ρυθμιστική αρχή ενέργειας κύπρου
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Keynote Talk

Development of future sustainable energy systems and strategies towards 2050

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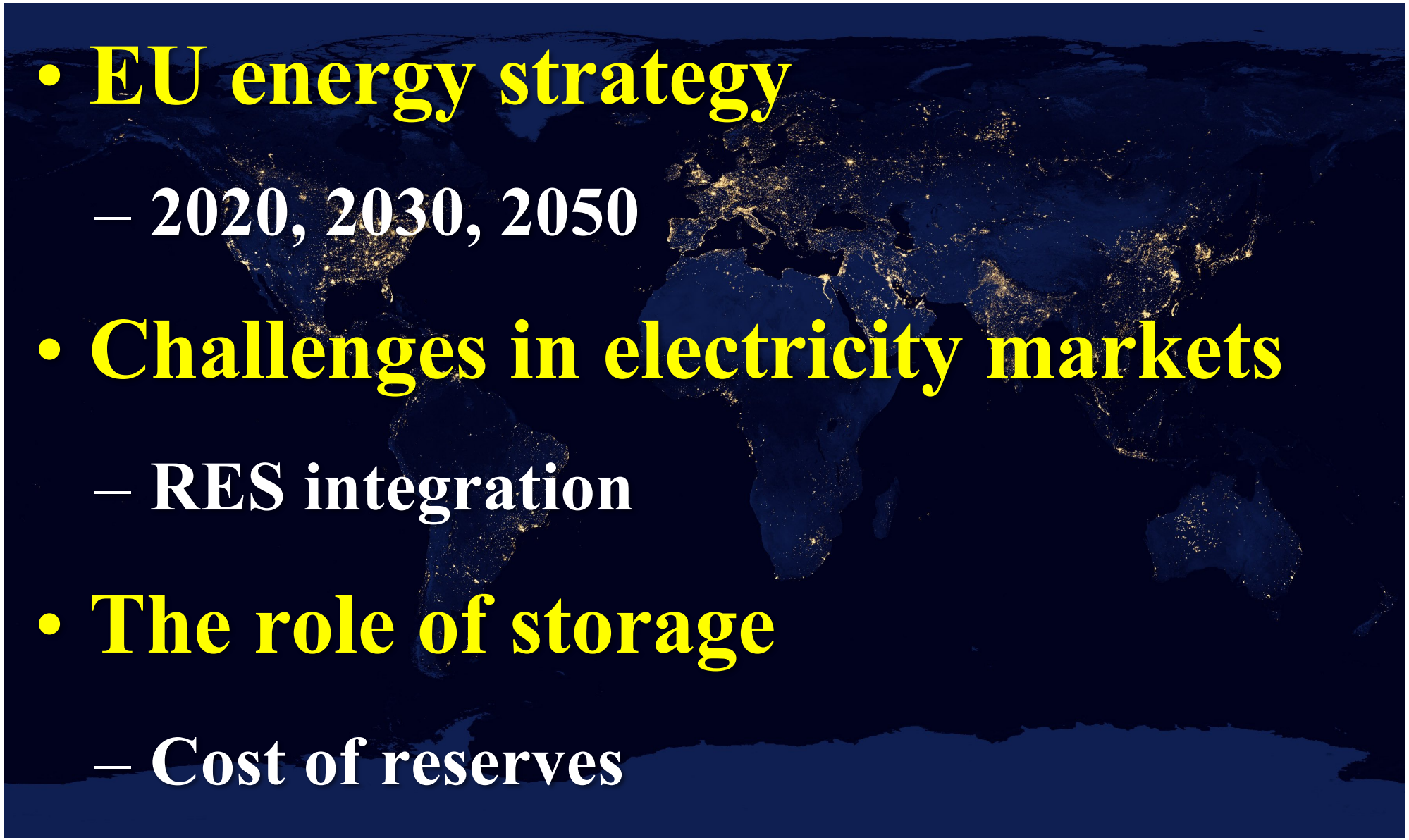

- **EU energy strategy**
  - 2020, 2030, 2050
- **Challenges in electricity markets**
  - RES integration
- **The role of storage**
  - Cost of reserves

EU energy strategy

2020, 2030, 2050

Future energy systems

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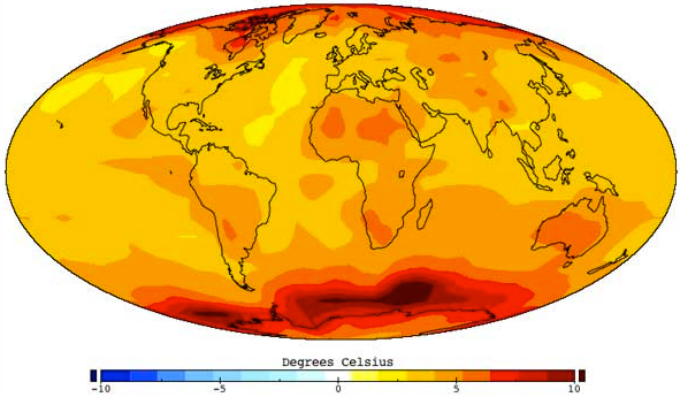
- **Climate change**

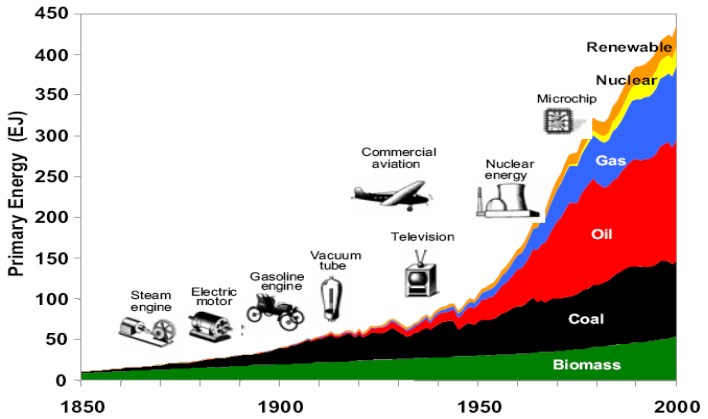


- **Third energy revolution**

- **Future energy economics**

EU energy objectives

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



EU medium and long term targets

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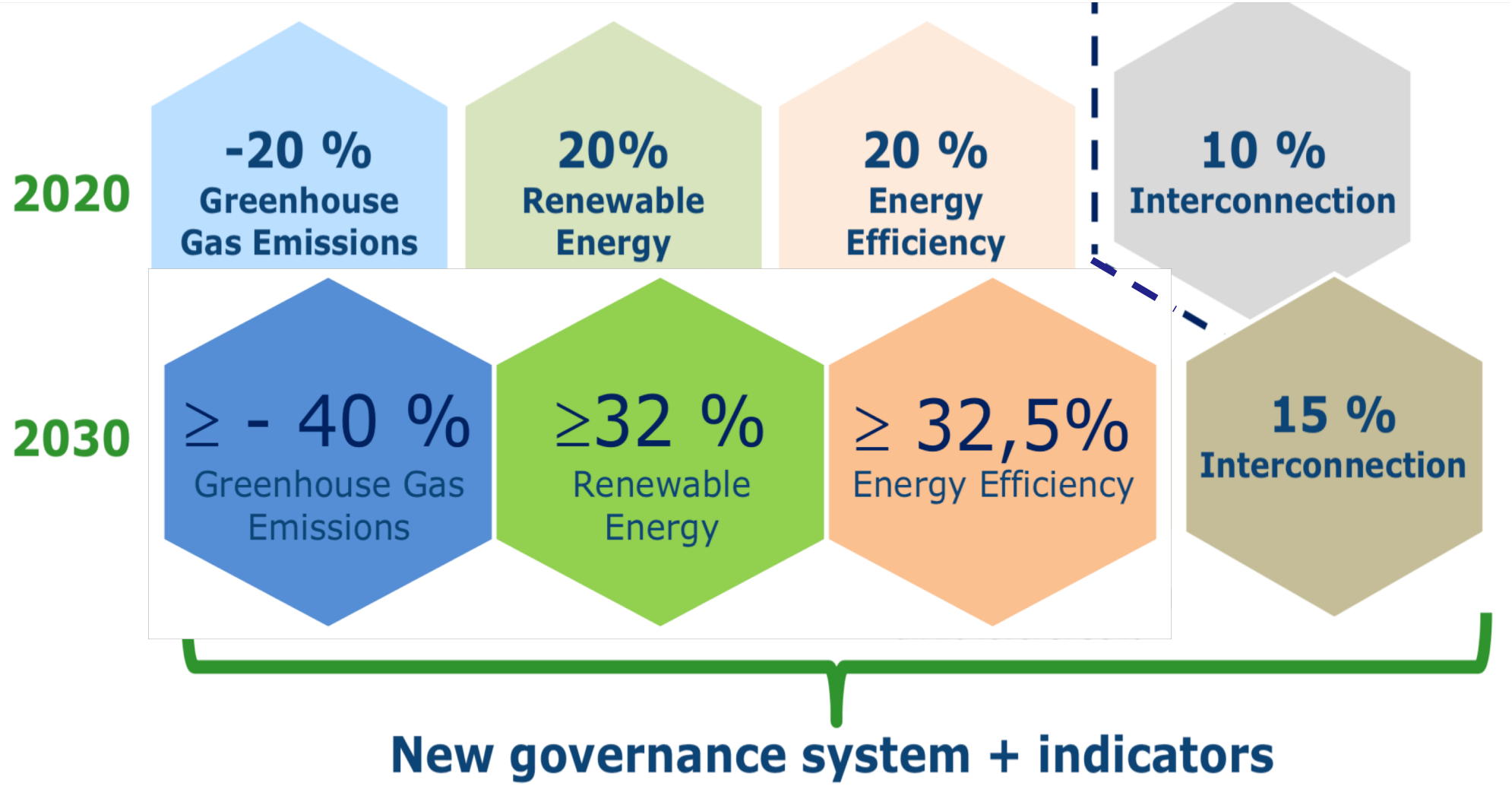
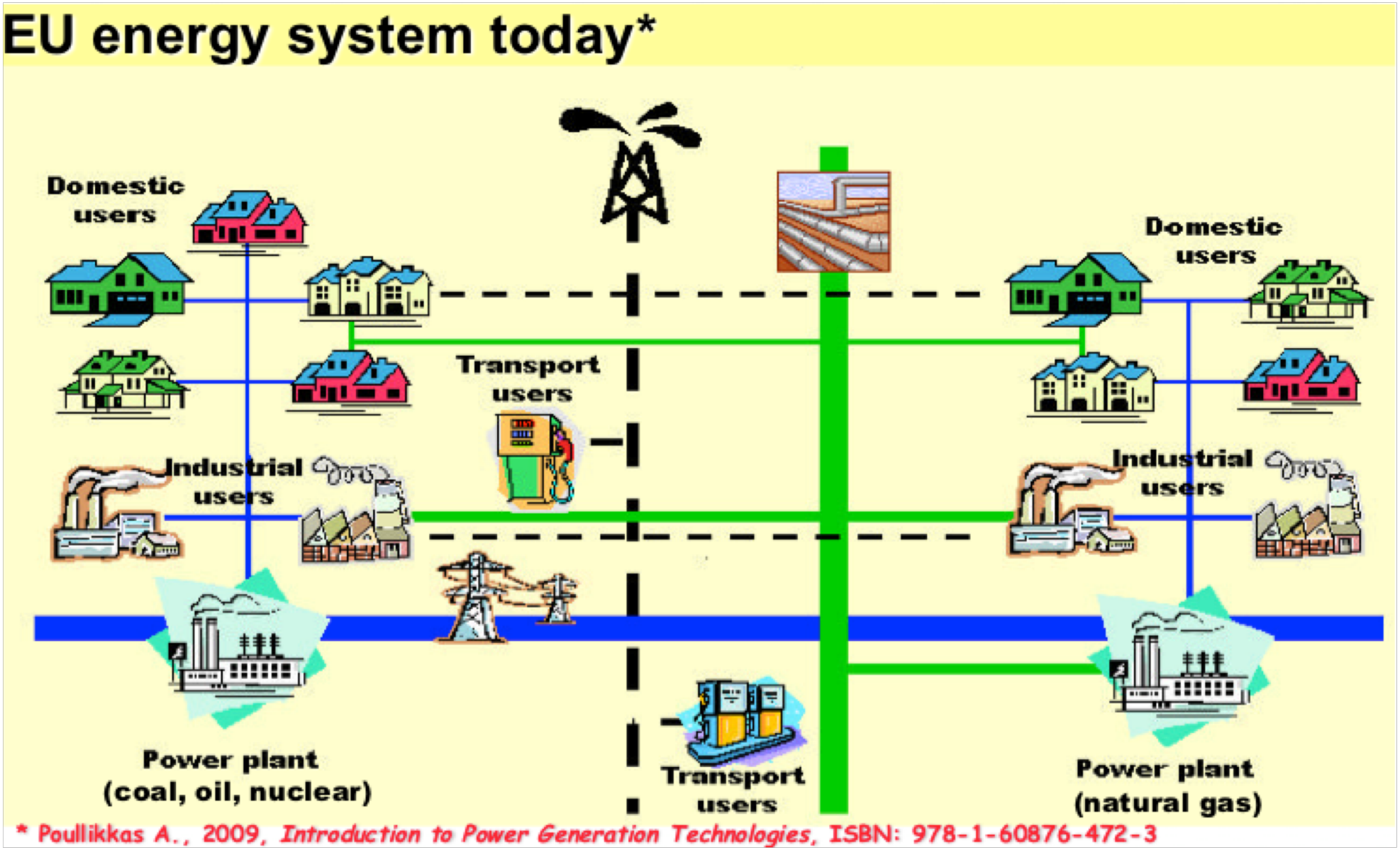


2050 -80% Greenhouse Gas Emissions

Current energy system



Future energy systems (optimistic scenario)

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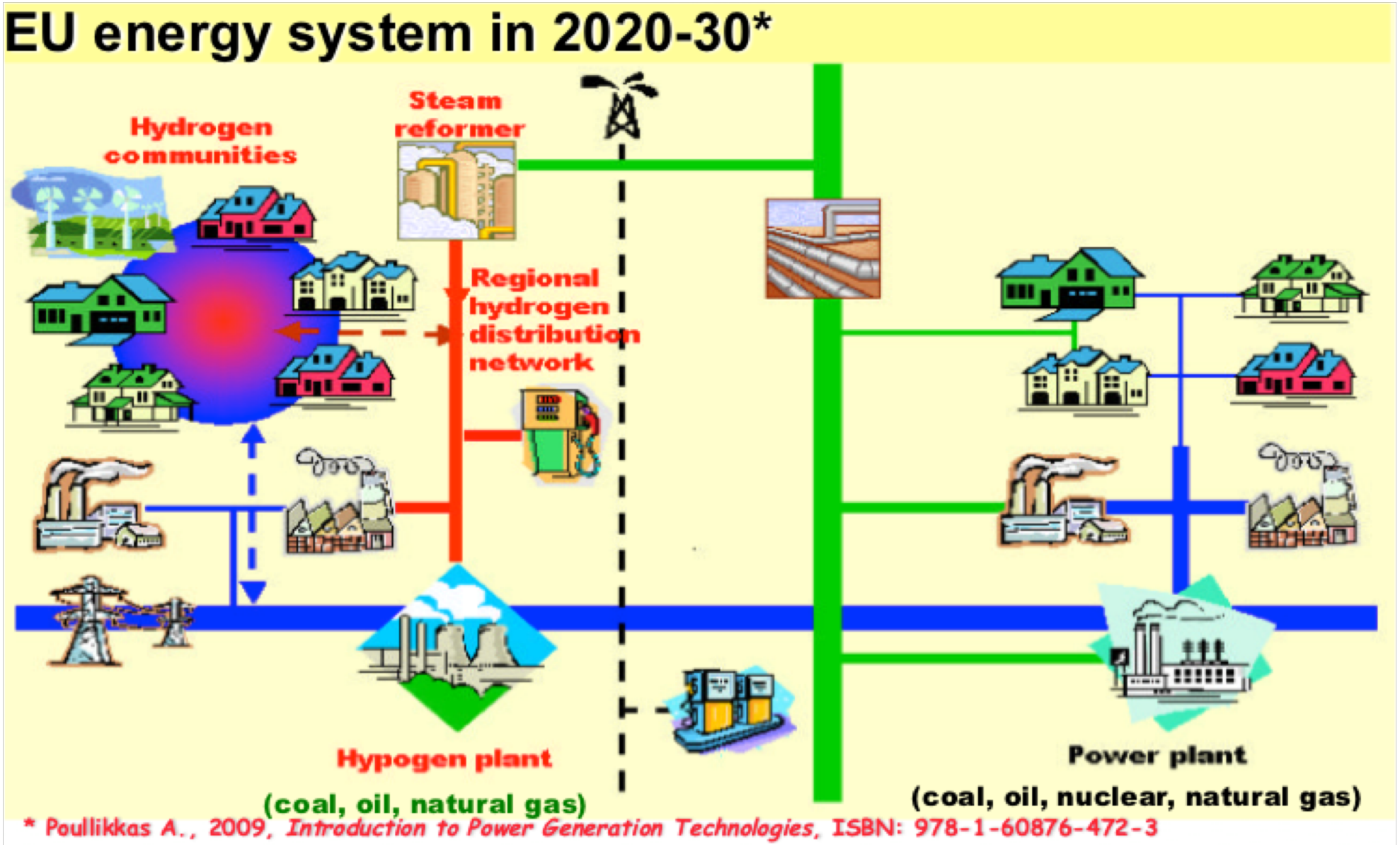

Future energy systems (optimistic scenario)

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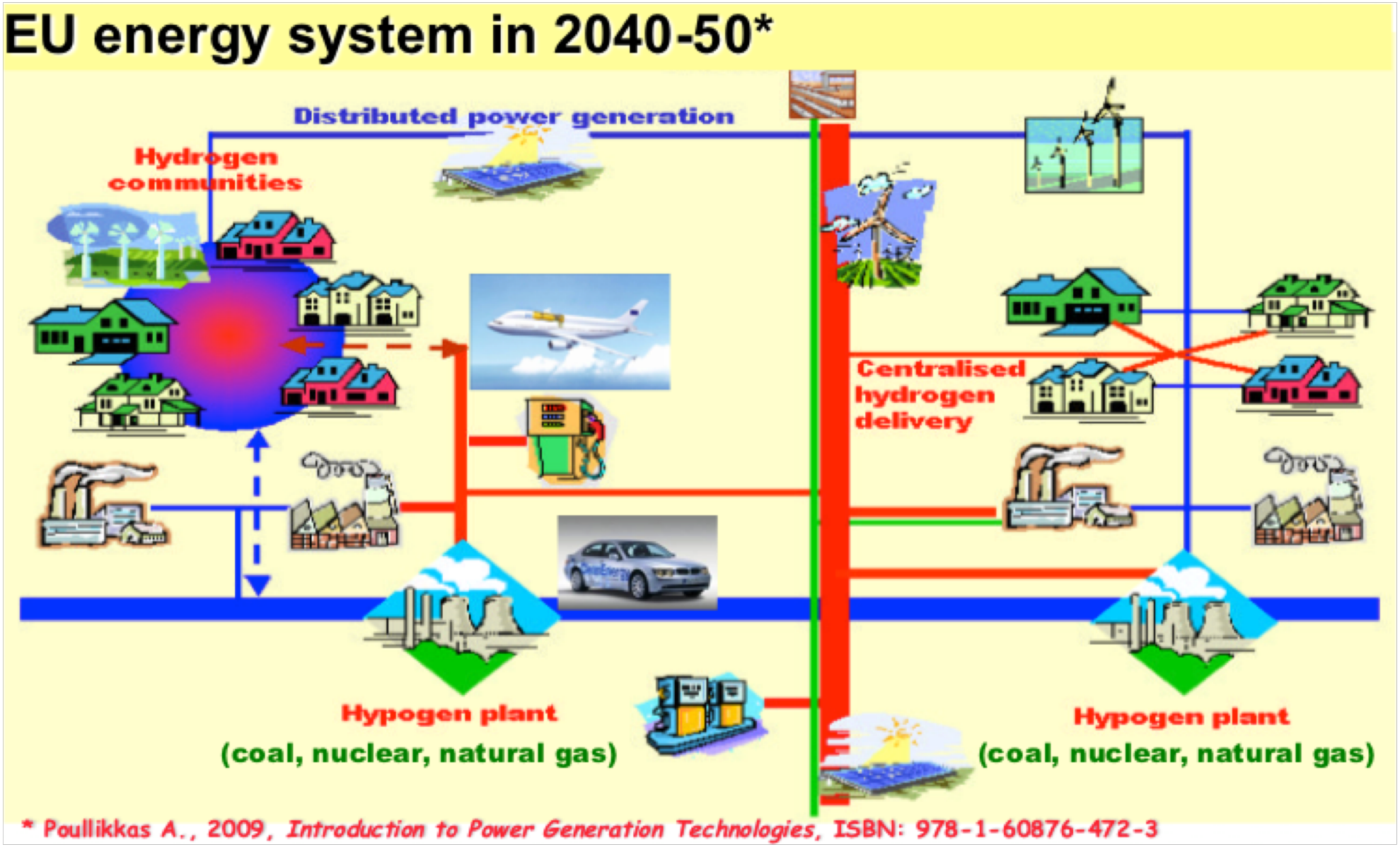
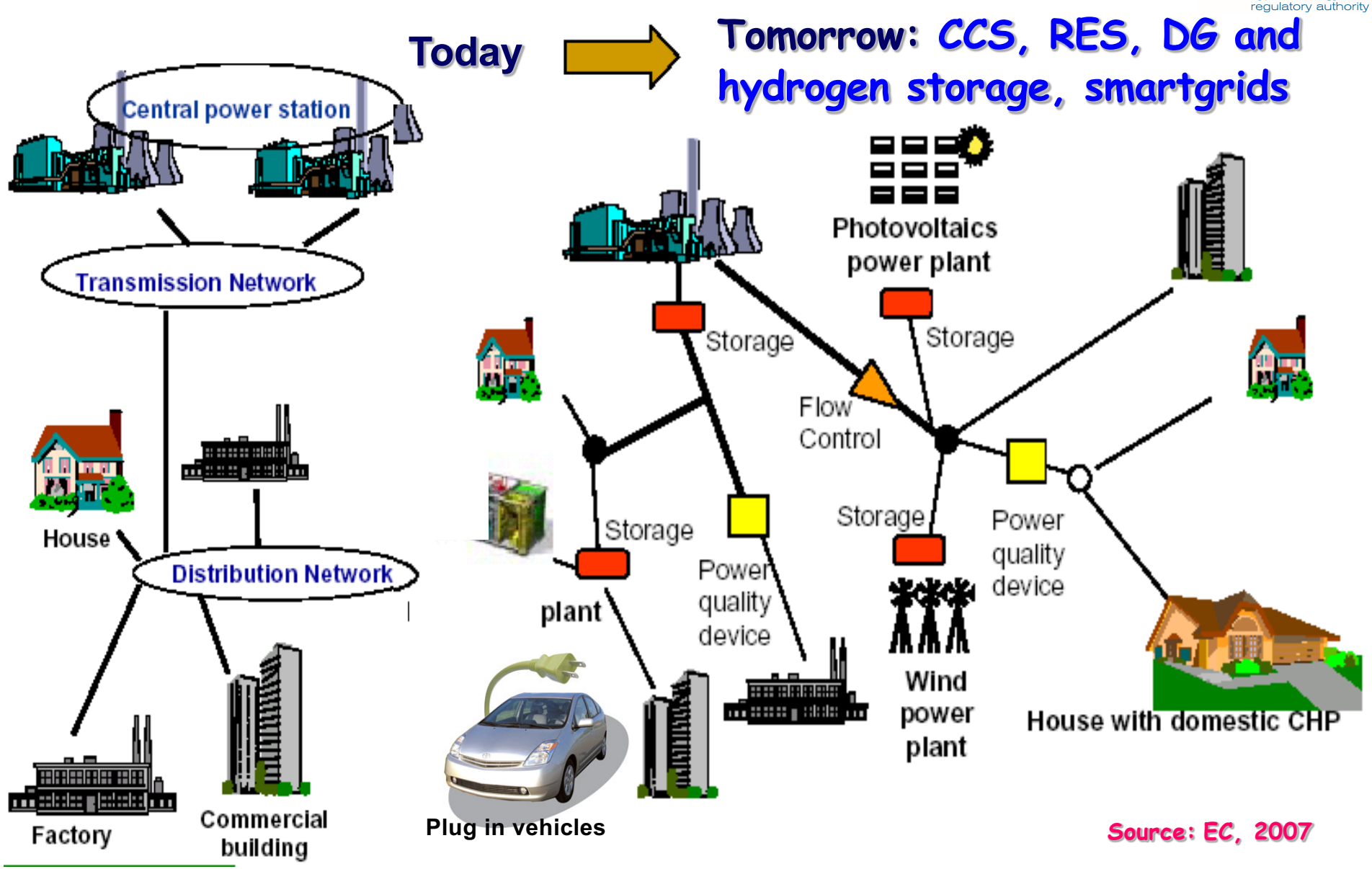


Future power systems



End goal – the smart future

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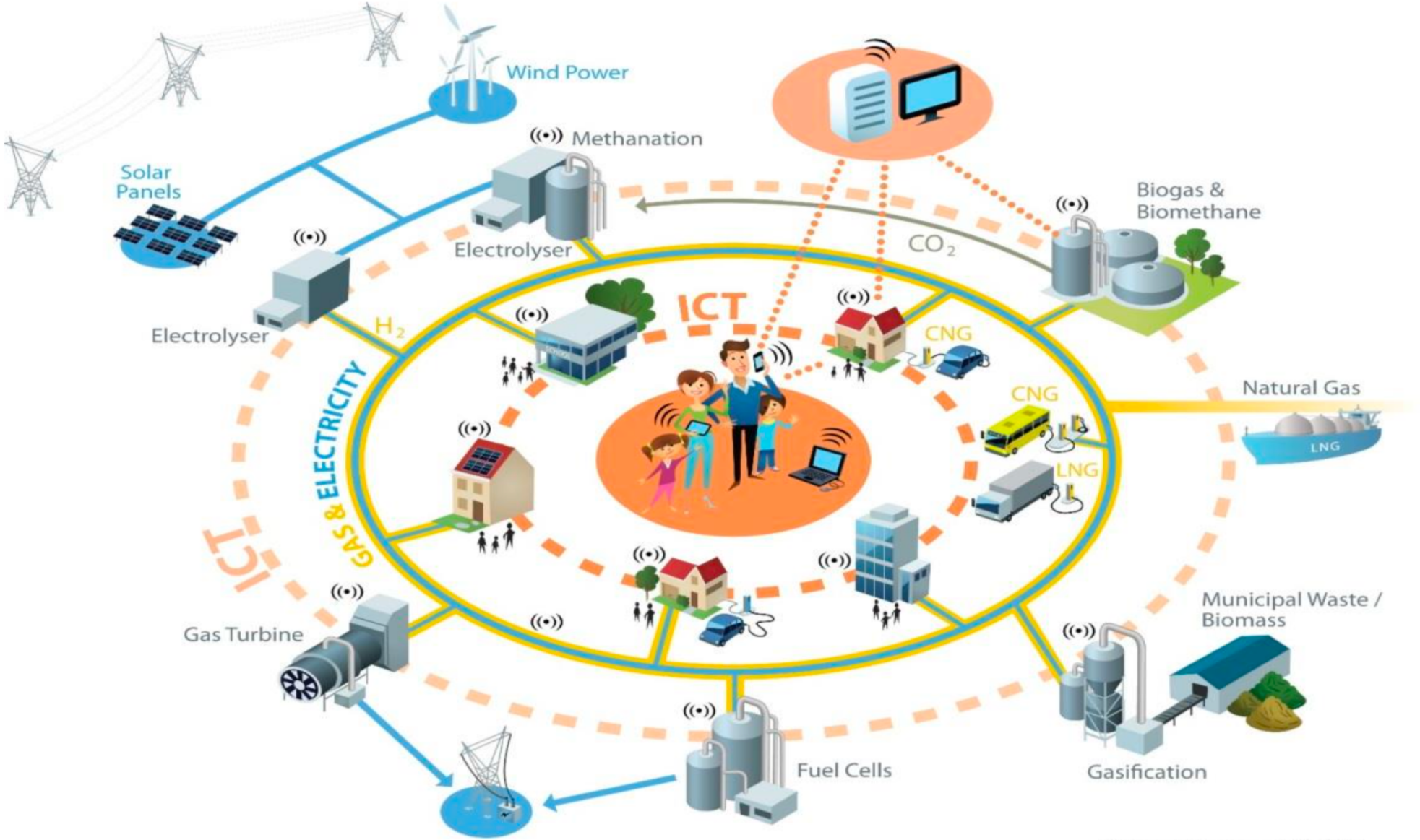

The Super Smart Grid after 2050*
(may allow for 100% RES)

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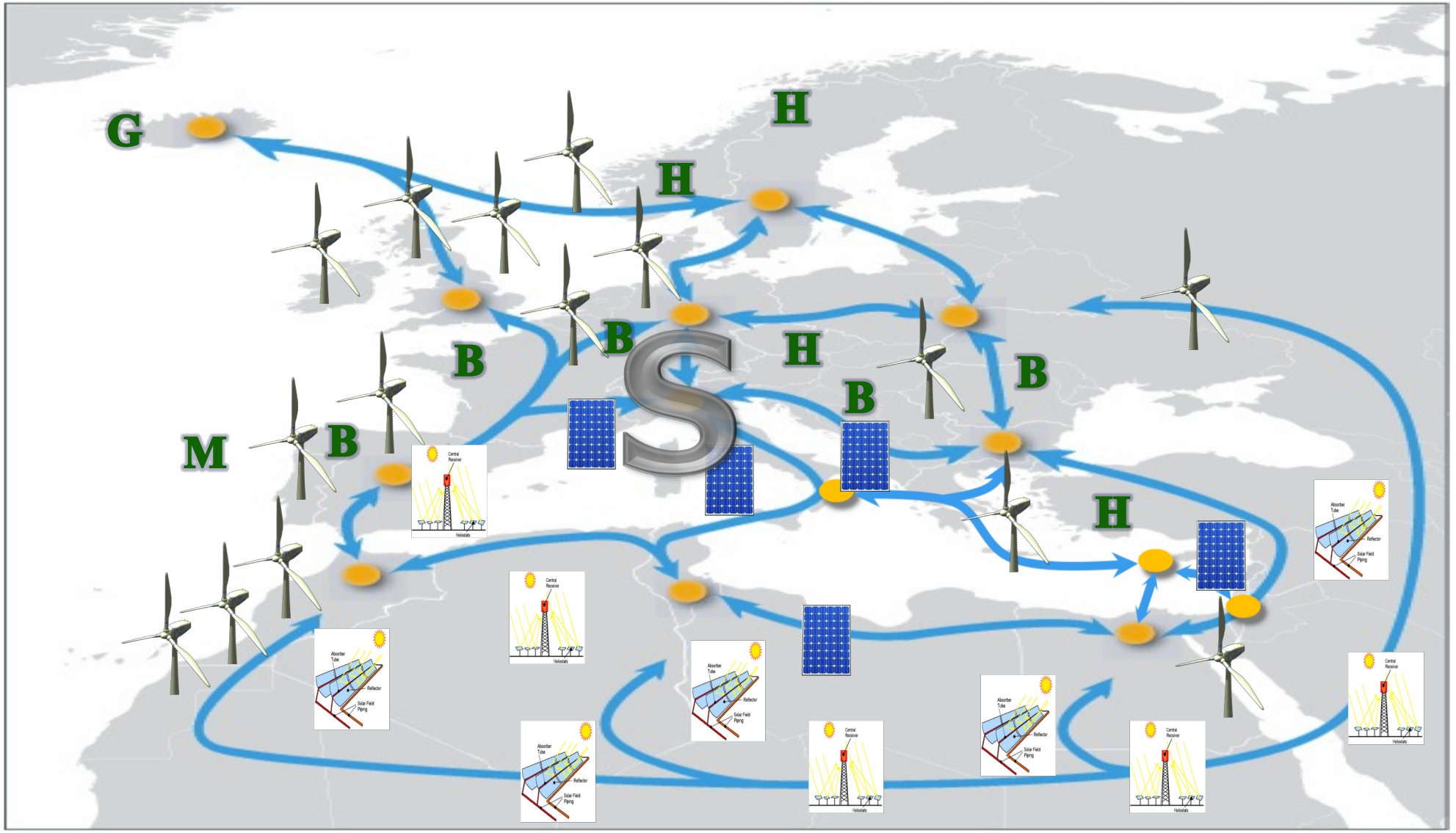
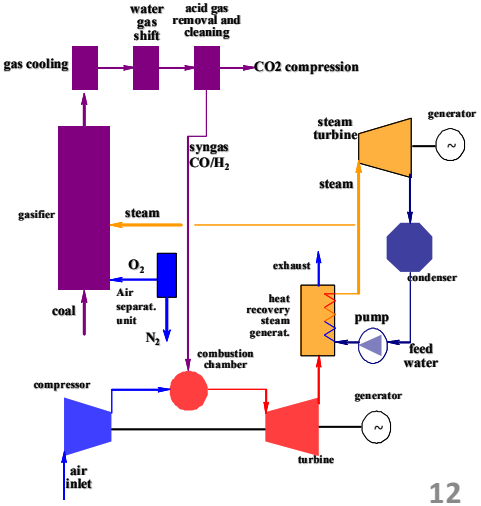


* Poullikkas A., 2013, *Sustainable Energy Development for Cyprus*, ISBN: 978-9963-7355-3-2

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



Need to develop advanced simulation tools, new sustainable technologies and infrastructure !!

Challenges in electricity markets

RES integration

EU electricity market target model

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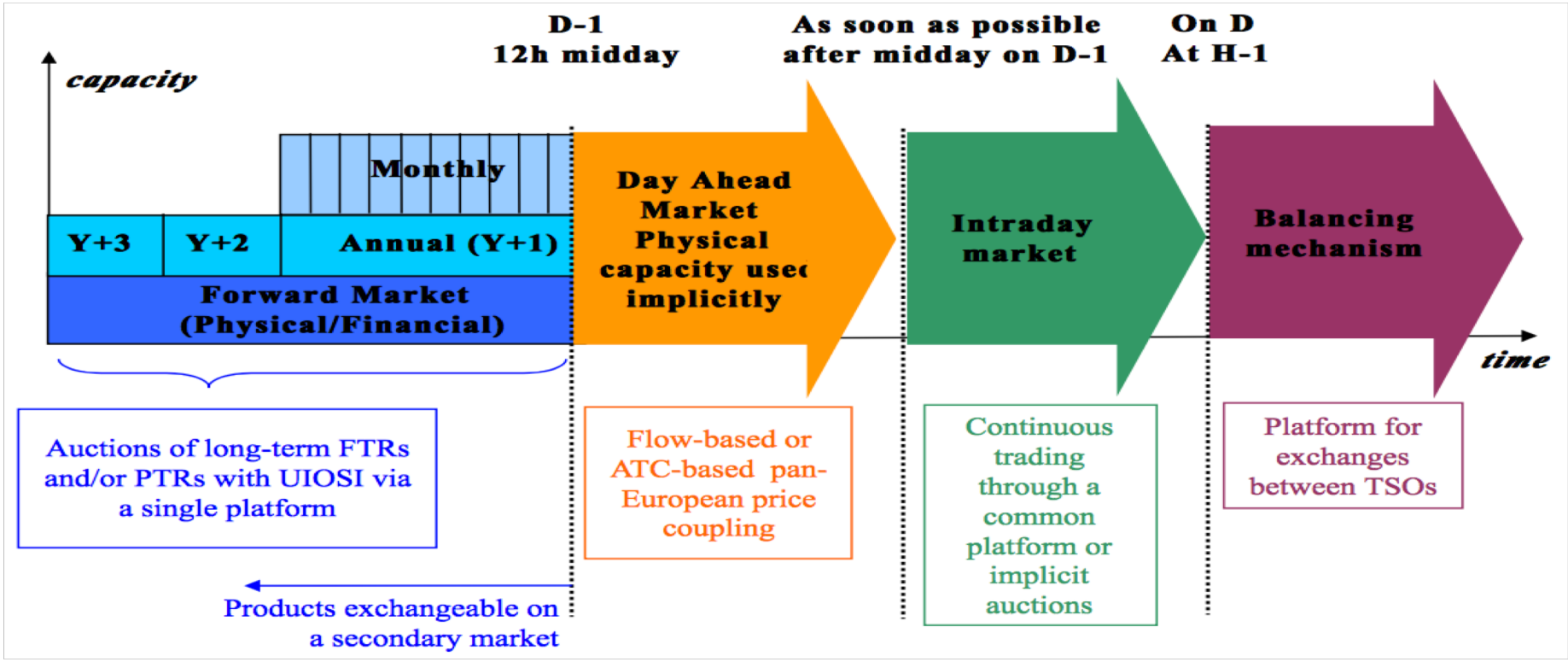


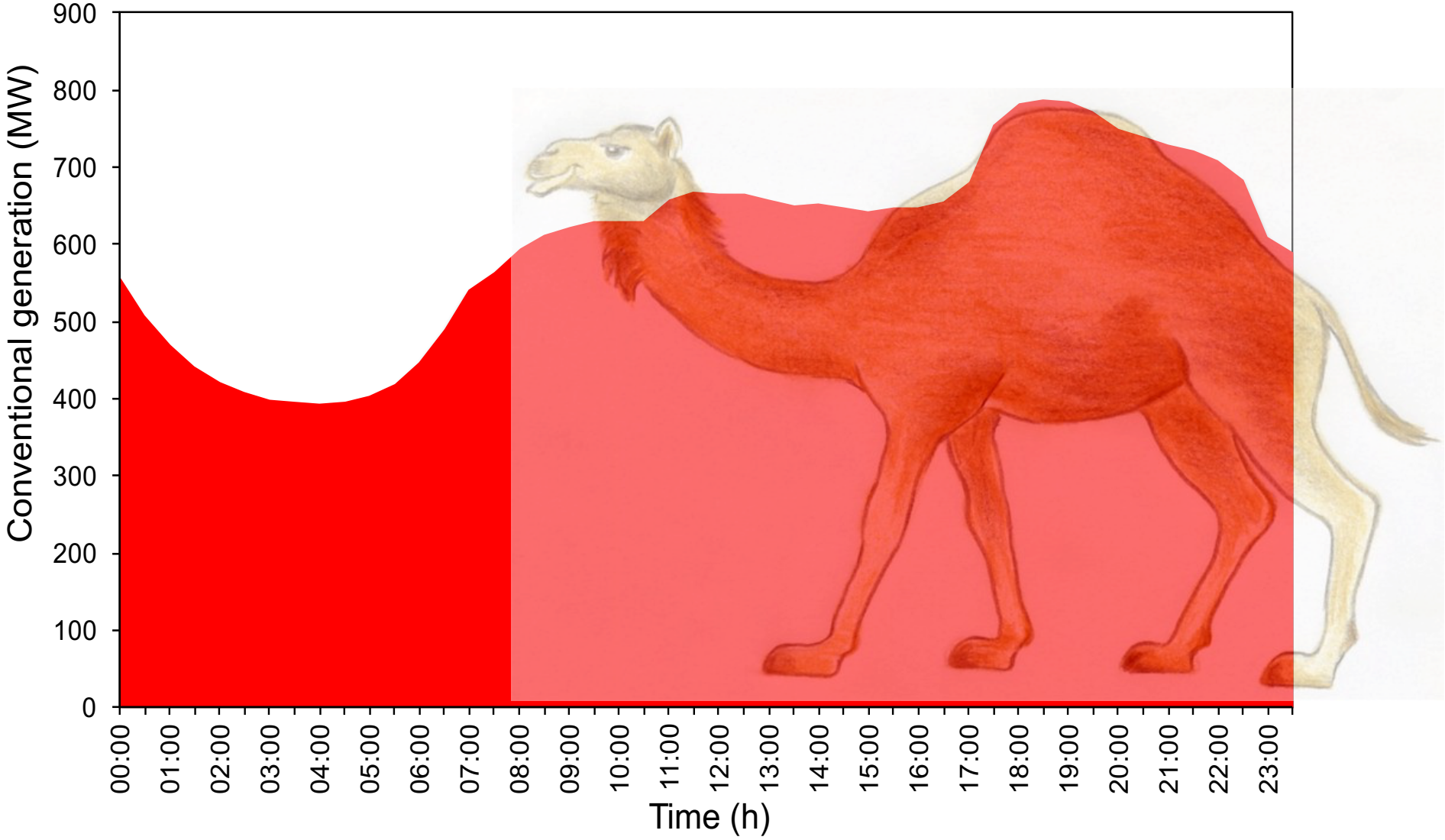
Integration of RES: LCOE *vs* Reliability

Power system reliability*

- **adequacy**, PS ability to satisfy customers needs both in power and electrical energy
- **security**, PS ability to remain in operation after sudden disturbances

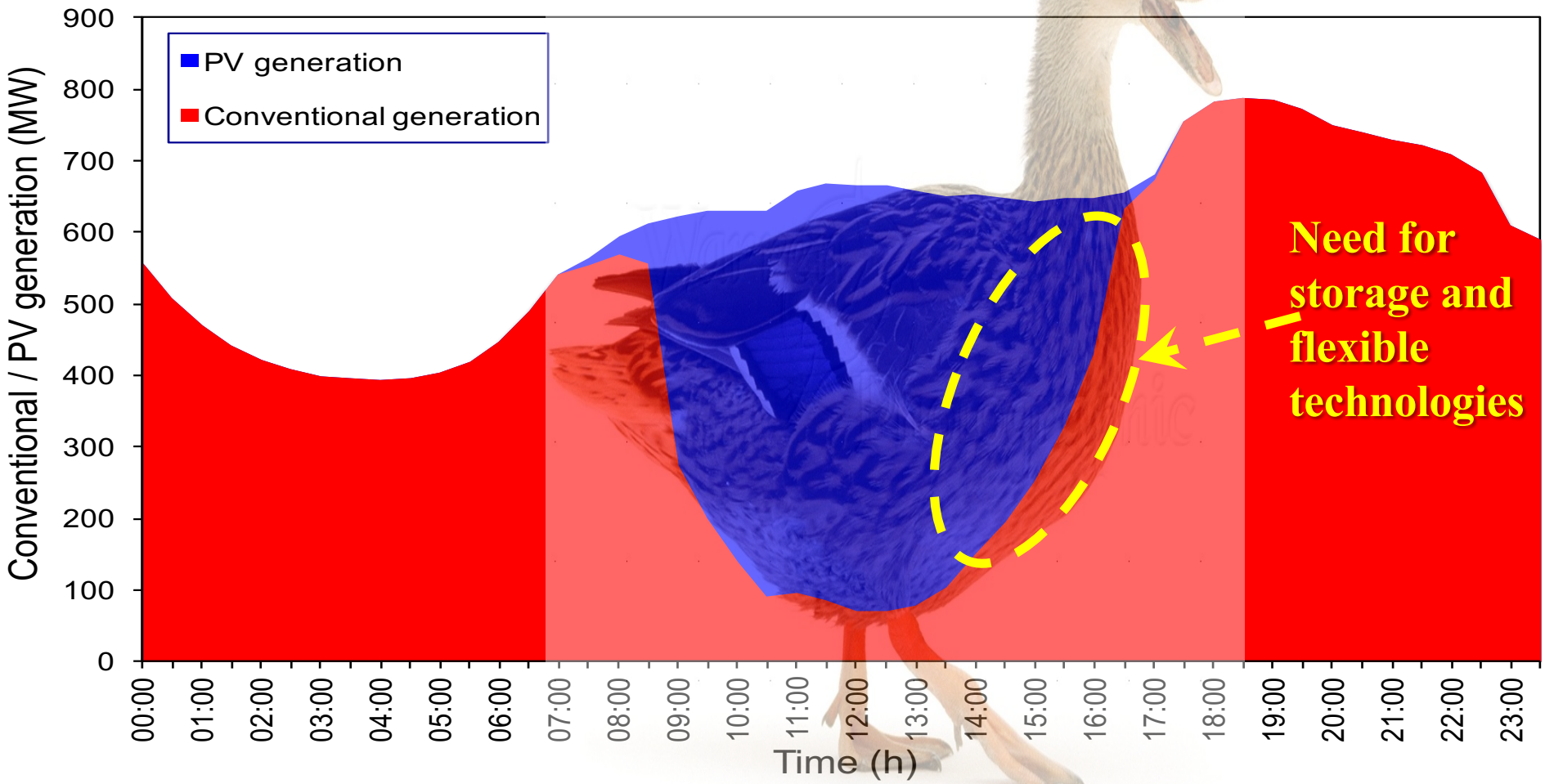
* Poullikkas A., 2016, *Fundamentals of Energy Regulation*, ISBN: 978-9963-7355-8-7

Daily load curve (the 'camel curve')*



* Poullikkas A., 2016, "From the 'camel curve' to the 'duck curve' on electric systems with increasing solar power", *Accountancy*

Effect of PV generation on load curve (the 'duck curve')*

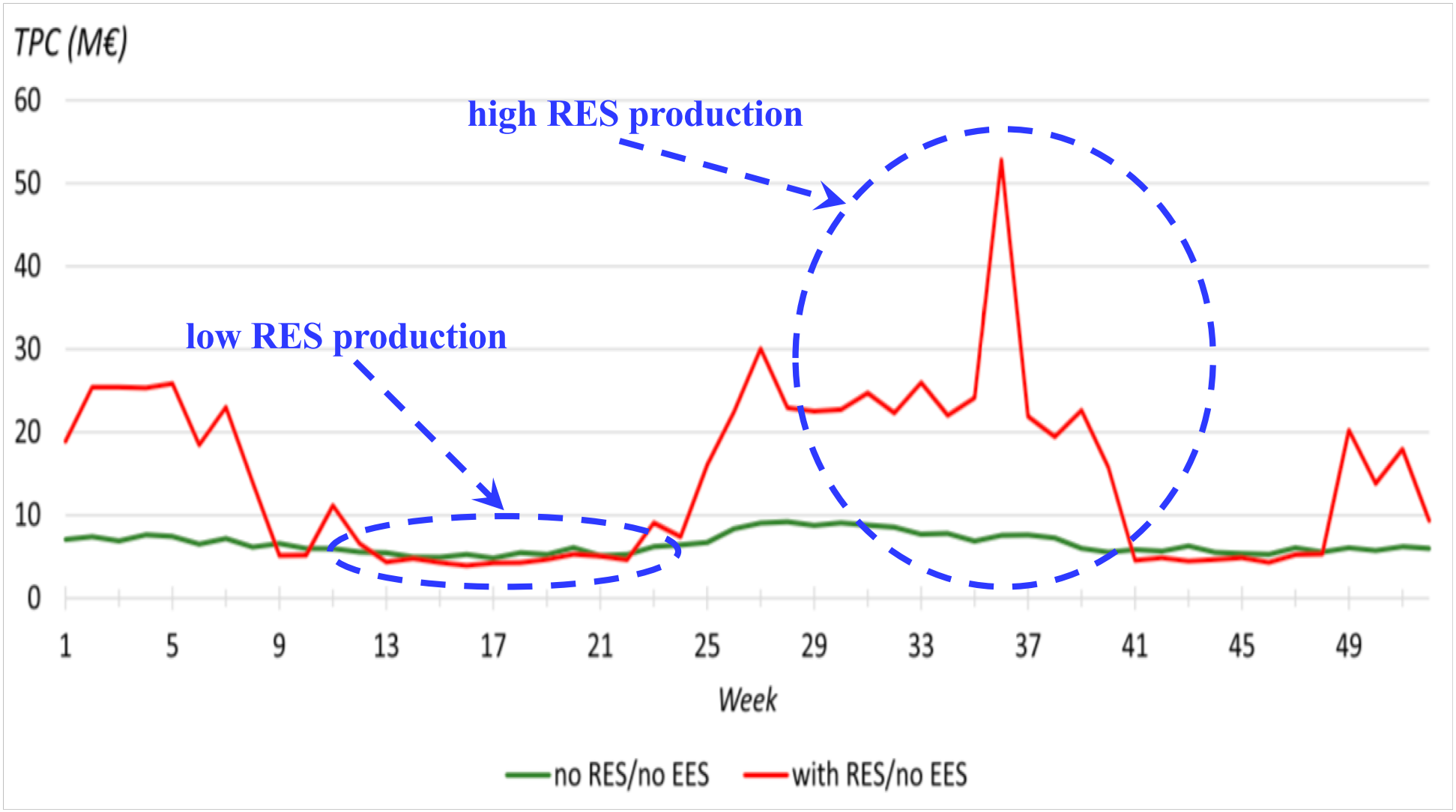


* Poullikkas A., 2016, "From the 'camel curve' to the 'duck curve' on electric systems with increasing solar power", *Accountancy*

The role of storage

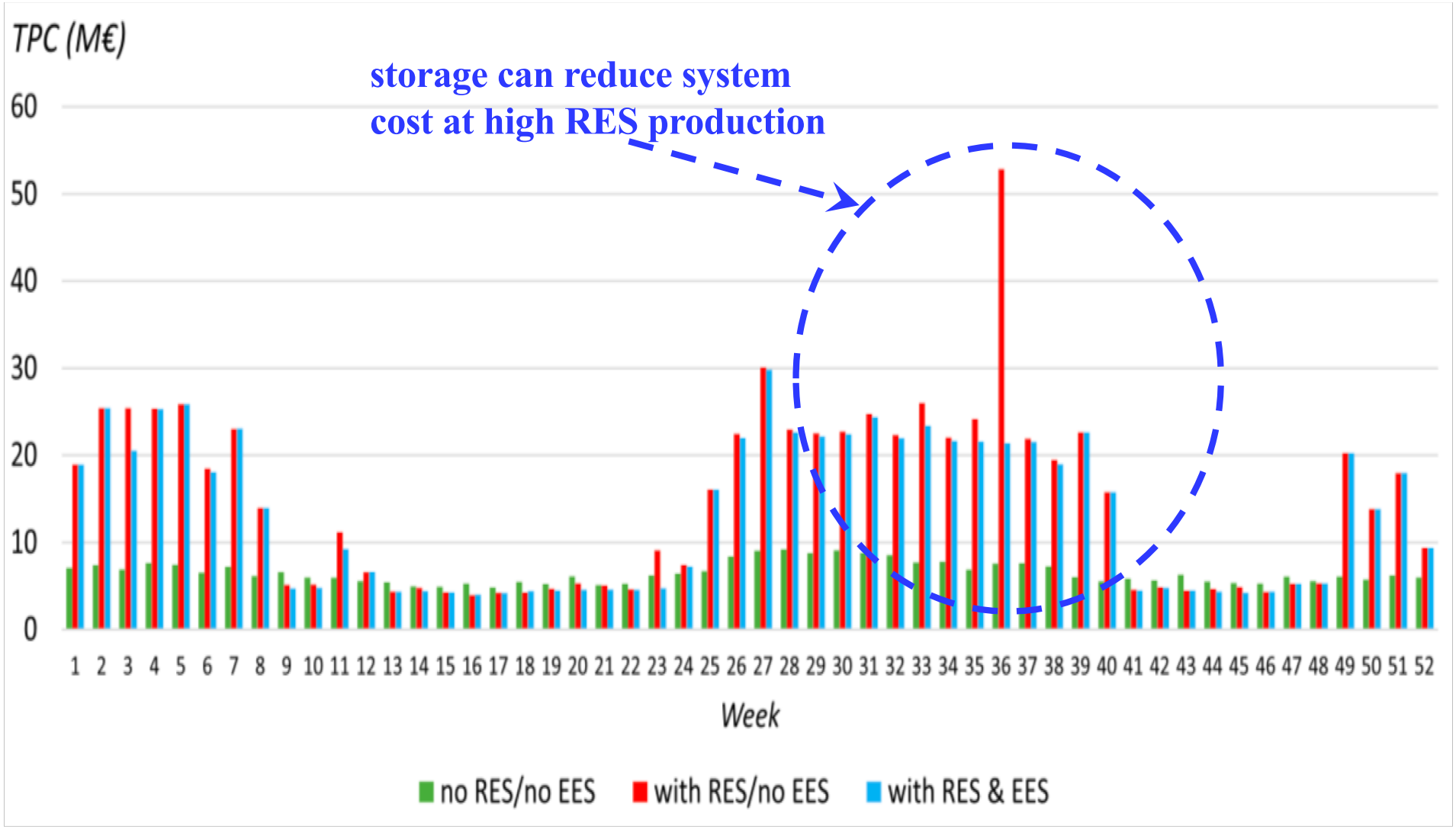
Cost of reserves

Cost of reserves with RES production*



* Nicolaidis P., Chatzis S., Poullikkas A., 2018, "Renewable energy integration through optimal unit commitment and electricity storage in weak power networks", *International Journal of Sustainable Energy*

Integration of storage*



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