

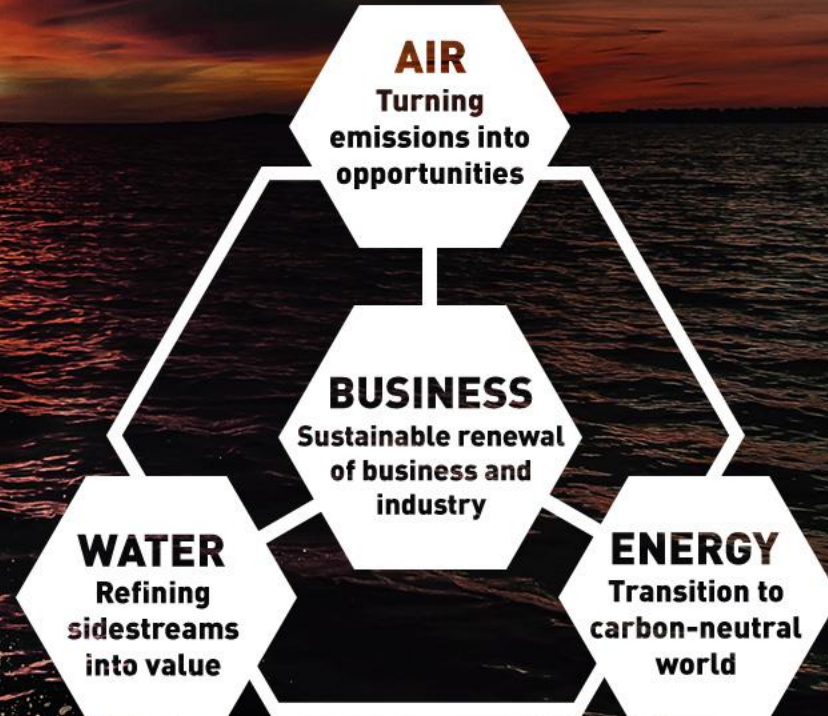


# LAND OF THE CURIOUS



SYSTEM

# EARTH



 ENERGY SEMINAR, HELSINKI 3.2.2023

# GREEN ELECTRIFICATION— OPPORTUNITY FOR FINLAND AND EUROPE

**Olli Pyrhönen**

Professor

Dean, LUT University, School of Energy Systems

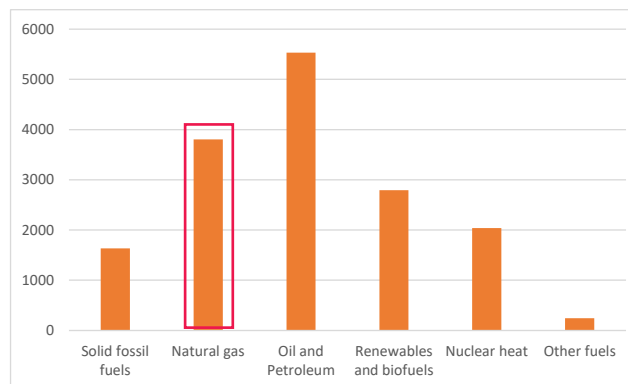
# ENERGY CRISES – SHORT TERM SOLUTION IS LNG

## » Russian import to Europe:

- » Pipeline gas import cancelled
- » LNG import still on-going
- » New LNG terminals in Europe under way

## » Finland has been proactive:

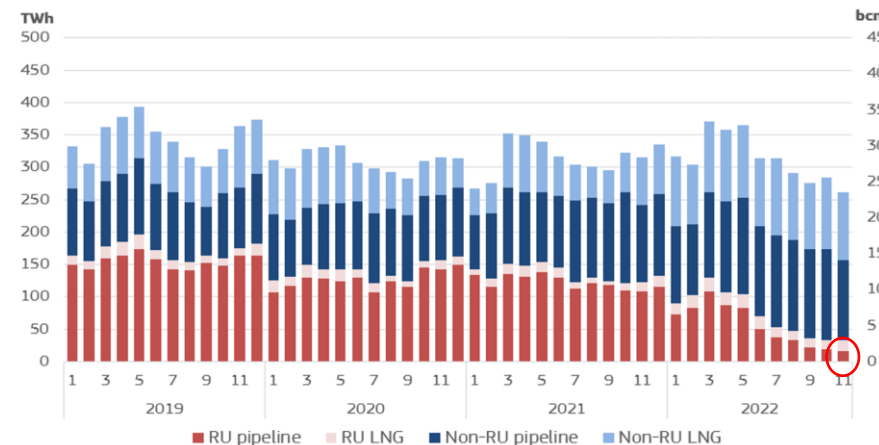
- » Electricity import cancelled
- » Biomass import cancelled
- » Coal import cancelled
- » Gas import cancelled
- » New LNG terminal build



Natural gas 24% of EU Energy in 2021 (Eurostat)

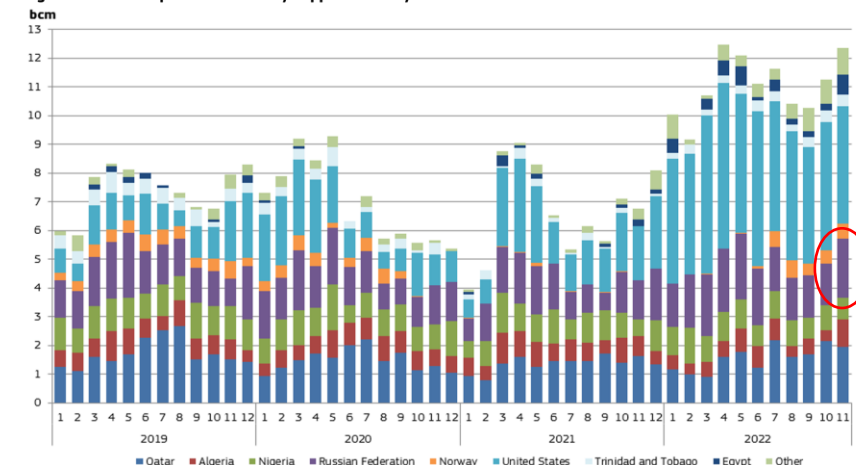


Figure 13 – Monthly pipeline and LNG imports from Russian and other sources

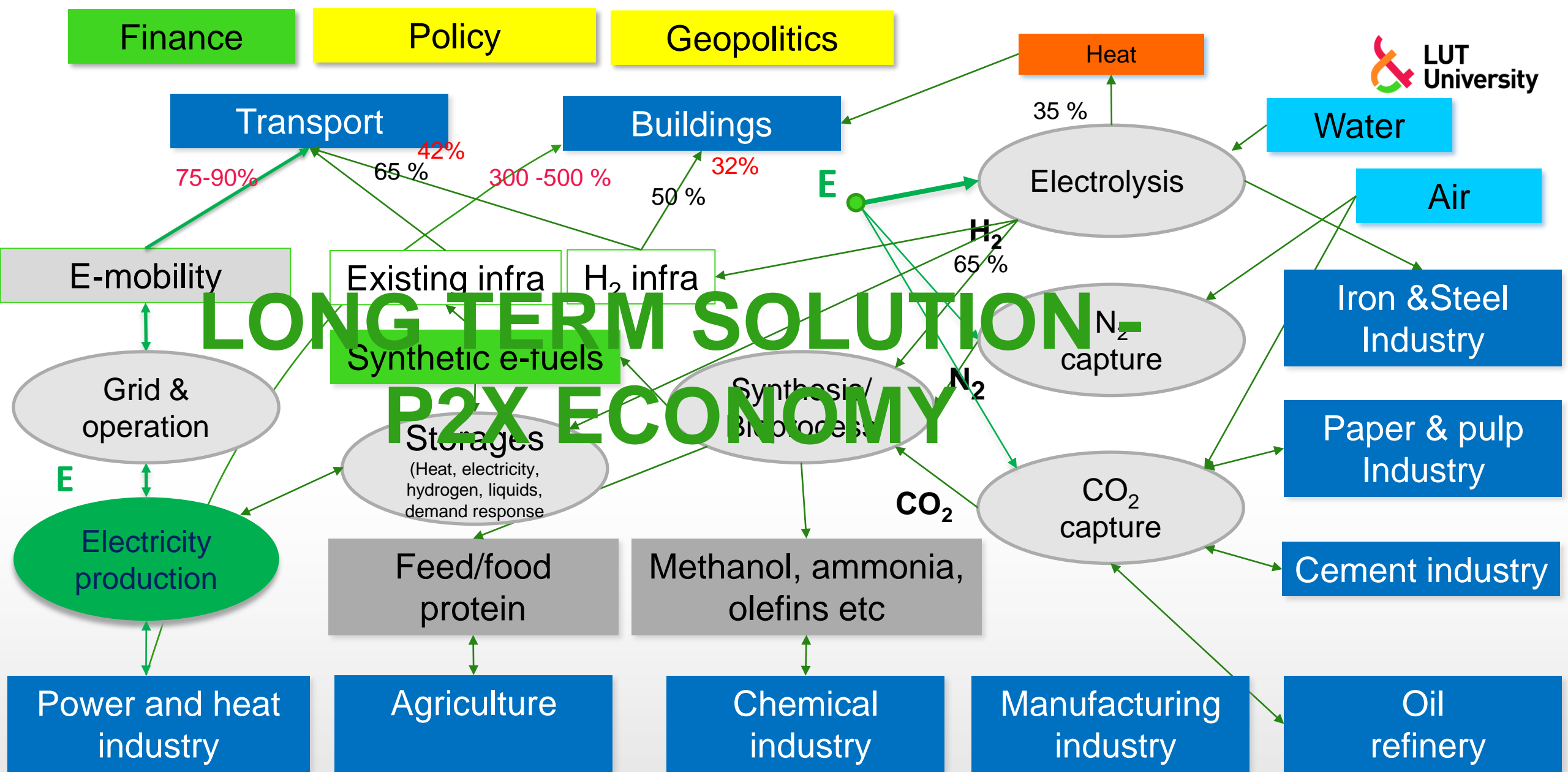


Source: Based on data from the ENTSO-G Transparency Platform, data as of 2 December 2022.

Figure 17 – LNG imports in the EU by supplier country



Source: Commission calculations based on tanker movements reported by Refinitiv. Imports coming from other EU Member States (re-exports) are excluded. \*Other\* includes Angola, Brazil, the Dominican Republic, Equatorial Guinea, Oman, Peru, Singapore, the United Arab Emirates and Yemen



Detailed P2X system models has been analysed intensively at LUT by prof. Breyer and his research team

# KEY TECHNOLOGIES FOR RENEWABLE FUTURE

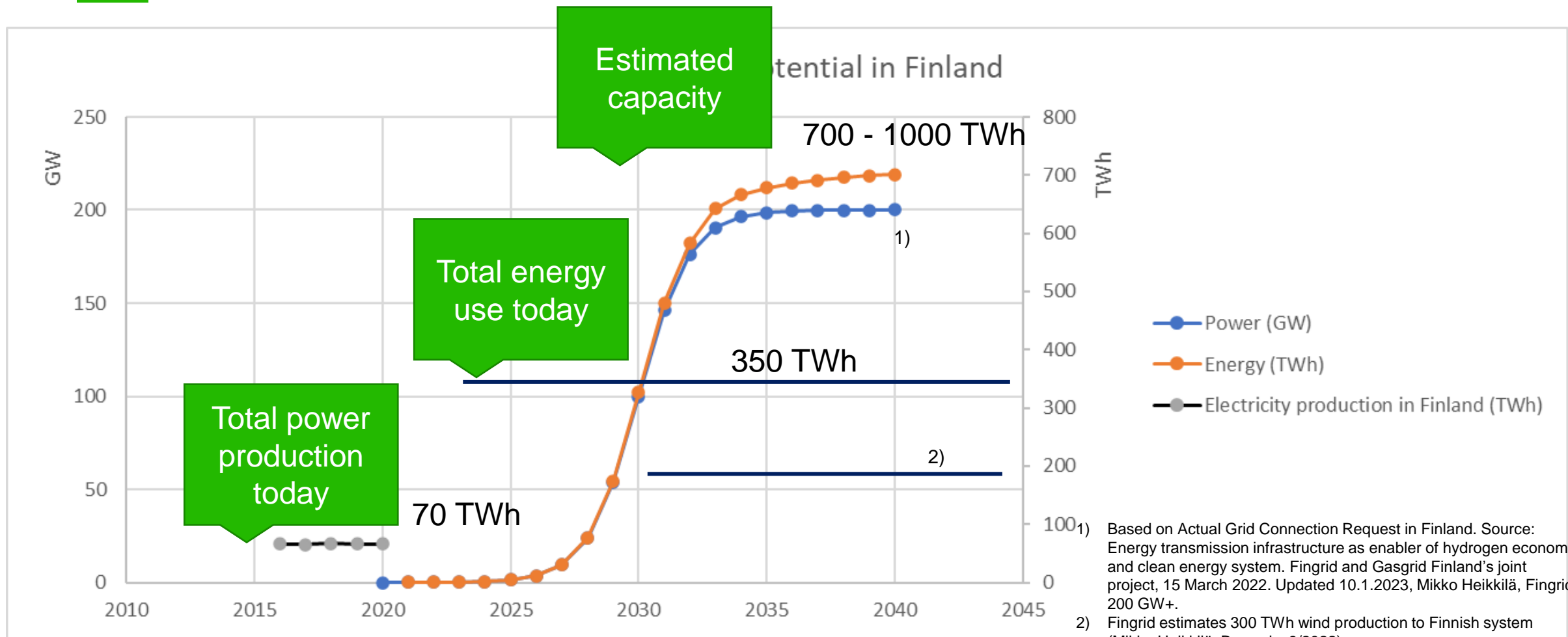
---

- » High efficiency **P2X(2P) conversion** for hydrocarbons and ammonia
- » **Batteries** for electric mobility and power system
- » **Heat pump systems** for high efficiency electro-thermal conversion
- » High efficiency **electrified industrial processes**
- » Effective **recycling of critical materials, new alternative materials**
- » **Energy grids and storages** (electricity, gas, heat)
- » Strong **sector coupling** between industrial processes
- » **Information technology** for dynamic control and optimization



# THE ROLE OF NORDIC COUNTRIES IN EUROPE

# WIND ELECTRICITY POTENTIAL IN FINLAND



1) Based on Actual Grid Connection Request in Finland. Source: Energy transmission infrastructure as enabler of hydrogen economy and clean energy system. Fingrid and Gasgrid Finland's joint project, 15 March 2022. Updated 10.1.2023, Mikko Heikkilä, Fingrid 200 GW+.

2) Fingrid estimates 300 TWh wind production to Finnish system (Mikko Heikkilä, Bryssels, 9/2022)

3) Timeline not real estimate, just referential.



# INVESTORS TRUST ON FINNISH HYDROGEN FUTURE

- » Wind power investments are accelerating
- » Industrial investments to hydrogen and hydrocarbon production have started
  - » Hydrogen, methanol, methane, ammonia
  - » Competitive, when close to power generation
- » Total renewable power production Finland could be **1000 TWh** – market value **30 BEUR**, 5% land of Finnish territory
- » Nordic countries together could produce **3500-4500 TWh** renewable power, more than **one third of EU energy need**
- » Domestic market accelerate technology development and creates technology export opportunities – e.g. for reconstruction of Ukraine



"Vihreä vety tuomassa Suomeen 10 mrd euron investoinnit", [Yle uutiset 30.1.2023]

# KEY ACTIONS FOR ENERGY TRANSITION

---

- »» Regulation is needed to support energy transition, but
  - »» Should be predictable
  - »» Should be consistent and not too detailed
  - »» Should encourage companies to develop new competitiveness for Europe
- »» Let the best technologies win
  - »» Good regulation let the technologies compete
  - »» Research for higher efficiencies, better processes and materials needed
  - »» Technology companies and industrial investors bring needed solution to the markets, when the regulation environment is consistent and predictable



 LUT University ranks

# NINTH IN THE WORLD

in terms of climate actions – SDG 13

The Times Higher Education Impact Rankings 2022 assess the social and economic impact of universities against the UN's Sustainable Development Goals.



**Thank you!**

