



Future sustainable EU energy systems and the case of Cyprus

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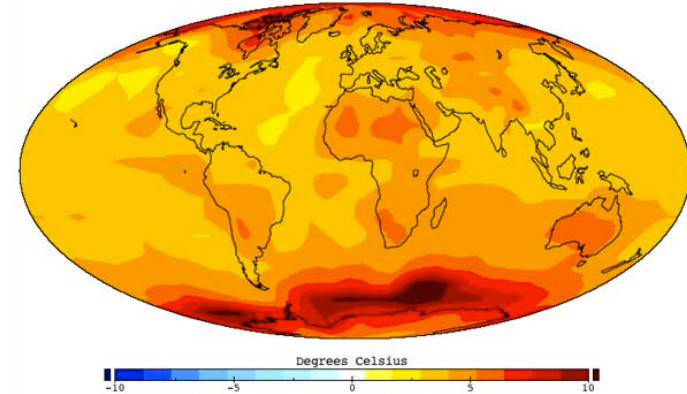
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EU long term energy strategy

Future energy systems

- **Climate change**

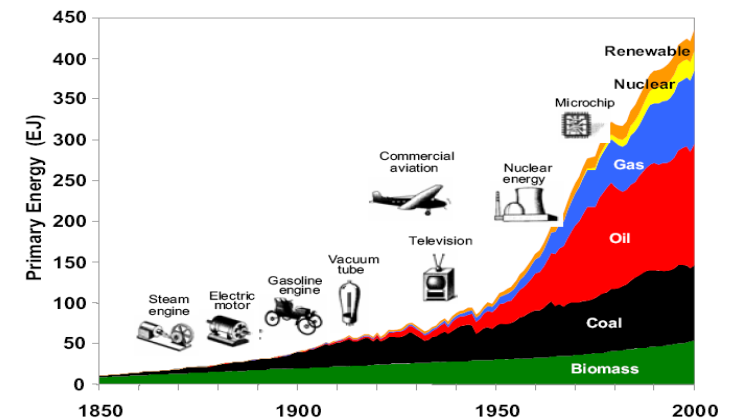


- **Third industrial revolution**

- **Future energy economics**

EU energy objectives

- **greenhouse gas reduction**
- **sustainable production and consumption**
- **competition in electricity and natural gas markets**
- **security of supply**



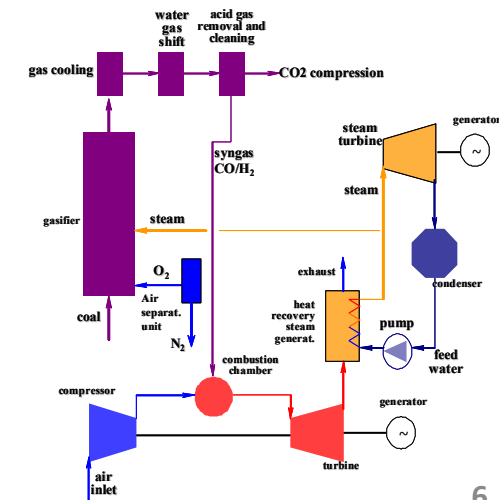
Energy Union

- a binding EU target of at least 40% less greenhouse gas emissions by 2030, compared to 1990
- a binding target of at least 27% of renewable energy use at EU level
- an energy efficiency increase of at least 27%
- the completion of the internal energy market by reaching an electricity interconnection target of 15%
- increase energy security (natural gas South Corridor)

Long term EU energy strategy (2050)

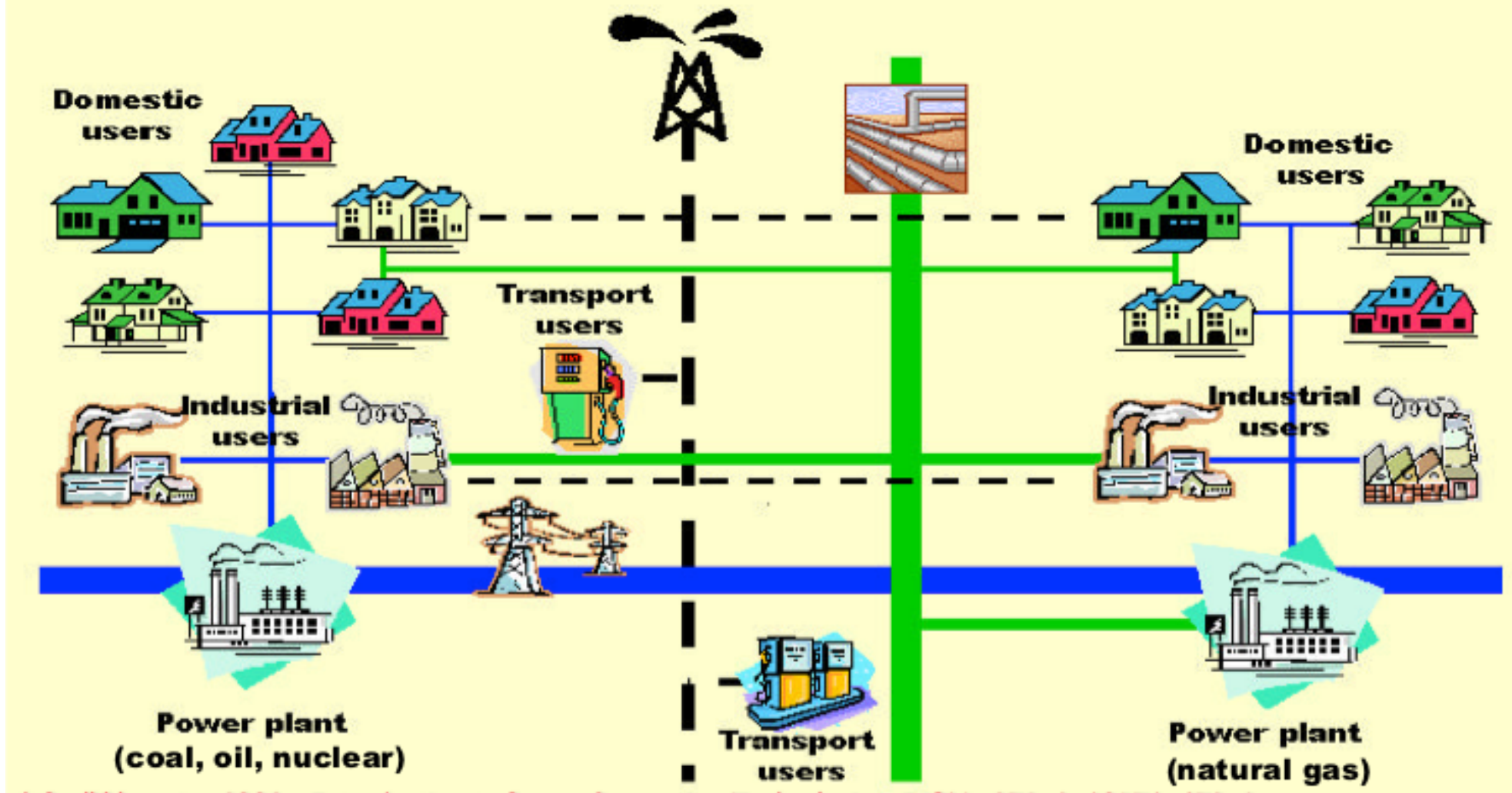
- A vision of carbon free EU
- Main ingredients of future sustainable energy systems:
 - Large scale integration of renewable energy sources
 - Distributed generation
 - Carbon capture and storage
 - Smartgrids
 - Electric vehicles
 - Storage devices
 - Hydrogen

Development of new sustainable technologies and infrastructure



Current energy system

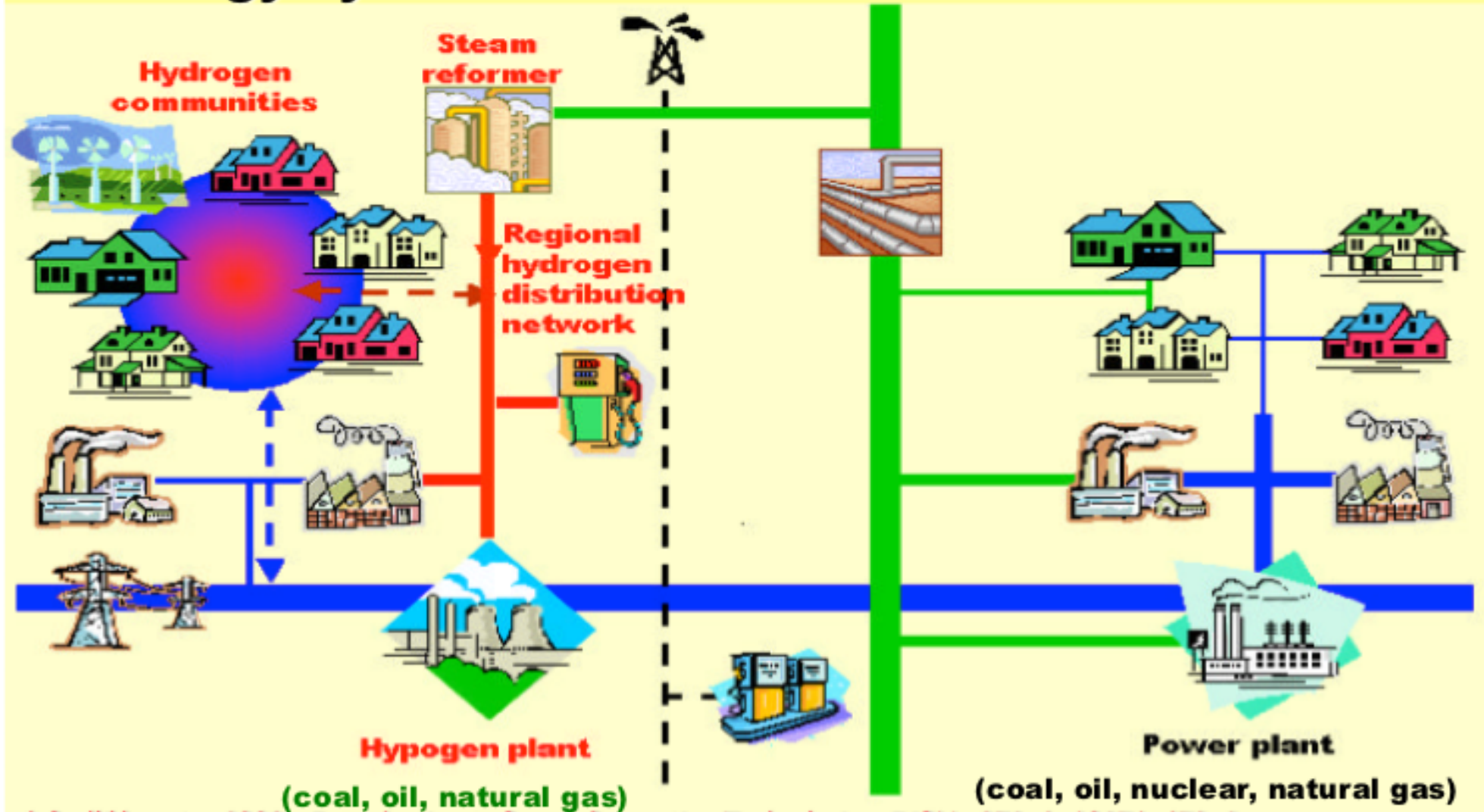
EU energy system today*



* Poullikkas A., 2009, *Introduction to Power Generation Technologies*, ISBN: 978-1-60876-472-3

Future energy systems (optimistic scenario)

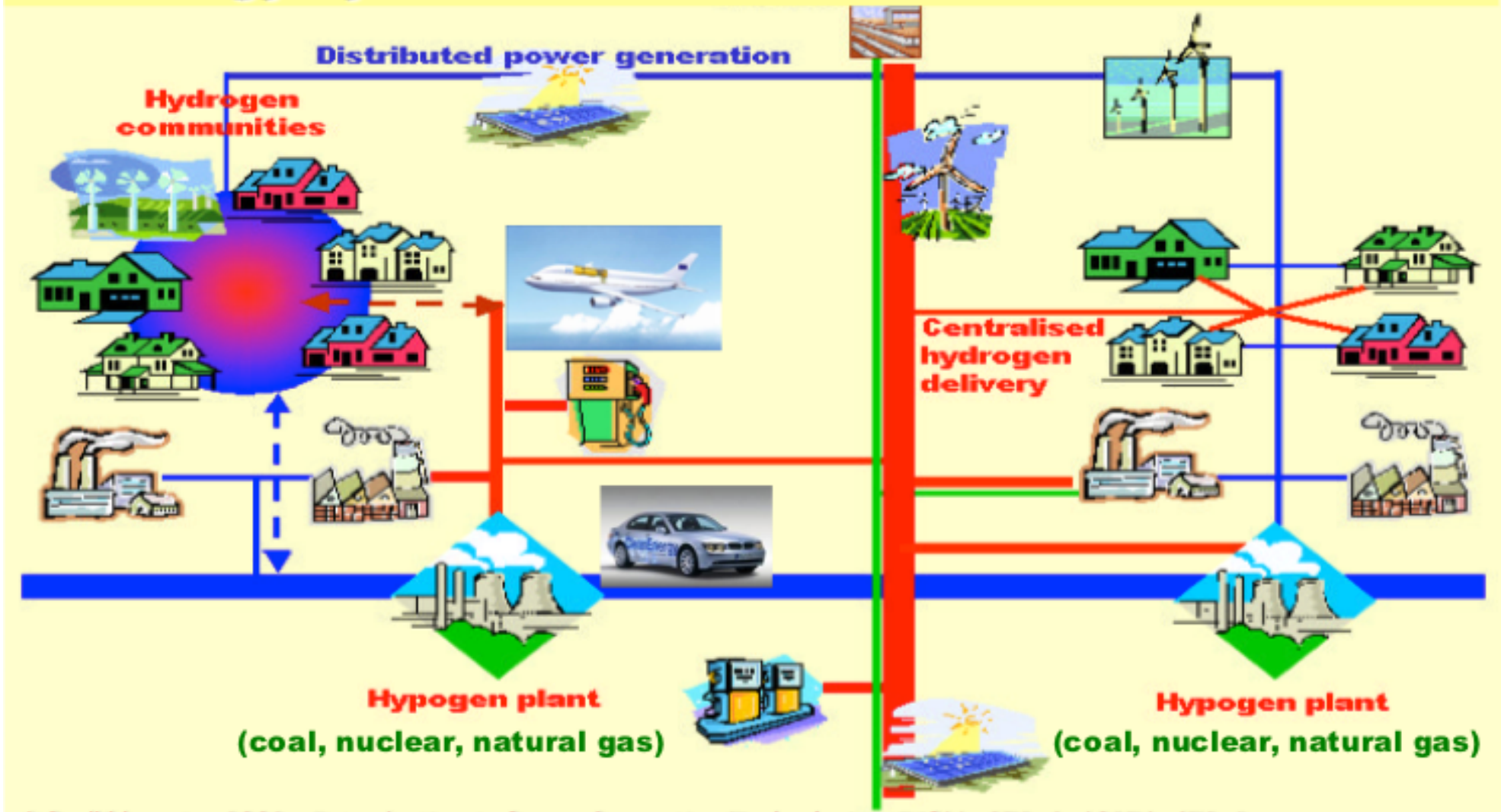
EU energy system in 2020-30*



* Poullikkas A., 2009, *Introduction to Power Generation Technologies*, ISBN: 978-1-60876-472-3

Future energy systems (optimistic scenario)

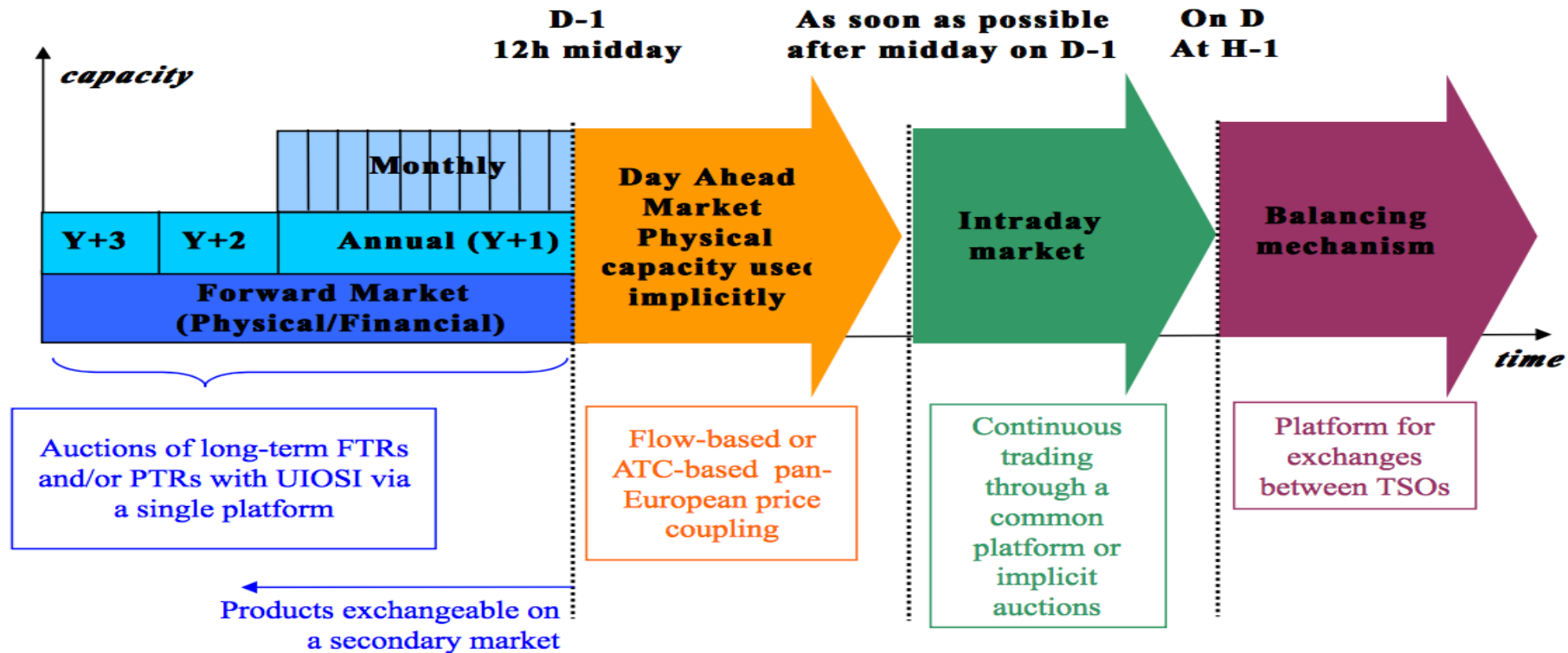
EU energy system in 2040-50*



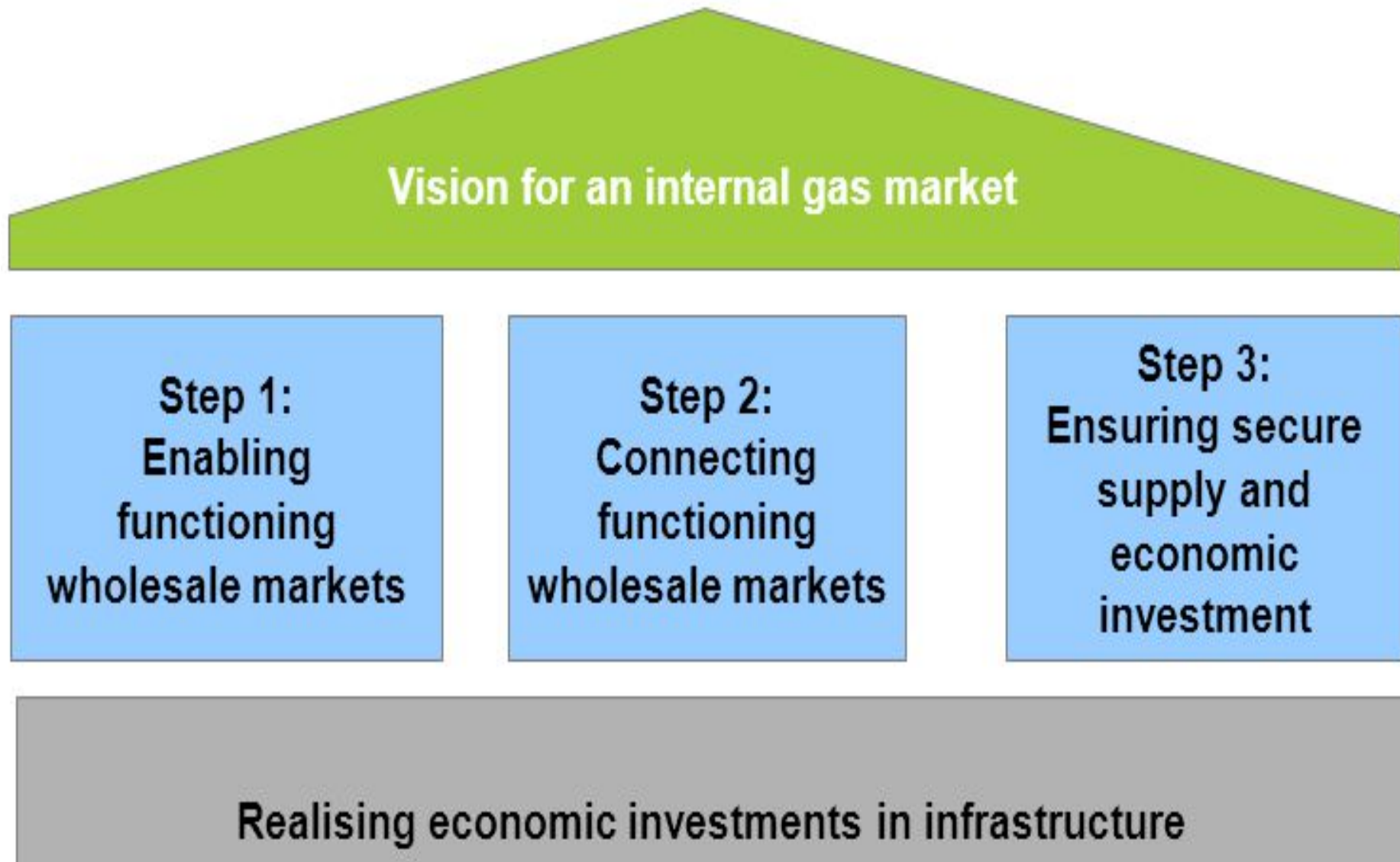
* Poullikkas A., 2009, *Introduction to Power Generation Technologies*, ISBN: 978-1-60876-472-3

Regulatory challenges for Cyprus

EU electricity market target model

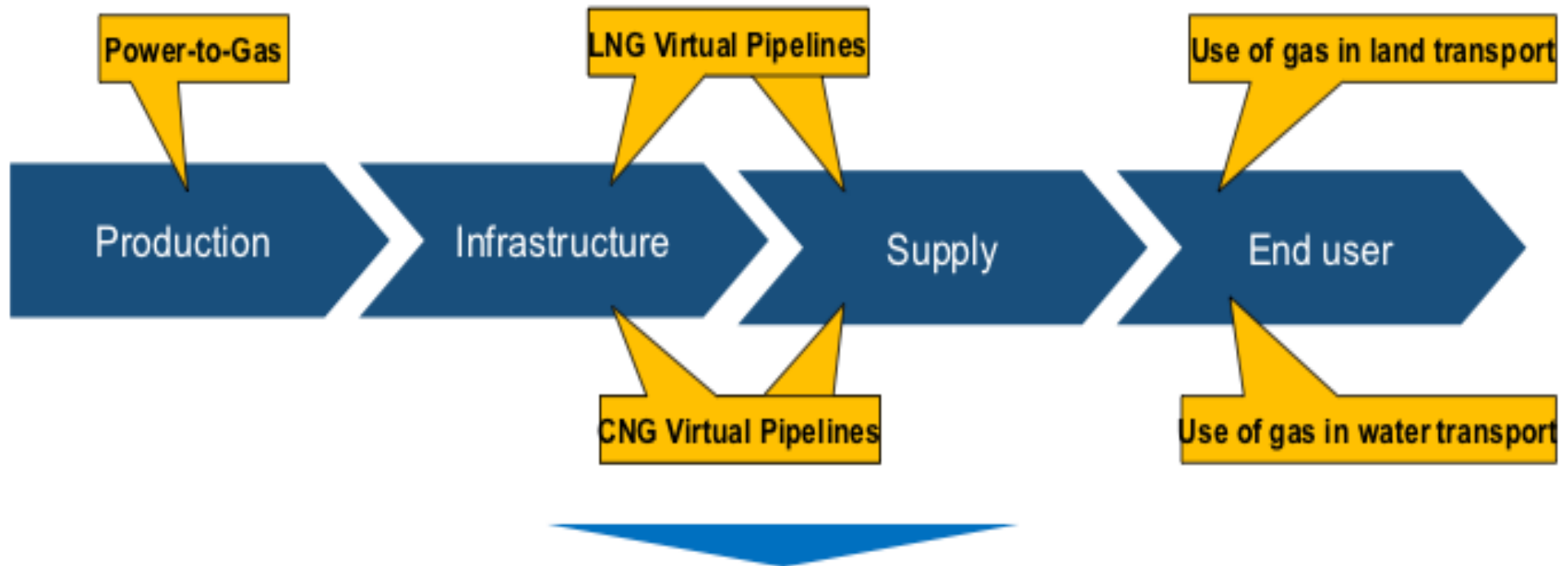


EU gas market target model



EU gas market target model

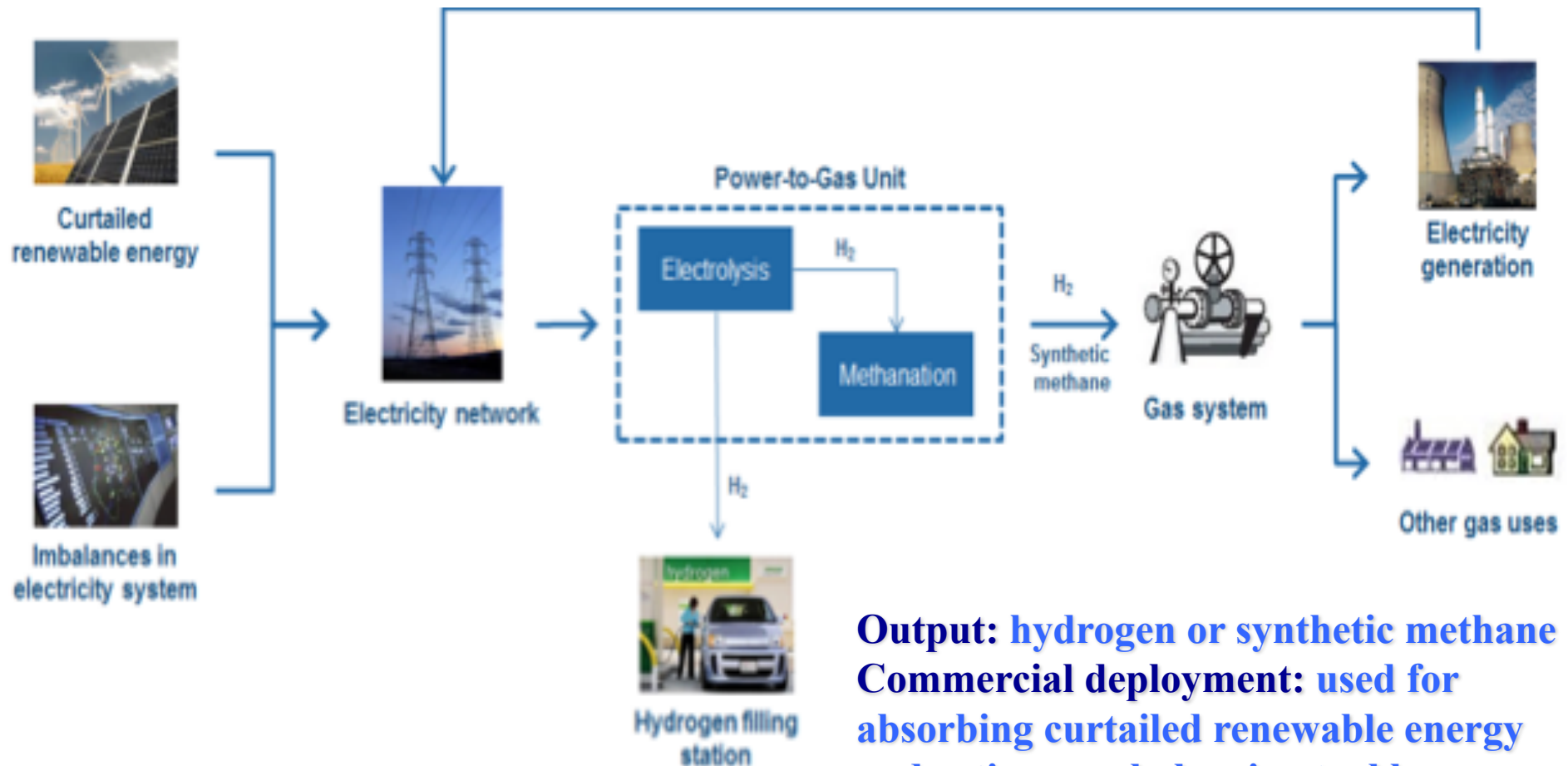
- The new uses for gas have different roles across the gas supply chain



Virtual pipelines are closely related to the development of the use of gas in the transport sector, particularly in the case of LNG

Power-to-Gas (P2G)

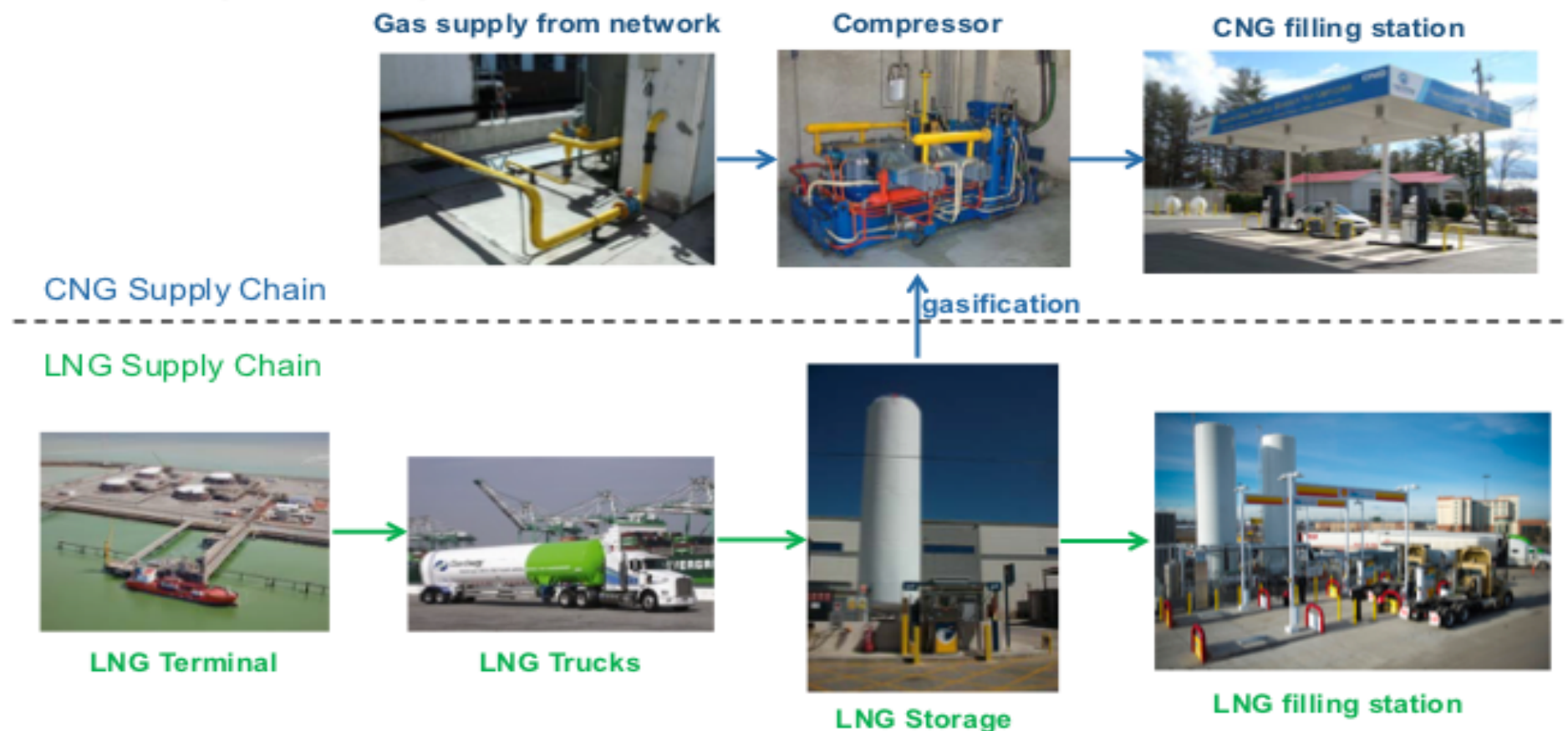
- energy storage technology linking the electricity and gas infrastructure



Output: hydrogen or synthetic methane
Commercial deployment: used for absorbing curtailed renewable energy and acting as a balancing tool by electricity TSOs

Virtual pipelines

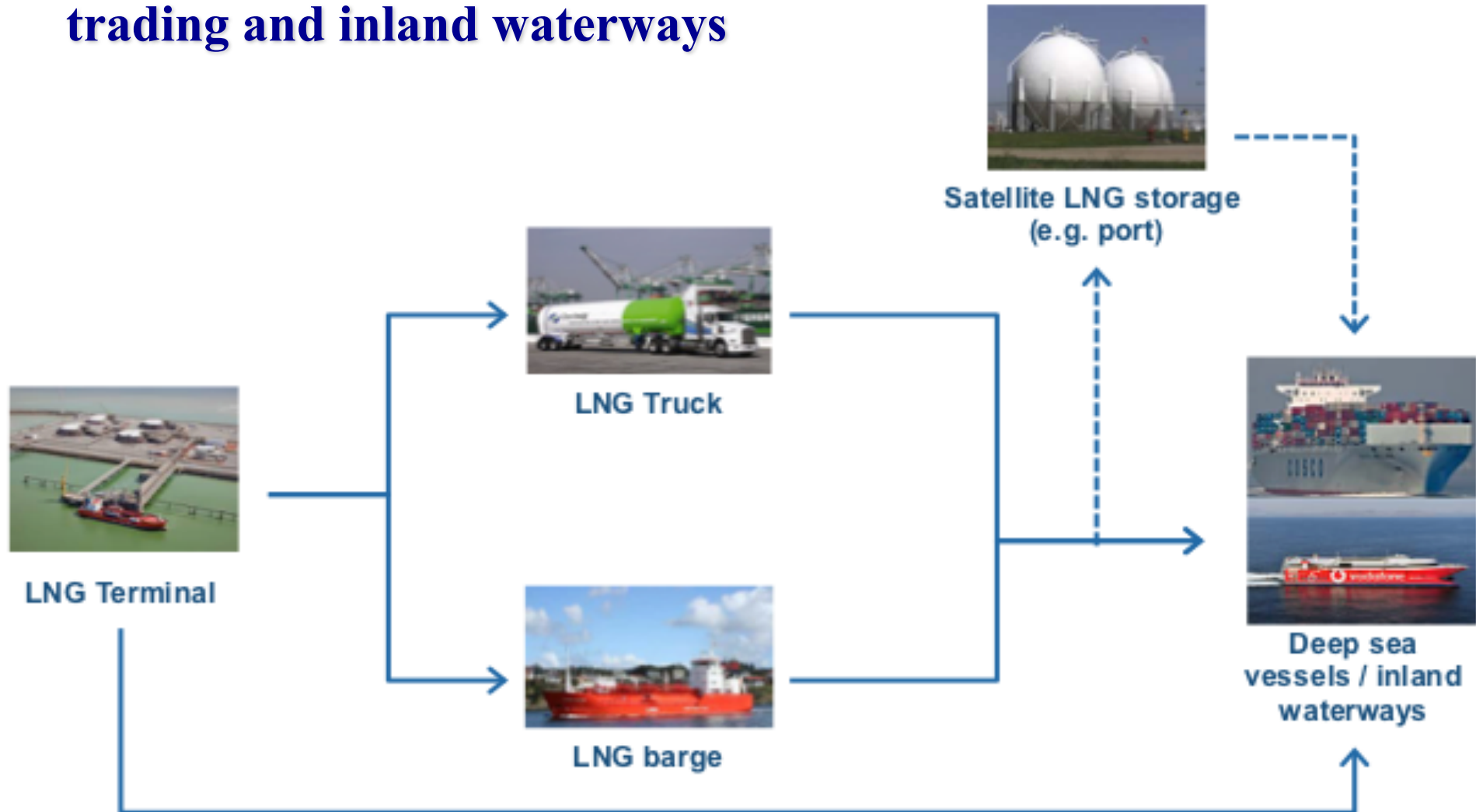
- **LNG stations are supplied through trucks**
- **CNG stations are supplied either from the network or with LNG (L- CNG)**



Virtual pipeline: the supply chain transporting natural gas to final consumers in the form of CNG or LNG, using road and sea means of transportation, such as trucks, vessels and rail

LNG bunkering

- Supply chain is the same for applications in deep-sea trading and inland waterways

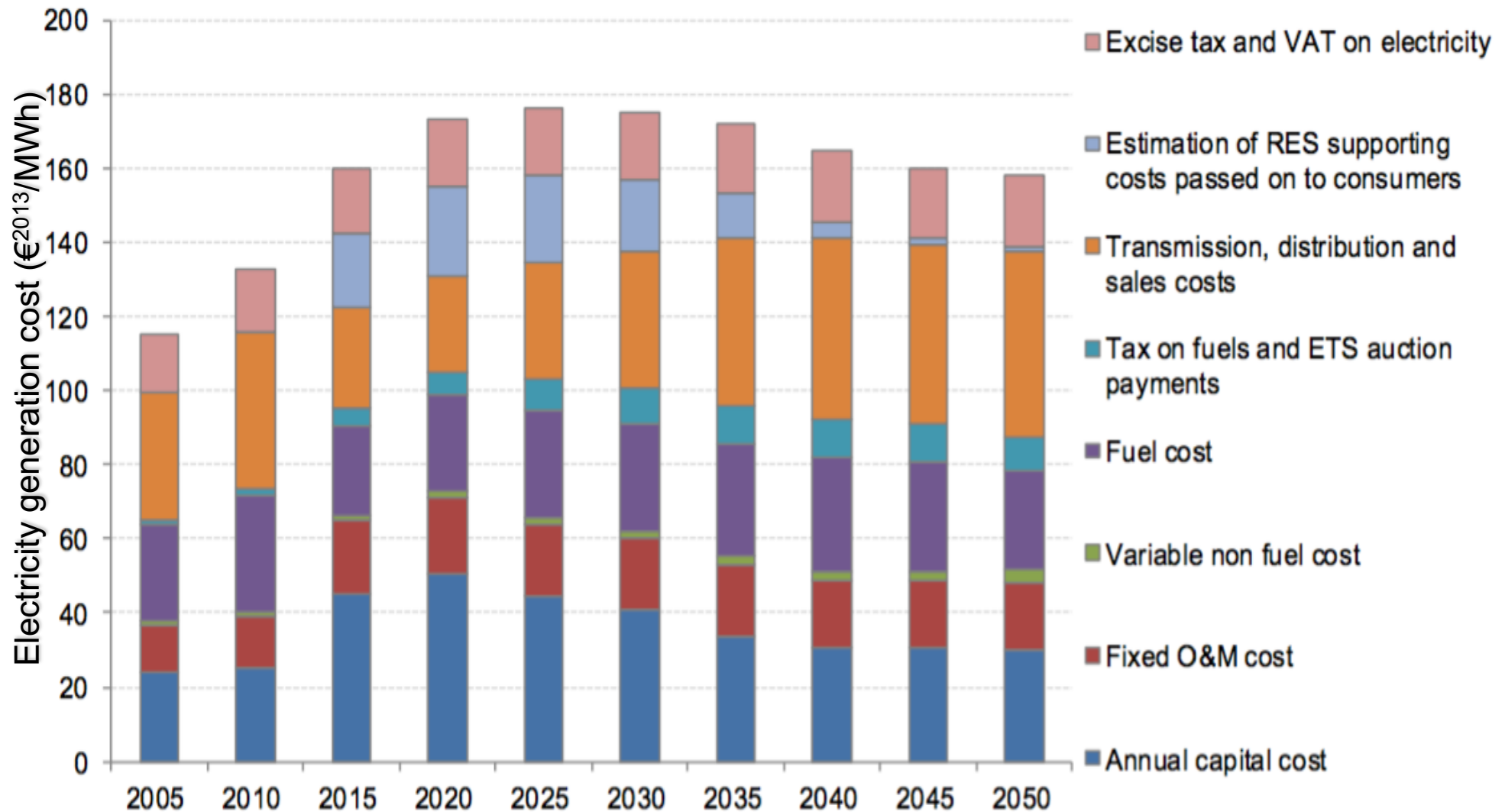


**LNG bunkering options: Ship-to-Ship (STS),
Truck-to-Ship (TTS), Terminal-to-Ship (TPS)**

Energy cost

Energy cost

EU reference scenario 2016

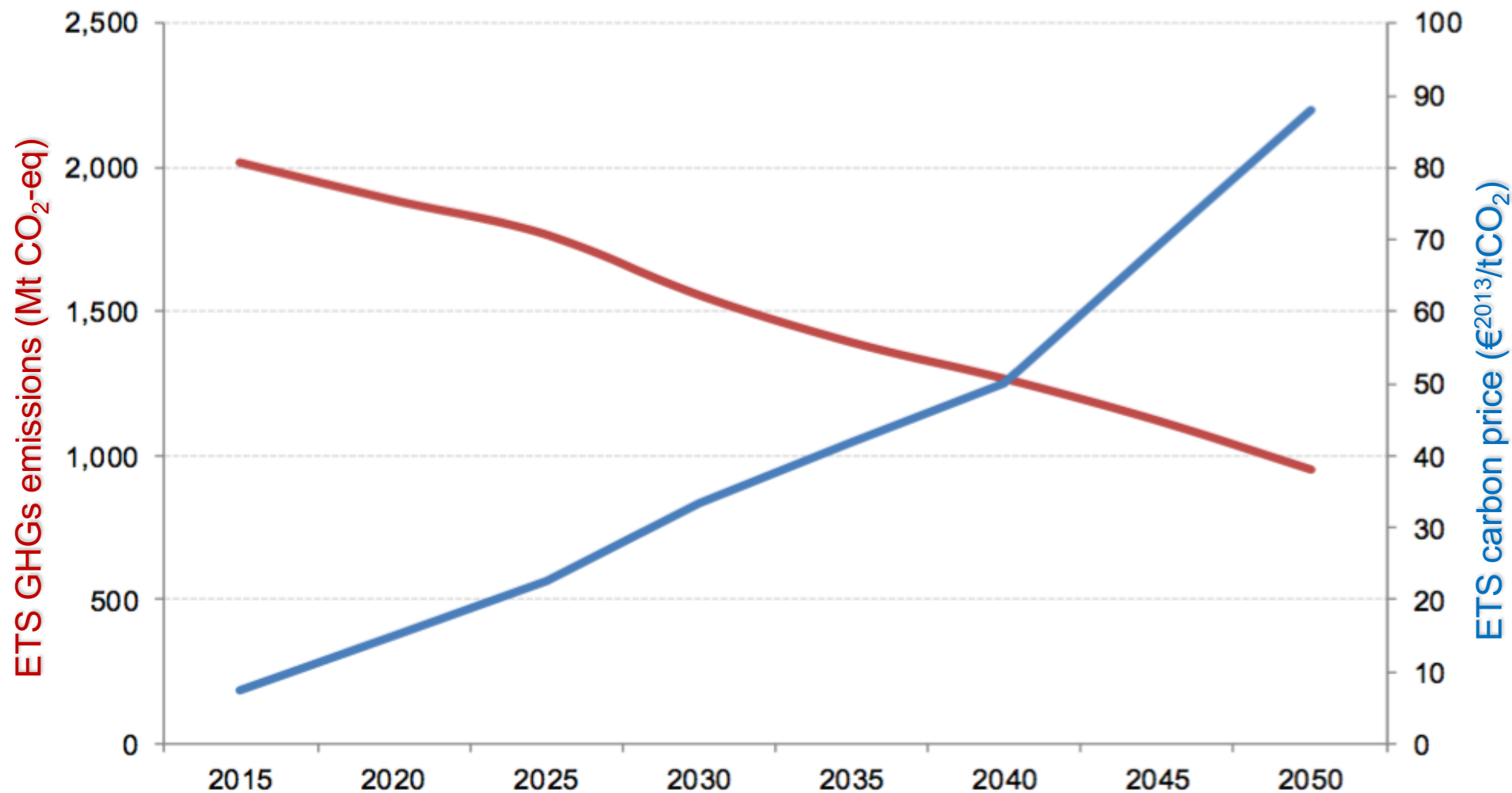


Source: PRIMES

8th Mediterranean Oil & Gas Forum 2017
 Nicosia, 1-2 March 2017

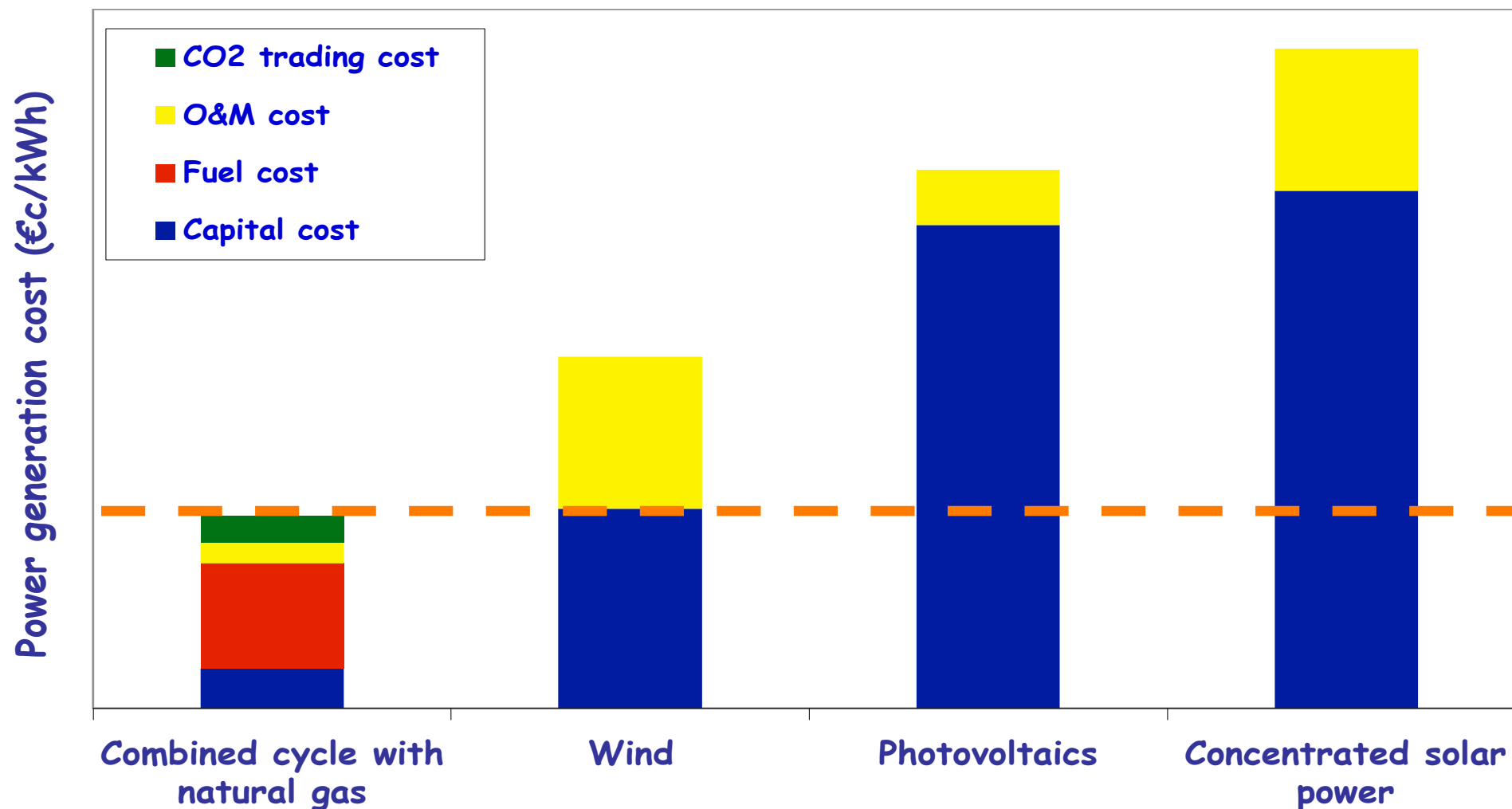
CO₂ cost

EU reference scenario 2016



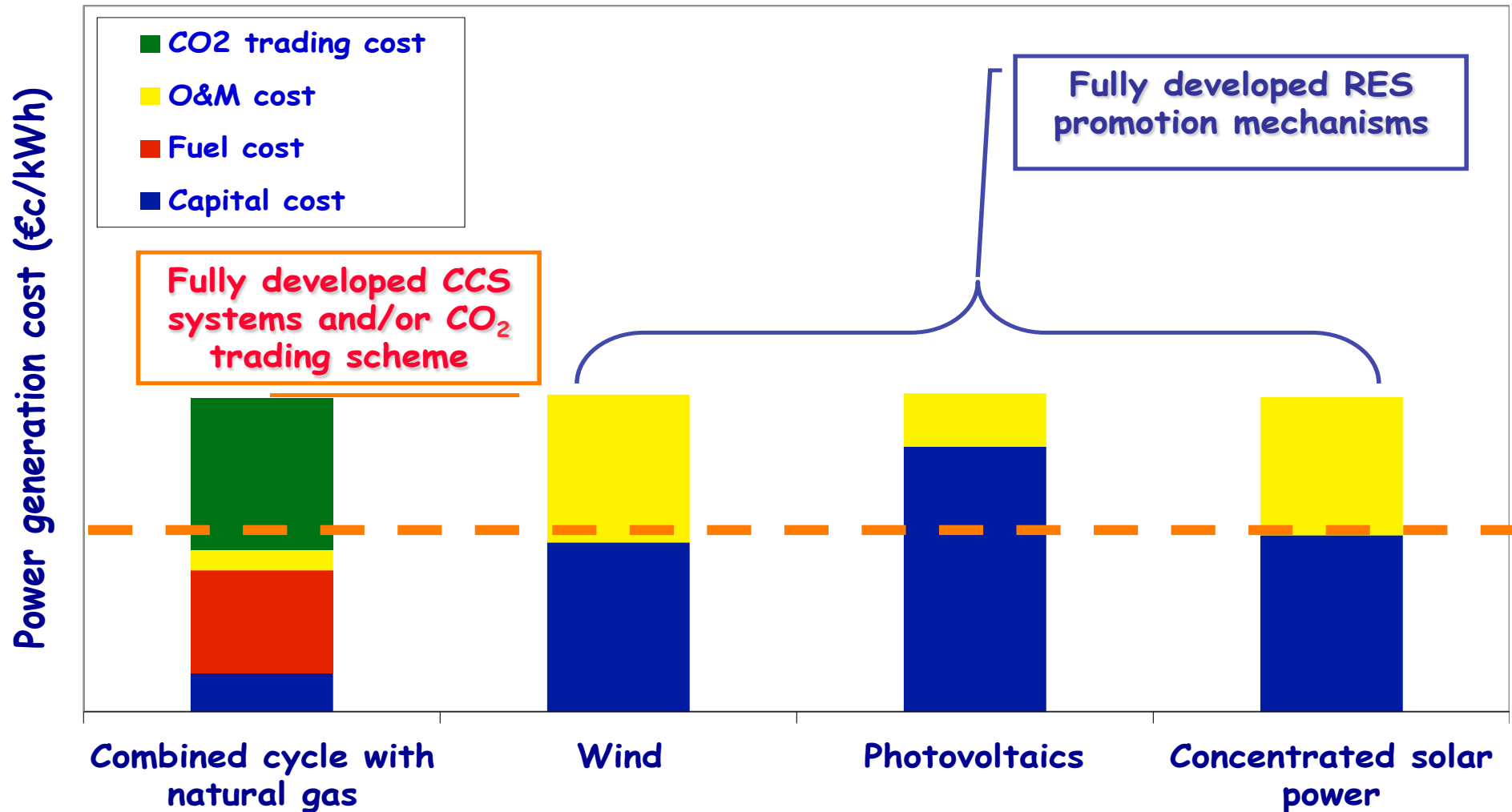
Source: PRIMES, GAINS

Power generation cost (year 2010)*



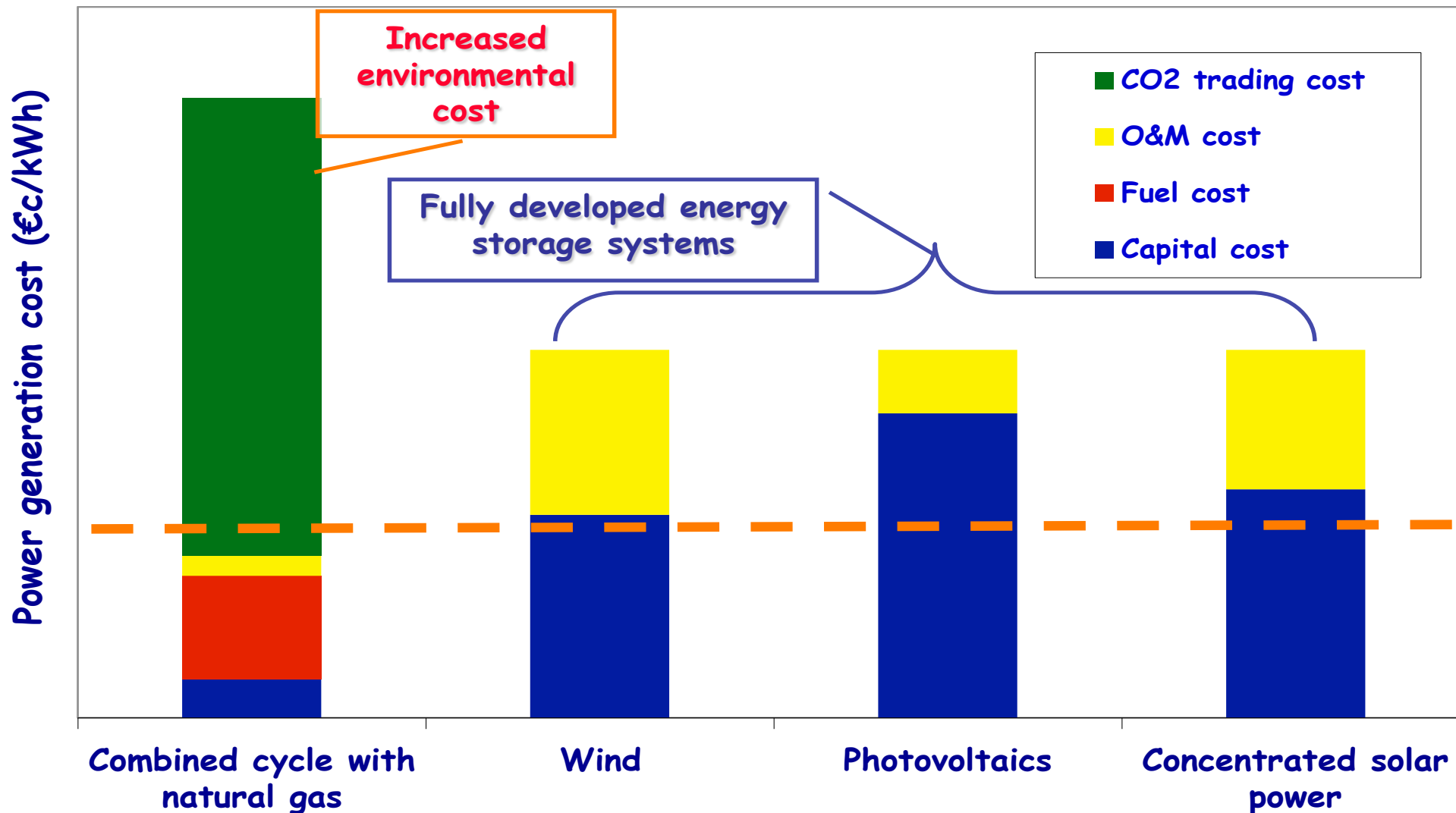
* Poullikkas A., 2010, "The cost of integration of renewable energy sources", *Accountancy*

Power generation cost (year 2020-30)*



* Poullikkas A., 2010, "The cost of integration of renewable energy sources", *Accountancy*

Power generation cost (year 2040-50)*



* Poullikkas A., 2010, "The cost of integration of renewable energy sources", Accountancy