with nature and biodiversity**, promoting mitigation, enhancement and restoration measures.

Societal

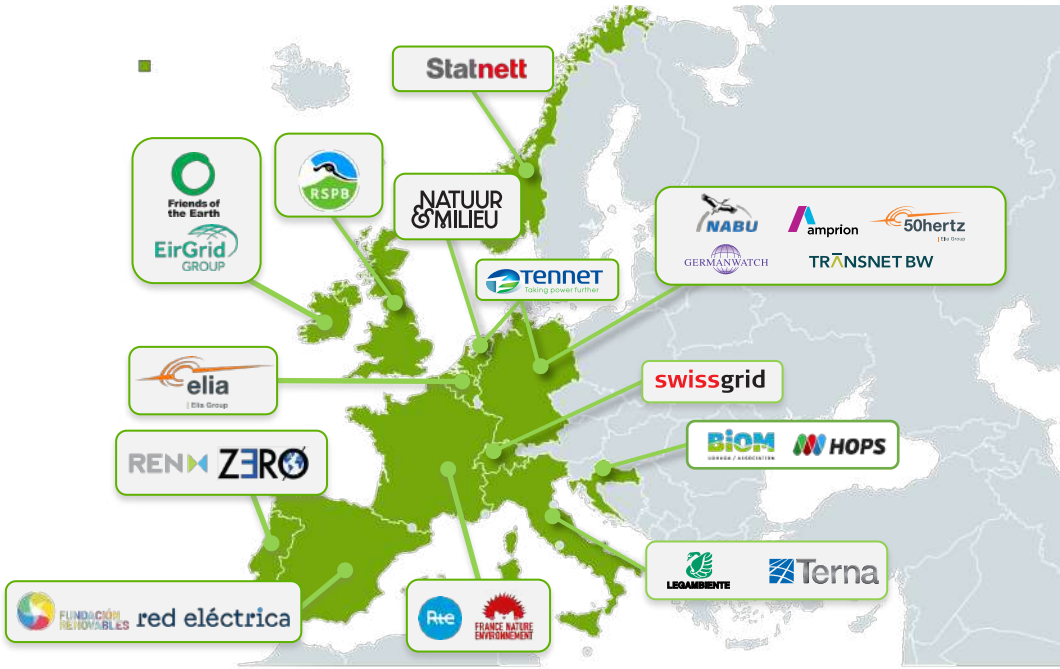
We **include and engage citizens, civil society and policy makers** on strategies towards full decarbonisation, improving capacity and knowledge on the role of grids within for the energy transition.

European Organisations

CAN Europe · WWF · BirdLife International · Bellona Europa · EMBER

Supporting Members

europacable · IUCN



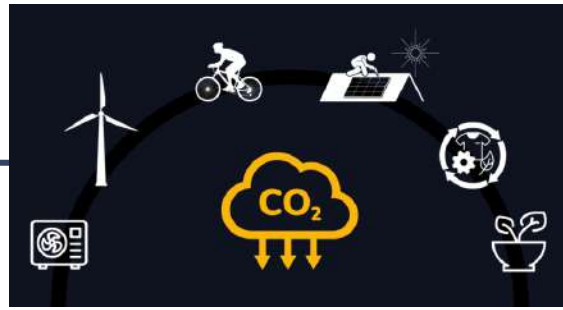
Renewables Grid Initiative

Workshop background

2018

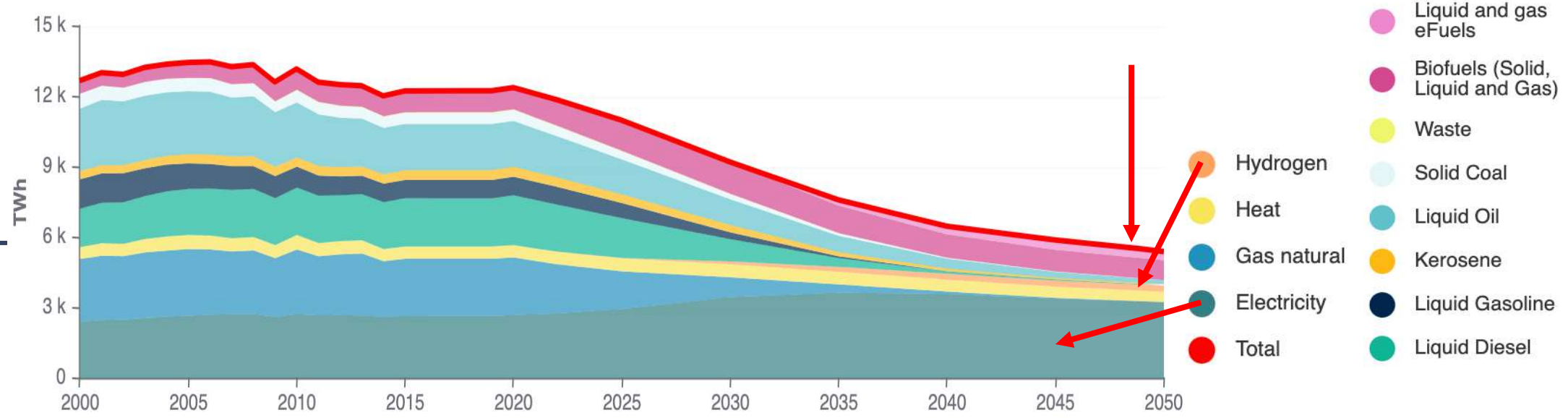
Paris Agreement Compatible Scenarios for Energy Infrastructure

Renewables Grid Initiative · REN21 · EEB European Environmer Bureau · CAN Europe



- **- 65% GHG emissions by 2030**
- **net-zero GHG emissions by 2040**
- **100% renewables by 2040**

2021 / 2024



https://pathwaysexplorer.climact.com/

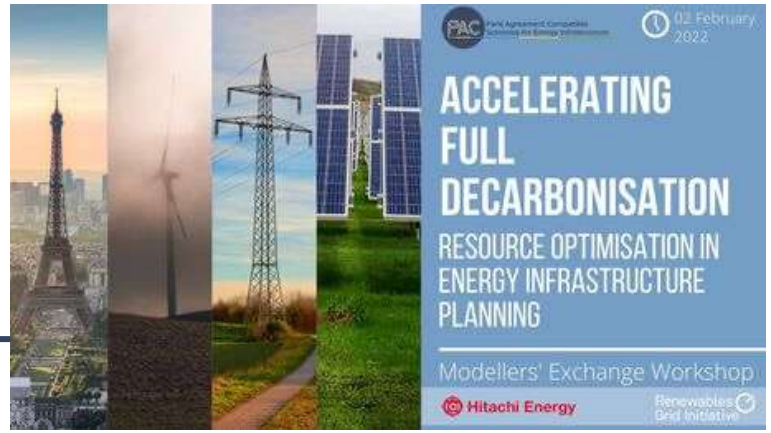
Renewables Grid Initiative

Workshop background

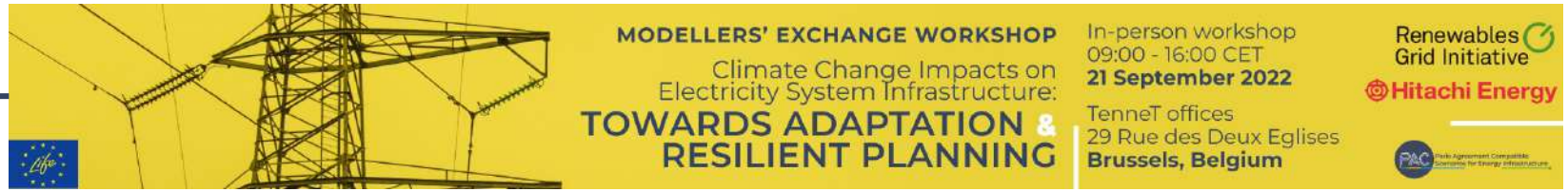
2018 / 2024

PAC Paris Agreement Compatible Scenarios for Energy Infrastructure

Feb 2022



Sept 2022



12 Jul 2023

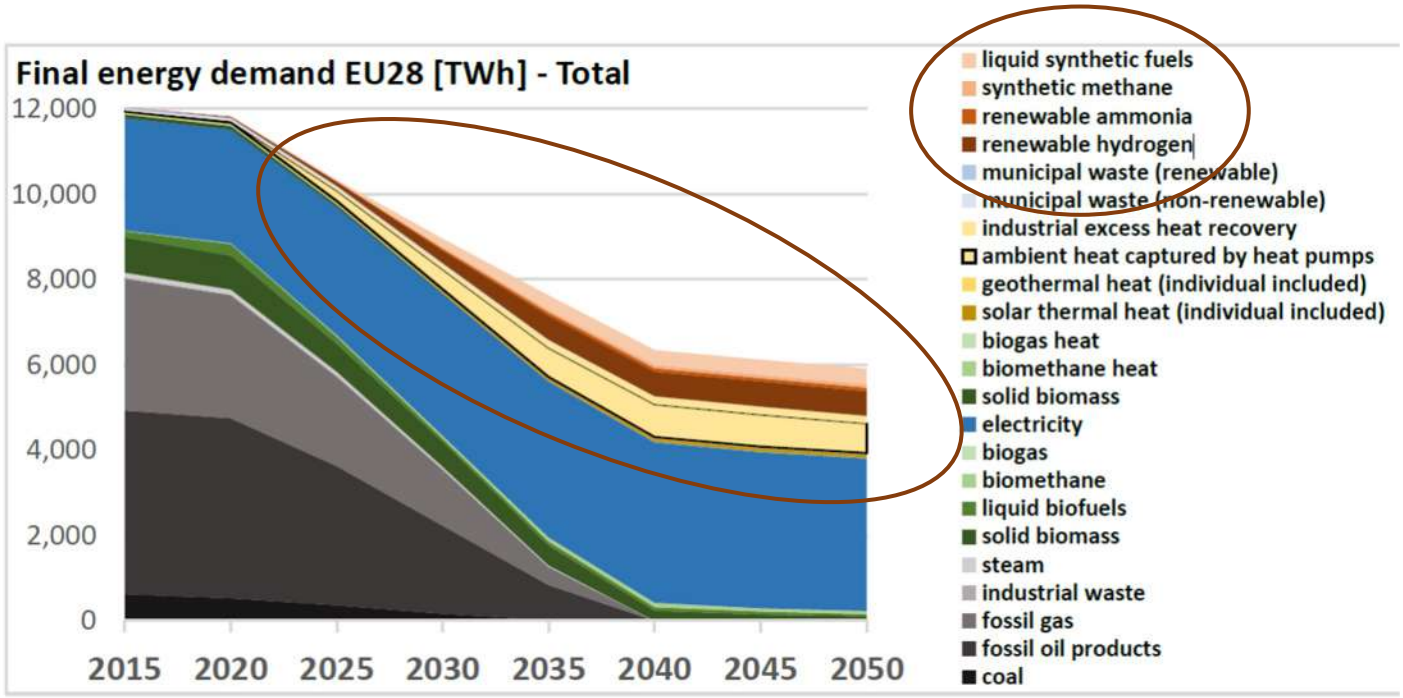
Renewables Grid Initiative

Renewable hydrogen (H_2) in 2040: Revisiting The Paris Agreement Compatible scenario 1.0

Joni Karjalainen
Energy Transition Analyst
Climate Action Network (CAN) Europe
joni.karjalainen@caneurope.org

Modellers Exchange Workshop on Hydrogen
12 July 2023

Renewable hydrogen (RE H_2) in PAC 1.0



PAC 1.0 scenario 2040, change from present

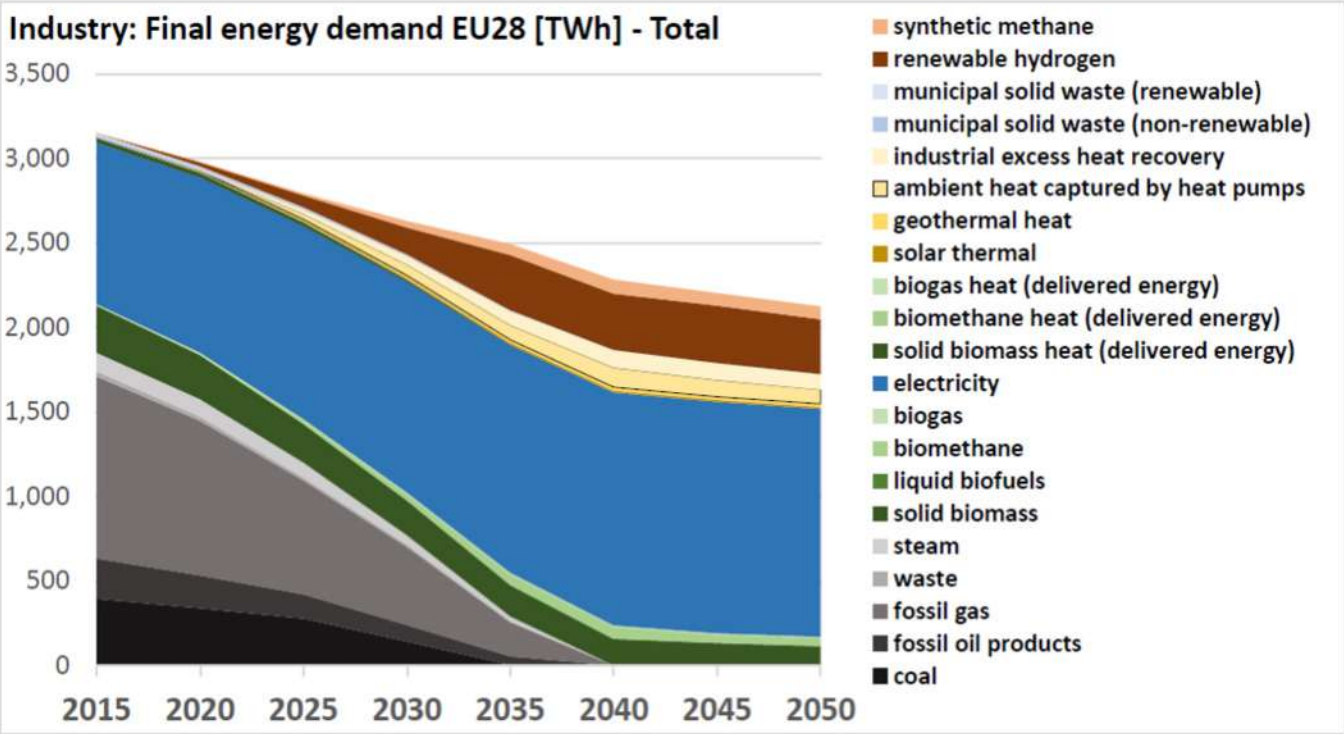
- Wind energy for producing renewable hydrogen +++ (high growth)
- Solar PV for producing renewable hydrogen +++ (high growth)
- All H_2 is RE H_2

Overall storyline (EU28)

- Swift market introduction of RE H_2 substitutes coal and fossil gas.
- Most excess renewable electricity is used by flexible electrolysers to produce RE H_2.
- Synthetic gases and fuels are produced through electrolysis for decarbonising industry (high temperature heat) and aviation. Limited role for non-fossil gases and fuels = RE H_2.
- Additional electricity needed for producing RE H_2 from domestic EU potentials

Source: CAN Europe/EEB technical summary June 2020
CAN Europe/EEB: Summaries of PAC scenario workshops and General Assemblies workshops on 24 April 2019, 9 July 2019, 9 October 2019, 7 November 2019 and 31 January 2020.

Renewable hydrogen (RE H_2) in PAC 1.0: industry

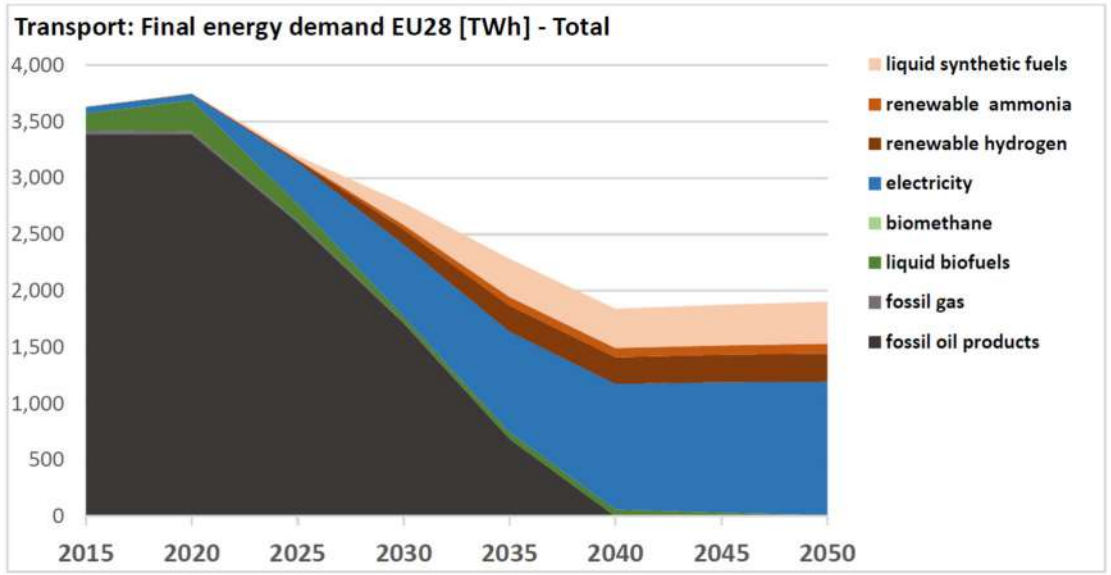


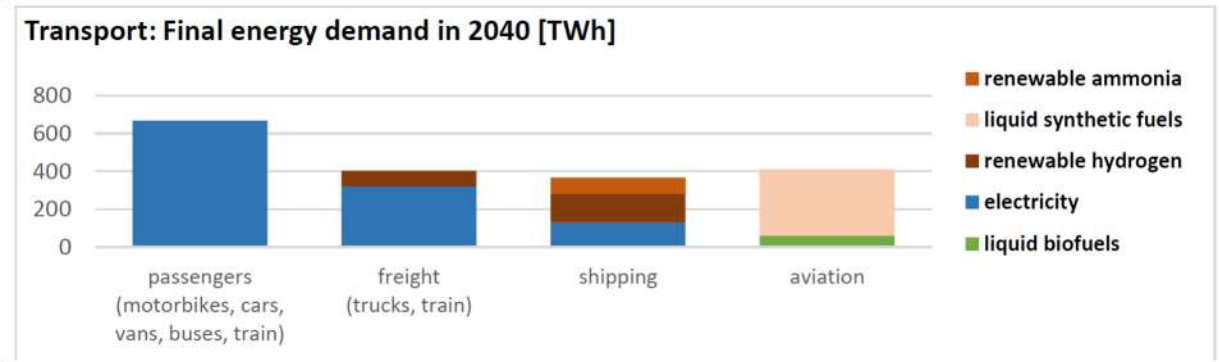
- **Modelling limitation**: No detailed modelling was carried out with regards to the infrastructure use (electricity, gas and H_2 grids) for the future

- Already during the 2020s, RE H_2 appears **in energy-intensive industries**.
- By 2030, 6% of industry's final energy demand is covered by 161 TWh of RE H_2.
- Between 2035 and 2050, RE H_2 demand remains stable in these sectors with 320 to 340 TWh, covering 15% of demand at the EU28.
- RE H_2 and synthetic methane demand met exclusively with RES electricity. From almost zero in 2015 to circa 400 TWh throughout the years 2035 to 2050.
- The demand for gaseous energy carriers falls to less than a ¼ of final energy demand in 2040, covered by RE H_2 and to a minor extent by synthetic methane, biomethane and biogas.

Source: CAN Europe/EEB technical summary June 2020, p. 8

Renewable hydrogen (RE H_2) in PAC 1.0: transport





Overall

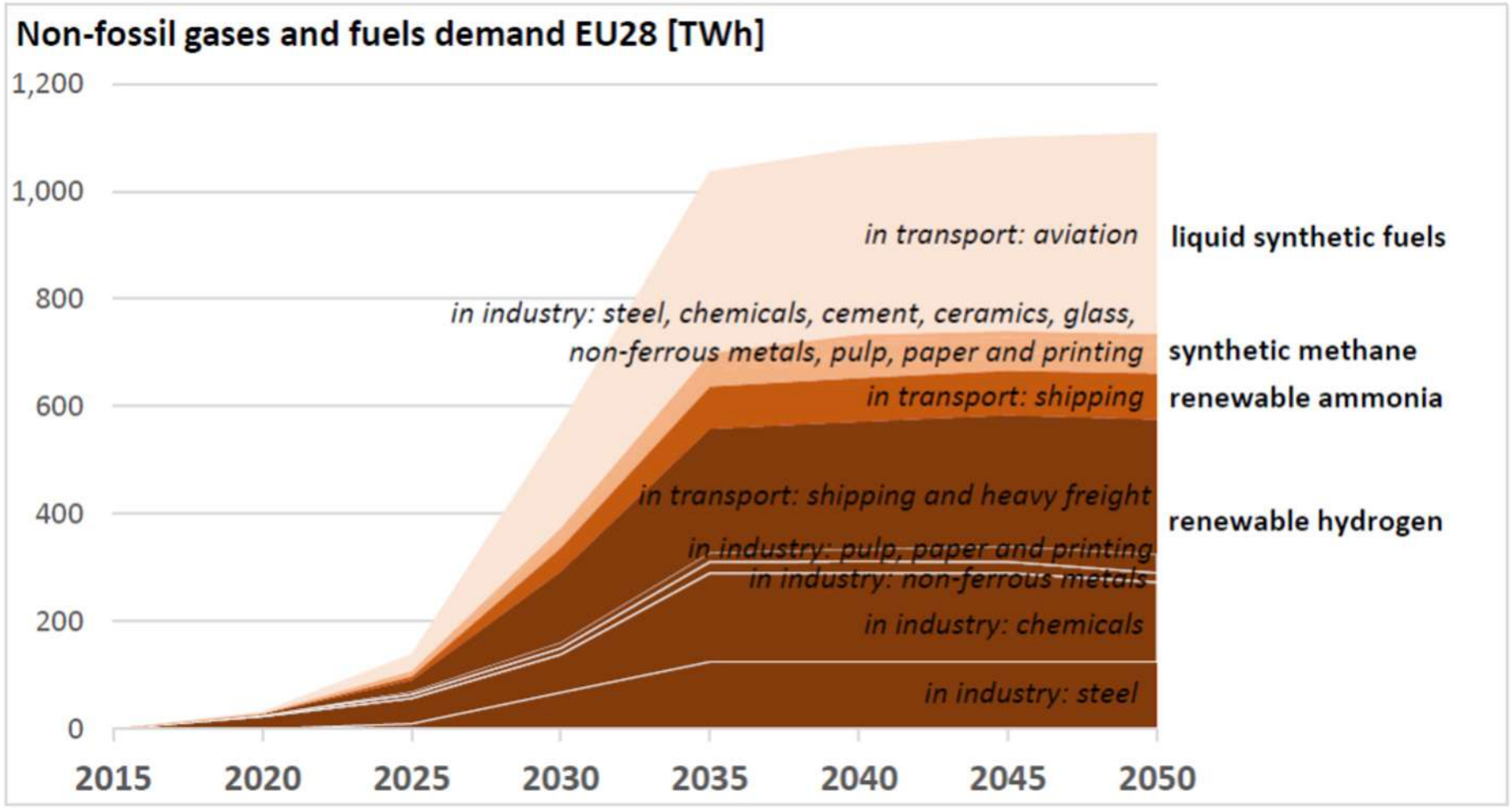
- RE H_2, RE ammonia and liquid synthetic fuels cover up to 37% of transport's final energy demand in 2050 for EU28.
- RE H_2 scaled up to cover 131 TWh of demand in 2030 (5% of transport's final energy demand), increasing to 250 TWh in 2050 (13% of demand).
- Only a very swift and broad scaling up of RE H_2 generation allows for the ambitious fossil oil phase out in transport.

Transport segments

- For private cars, the PAC 1.0 scenario assumes a fully electrified fleet by 2040
- Road freight: primarily electrification
- RE H_2 mainly in heavy freight to substitute fossil oil products, and in fuel cells in mid-distance shipping.
- RE H_2 is converted to RE ammonia for long-distance shipping (max. 86 TWh in 2050, 4% of the transport sector's final energy demand).

Source: CAN Europe/EEB technical summary June 2020, p. 16

RE H_2 in PAC 1.0 at a glance

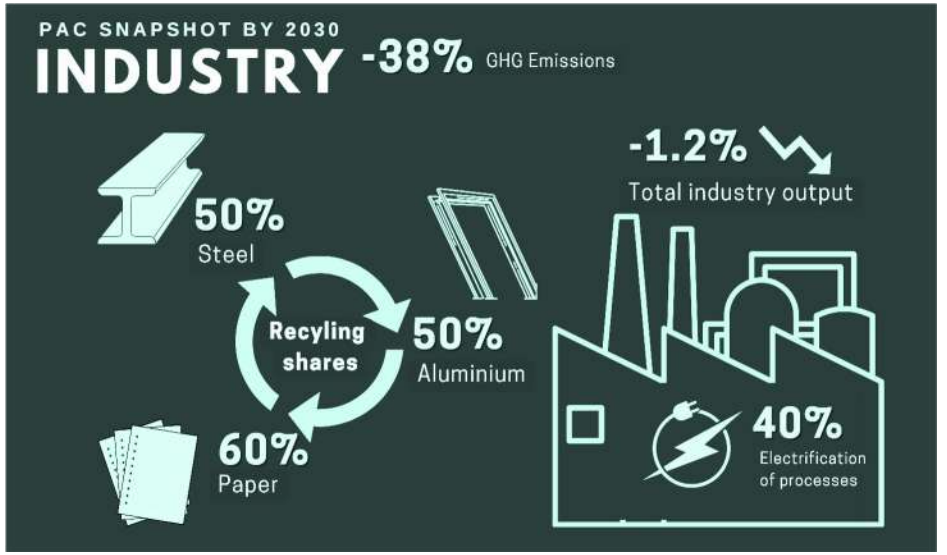


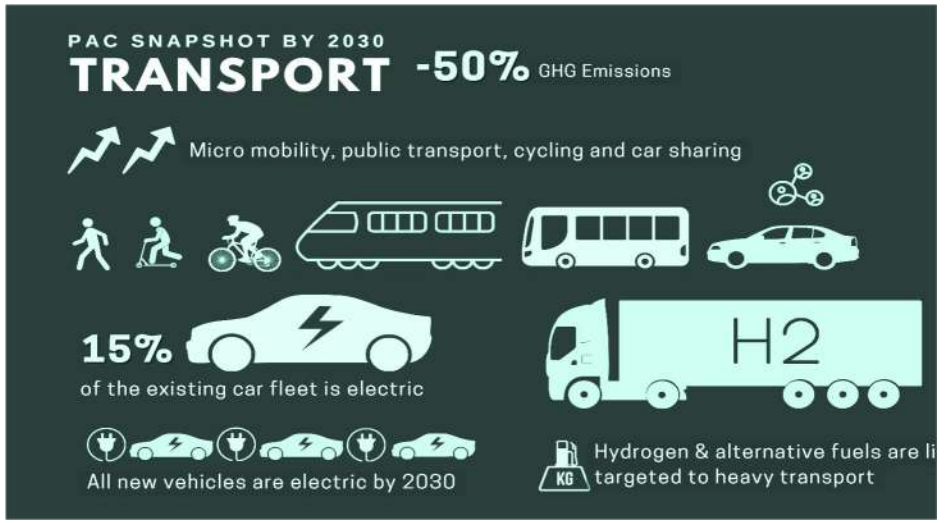
Other sectors: No demand for RE H_2 nor synthetic methane in the residential sector or the tertiary sector (services).

Note: As a reminder, the final energy consumption under the PAC scenario halves between 2015 and 2050. A far more efficient energy system of the future, although the production of RE H_2 makes PEC to increase after 2035 to reach 1,308 Mtoe in 2050.

Renewable hydrogen (RE H_2) in PAC 2.0

- At this point, lower figures for RE H_2 could be expected in PAC 2.0 than PAC 1.0
- More precise calculations about the role of RE H_2 are anticipated to be achieved with **PyPSA** infrastructure modelling: cost-optimal flexibility, storage and infrastructure options and needs. detailed RES-based supply, with hourly time resolution (work on-going for more detailed modelling)





CAN
CLIMATE ACTION NETWORK
Europe

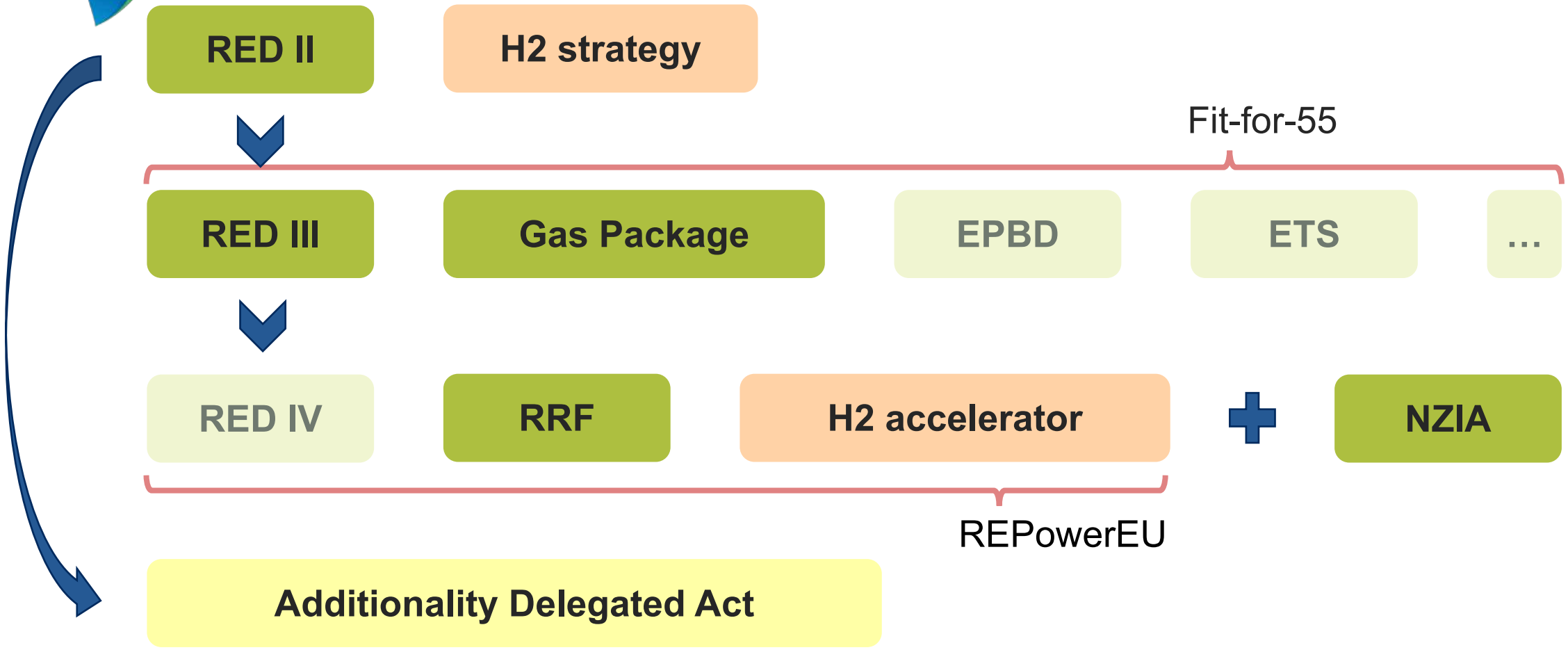
PAC Paris Agreement Compatible Scenarios for Energy Infrastructure

We are fighting dangerous climate change, following scientific findings

LISTEN TO OUR LATEST PODCAST EPISODE

Over 180 member organisations active in 38 European countries, representing over 1.700 NGOs and more than 40 million citizens, CAN Europe promotes sustainable climate, energy and development policies throughout Europe

The “puzzle” of EU hydrogen policy



The (future) challenges

This wealth of EU public policy highlights the challenges (tech, infrastructure, etc.) of scaling up renewable hydrogen.

The **work of the modelling community is key** to anticipating these challenges and informing policy!

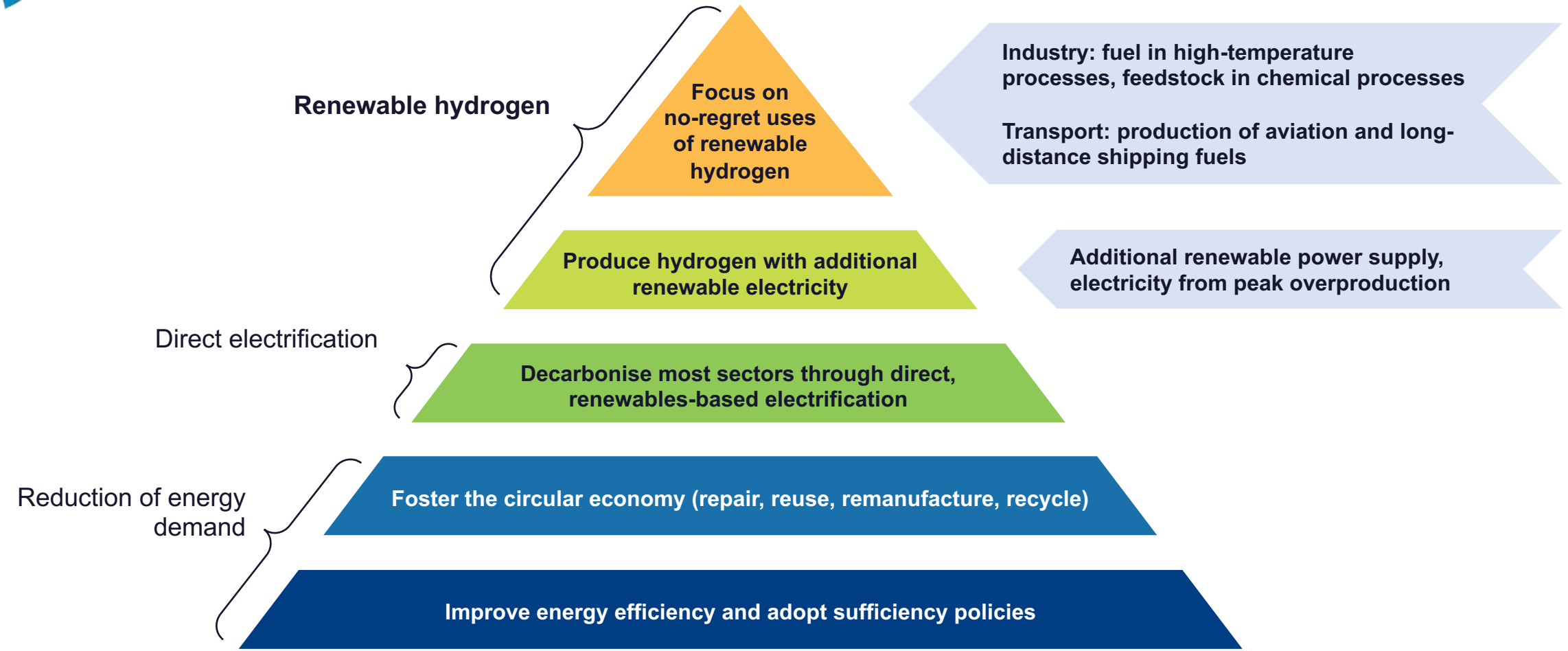
Robust scenario analysis is also key for environmental NGOs to advocate for public policies that promote the right ambition and safeguards.

EEB policy brief

Key findings:

- The production, transport and use of H2 has environmental impacts, requires large public subsidies and carries the risk of fossil lock-in and competition for renewable generation.
- High production costs, uncertain technology uptake and inherent inefficiencies of H2 as an energy vector cast doubt on the future deployment of renewable H2.
- REPowerEU targets for renewable H2 by 2030 look very high and at risk of being unachievable.

An energy system hierarchy



Workshop objectives

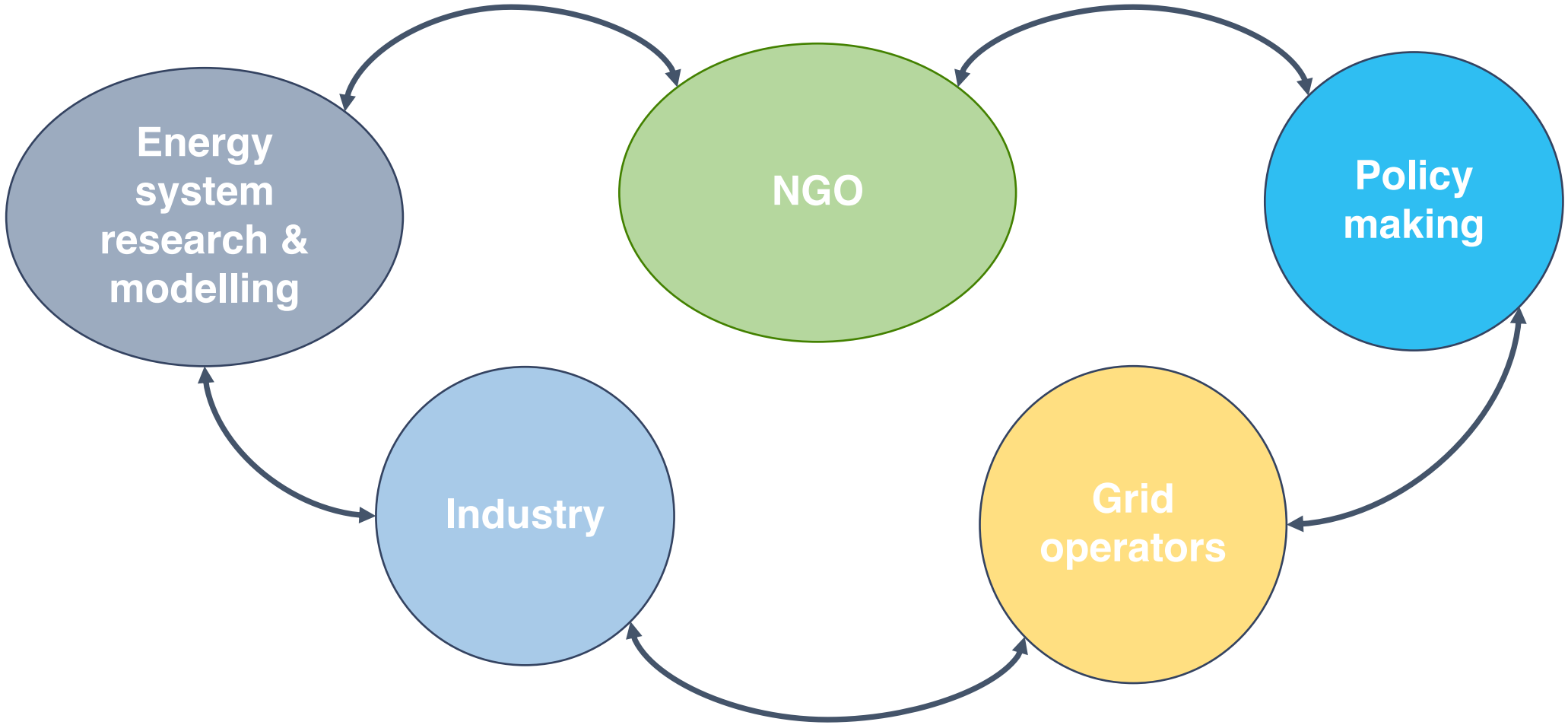
Discuss the **green hydrogen targets** envisaged in the REPowerEU by 2030 and the **impacts on the European energy system**.

Discuss **different perspectives on the barriers, drivers and opportunities** related to the deployment, transport and uptake of green hydrogen.

Stimulate exchanges on potential solutions, including policy, regulatory and governance frameworks, that would enable a **swift, cost- and resource-efficient decarbonisation.**

Facilitate exchanges within the **energy modelling community and ecosystem of actors** on the **needs across the green hydrogen value chain**, including related energy infrastructure as well as potential trade offs.

Who is in the room today?



Renewables Grid Initiative

Workshop agenda

12:00 – 13:30	**Networking lunch**
13:30 – 14:00	**Welcome, agenda and workshop's objectives** – Renewables Grid Initiative (RGI), European Environmental Bureau (EEB), CAN Europe
14:00 – 14:20	**Role of green hydrogen in future decarbonised and optimised European energy systems** *– Andrzej Ceglarz (RGI), Alexandre Oudalov (Hitachi Energy)*
14:20 – 14:40	**The need for hydrogen infrastructure in 2030 – reality checks** *– Paul Brière (Artelys)*
14:40 – 15:00	**Energy needs for the decarbonisation pathway of the European steel industry** *– Jean Theo Ghenda (EUROFER)*
15:00 – 15:45	**Discussion**

Workshop agenda

15:45 – 16:00	**Coffee break**
16:00 – 16:20	**Impacts of the EU H2 and e-fuels targets** *– Simon Suzan (Transport & Environment)*
16:20 – 16:40	**Decarbonising Europe: The Interplay of Power Transmission and Hydrogen Networks** *– Elisabeth Zeyen (TU Berlin)*
16:40 – 17:20	**Discussion**
17:20 – 17:30	**Wrap-up and outlook**

Role of green hydrogen in future decarbonised and optimised European energy systems

Andrzej Ceglarz (RGI), Alexandre Oudalov (Hitachi Energy)

The need for hydrogen infrastructure in 2030 – reality checks

Paul Brière – Artelys

Energy needs for the decarbonisation pathway of the European steel industry

Jean Theo Ghenda – EUROFER

Energy needs for the decarbonisation pathway of the European steel industry

Jean Theo Ghenda – EUROFER

It is time for…

Discussion

It is time for…

Coffee break– until 16:05

Impacts of the EU H2 and e-fuels targets

Simon Suzan – Transport&Environment

Decarbonising Europe: The interplay of power transmission and hydrogen networks

Elisabeth Zeyen – TU Berlin

It is time for…

Discussion

Concluding remarks and next steps

12 Jul 2023	Modellers' Exchange Workshop: REPowerEU Hydrogen Targets and impacts on energy infrastructure
Jul 2023	Follow up emails and sharing the content presented today
Aug 2023	Summary report presenting the outcome and main messages from the workshop
19 Oct 2023	Expert workshop on integration of climate adaptation indicators into the TYNDP CBA methodology
Oct/Nov 2023	Expert workshop on flexibility delivered by industry and the 24/7 CFE approach (date TBC)

Let’s stay in touch!

MODELLERS’ EXCHANGE WORKSHOP

Towards climate neutrality:

Role of green hydrogen in future decarbonised and optimised European energy systems

12 July 2023 | Offices of the European Environmental Bureau (EEB), Rue des Deux Églises 14, 1000 Brussels | Networking Lunch 12:00 - 13:30 CET | Workshop 13:30 - 17:30 CET

Organised by Renewables Grid Initiative | With support from EEB | In collaboration with Hitachi Energy

Andrzej Ceglarz
Programme Manager - Socio-Energy Systems
t: +49 30 233211014
andrzej[at]renewables-grid.eu

Alexandros Fakas Kakouris
Manager - Energy and Policy Systems
t: +49 30 2332 11021
alexandros[at]renewables-grid.eu

Léa Hayez
Junior Manager - Energy Systems
t: +49 30 2332 11032
lea[at]renewables-grid.eu

RGI website: renewables-grid.eu PAC project: pac-scenarios.eu

@Renewables Grid Initiative @RenewablesGrid

Renewables Grid Initiative