

POWER-TO-X FUELS

GLOBAL MARKET POTENTIAL
AND ECONOMIC VIABILITY

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POWER-TO-X: FINAL PUSH TO 100% RENEWABLE ENERGY SYSTEMS

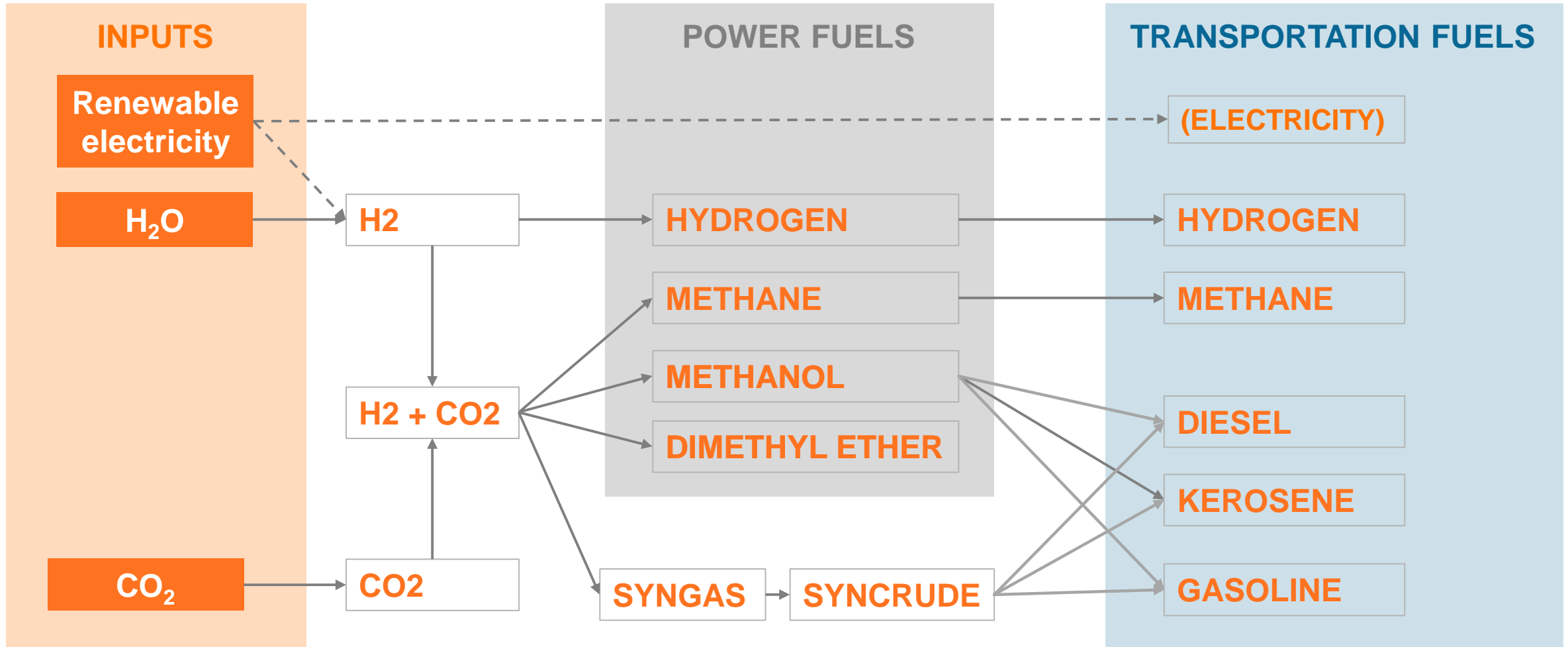
**FINAL PUSH TO
100% RENEWABLE
ENERGY SOURCES**

**TECHNOLOGY FOR
LONG-TERM POWER
SYSTEM BALANCING**

**CARBON NEUTRAL
RENEWABLE
SYNTHETIC FUELS FOR
TRANSPORTATION**

**RENEWABLE ELECTRICITY
AS RAW MATERIAL**

CARBON NEUTRAL FUELS ARE PRODUCED FROM ELECTRICITY, WATER AND CARBON DIOXIDE



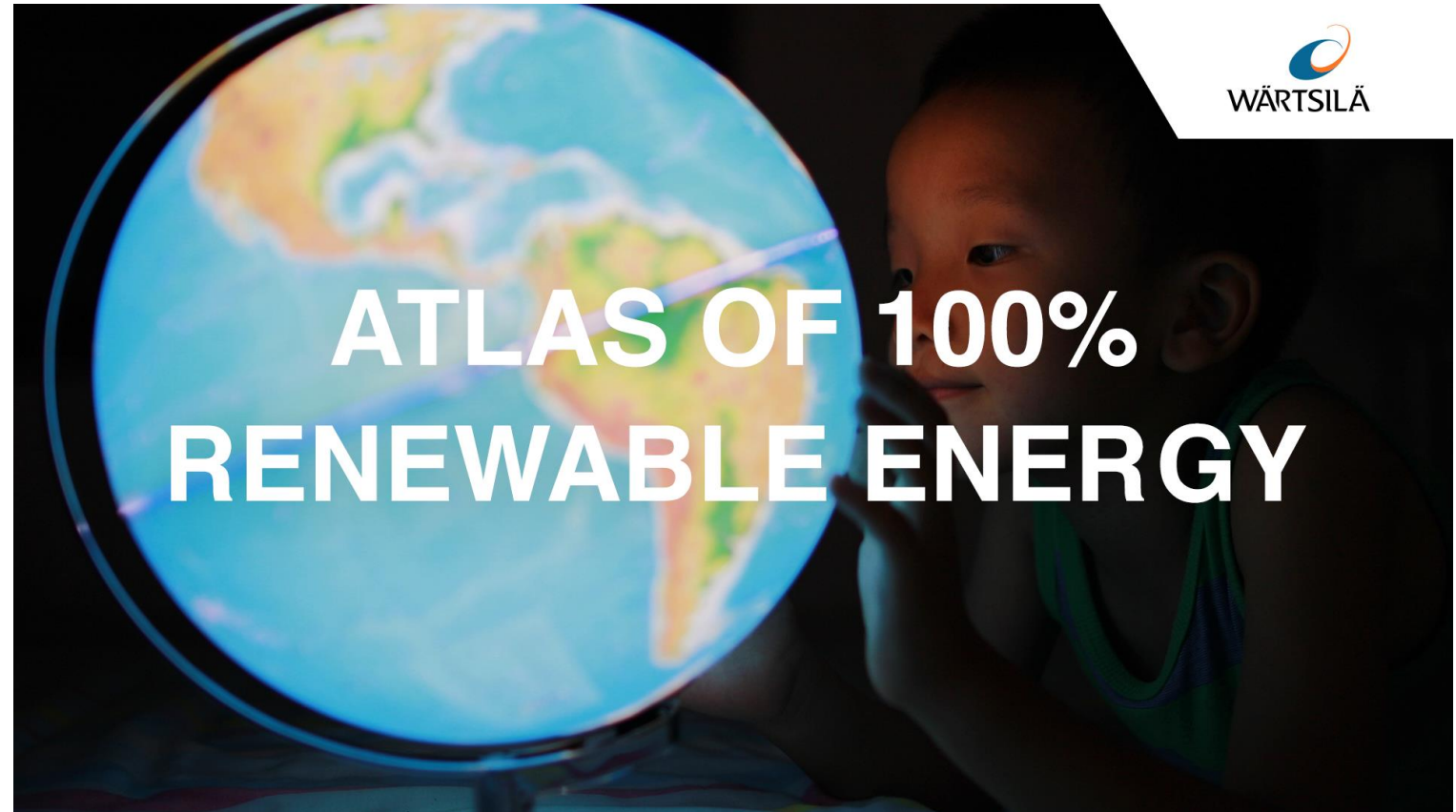
GLOBAL 100% RENEWABLE POWER SYSTEM WOULD REQUIRE 900 GW OF POWER-TO-X CAPACITY



Atlas of 100% Renewable Energy presents cost-optimal, 100% renewable energy systems in 145 countries



900 GW of demand for Power-to-X in a global 100% renewable power system



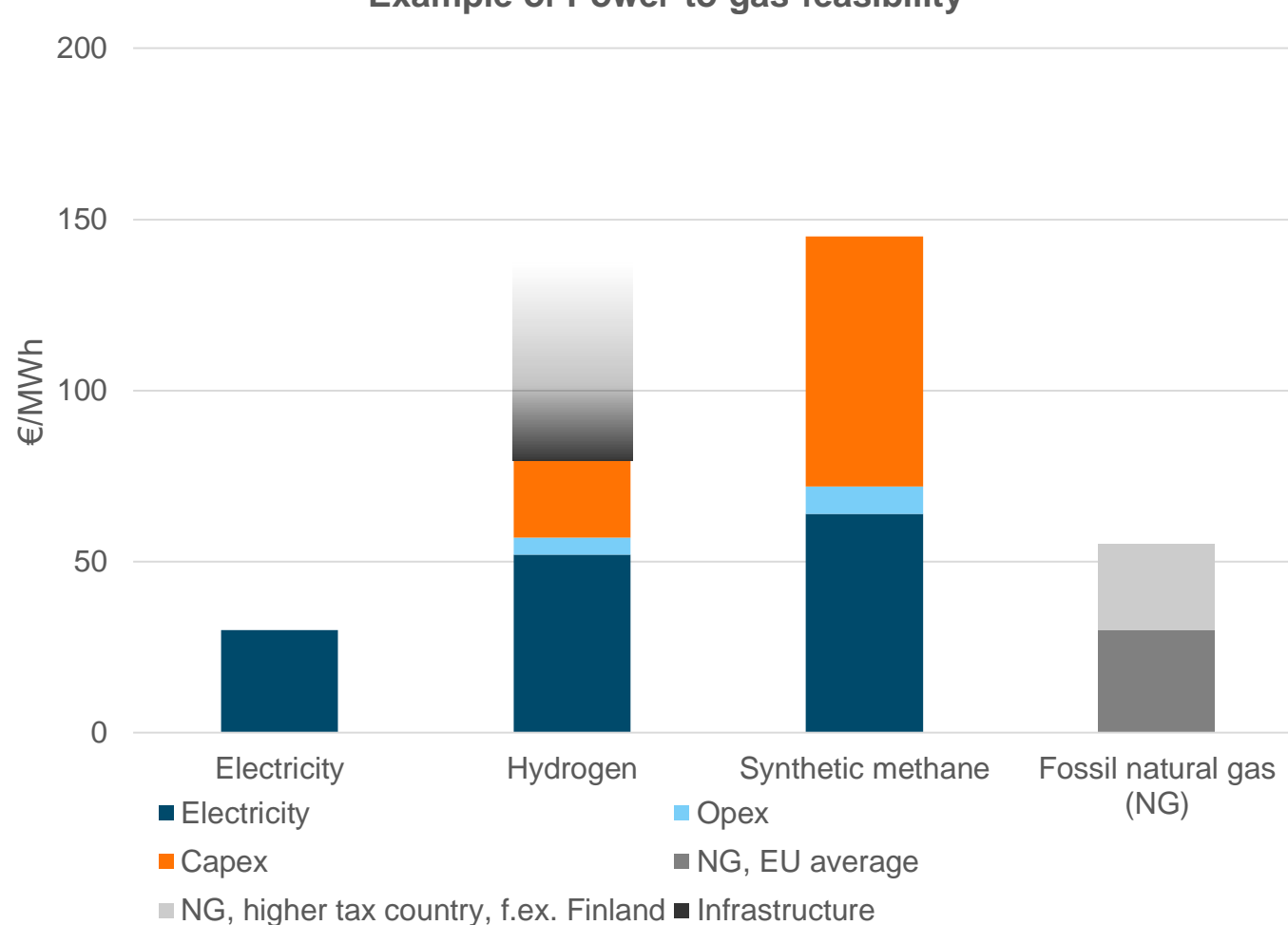
wartsila.com/atlas

FEASIBILITY OF POWER-TO-X FUELS IS DRIVEN BY ELECTRICITY AND EQUIPMENT PRICE, MARKET DEMAND

Feasibility of Power-to-X fuels is driven by three factors:

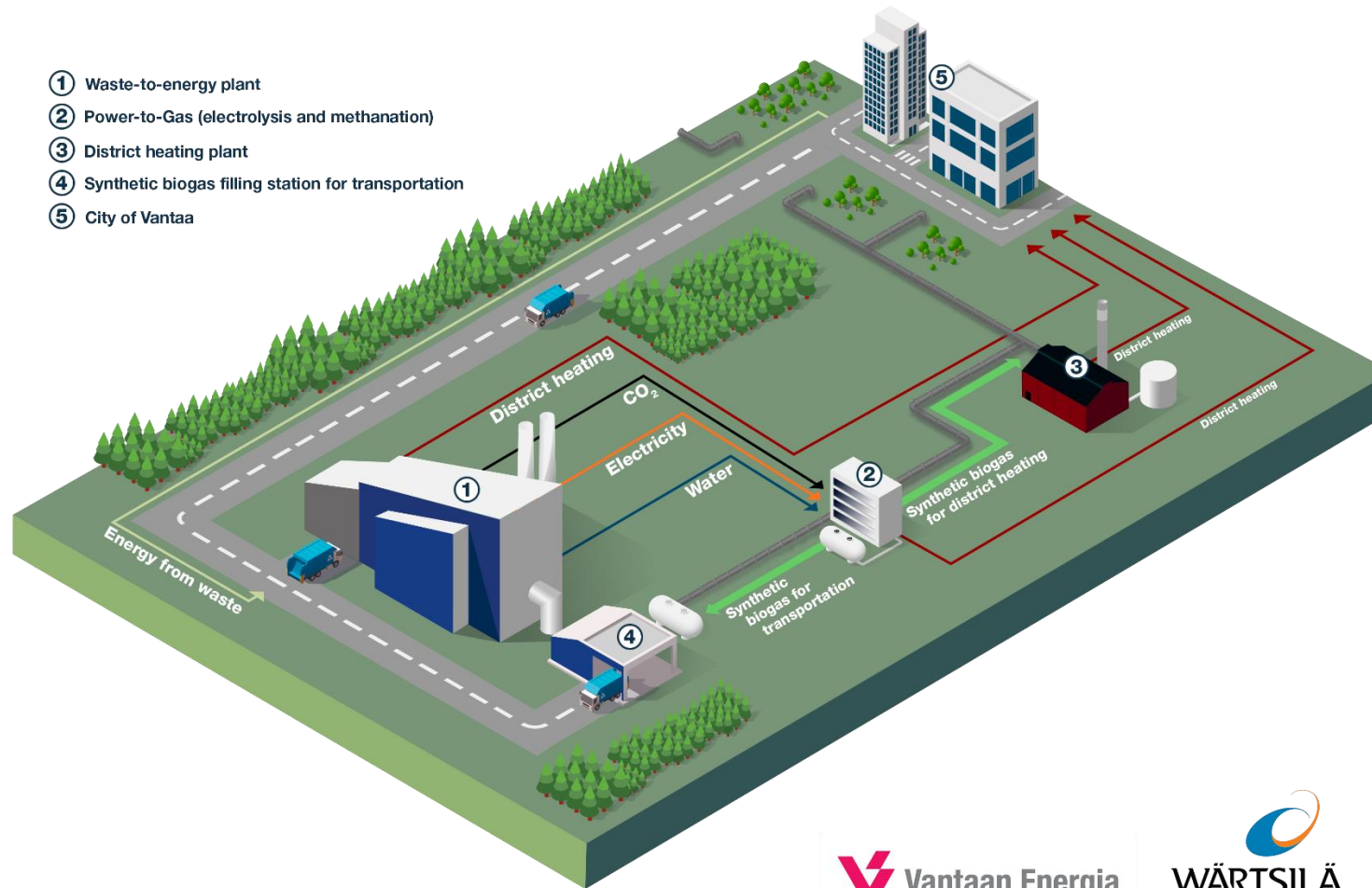
- **Electricity price**
 - Low cost, high volatility in high RES systems
- **Price of equipment**
 - Modularisation
 - Subsidies to kick start industry
- **Market for Power-to-X fuels**
 - Taxation of fossil fuels
 - Price of CO₂
 - Market creation

Example of Power-to-gas feasibility



Assumptions: Electricity price 30 €/MWh, 8500 h operation, waste heat not utilised

WÄRTSILÄ AND VANTAAN ENERGIA COLLABORATE ON A CARBON NEUTRAL SYNTHETIC GAS PRODUCTION IN FINLAND





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