

# The Power-to-X Opportunity: Markets, Technologies and Costs

Brussels, 7 October 2020

# Power-to-X for Applications

Over 100 working group members from the complete value chain



# Nations Unies

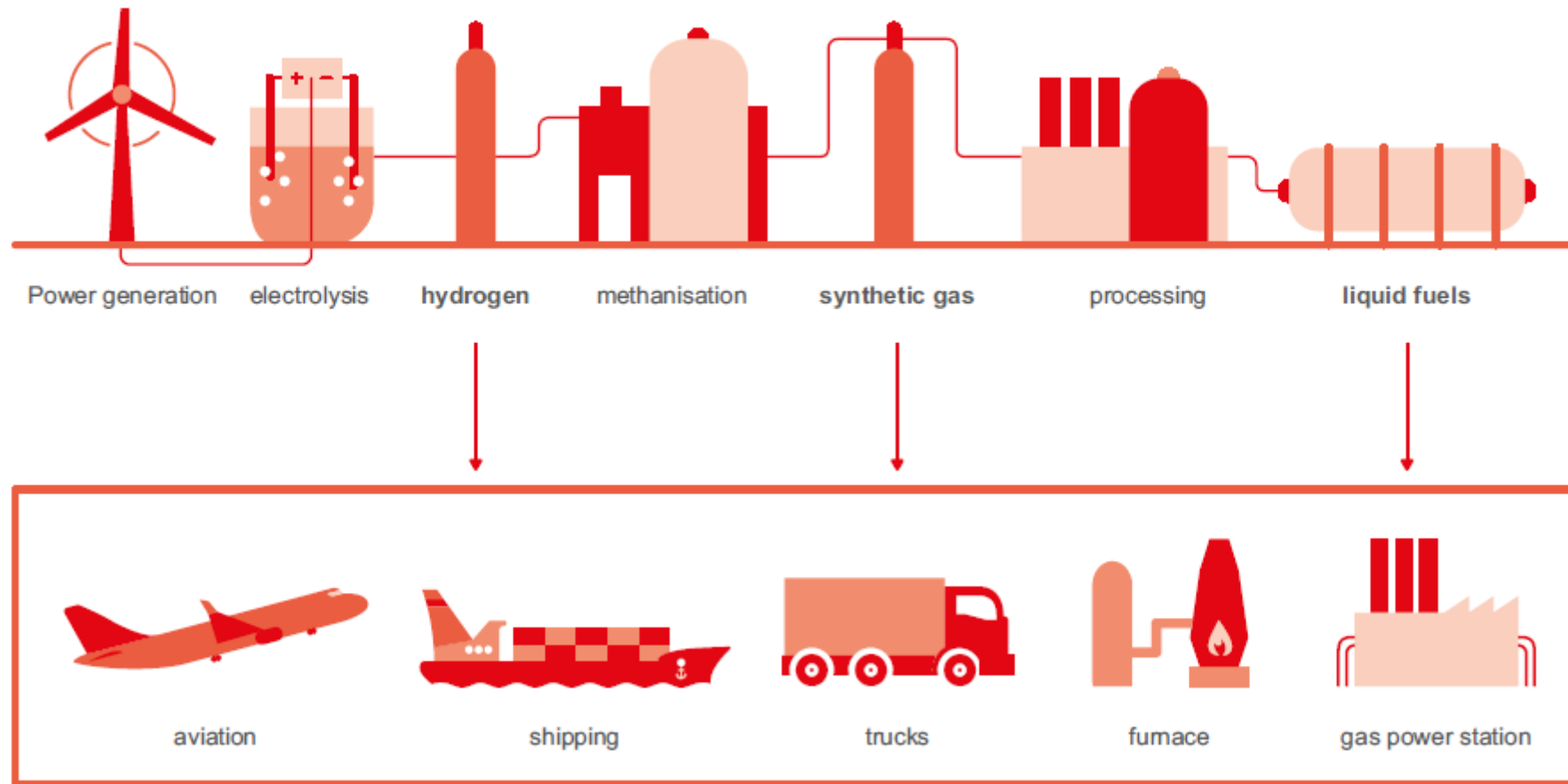
## Conférence sur les Changements Climatiques 2015

COP21/CMP11

### Paris France

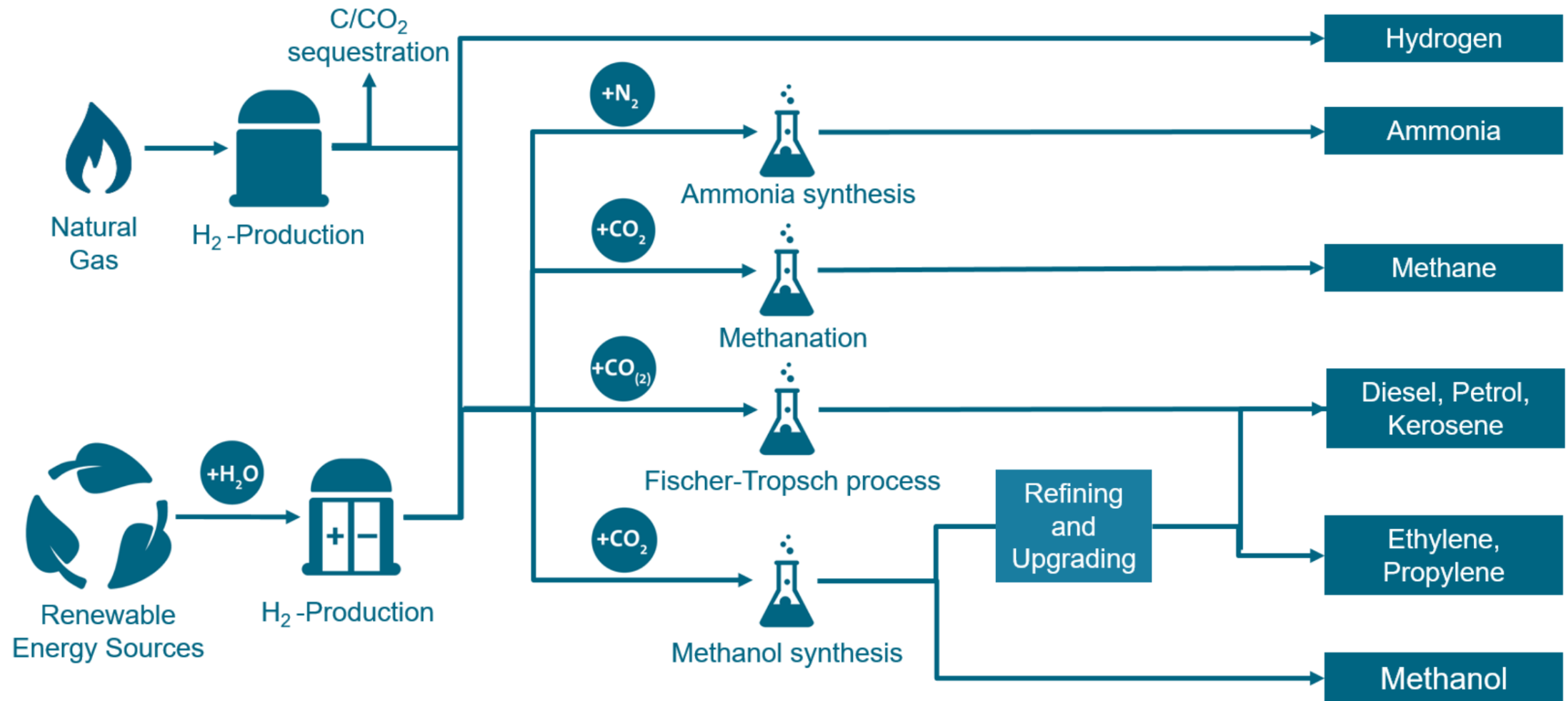


# Hydrogen and its derivatives will play a crucial role in future energy systems



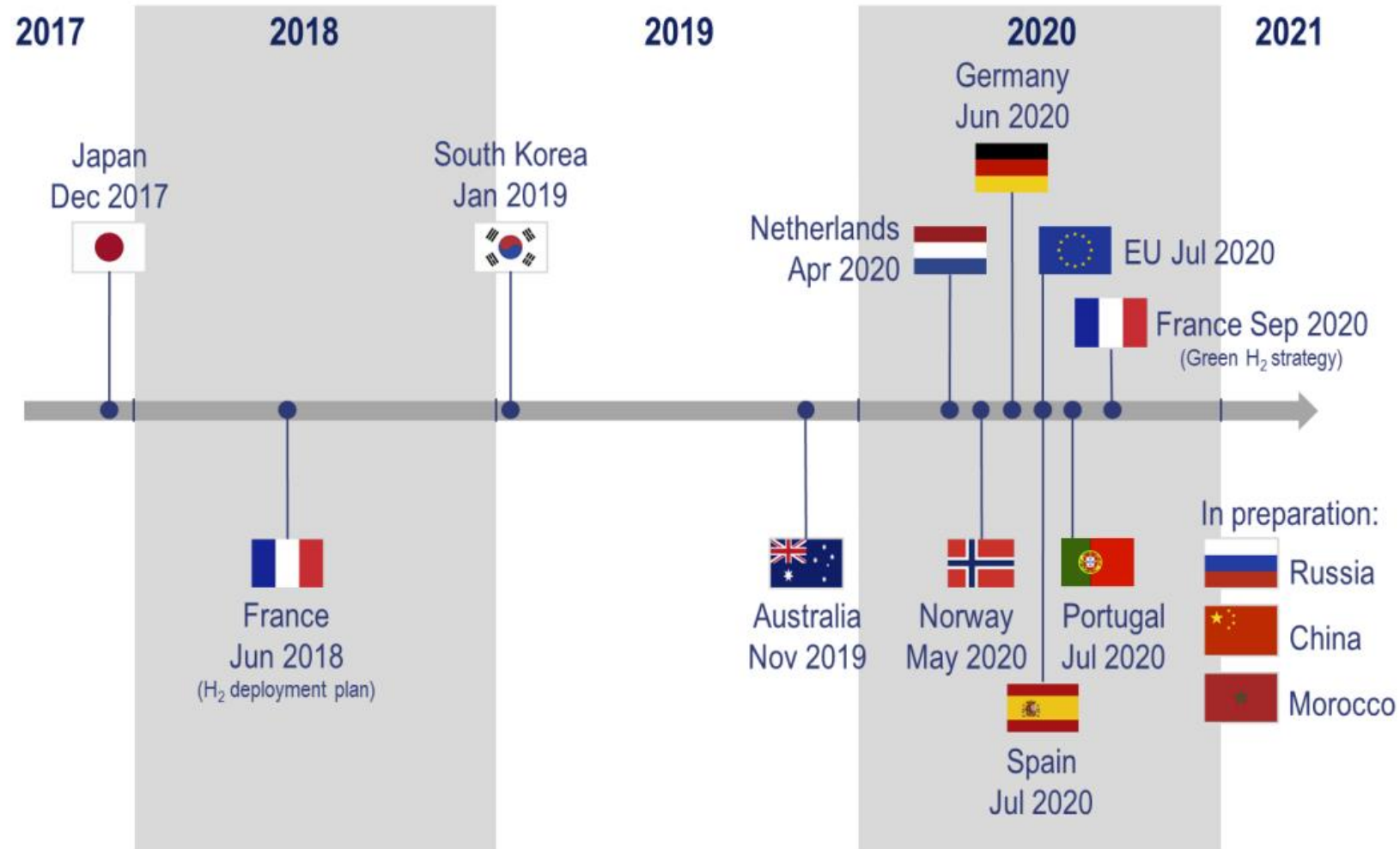
# Power-to-X for Applications

## Production and products





# Quickly emerging hydrogen strategies indicate dynamically growing market



# The EU Hydrogen Strategy

**2024**

- 6 **GW** of renewable hydrogen electrolyzers
- Replace **existing hydrogen production**
- Regulation for liquid hydrogen markets
- Start planning of hydrogen infrastructure

**2030**

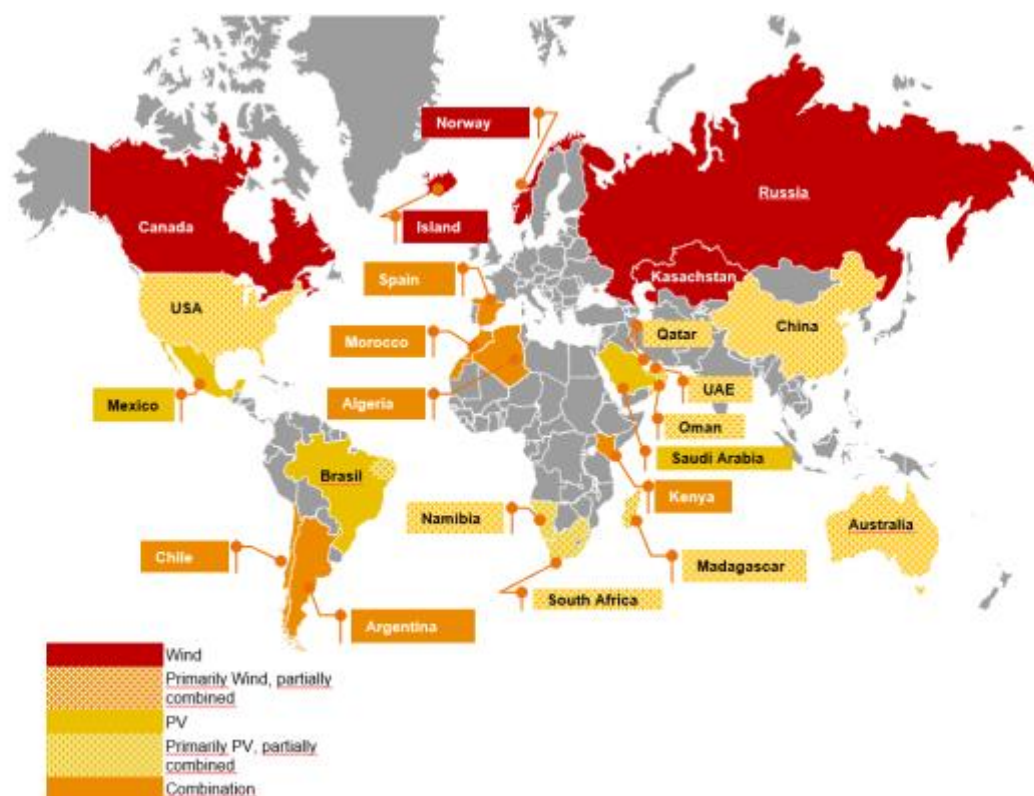
- **40 GW** of renewable hydrogen electrolyzers
- Another **40 GW** of hydrogen as imports
- New applications in **steel and transport**
- Creation of "Hydrogen Valleys"
- Cross-border logistical infrastructure

**2050**







- Scale-up to **all hard-to-decarbonise sectors**
- Expansion of hydrogen-derived **synthetic fuels**
- EU-wide infrastructure network
- An open international market with € as benchmark

# Developing international markets

## Maintaining industrial value chains in Europe by importing P2X



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Type	PtX motivation and readiness	Selected example
 Frontrunners	<ul style="list-style-type: none"> <li>PtX already on countries (energy) political radar</li> <li>Export potential and PtX readiness evident</li> <li>Uncomplicated international trade partner</li> <li>➤ Especially favourable in early stages of market penetration</li> </ul>	Norway
 Hidden Champions	<ul style="list-style-type: none"> <li>Fundamentally unexplored RES potential</li> <li>Largely mature, but often underestimated, (energy) political framework with sufficiently strong institutions</li> <li>➤ PtX could readily become a serious topic if facilitated appropriately</li> </ul>	Chile
 Giants	<ul style="list-style-type: none"> <li>Abundant resource availability: massive land areas paired with often extensive RES power</li> <li>PtX readiness not necessarily precondition, may require facilitation</li> <li>➤ Provide order of PtX magnitudes demanded in mature market</li> </ul>	Australia
 Hyped Potentials	<ul style="list-style-type: none"> <li>At centre of PtX debate in Europe with strong PtX potential</li> <li>Energy partnerships with Europe foster political support</li> <li>➤ Potential to lead technology development; may depend strongly on solid political facilitation</li> </ul>	Morocco
 Converters	<ul style="list-style-type: none"> <li>Global long term conversion from fossil to green energy sources</li> <li>PtX to diversify portfolio as alternative long-term growth strategy</li> <li>➤ Strong motivation for PtX export technology development; may require political facilitation and partnership with the EU/DE</li> </ul>	Saudi Arabia
 Uncertain Candidates	<ul style="list-style-type: none"> <li>Partially unexplored RES potentials, possibly paired with ambitious national climate change policies</li> <li>PtX export in competition with growing national energy demand</li> <li>➤ PtX export motivation and potential unclear – may drive PtX technology development, however export uncertain</li> </ul>	China

Source: Frontier Economics.

Note: The PtX types and the allocation of a possible candidate country within each category serve as starting point to identify possible PtX development strategies; not a concise list and readily alterable.



# Emerging opportunities for the industry along the P2X value chain

- » The next decade will be characterized by a significant market ramp-up of green hydrogen production.
- » We will see a move from the currently installed base of electrolyzers in the lower Megawatt range to Gigawatt-size capacities. This will contribute to economies of scale for electrolyzers and drive down CAPEX.
- » The EU target alone indicates a cumulative market size for electrolyzers and balance of plant of more than 40 B€ within the EU until 2030.
- » Target sectors will be transport (aviation and maritime) and industry (chemicals, steel)
- » E-fuels should also play a role in road transport (e.g. long distance and heavy duty)
- » P2X energy carriers can become an important commodity for the international energy market and generation capacities can be built in regions with low electricity generation costs.



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