ETIP Wind

EUROPEAN TECHNOLOGY & INNOVATION
PLATFORM ON **WIND ENERGY**

Power to X
The missing link to a sustainable future

Webinar Energies Marines Renouvables
& Power to X Perspectives
July 2020

etipwind.eu

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Member ETIPWIND Executive

Legal

The following presentation is meant to foster debate and does not purport to reflect directly or indirectly the thoughts or strategies of any single member of the ETIPWind or of that body collectively.

Agenda

- ETIPWind
- Power to X ? Why it is needed
- Hydrogen and NH3
- Power to heating and cooling
- Do not forget batteries! Or Aviation
- Summary

ETIPWinds function

What are ETIPs?

European Technology and Innovation Platforms are industry-led stakeholder fora recognised by the European Commission

Goals

- Drive innovation, knowledge transfer and European competitiveness
- Develop research and innovation agendas and roadmaps for action at EU and national levels

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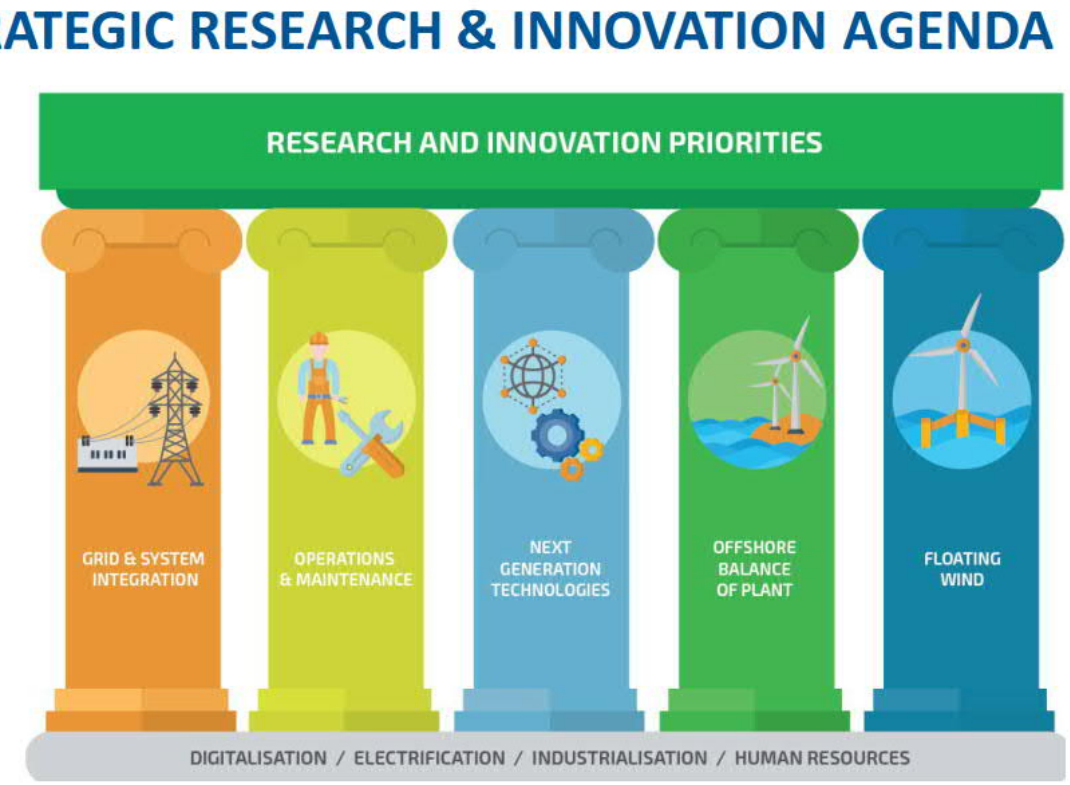
Drive the dialogue on R&I funding at EU level



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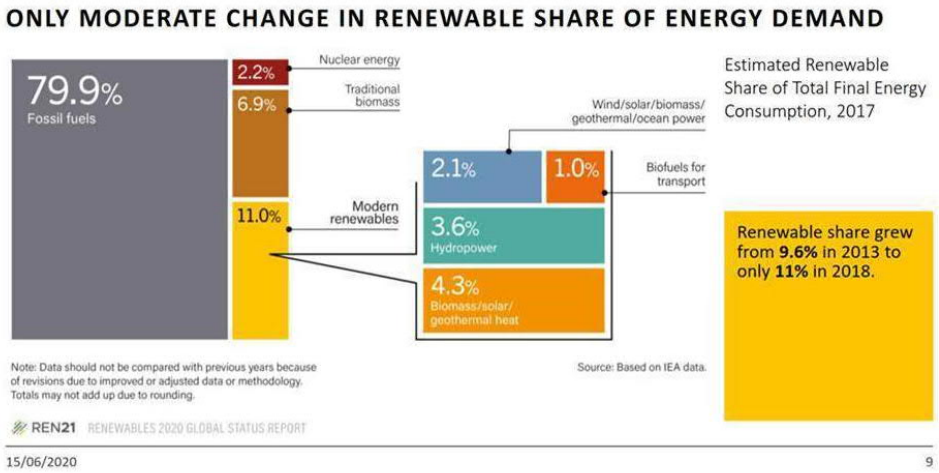
Why is power to X needed 1

- Renewables are a huge ressource but deliver little of total energy demand.



- Wind power and PV can deliver huge amounts of green power but have to lever their power to make it a saleable clean green commodity.
- Floating wind power can increase access to offshore wind by a factor of 10 globally

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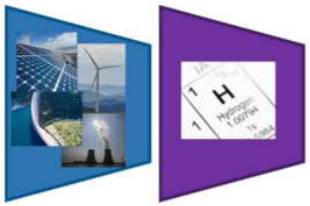
Why is it needed 2 - The electrical grid will not deliver

- Extremly slow build-out
  - Pipelines faster – out of sight out of mind
- 1 state of the art HVDC can ship 4 GW
- 1 pipeline can ship 44GW NH3
- Trans European cooperation is key – a pooling of expertise and markets
- Gas pipelines have been a success in Europe much more than hard wired electricity system

If the grid is not built out to accept the renewable resources then it will be left behind with power to gas and new battery technologies eating up the market

IEA Task 48

The "**Power-to-hydrogen**" concept means that hydrogen is produced via electrolysis supplied with low-carbon and/or low-cost electricity



Electricity supply *can be either:*

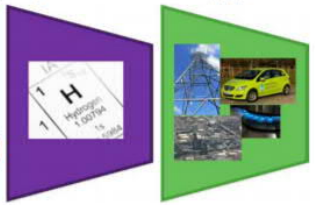
- *On-Grid*
- *Off-grid*
- *or hybrid systems*

With particular attention devoted to:

- *Provision of services to the grid*
- *Characterization of hydrogen relevance for energy storage*

"**Hydrogen-to-X**" implies that the hydrogen supply concerns a large portfolio of applications:

- Transport: hydrogen for fuel cells
- "Green" gas (either through methanation or not)
- Industry (refinery, steel, ammonia, synfuels, etc.)
- Re-electrification (towards the power grid or for remote areas)



HYDROGEN IN NUMBERS (I) SOURCE WIND EUROPE & IEA

70 Mt — **Hydrogen per year** is used today in pure form

95-99% — **of this hydrogen is supplied using fossil fuels**

- 76% produced from natural gas, 23 % produced from coal, less than 2% produced via electrolysis
- < 0.4 Mt (0.6%) produced with CCUS
- < 0.1 Mt (0.1%) produced with Renewables

~830 Mt CO2 — **emissions per year** (equivalent to **UK + Indonesia**)

➔ **Significant potential for emissions reductions from clean H_2**

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**All figures from IEA – The future of Hydrogen Report 2019, except EU-28 gross electricity production: Eurostat = 3 294 TWh in 2017*

HYDROGEN IN NUMBERS (II)

- **H_2 use is currently dominated by industry:** oil refining (33%), ammonia production (27%), methanol production (11%) and steel production (3%)

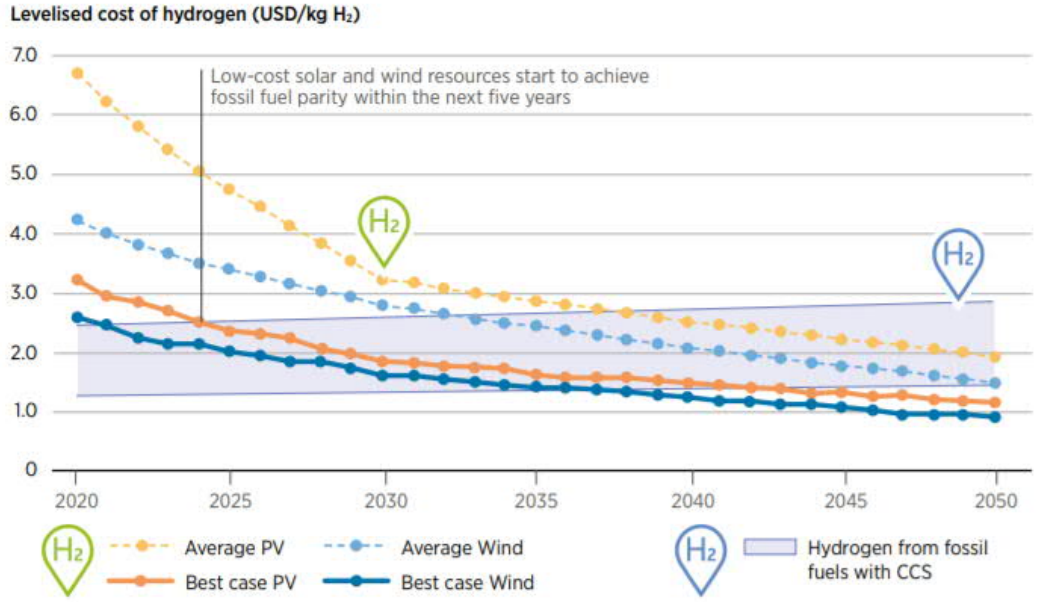
- If the **70 Mt H_2** were produced **through water electrolysis**, it would result:

  - **3 600 TWh** — **electricity demand** – more than the EU-28 gross electricity production

  - **617 million m3** — **water requirements** – i.e. 1.3% of the water consumption of the global energy sector today or more than a 10 million people city consumption

Blue hydrogen v Green hydrogen ? Getting to zero, Irena April 2020.

Figure 5.10 Green hydrogen production costs: Approaching competitiveness with blue hydrogen
Hydrogen production costs from solar and wind vs. fossil fuels with carbon capture and storage, 2020-2050



Note: Electrolyser costs: 770 USD/kW (2020), 540 USD/kW (2030), 435 USD/kW (2040) and 370 USD/kW (2050). CO_2 prices: USD 50 per tonne (2030), USD 100 per tonne (2040) and USD 200 per tonne (2050).

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Some little problems

- Huge amounts of H2 needed
- H2 infrastructure currently incrediblly expensive as is O&M.
- Need electrolysers that can operate economically, at below average of 50% full load hours.
- Water needs to be clean
- Offshore desalination will increase costs and salt dense water has to be dispersed over a wide area to avoid toxic zones.

Shipping – The low hanging fruit and agriculture

- Imagine shipping 2050
  - 4 vast floating offshore wind farms produce H2 and NH3.
    - Autonomous NH3 powered gas tankers load up and once loaded the cargo is assigned to a market be it Amsterdam or Liverpool to which it sails to discharge its cargo.
  - Decommissioned power stations and airfields house large tank farms containing ammonia and H2 that can be used as backup power when renewables production falls
- Imagine Agriculture
  - An NH3 power robot that weeds and controls pests in a benign and non toxic replacing sprays.
  - An NH3 feeding system that only doses the correct amount of fertilizer not the hit and miss system we have today.

Power to H (heating) and power to C (cooling)

- Heating and cooling present also big wins for renewables.
  - Heat can be stored in the short term and used in industrial processes or in district heating systems.
  - As the climate warms we will need increasingly more cooling capacity.
  - The provision of cooling for the pupulation can mitigate high death rates.
  - We may need large cooling shelters in urban areas to keep our population safe due to climate change

Power to B (Batteries)

- Battery technology is being driven by demand for EV´s
- Now Catl in conjunction with Tesla have created a battery that can last 1.6million km. Lifetime is fixed now we need to improve power density.
- H2 is loved by governments, researchers, gas industry and turbine manufacturers as the answer to everthing. We will need a mix of many technologies.

Batteries will deliver huge improvememts in the next 10 years.

Large scale deployment of batteries will make green power a commodity.

Summary

- Power to X is vital to deliver an energy transition in time
- Power to X is the only way for renewables to reach a penetration that can drive the energy transition.
- Covid 19 is a warning on what impacy climate change can have but this impact will be global multi impact on weather, food, disease, availability of water. Release of Co2 may have to be permitted and policed going forward.

To deliver the energy transition countries will have to work together to create the common standards and sheer volume need to deliver the technology on time.

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