



Sustainable Energy Futures

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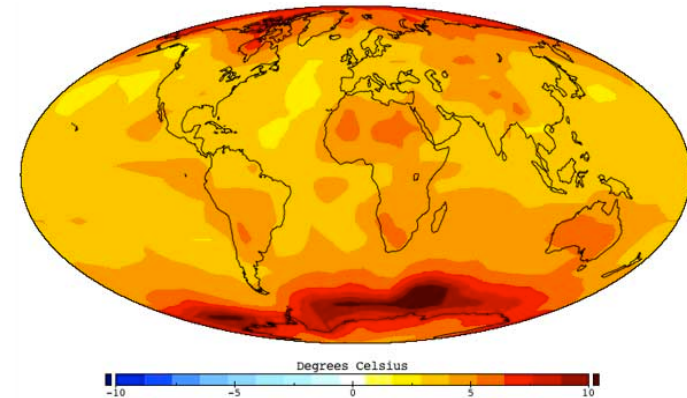
Contents

- **Long term strategies towards 2050**
- **Medium term strategies towards 2030**
- **Short term strategies towards 2020**

Long term strategies Towards 2050

Future energy systems

- **Climate change**

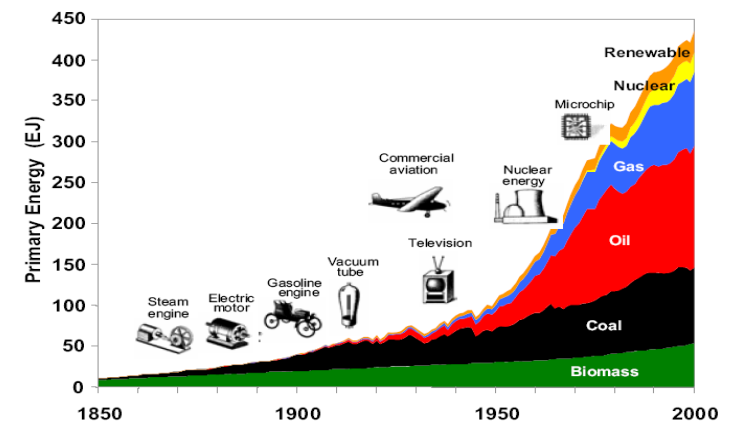


- **Third industrial revolution**

- **Future energy economics**

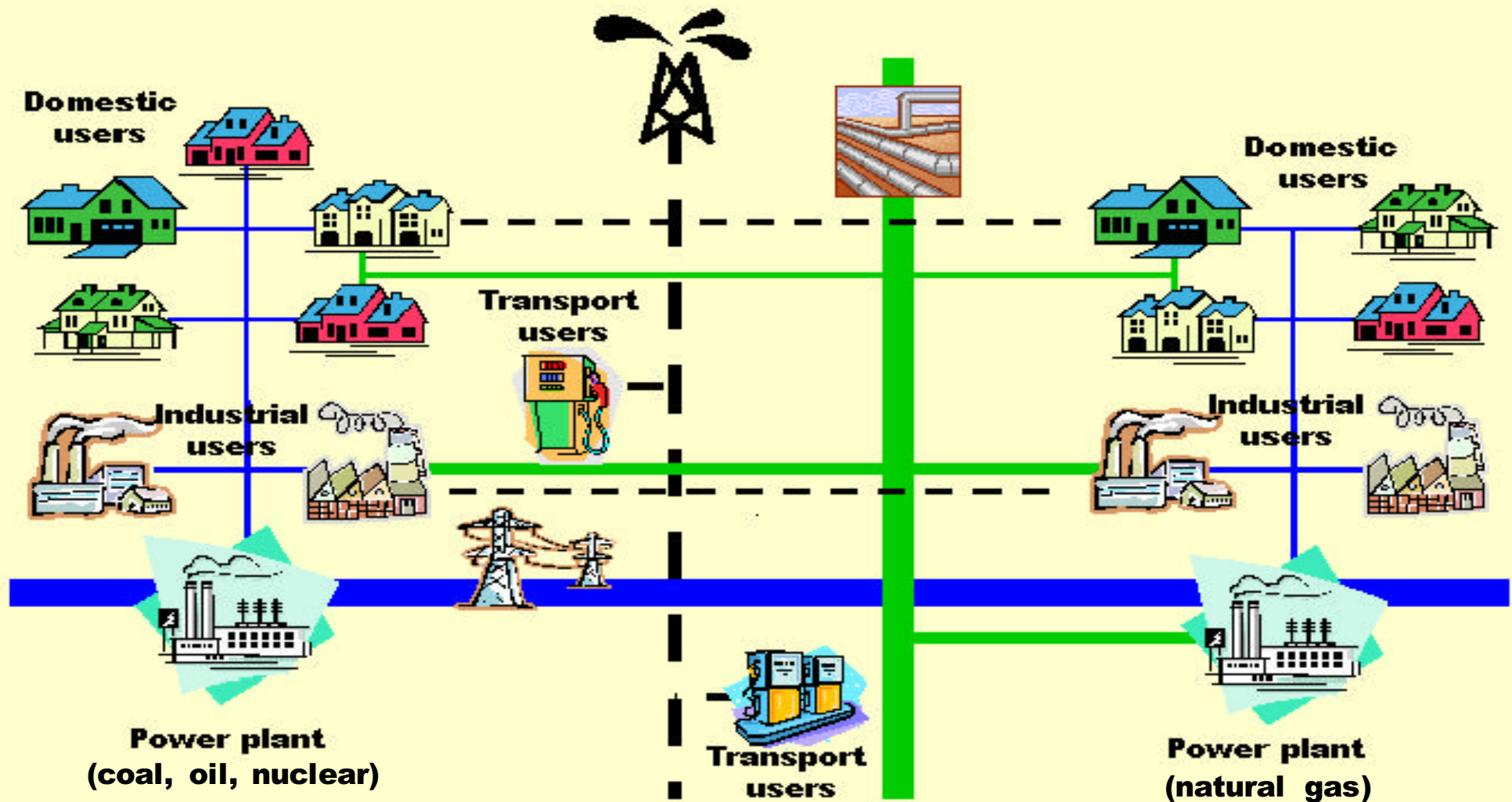
EU energy objectives

- greenhouse gas reduction
- sustainable production and consumption
- security of supply



Future energy systems

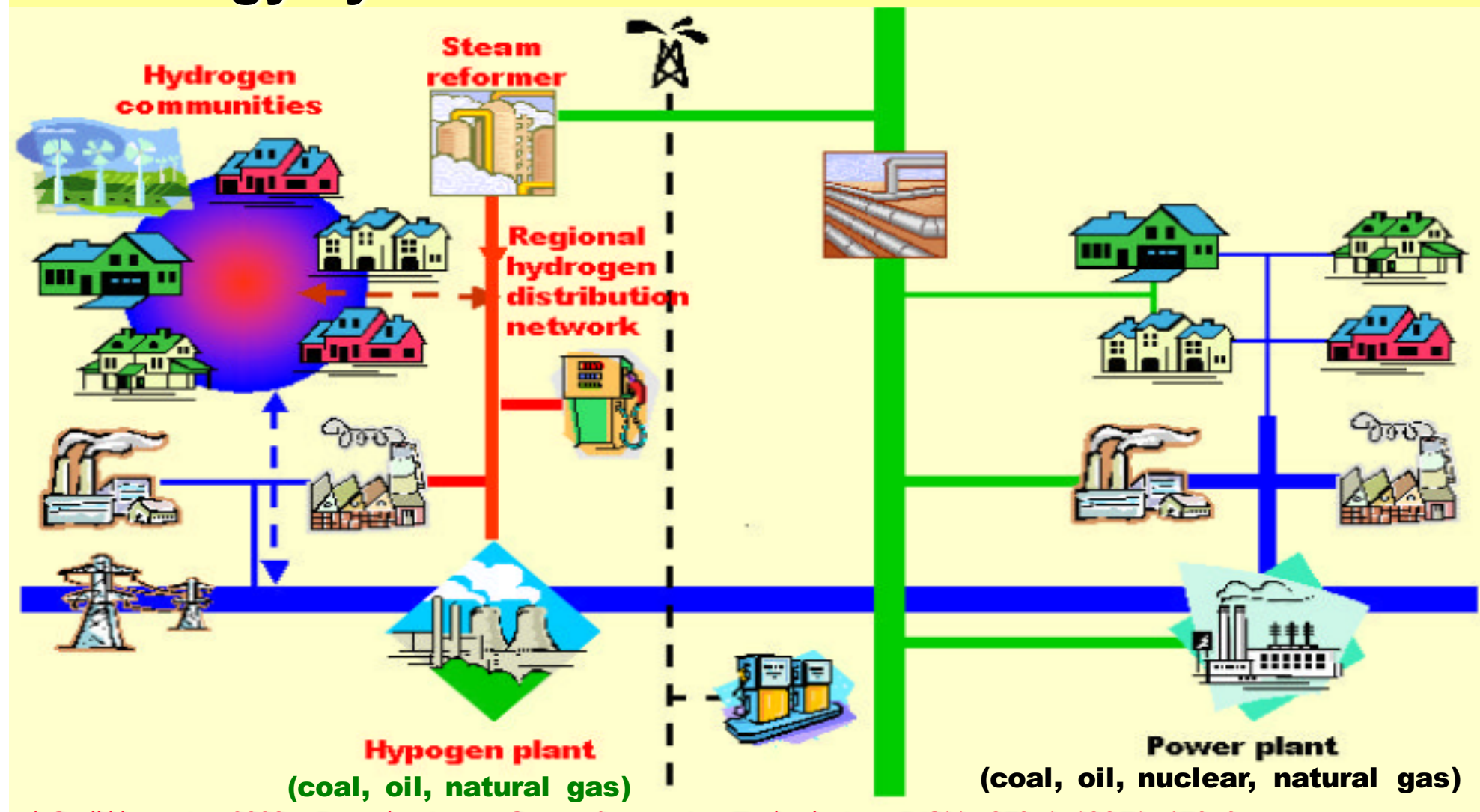
EU energy system today*



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

Future energy systems

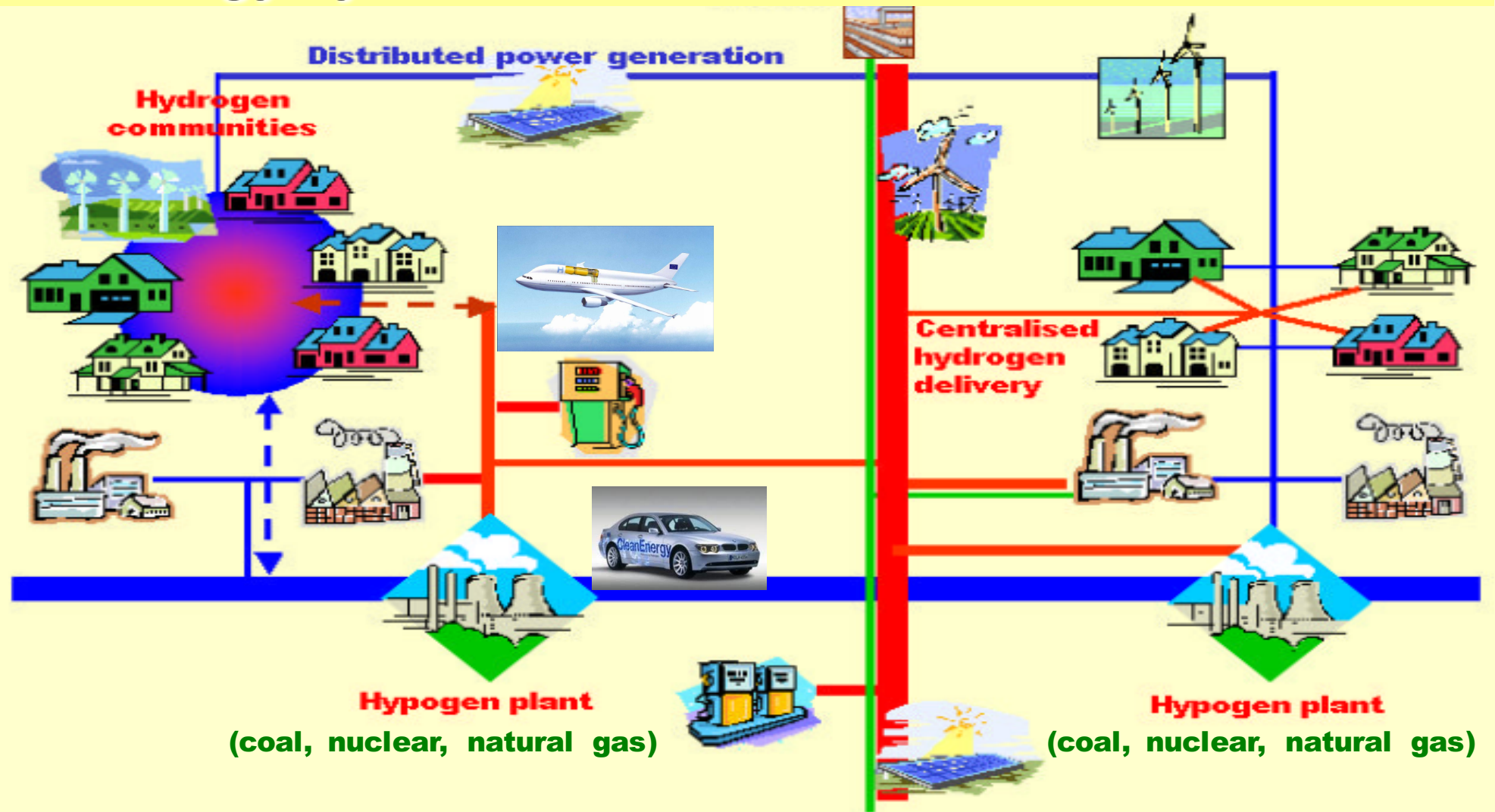
EU energy system in 2020-30*



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

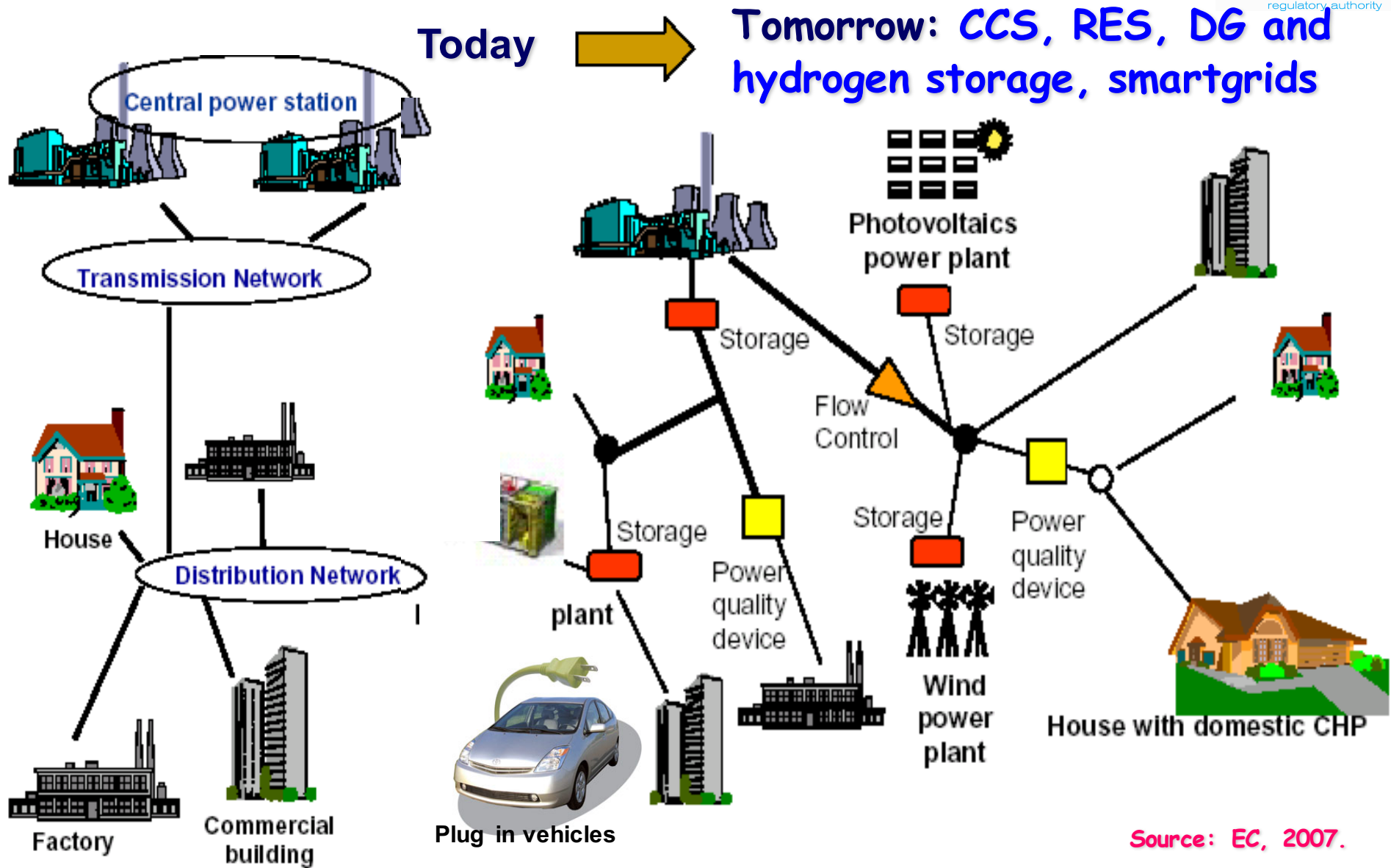
Future energy systems

EU energy system in 2040-50*



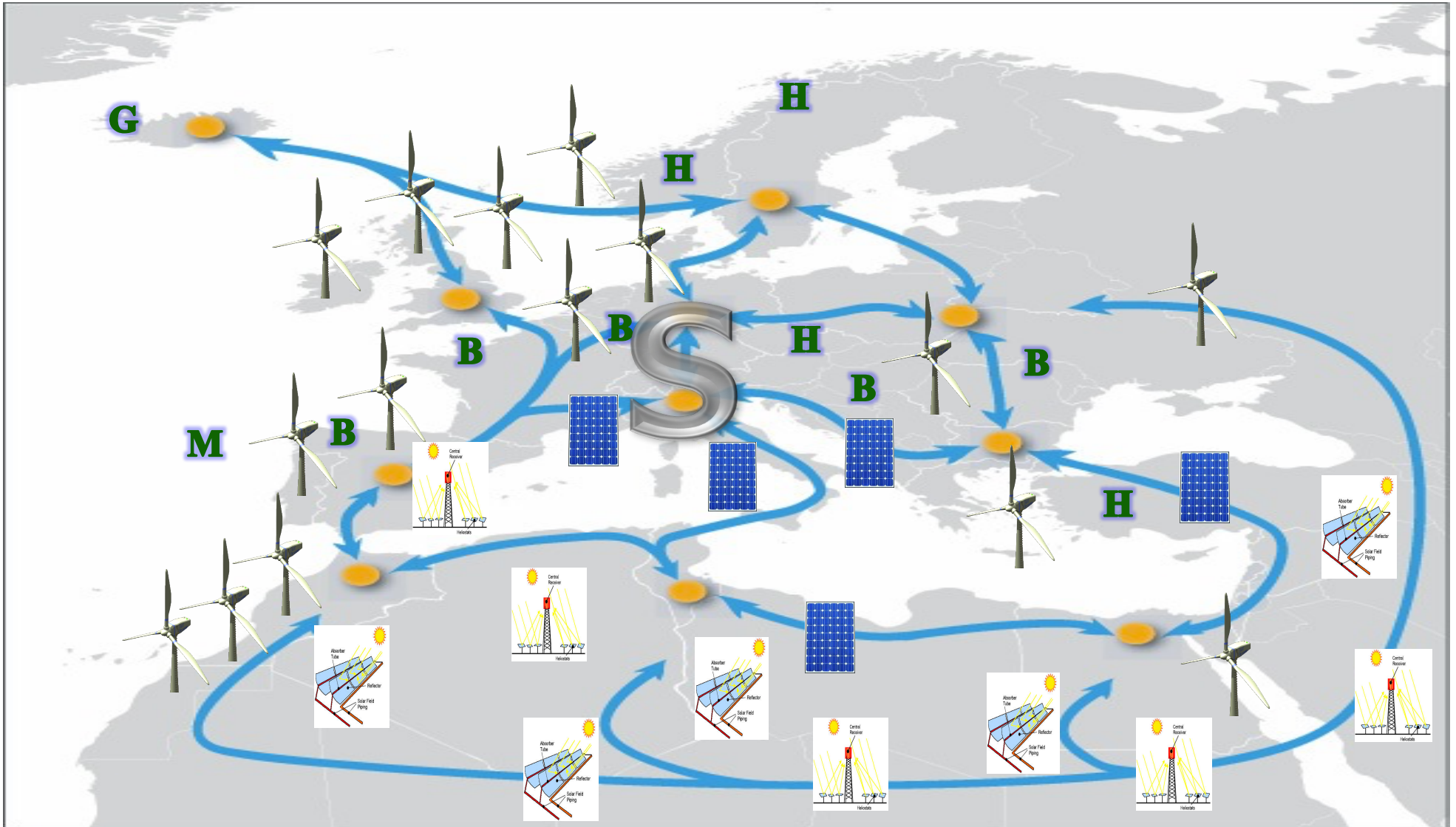
* Poullikkas A., 2009, *Introduction to Power Generation Technologies*, ISBN: 978-1-60876-472-3

Future PS



Source: EC, 2007.

The Super Smart Grid after 2050 (may allow for 100% RES)

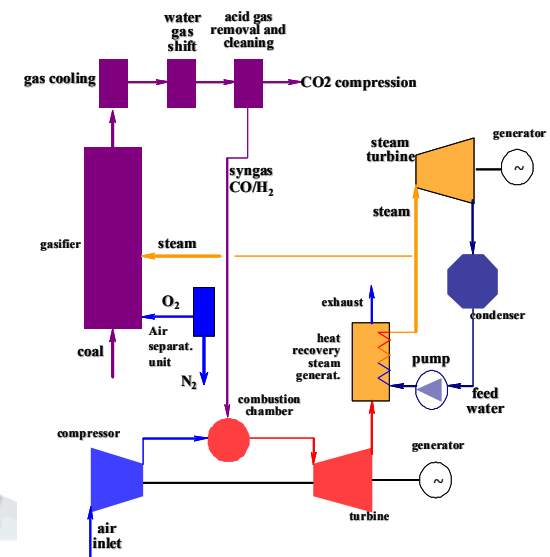


Main ingredients of future sustainable electric systems

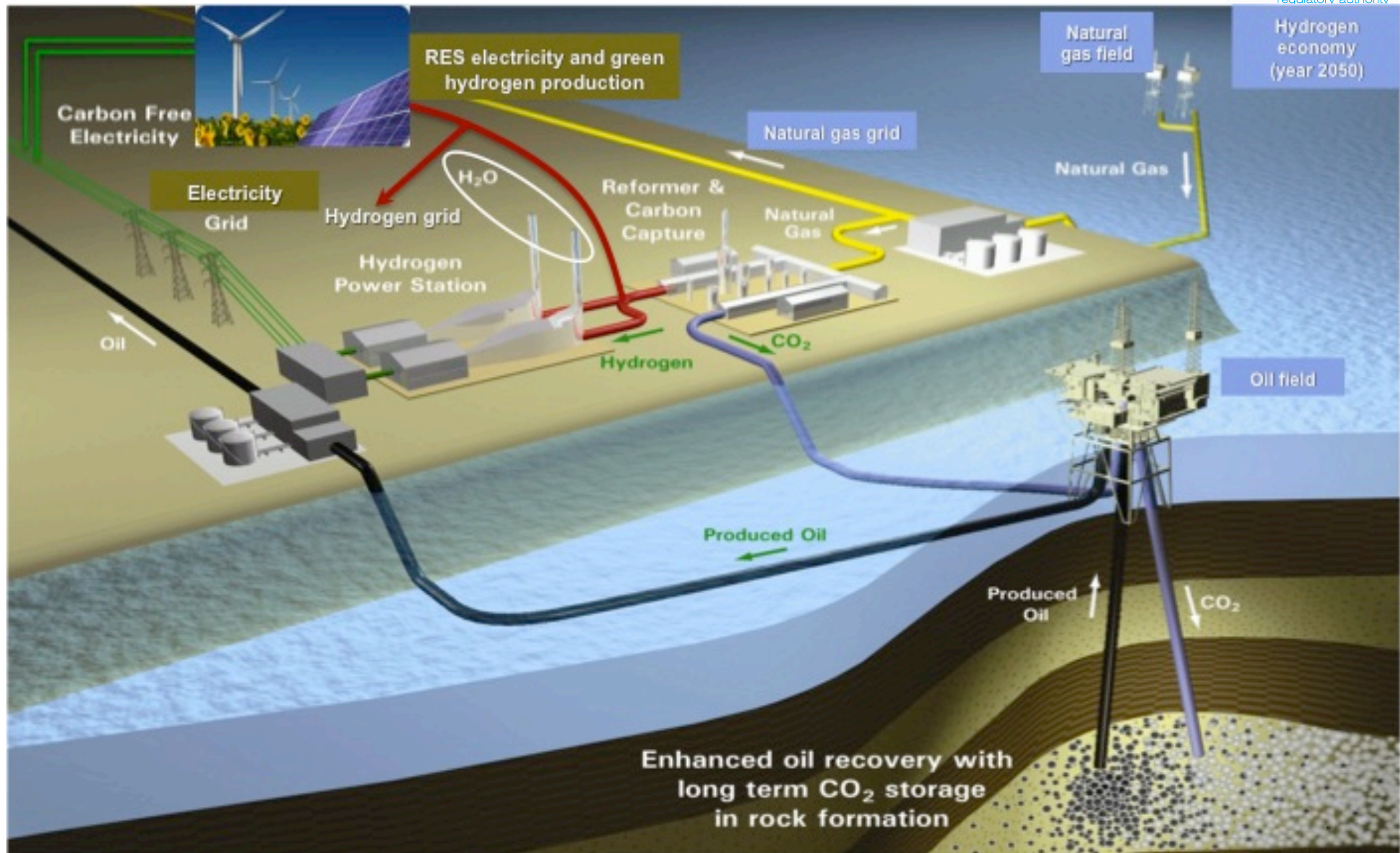
- Large scale integration of renewable energy sources
- Distributed generation
- Carbon capture and storage
- Smartgrids
- Electric vehicles
- Storage devices
- Hydrogen



Development of new sustainable technologies and infrastructure



Towards hydrogen economy in 2050



Medium term strategies Towards 2030

Towards Energy Union

« *I want to reform and reorganise Europe's energy policy in a new European Energy Union.* »

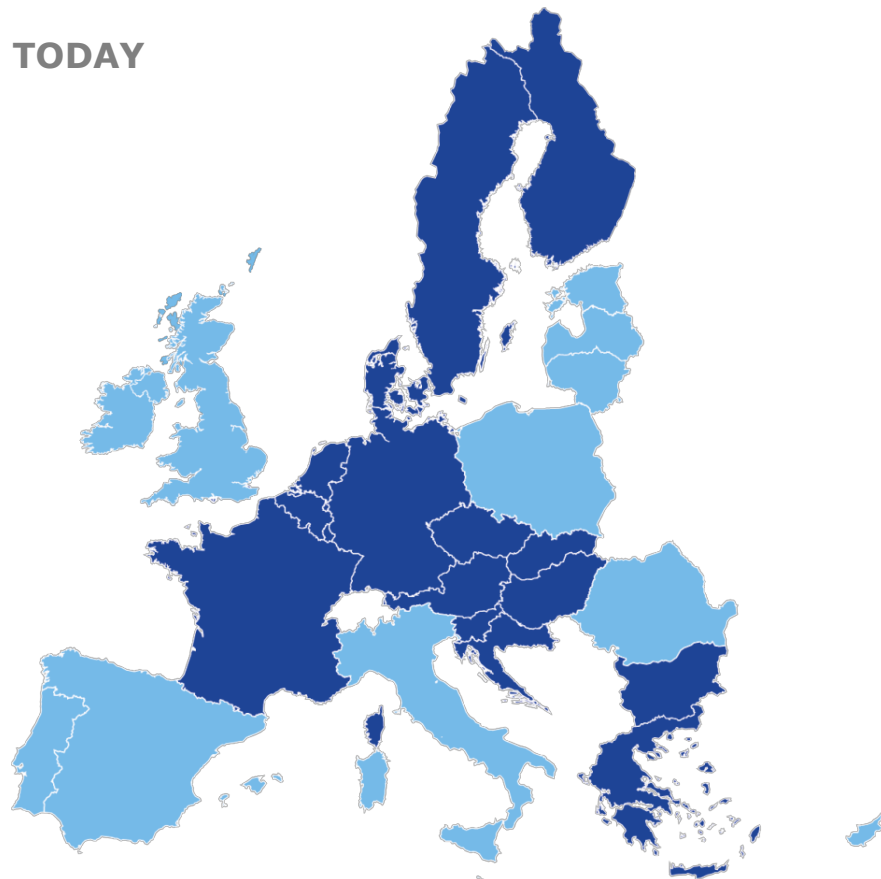
Jean-Claude Juncker

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)**

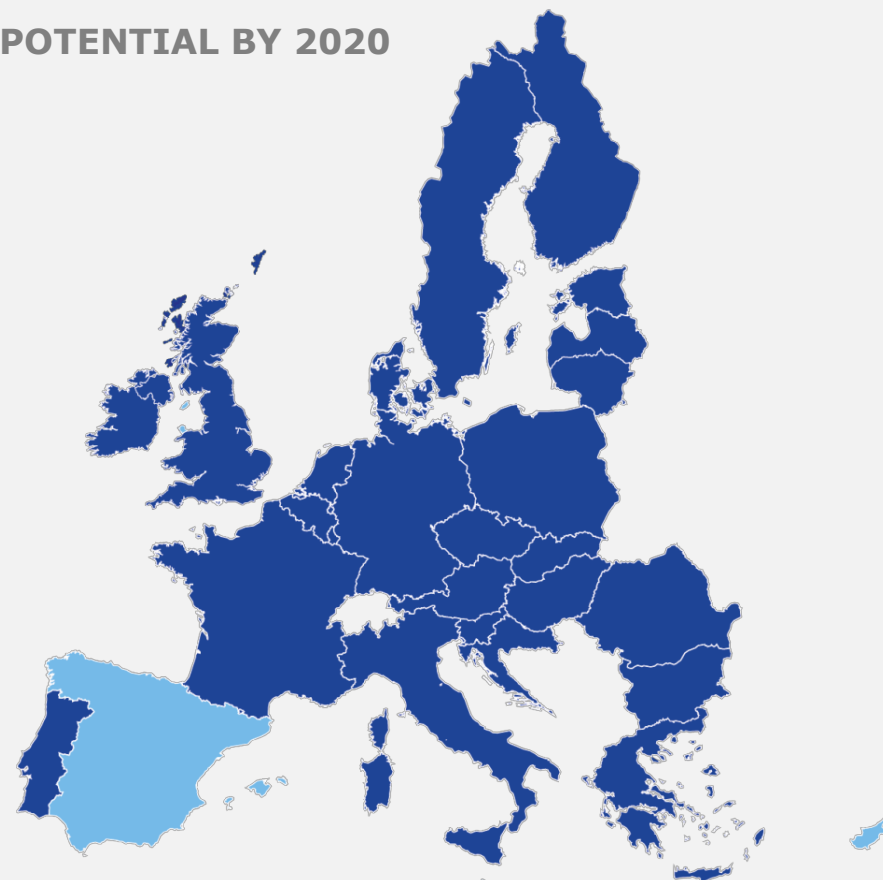
Connecting electricity markets

TODAY



- Countries meeting the 10% **interconnection** target
- Countries not meeting the 10% **interconnection** target

POTENTIAL BY 2020



Efforts need to be stepped up for those below the 10% target by 2020, mainly Spain and Cyprus, and in view of achieving the 15% target by 2030.

Importance for Cyprus



- **Great importance for Cyprus**
 - **Special attention is made to the more remote and isolated energy systems such as Cyprus**
 - **EU financing for electric interconnections with the rest of the internal energy market**
 - **implement critical projects of common interest in the gas sector, such as:**
 - **the Southern Gas Corridor**
 - **the promotion of a new gas hub in Southern Europe**
- **Action Plan**

Short term strategies Towards 2020

RES-E strategic plan 2010-20 main objective*

- ... to assess the optimum (minimum) increase in the cost of electricity of the Cyprus generation system by the integration of the necessary RES-E technologies for Cyprus to achieve its national RES energy target ...

* Poullikkas A., Kourtis G., Hadjipaschalis I., 2011, “A hybrid model for the optimum integration of renewable technologies in power generation systems”, *Energy Policy*

RES technologies considered

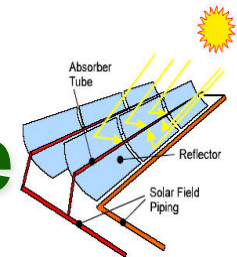
- Wind



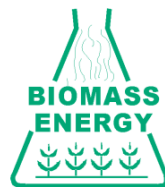
- PVs



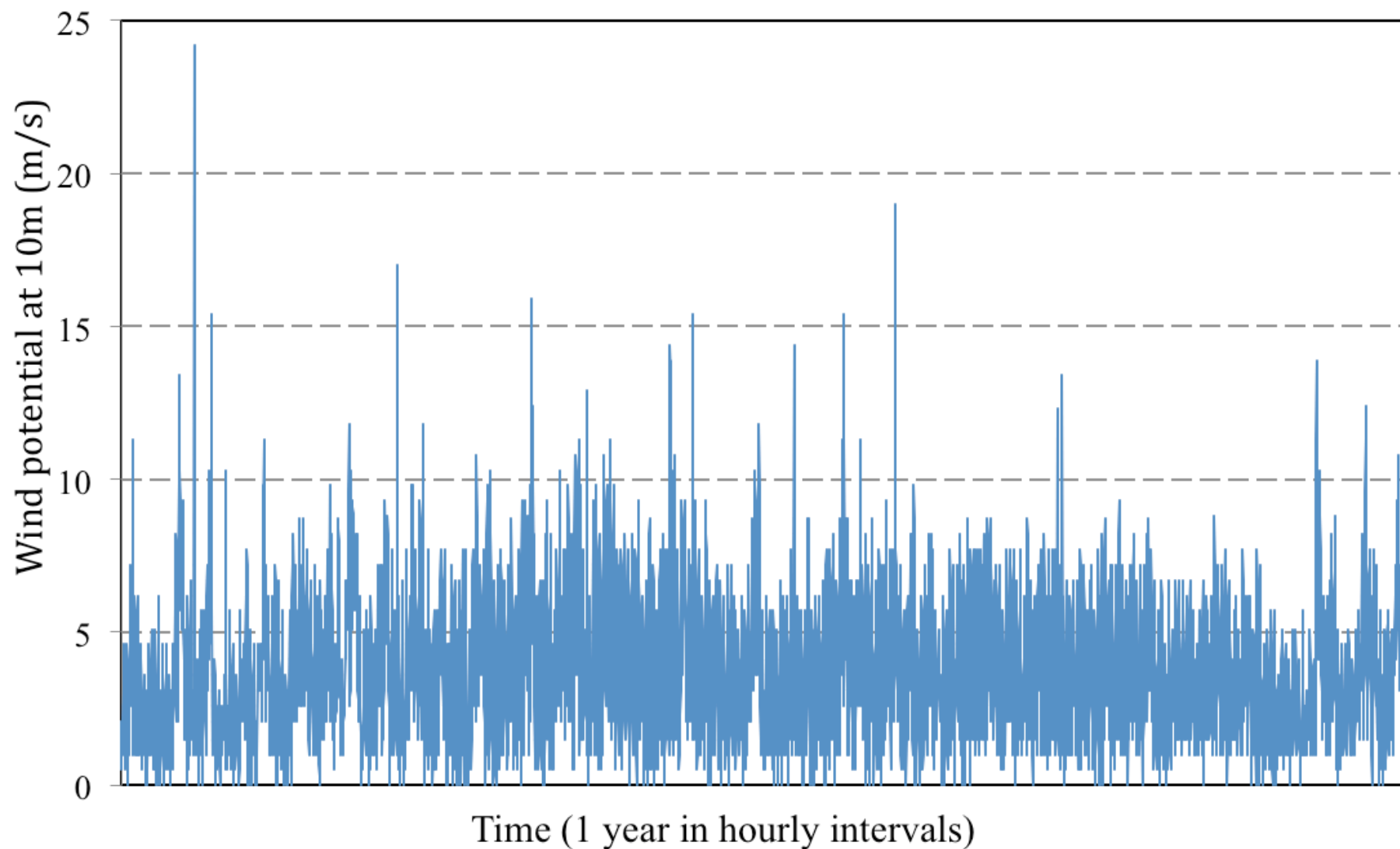
- CSP with 6 hours thermal storage



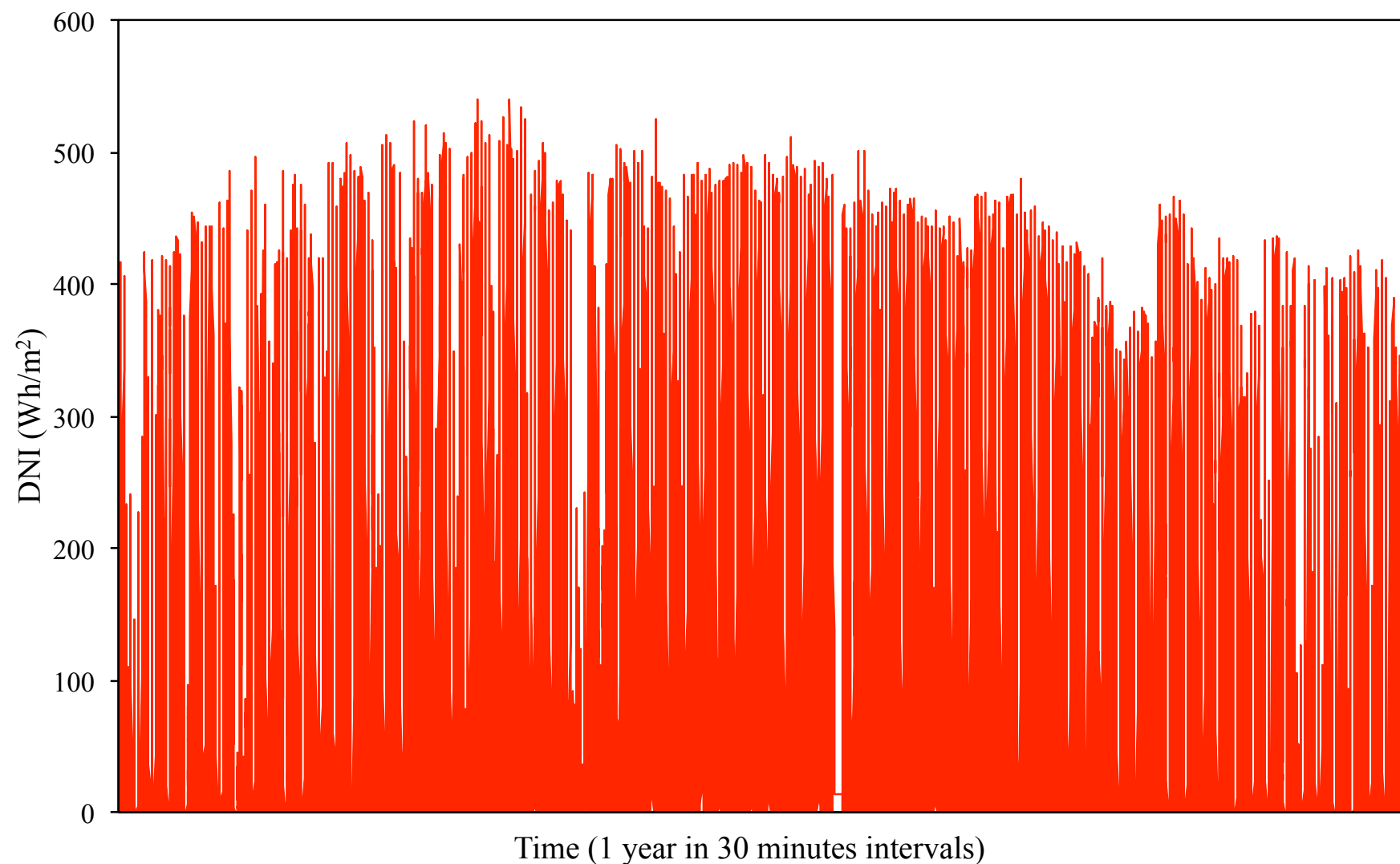
- Biomass



Hourly annual wind potential

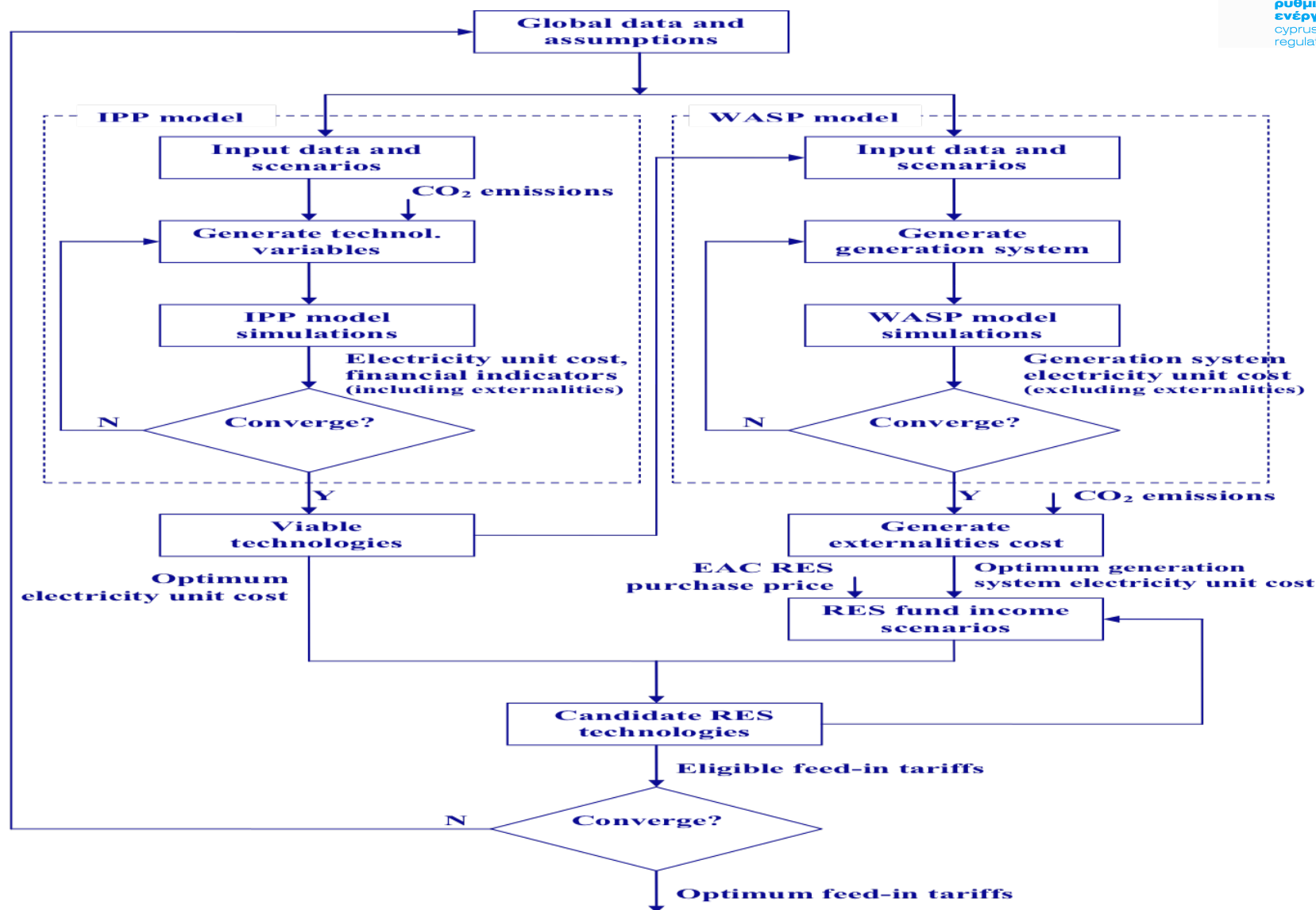


1/2 hour annual solar potential



Optimization model*

Optimization model (hybrid model
implementing IPP and WASP models)



* Poullikkas A., Kourtis G., Hadjipaschalis I., 2011, "A hybrid model for the optimum integration of renewable technologies in power generation systems", *Energy Policy* and Poullikkas A., 2009, "A decouple optimization method for power technology selection in competitive markets", *Energy Sources*.

RES-E strategic plan 2010-20



- RES-E penetration at 16% by 2020
- Important measures
 - Shifting from FiT mechanism, which is independent of electricity market prices, to a more market based mechanism
 - Introduction of the net-metering scheme
 - Use of competitive auctioning processes for RES-E capacity