



Ενεργειακή μετάβαση: Ρυθμιστικές προκλήσεις για τις αγορές ηλεκτρισμού και φυσικού αερίου

Δρ. Ανδρέας Πουλλικκός

M.Phil, Ph.D, D.Tech, FIET

Πρόεδρος Ρυθμιστικής Αρχής Ενέργειας Κύπρου

apoullikkas@cera.org.cy

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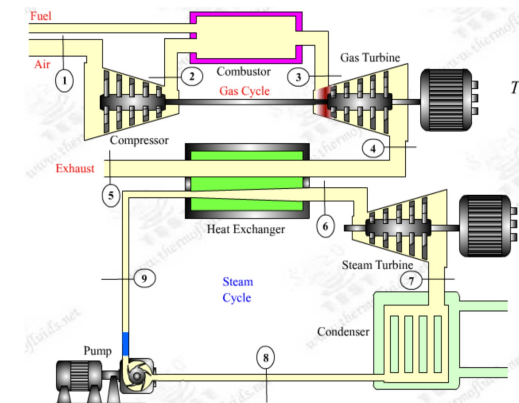
- **Cyprus current electricity and NG systems** – system characteristics
- **Energy transition for island systems** – solutions for isolated systems
- **Energy transition regulatory challenges** – towards sustainable energy

Cyprus current electricity and NG systems

System characteristics

Existing power generation system

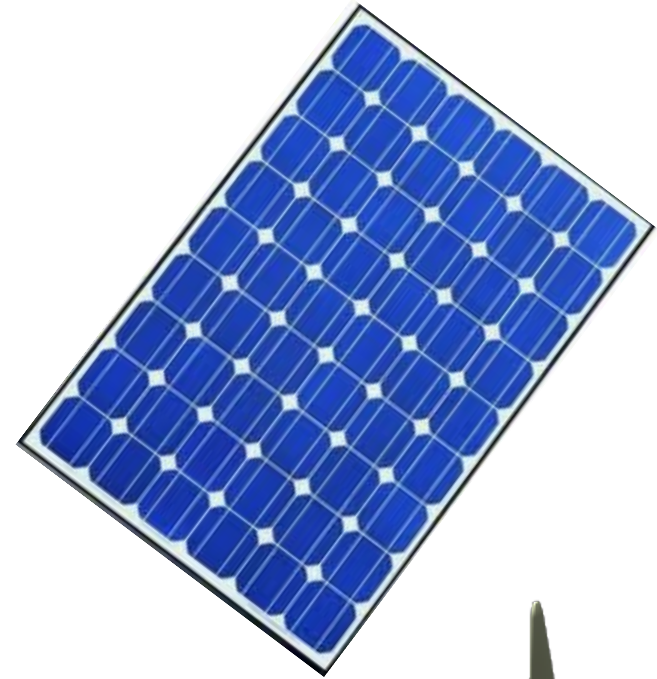
- **Steam turbine units (HFO)**
 - Dhekelia power station 6x60MWe
 - Vasilikos power station 3x130MWe
- **Internal combustion engines (HFO)**
 - Dhekelia power station 6x17.5MWe
- **Combined cycles (Diesel)**
 - Vasilikos power station 2x220MWe
- **Gas turbine units (Diesel)**
 - Moni power station 4x37,5MWe
 - Vasilikos power station 1x38MWe



Existing power generation system (cont.)

- **Renewables**

- **PVs: 380MWe**
- **Wind: 157MWe**
- **Biomass: 13MWe**

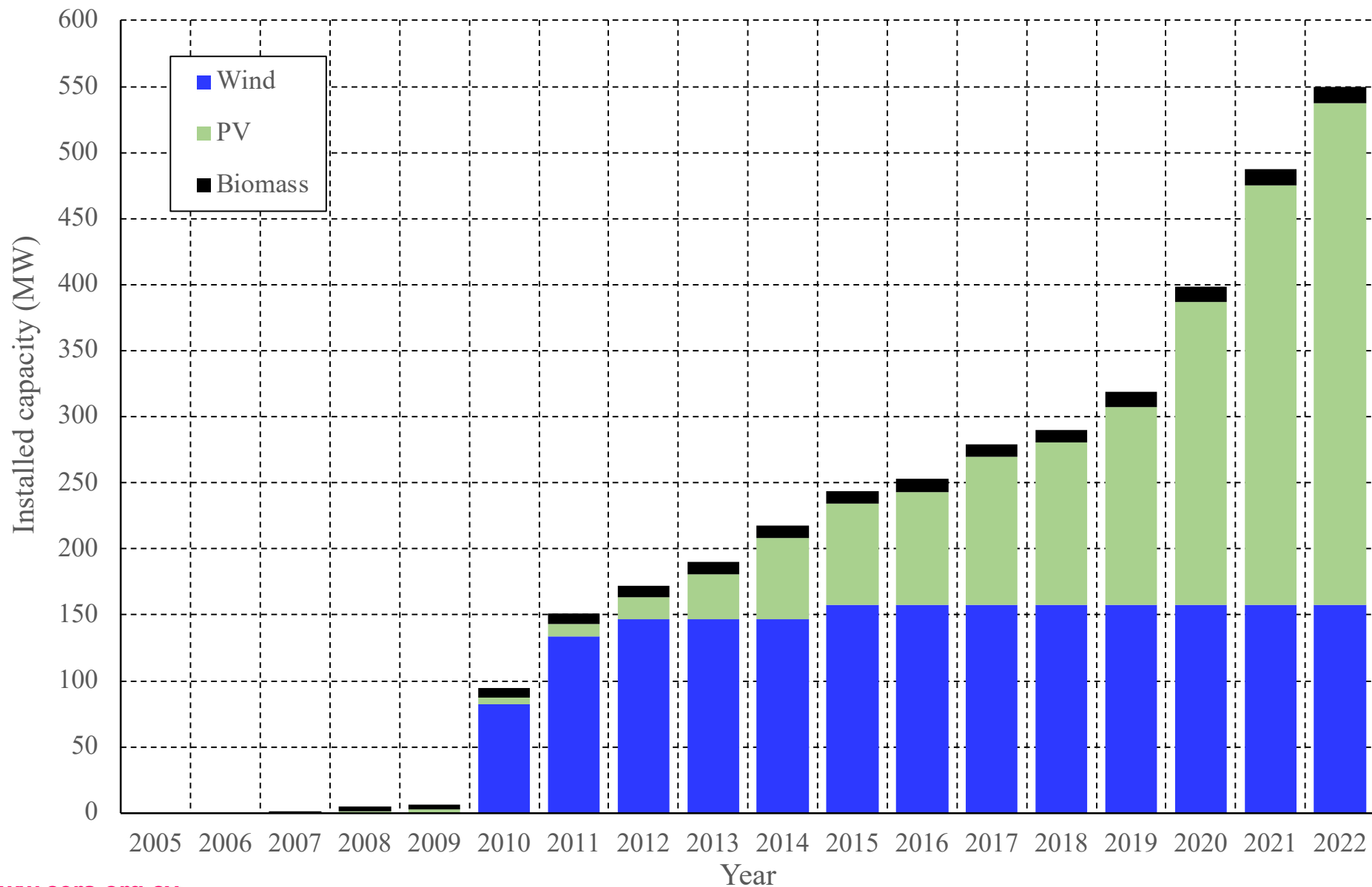


- **Total installed capacity:**

- **Conventional: 1483MWe**
- **Renewables: 550MWe**

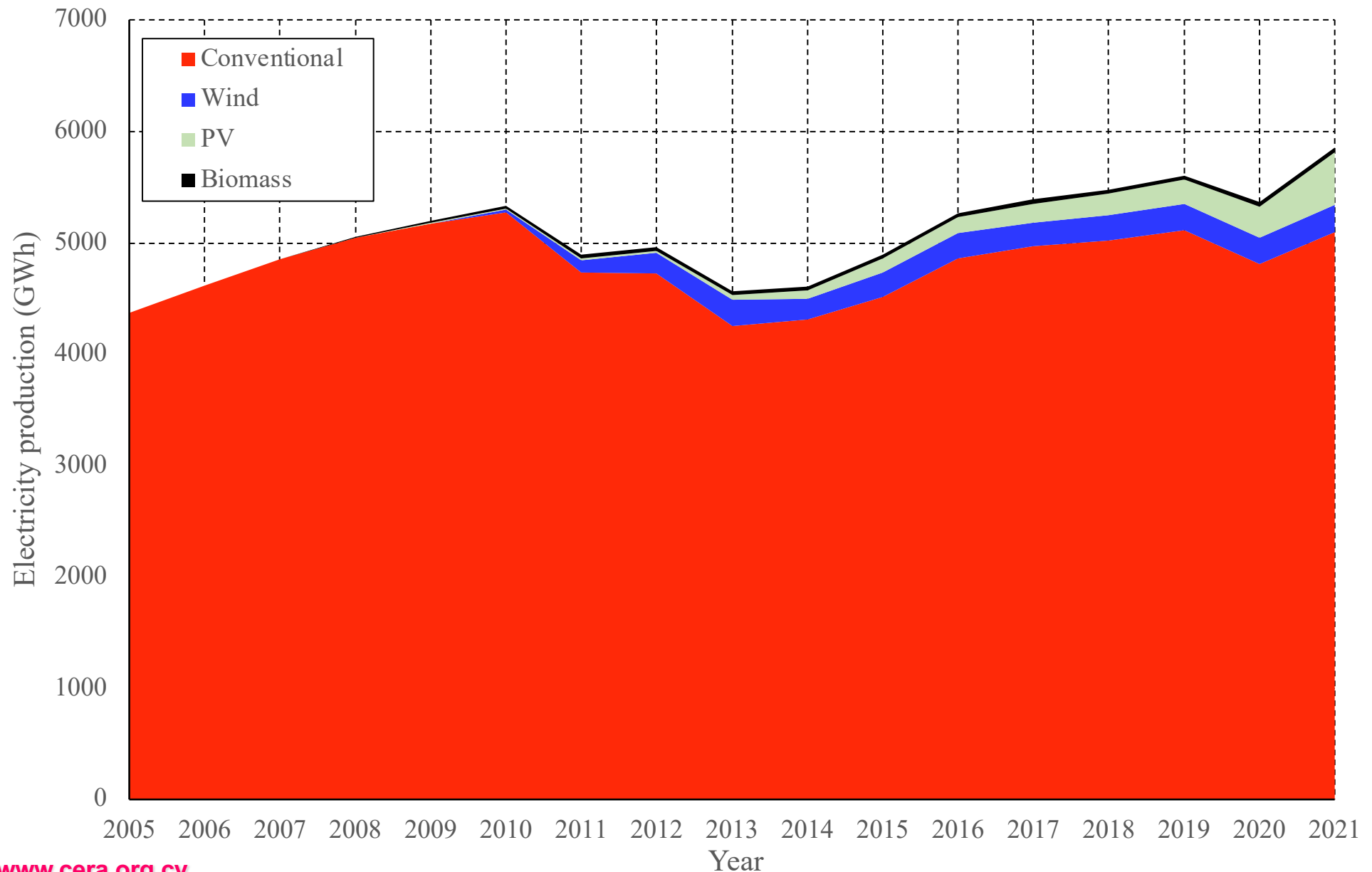


RES installed capacity*



* www.cera.org.cy

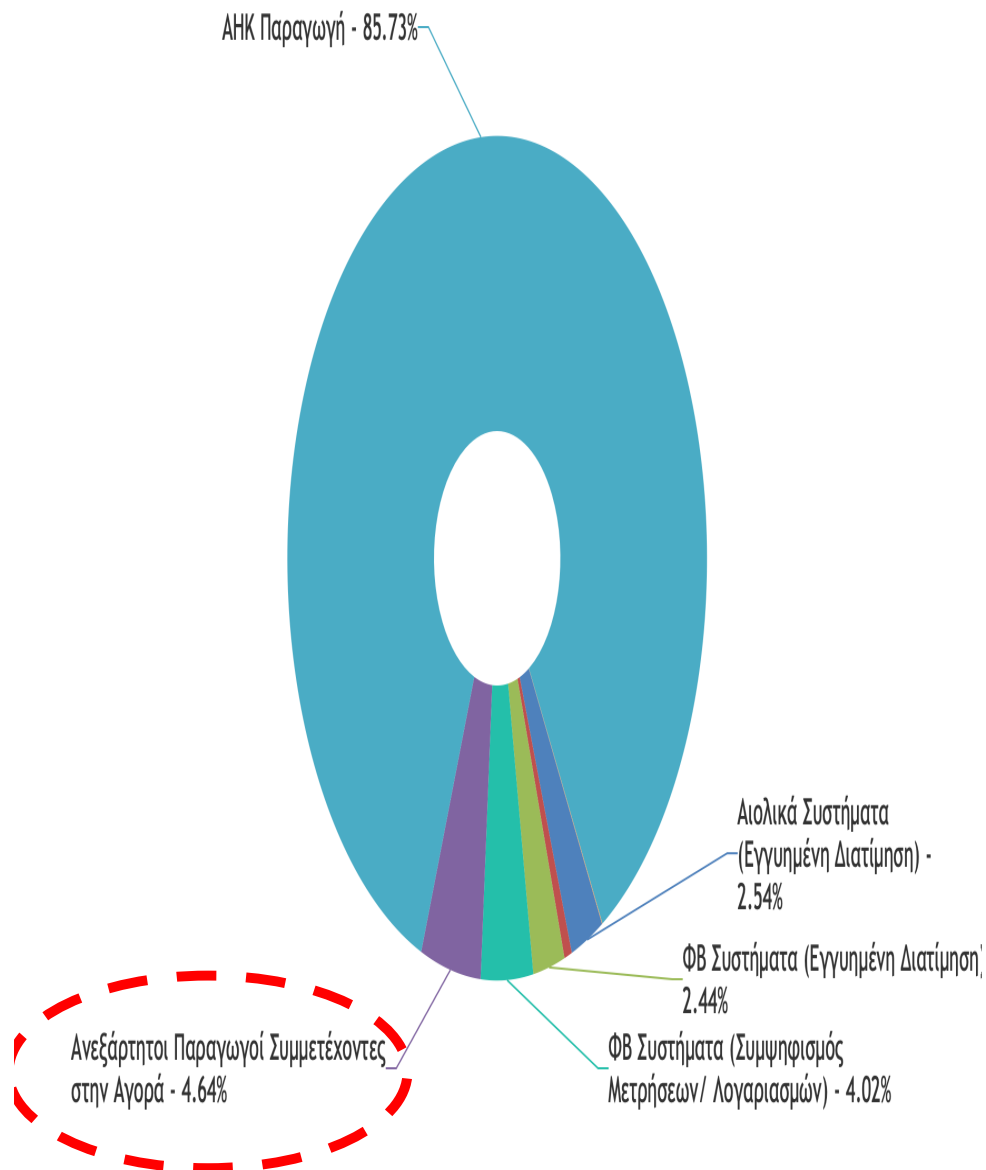
Total electricity production*



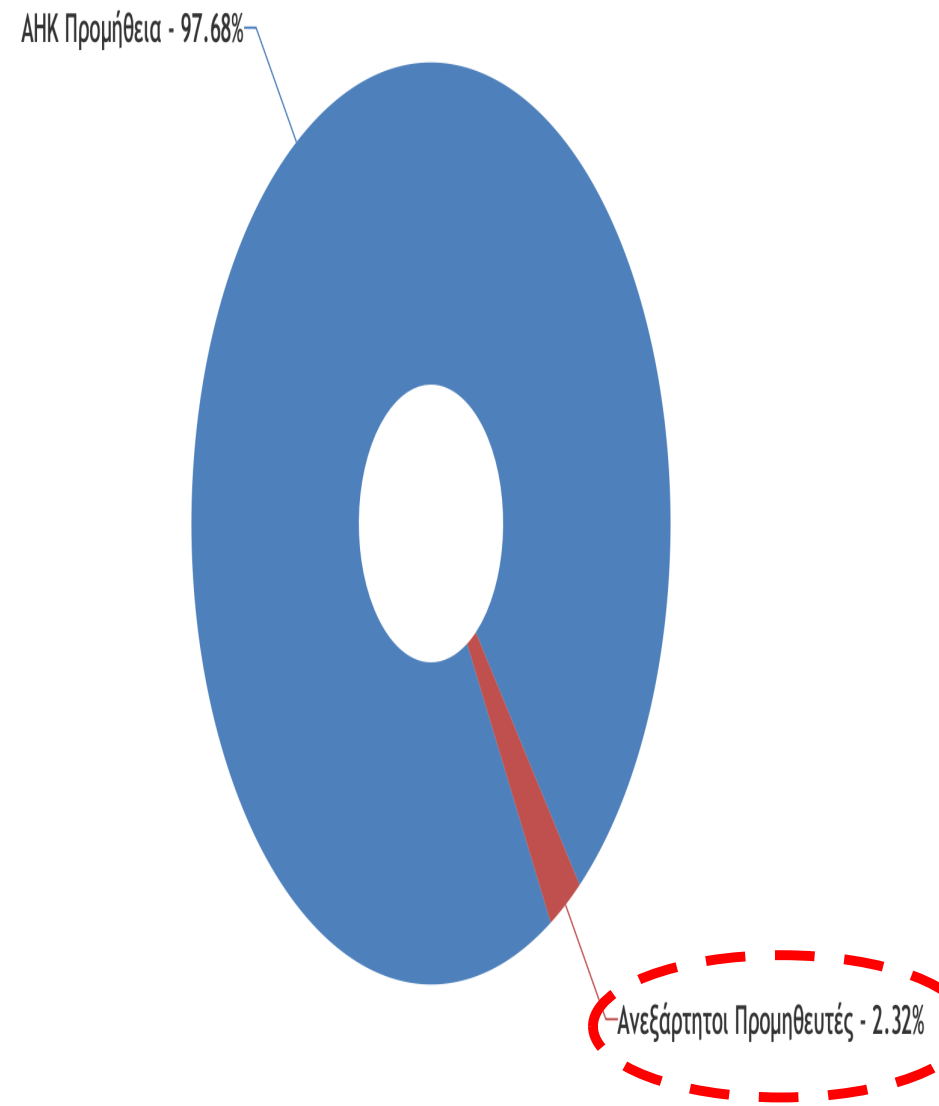
* www.cera.org.cy

Market share (Aug 2022)

Wholesale market

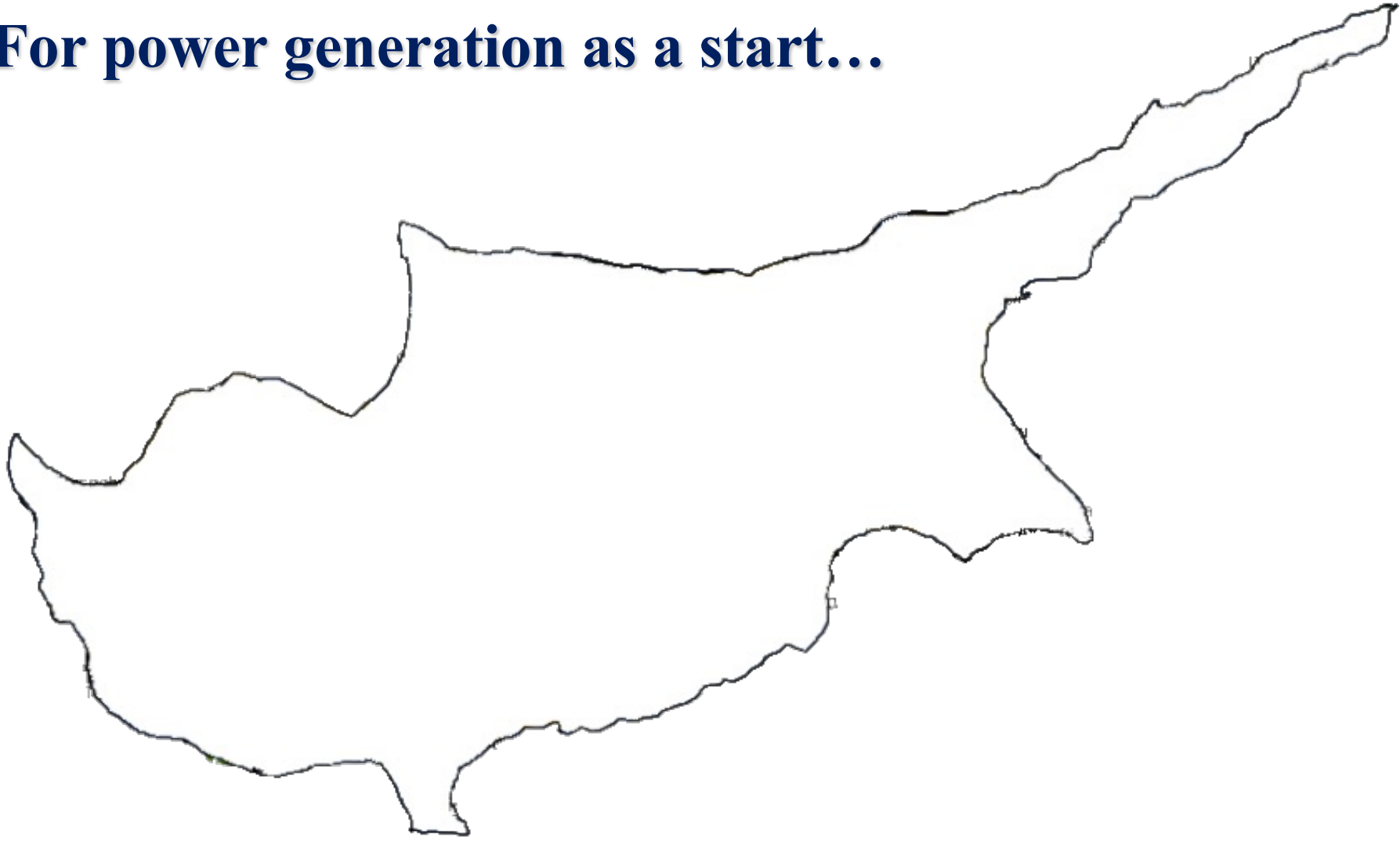


Retail market



Existing natural gas system

- **Under development !**
- **For power generation as a start...**



Energy transition for island systems

Solutions for isolated systems

Characteristics of isolated electricity systems*

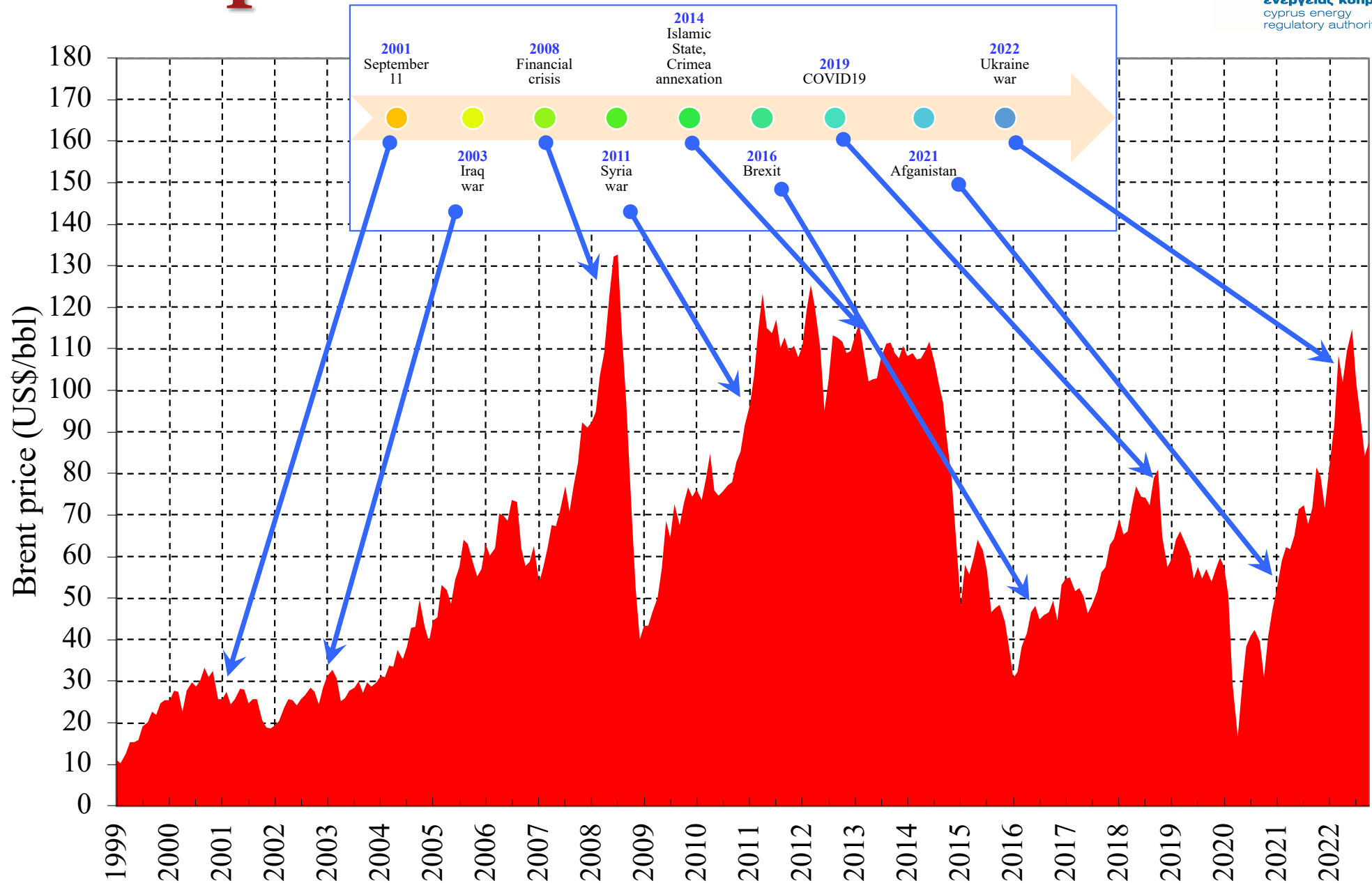


- **High fuel costs**
 - ~ use of oil derivatives
 - ~ high CO₂ emissions (additional cost)
- **Economies of scale cannot be adequately exploited**
 - ~ generation units cannot exceed a certain size since the loss of a unit would mean the loss of a high percentage of the entire system
- **Need to maintain high reserve capacity to ensure power system reliability**

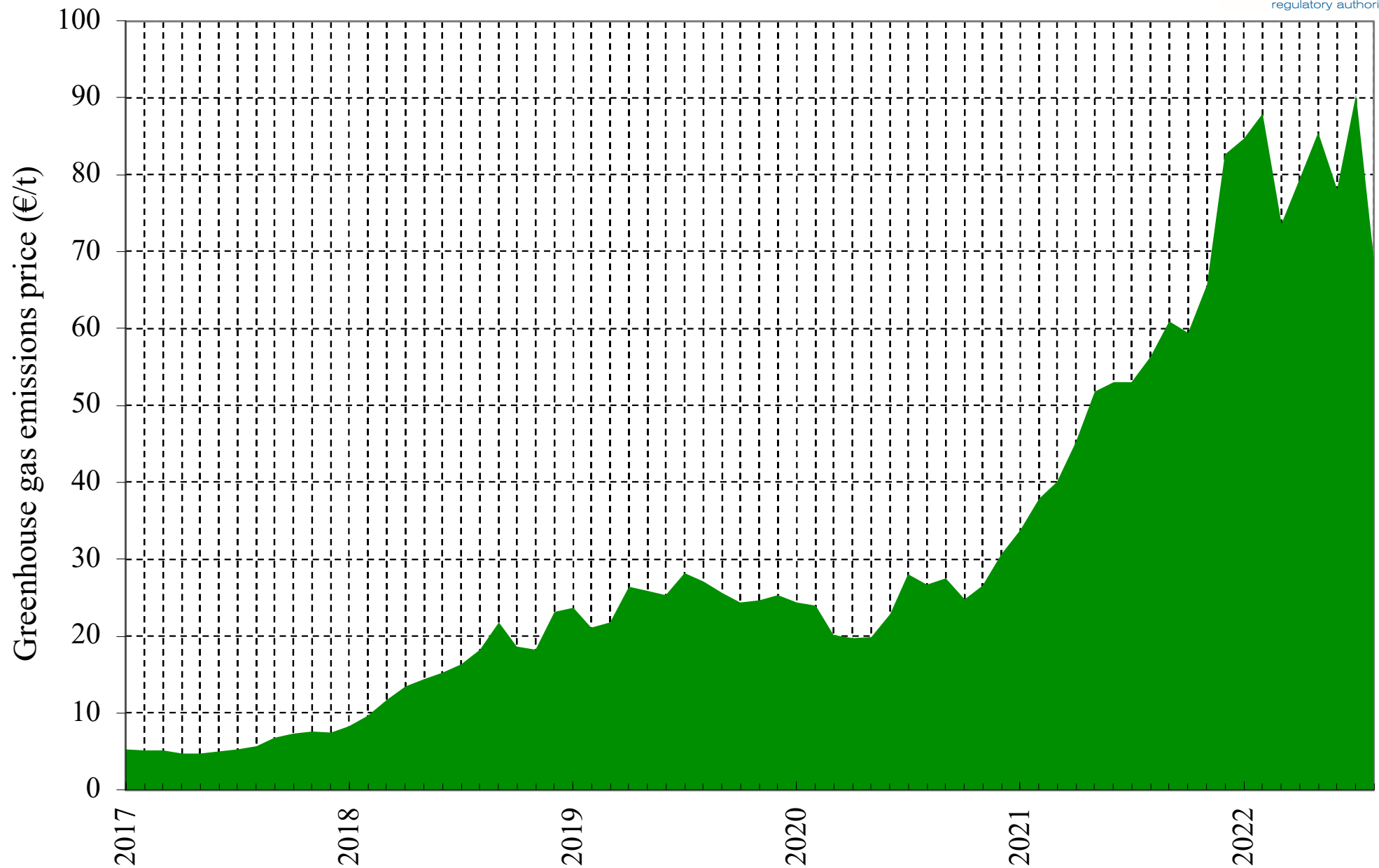
The smaller the electrical system size, the more the expenses will be

* Poullikkas A., 2015, *Sustainable Energy Policy for Cyprus*, ISBN: 978-9963-7355-6-3

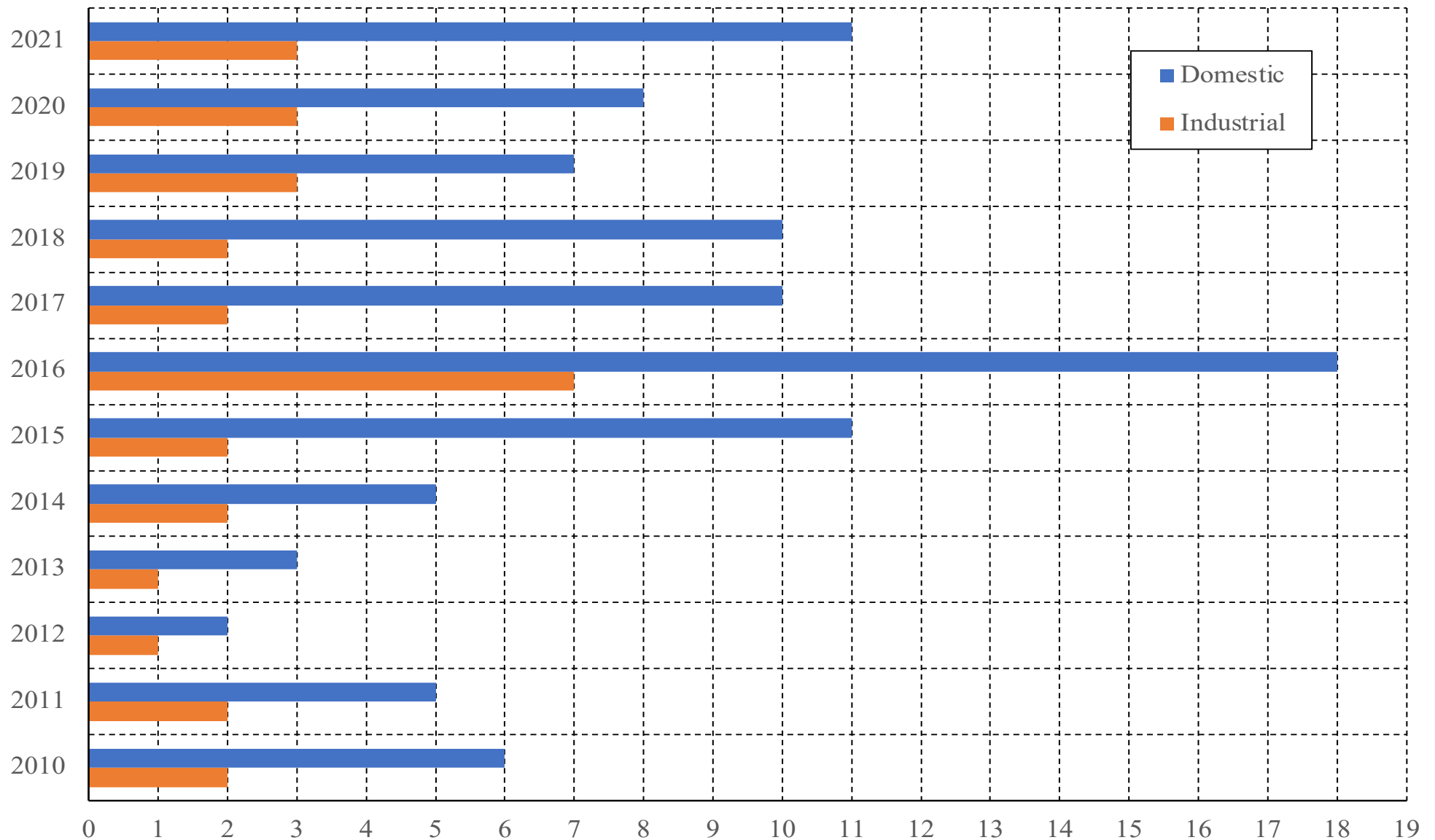
Brent price



Greenhouse gas emissions price

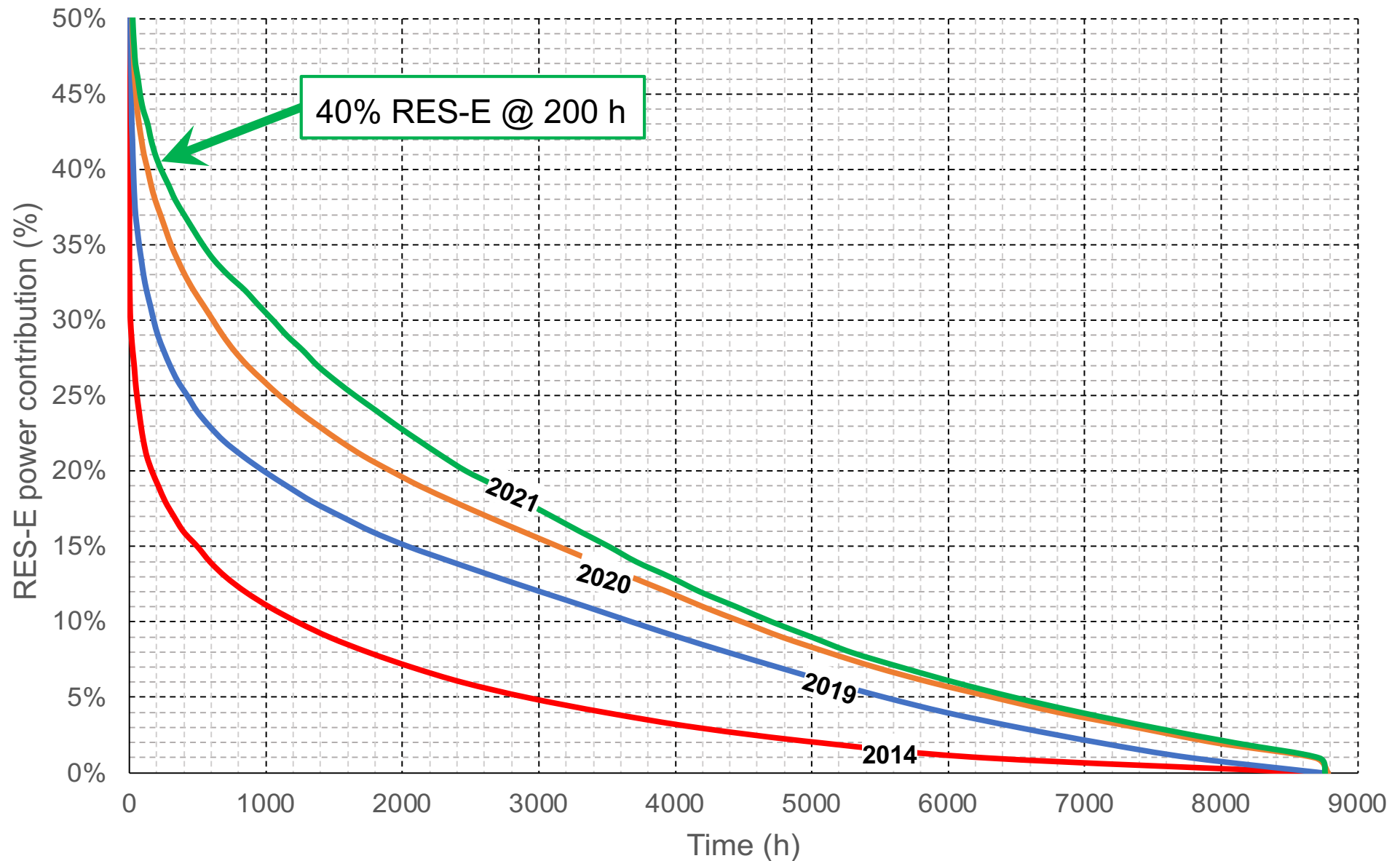


Electricity price - Position of Cyprus in EU*

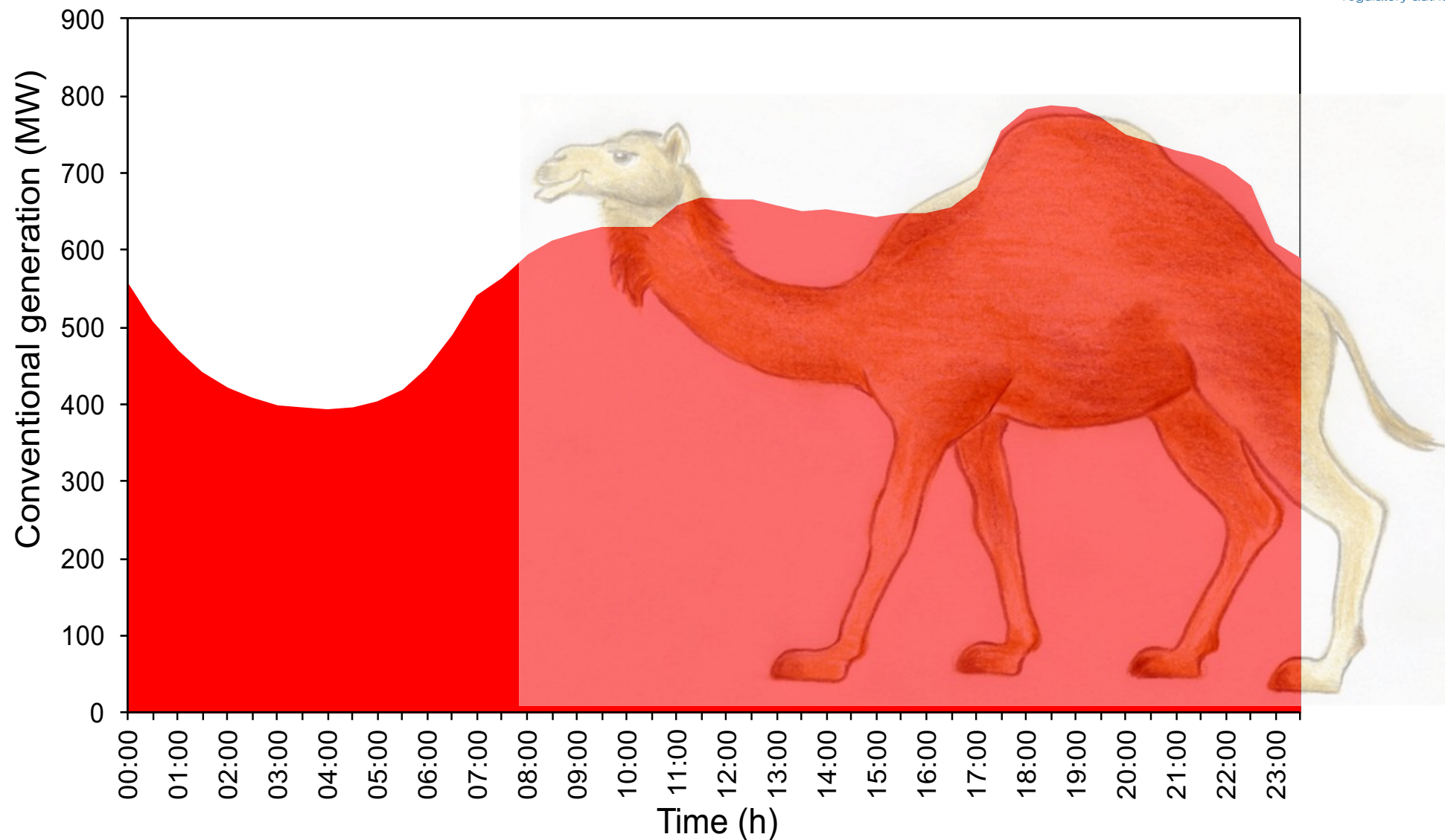


* Eurostat

RES-E Load Duration Curve

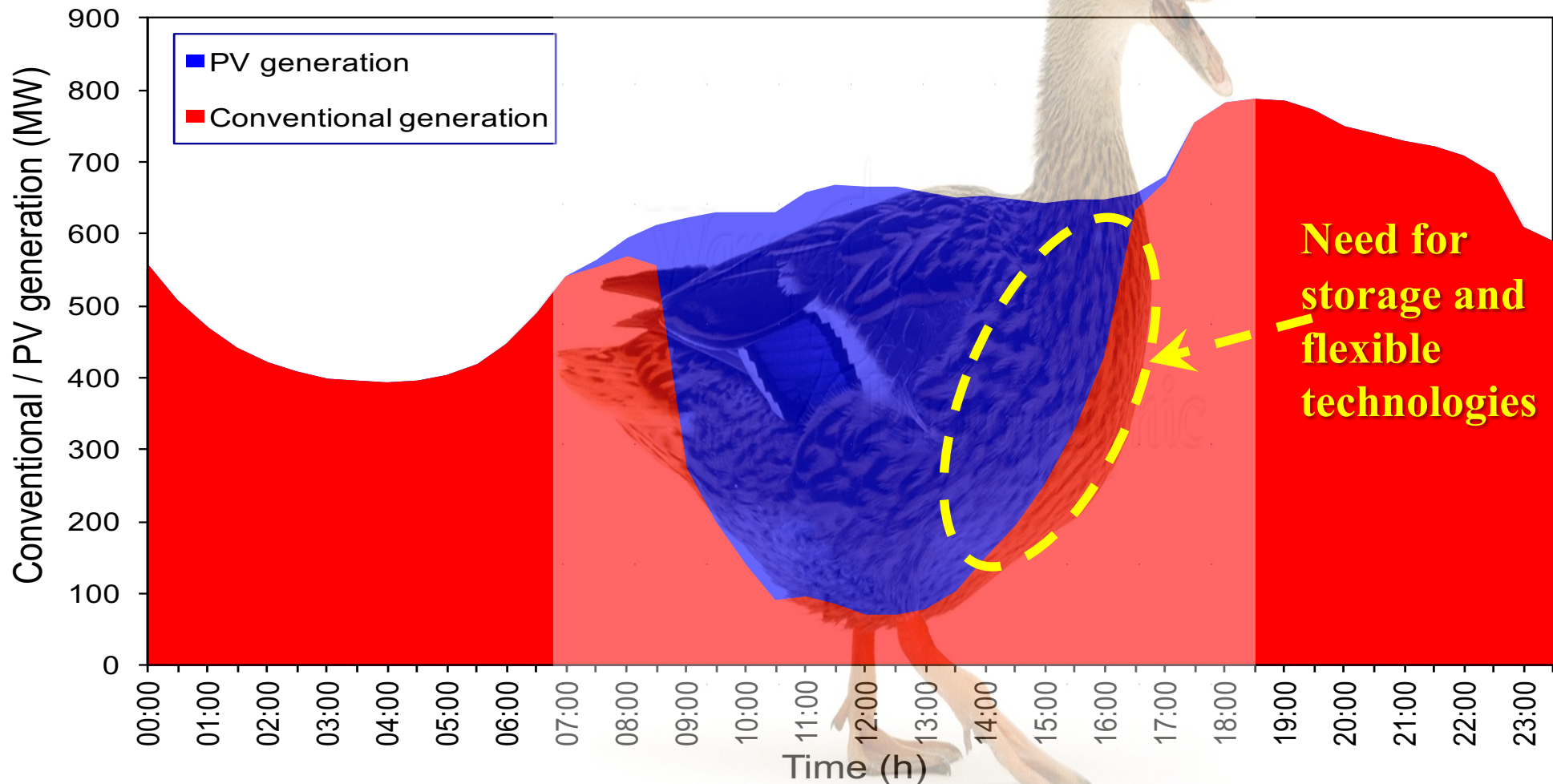


Daily load curve (the 'camel curve')*



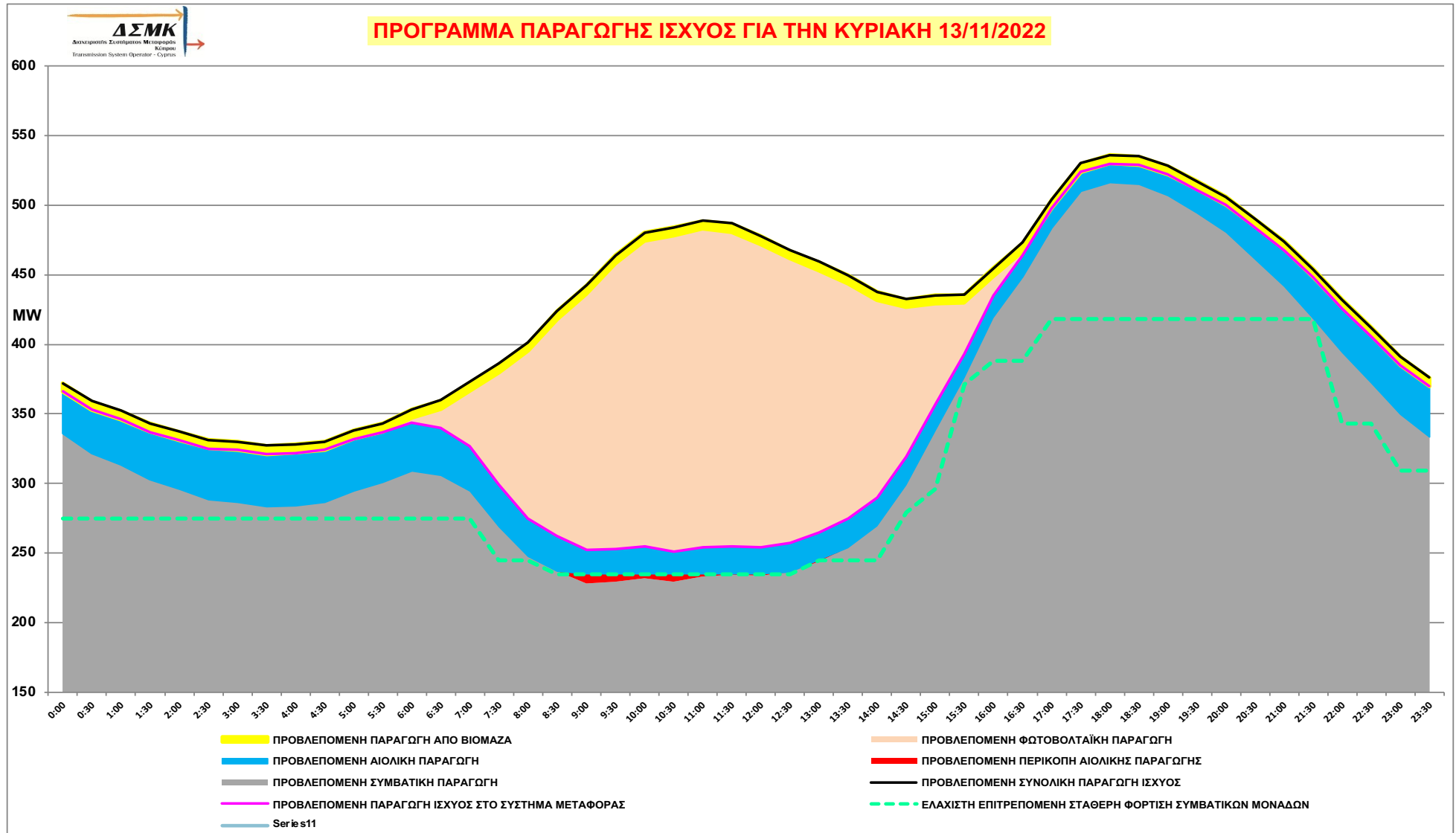
* Poullikkas A., 2016, "From the 'camel curve' to the 'duck curve' on electric systems with increasing solar power", *Accountancy*

Simulated effect of 500MW 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*

Real effect of 380MW PV generation on load curve*



* TSOC

The solution*

- **Increase system flexibility**
 - ~ integrate RES into electricity market
 - ~ use natural gas, storage and RES for power generation
 - ~ promote e-mobility (V2G technology - bidirectional flow of electricity between the electric car and the grid)
- **Establish electricity interconnections**
 - ~ with EU internal electricity market (the island of Cyprus is the only non-interconnected Member State)
- **Production of hydrogen (energy carrier)**
 - ~ from RES and natural gas

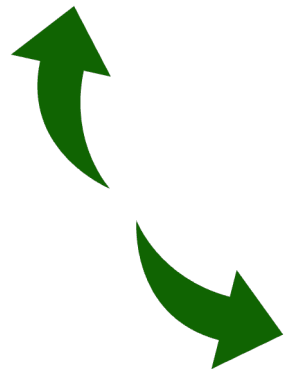
* Poullikkas A., 2016, *Fundamentals of Energy Regulation*, ISBN: 978-9963-7355-8-7

Storage and flexible technologies are the missing links



Energy storage

Flexible technologies

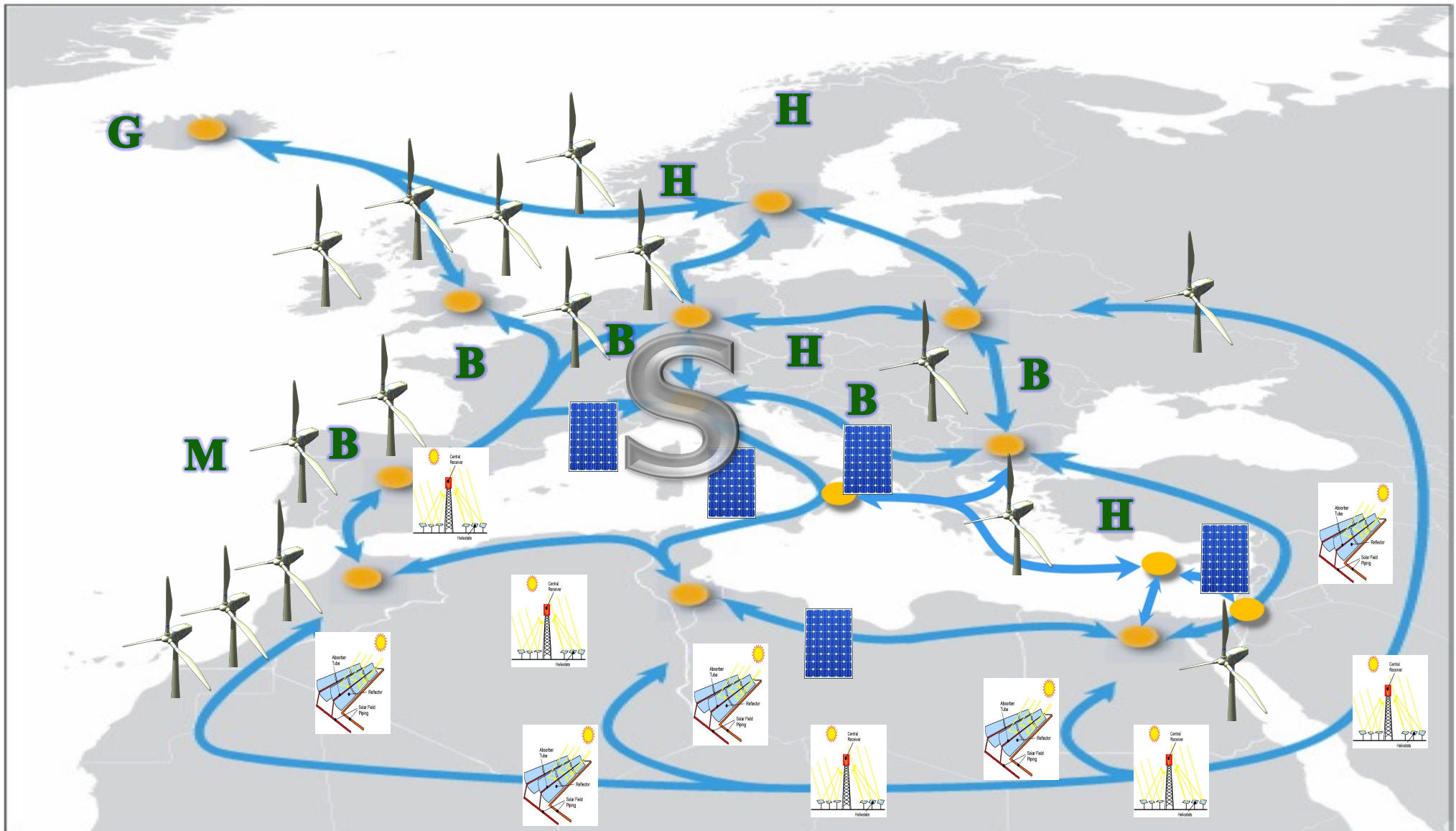


Hydrogen technologies



CERA
Storage, Flexible
Technologies and Hydrogen
Regulatory Frameworks

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



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

Energy transition

regulatory challenges

Towards sustainable energy

CERA Energy Transition Regulatory Decisions

- **Regulatory Decision 01/2017 (ΚΑΠ 34/2017):** A detailed schedule for the implementation of **EU electricity market target model**
- **Regulatory Decision 02/2018 (ΚΑΠ 259/2018):** The mass installation of an Advanced Metering Infrastructure including **smartmeters to all electricity consumers**
- **Regulatory Decision 02/2019 (ΚΑΠ 204/2019):** The establishment of basic principles of a regulatory framework for the **operation of electricity storage systems** in the wholesale electricity market
- **Regulatory Decision 03/2019 (ΚΑΠ 224/2019):** The redesign of the power grid to become **smart and bi-directional** in order to allow integration of large quantities of renewable energy sources in combination with energy storage systems

CEERA Energy Transition Regulatory Decisions (in preparation)

- **Regulatory framework: Energy communities and Renewable energy communities**
- **Regulatory framework: Electrical interconnections**
- **Regulatory framework: Hydrogen market**
- **Regulatory framework: Price comparison tools**

• ...

IN PROGRESS

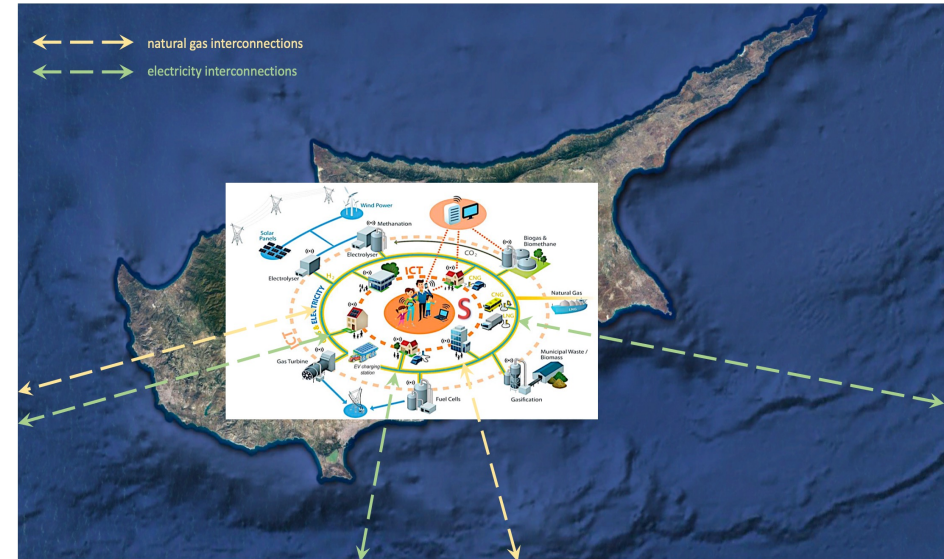
Energy transition by 2050

Cyprus' energy system:

- smart and digitised
- **flexible**
- decentralised
- **electrically interconnected**
- interconnected gas and/or hydrogen pipelines

Integration:

- hydrogen in all energy sectors
- **renewable energy sources**
- storage energy systems
- **electric mobility**



**Transition of Cyprus from the current carbon economy
to hydrogen economy by the year 2050**