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

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- **Energy transition for island systems** – solutions for isolated systems
- **Energy transition regulatory challenges** – towards sustainable energy

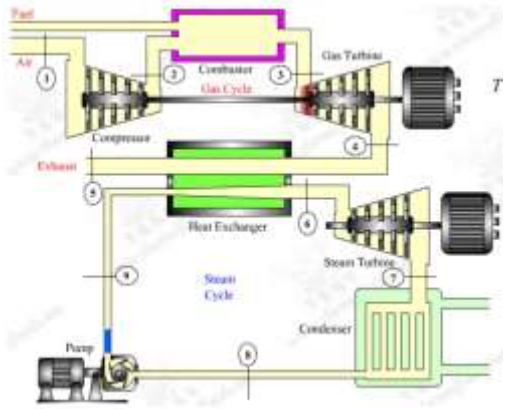
Cyprus current electricity and NG systems

System characteristics

Existing power generation system

- **Steam turbine units (HFO)**
  - Dhekelia power station 6x60MWe
  - Vasilikos power station 3x130MWe

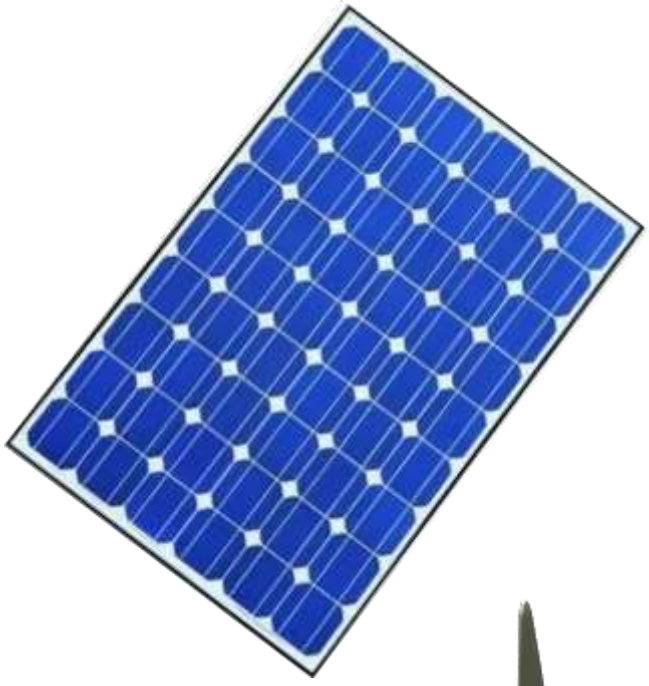
- **Internal combustion engines (HFO)**
  - Dhekelia power station 6x17.5MWe
- **Combined cycles (Diesel)**
  - Vasilikos power station 2x220MWe



- **Gas turbine units (Diesel)**
  - Moni power station 4x37,5MWe
  - Vasilikos power station 1x38MWe

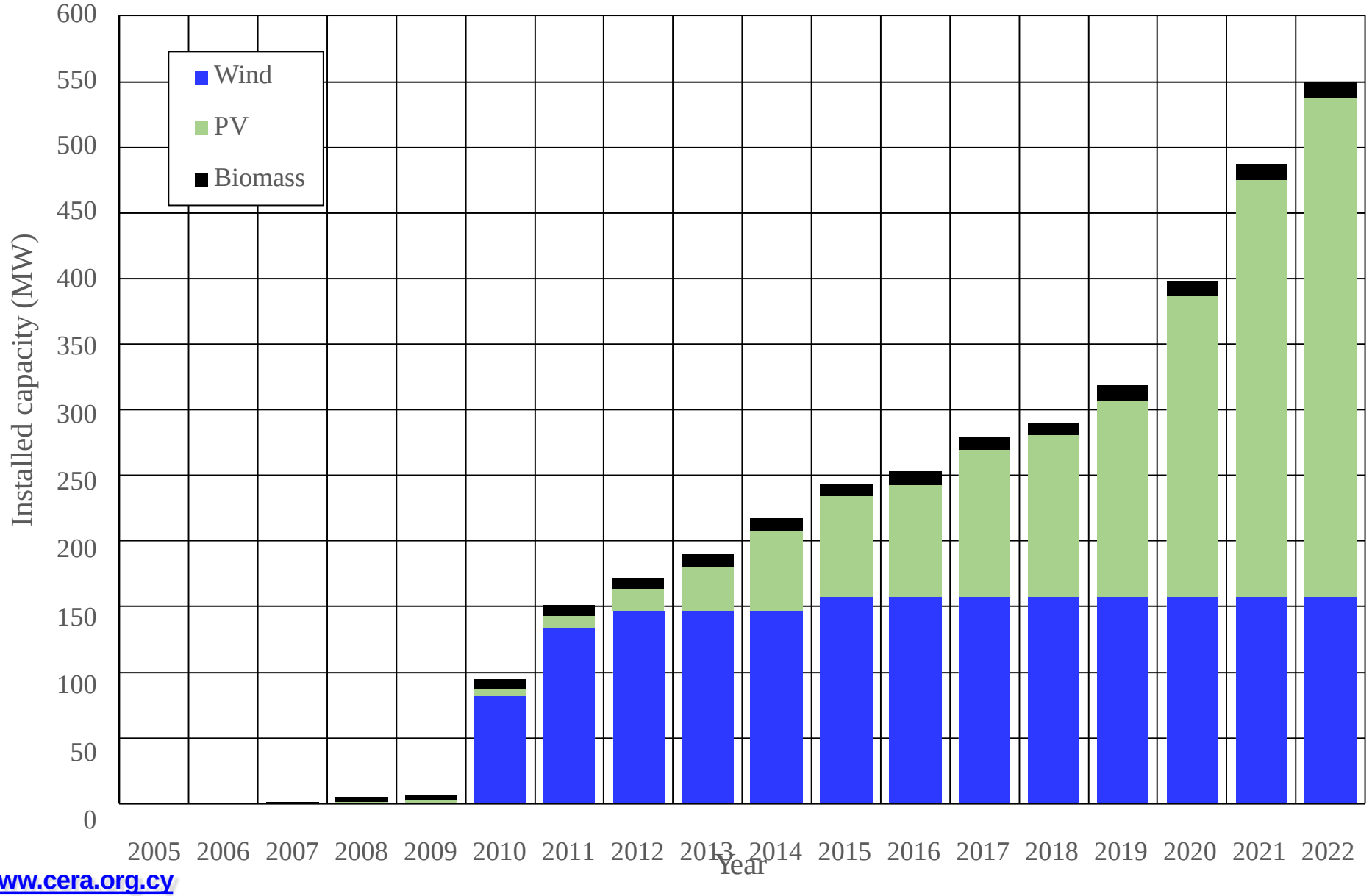
Existing power generation system (cont.)

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



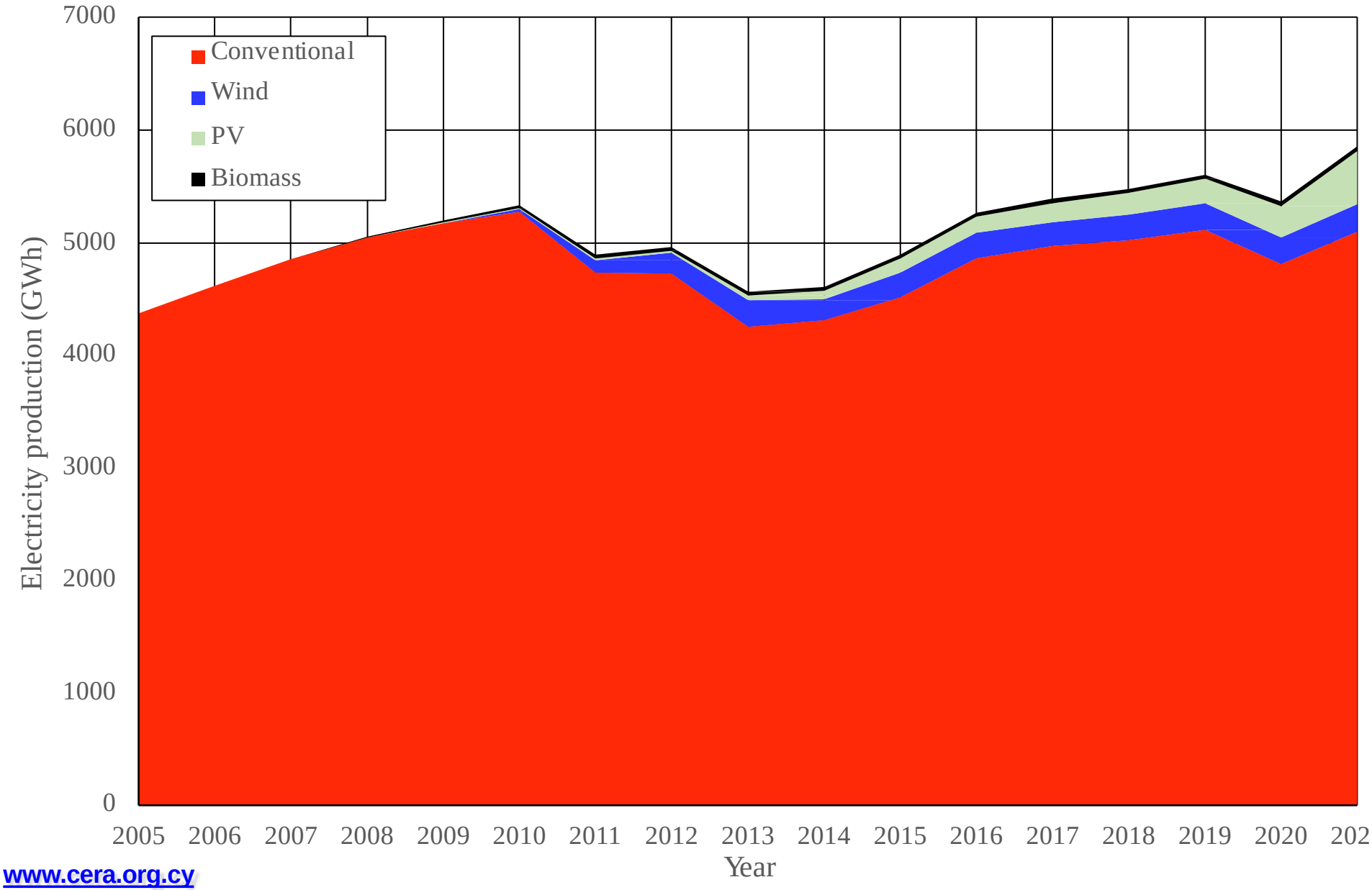
- **Total installed capacity:**
  - Conventional: 1483MWe
  - Renewables: 550MWe

RES installed capacity*



* www.cera.org.cy

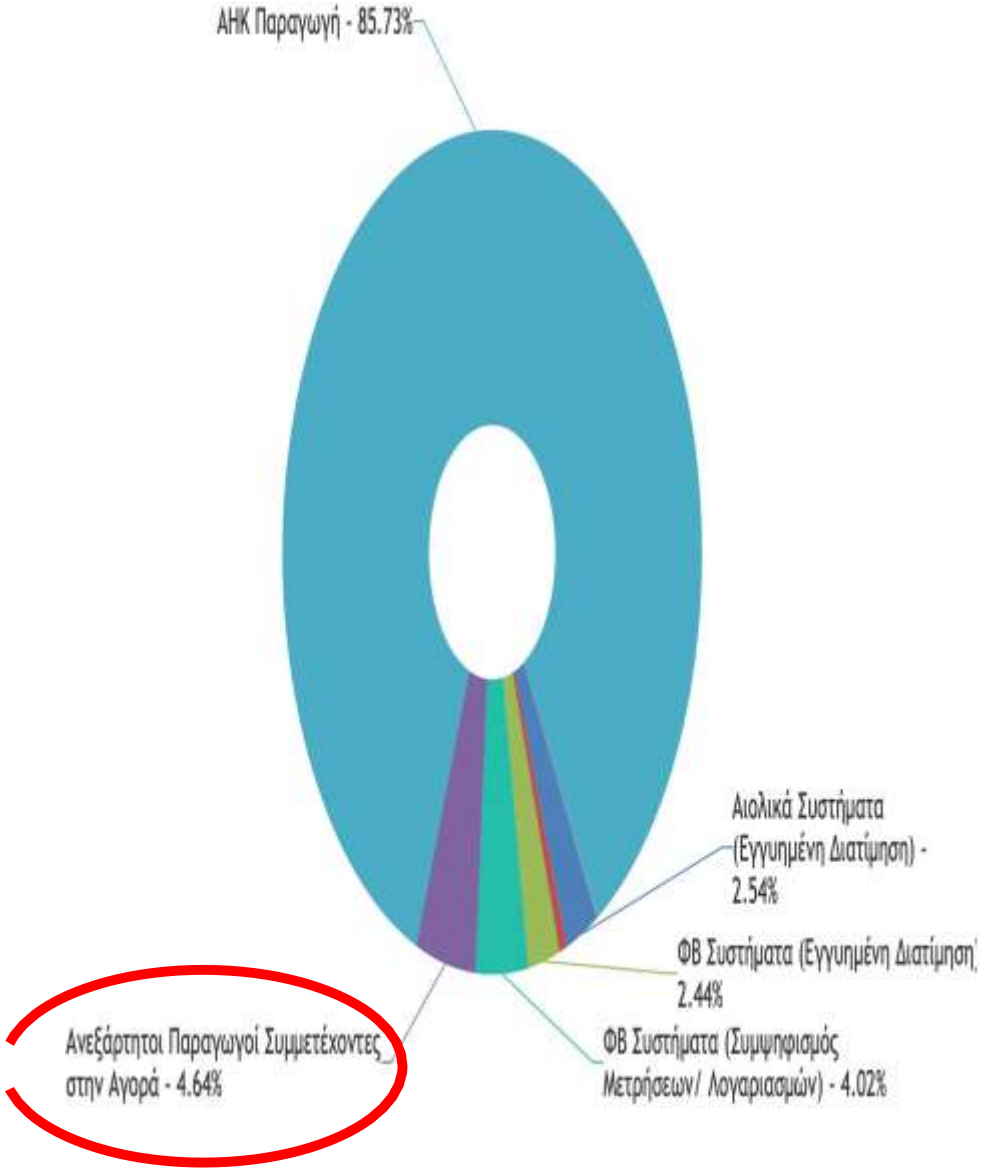
Total electricity production*



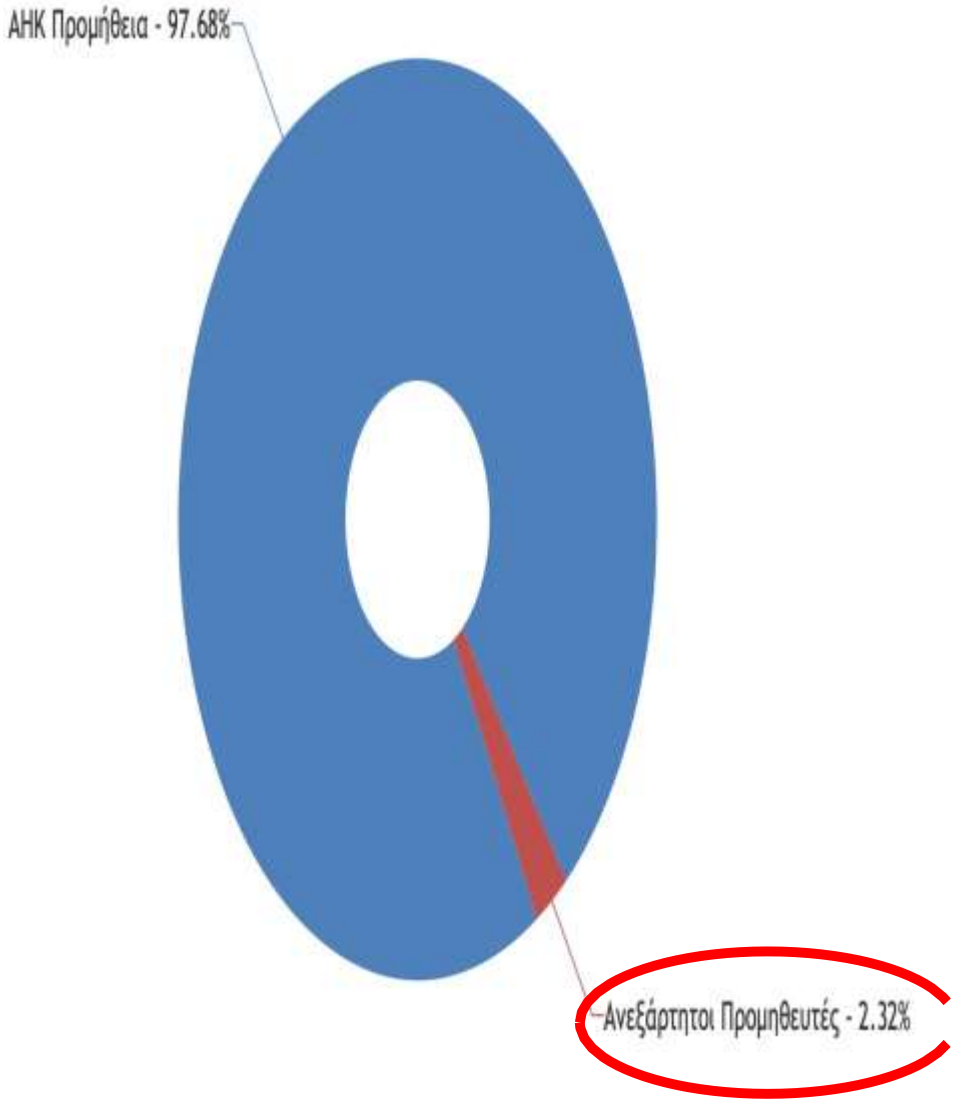
* www.cera.org.cy

Market share (Aug 2022)

Wholesale market



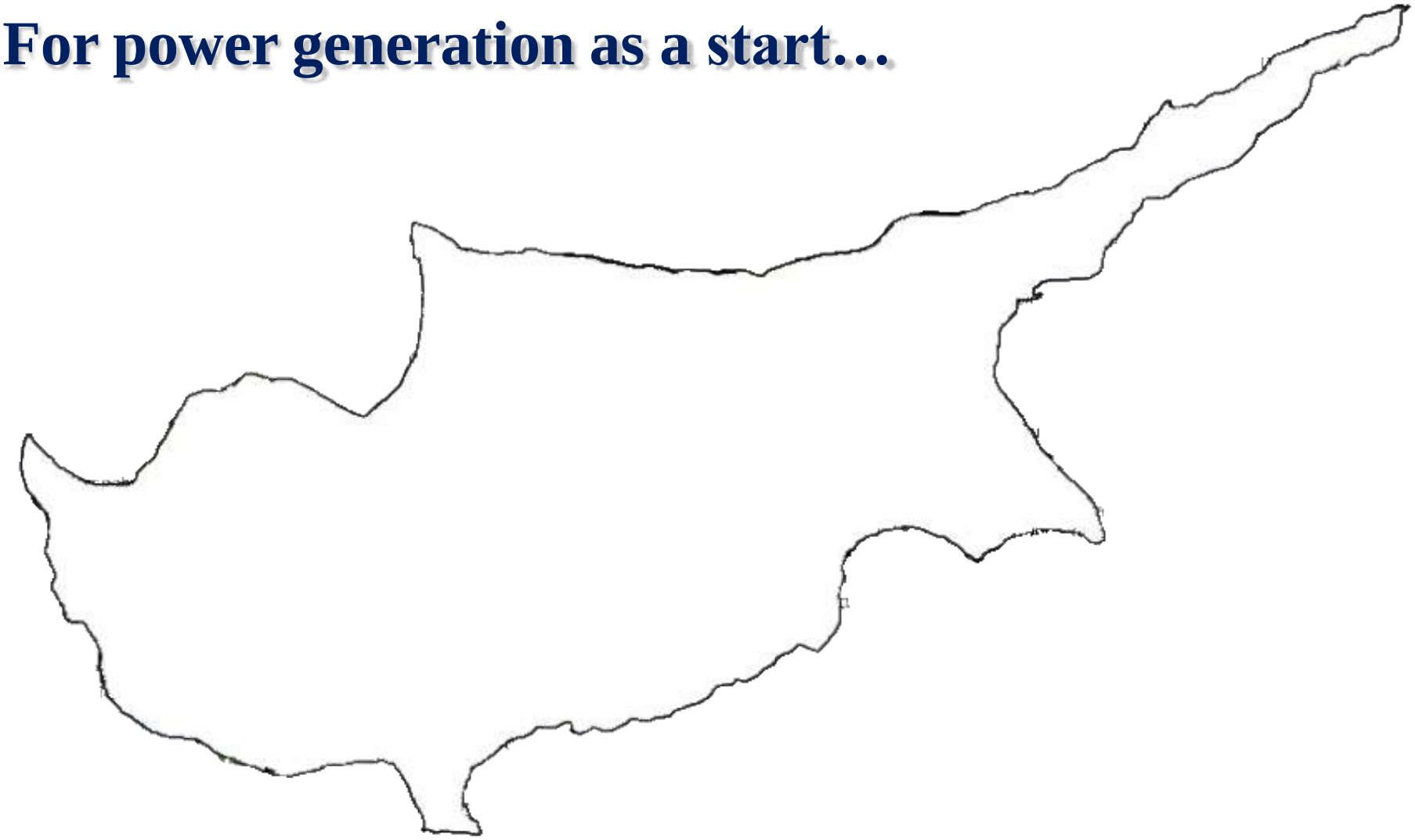
Retail market



Source: www.cera.org.cy

Existing natural gas system

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



Energy transition for island systems

Solutions for isolated systems

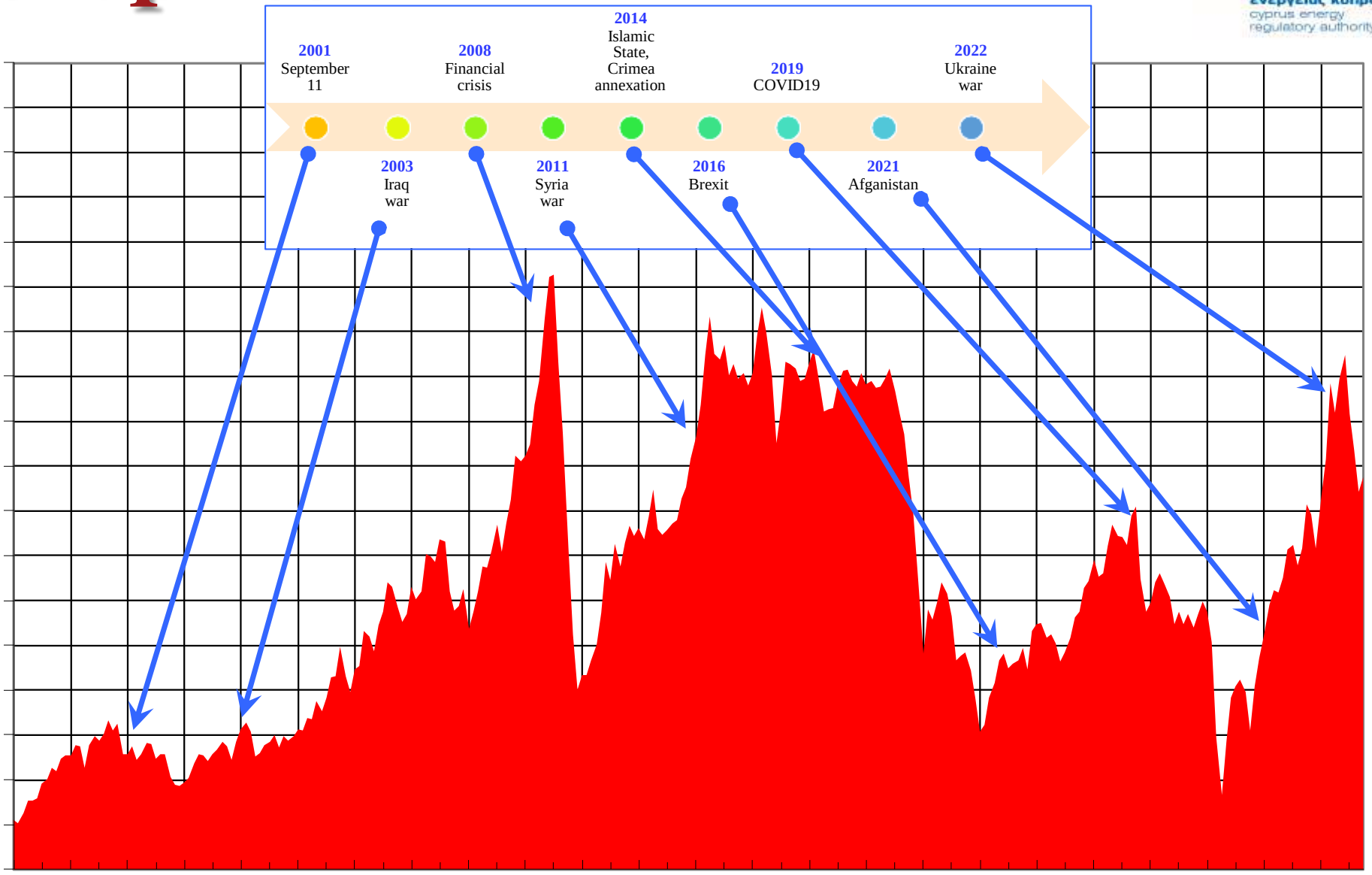
Characteristics of isolated electricity systems*

- **High fuel costs**
  - ~ use of oil derivatives
  - ~ high CO_2 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**

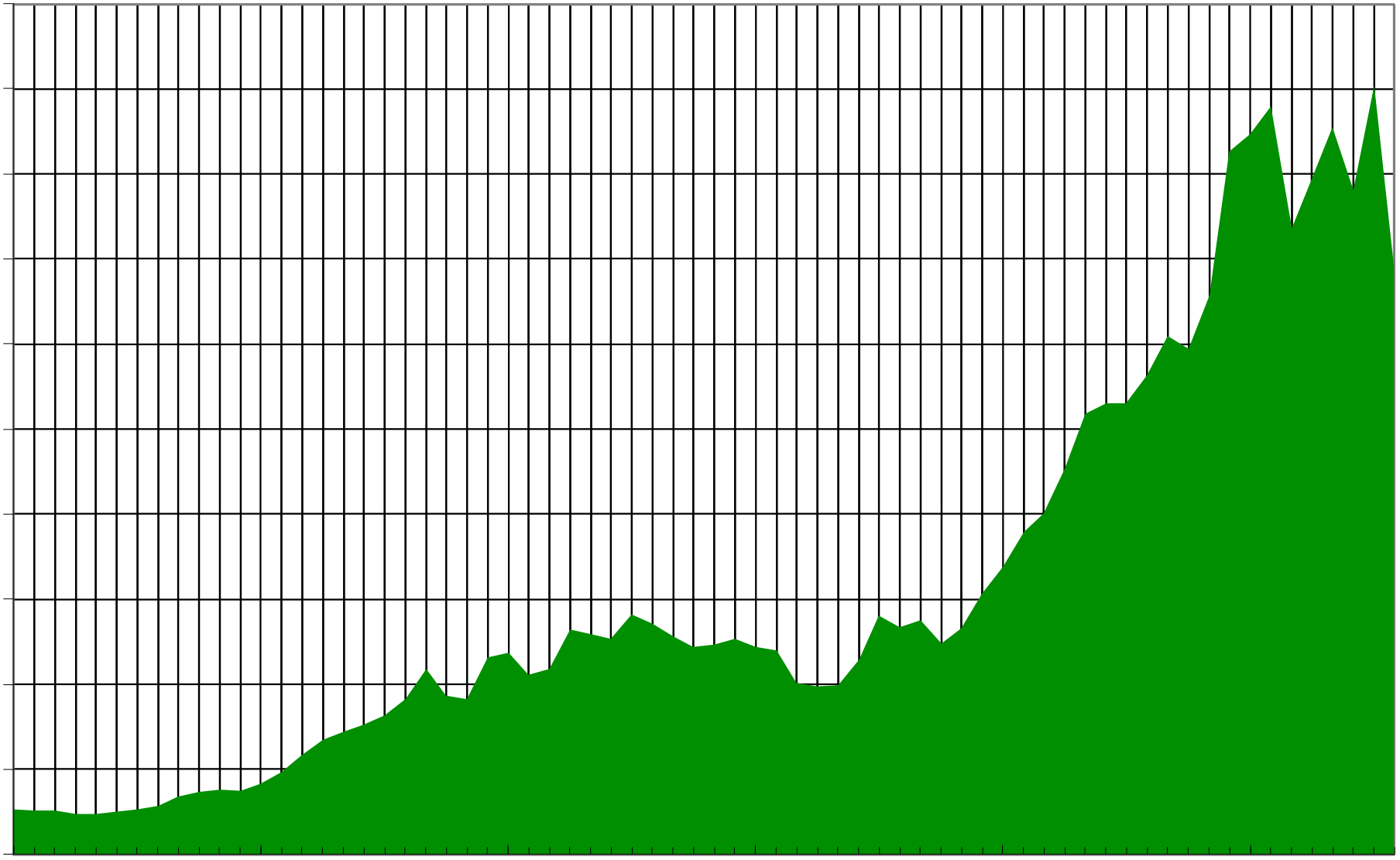
The smaller the electrical system size, the more the expenses will be

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

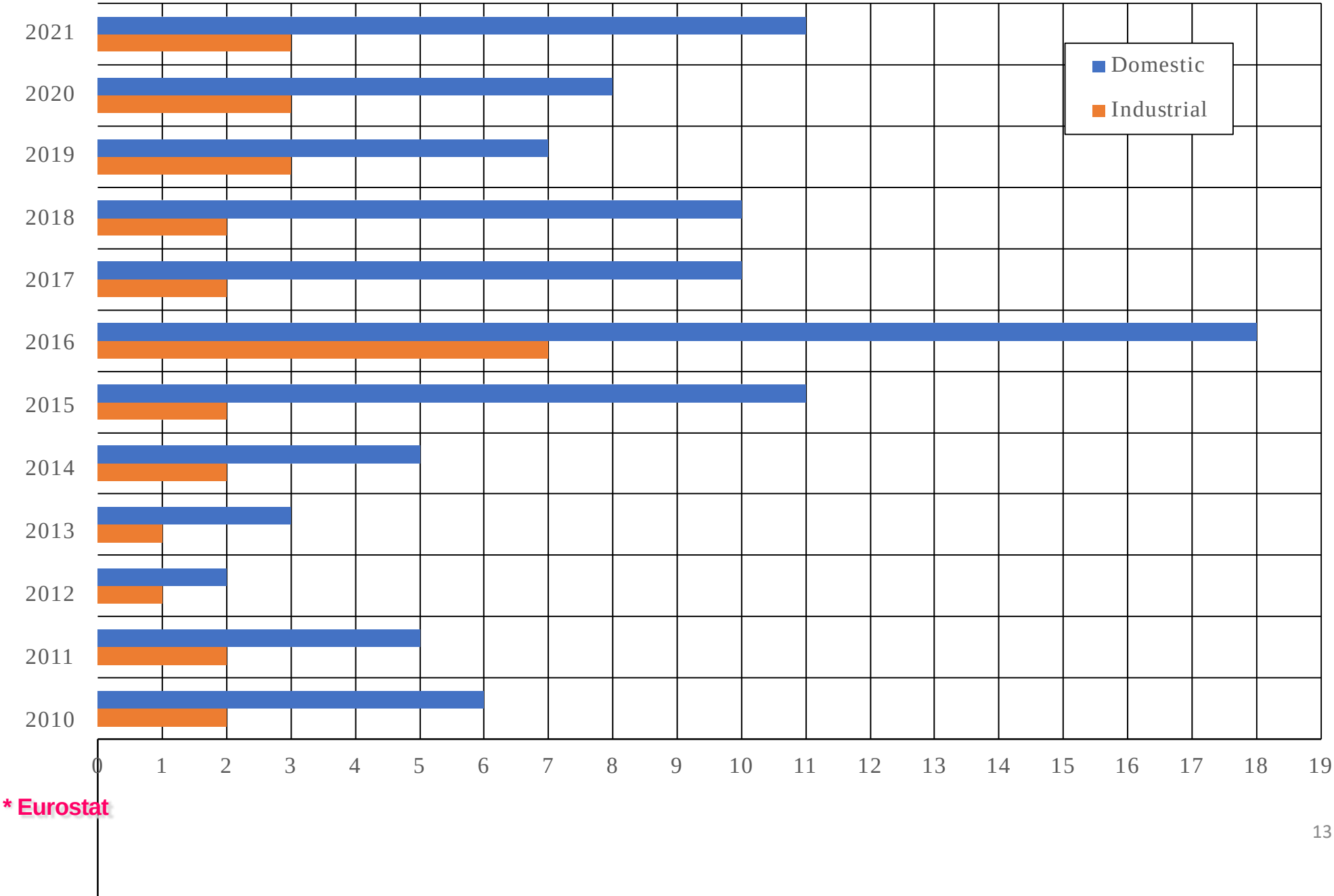
Brent price


2001
September
11
2003
Iraq
war
2008
Financial
crisis
2011
Syria
war
2014
Islamic
State,
Crimea
annexation
2016
Brexit
2019
COVID19
2021
Afganistan
2022
Ukraine
war

Greenhouse gas emissions price

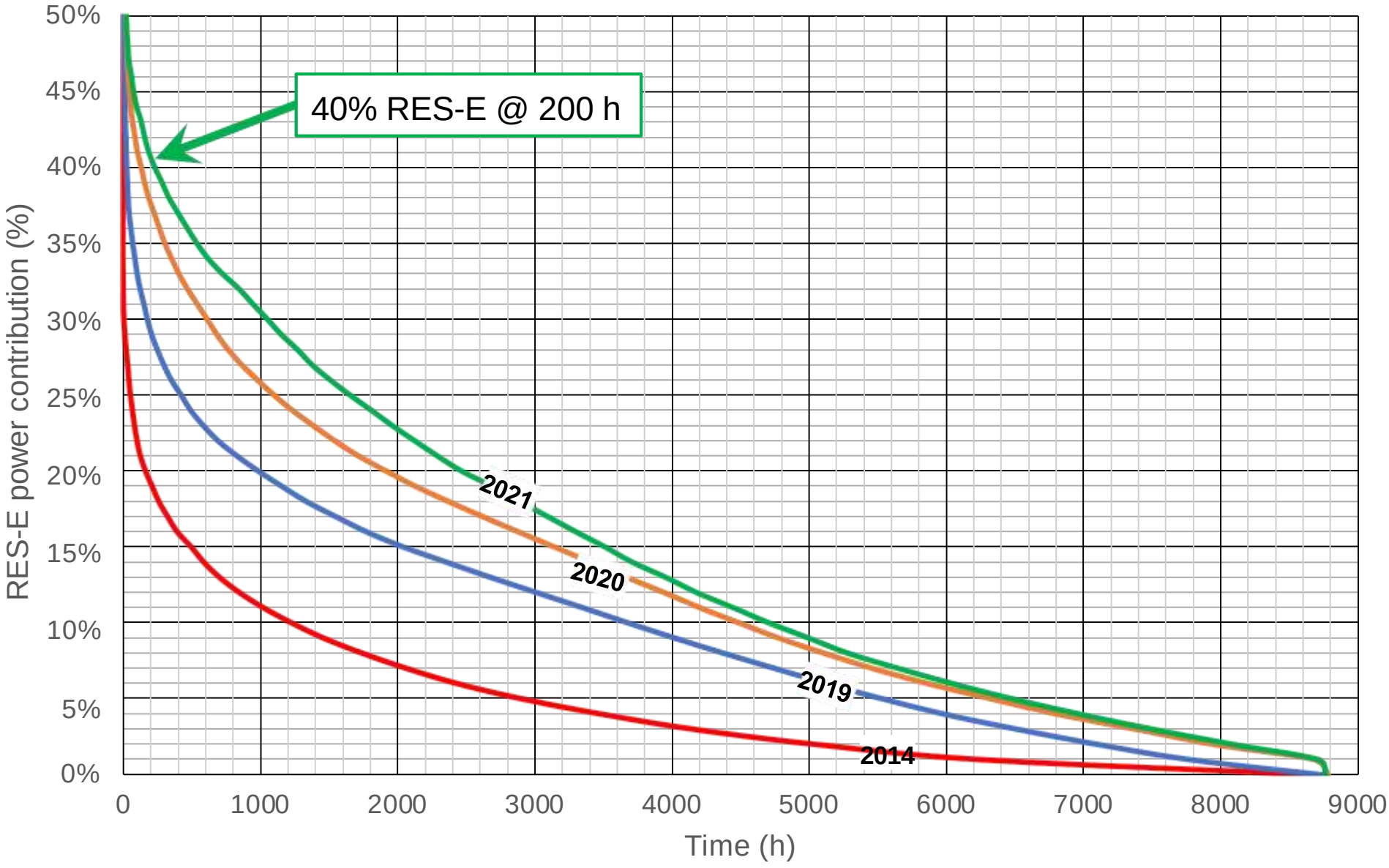


Electricity price - Position of Cyprus in EU*

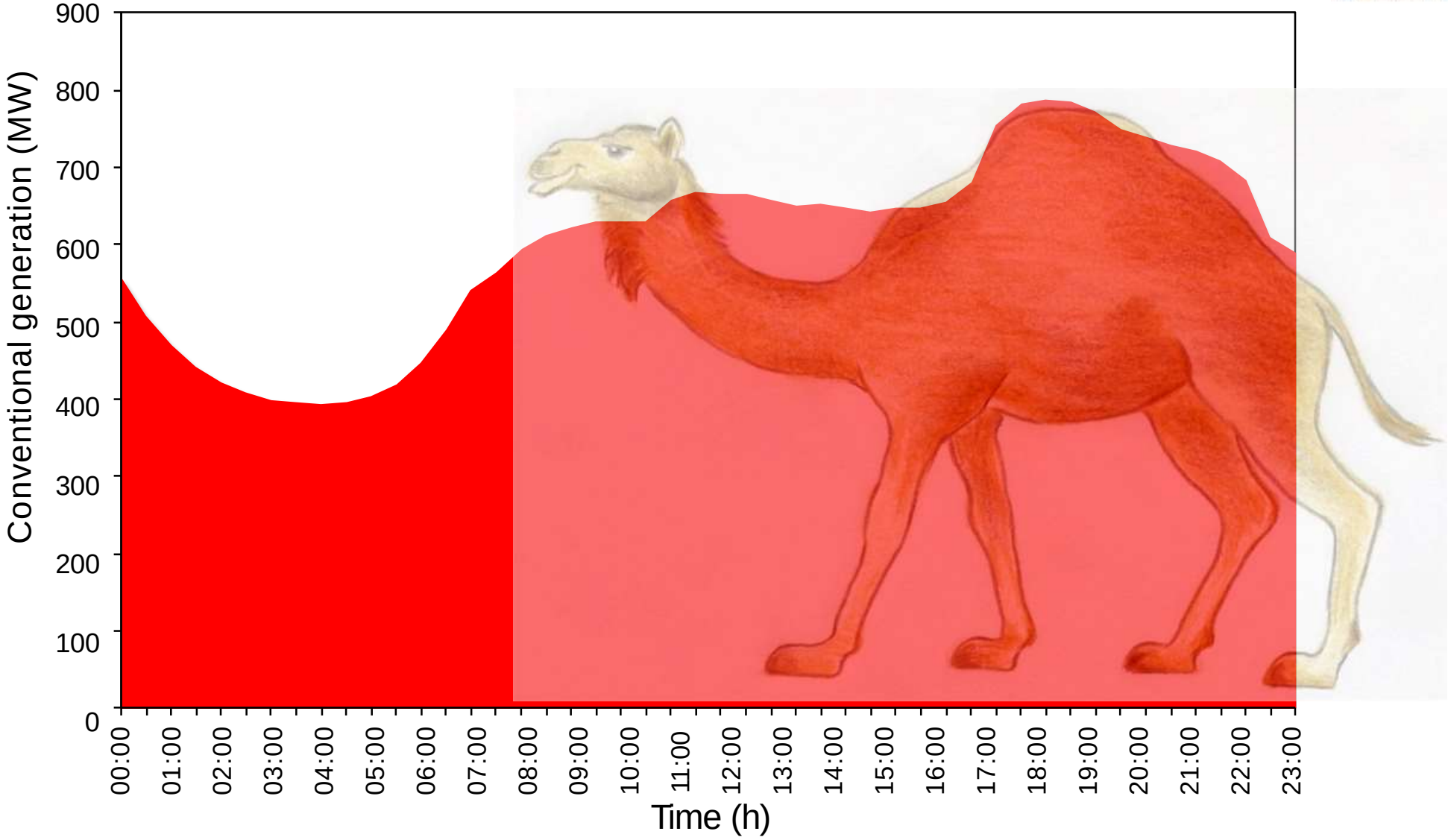


* Eurostat

RES-E Load Duration Curve

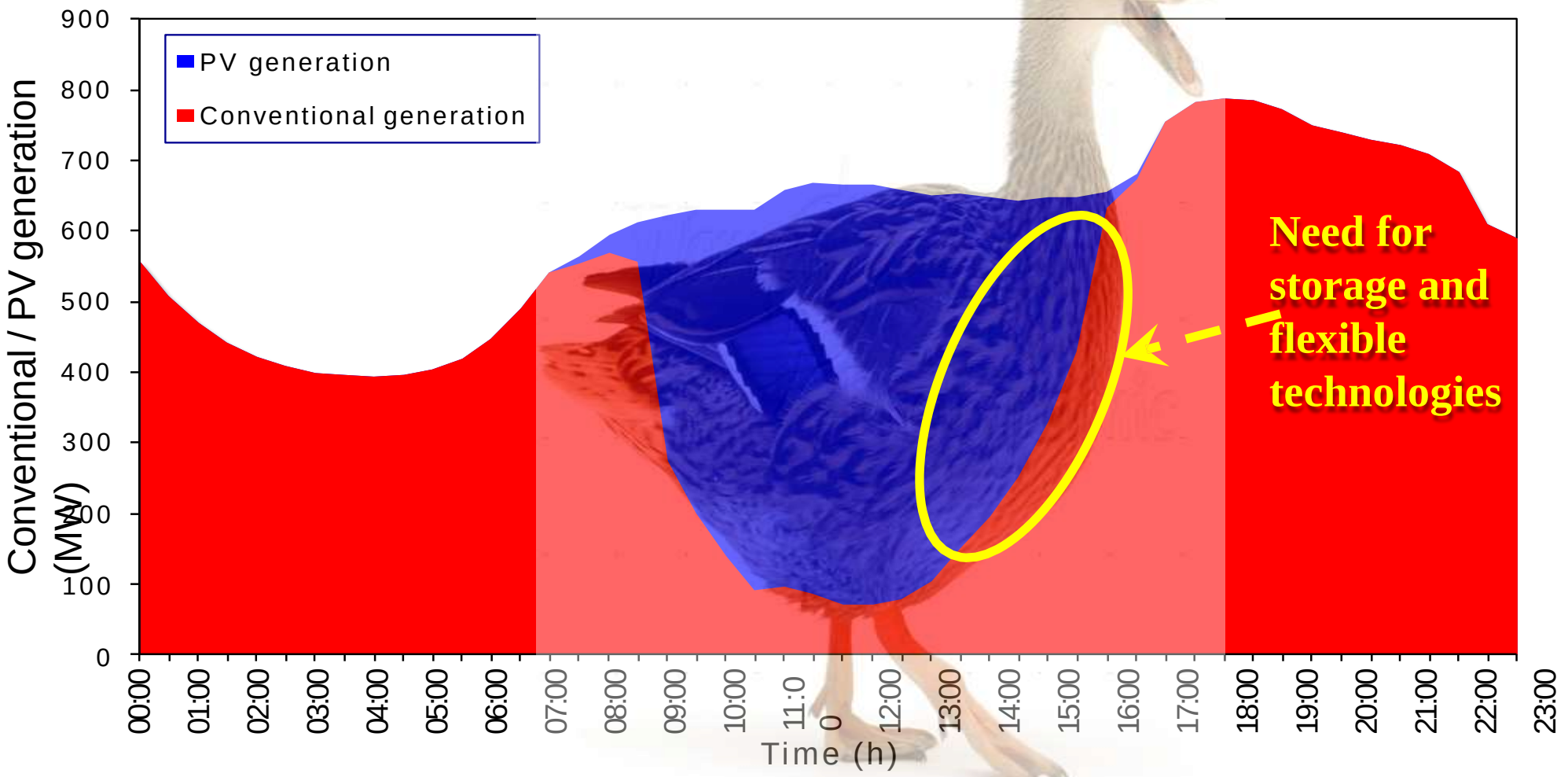


Daily load curve (the 'camel curve')*



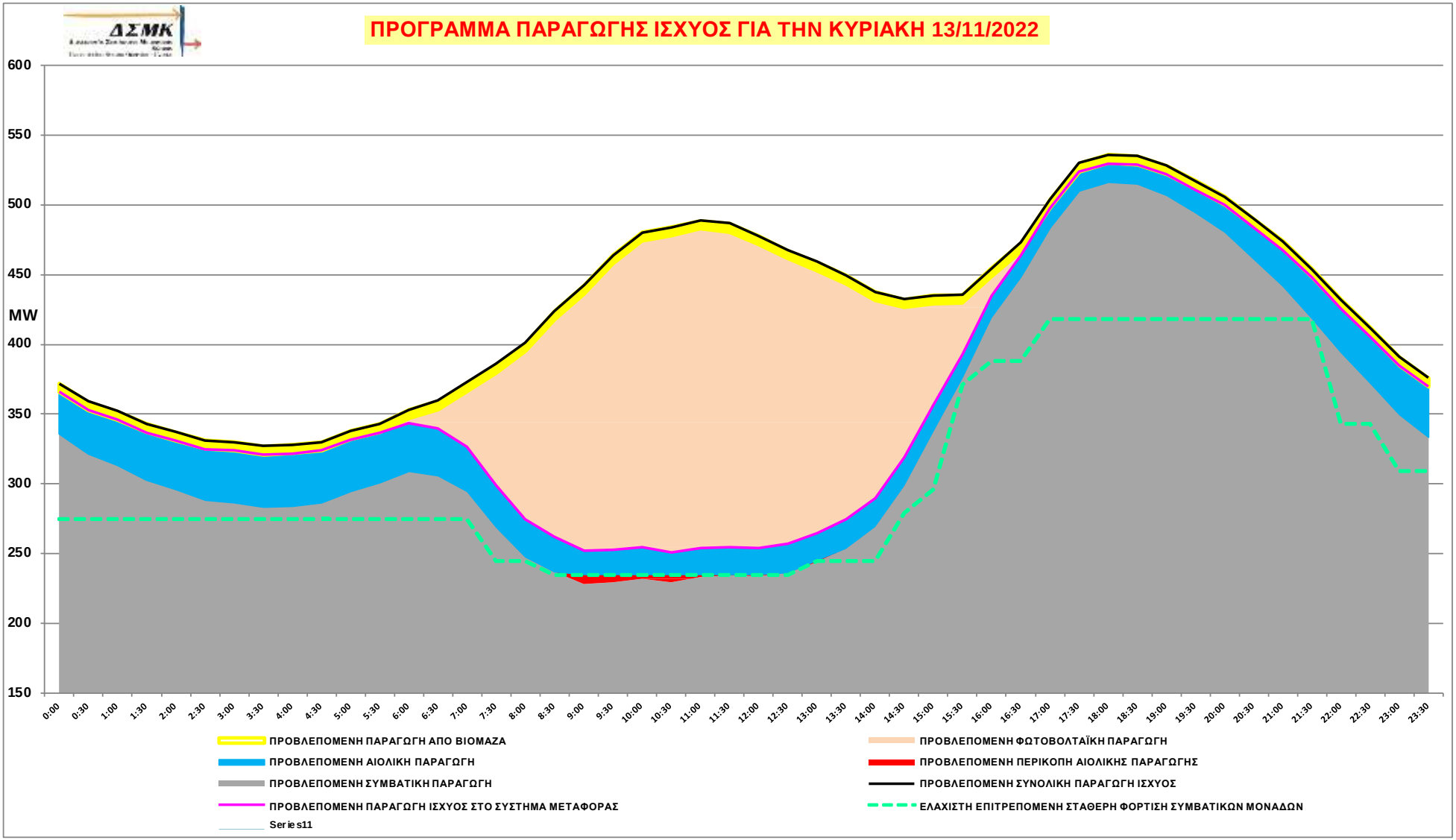
* Poullikkas A., 2016, "From the 'camel curve' to the 'duck curve' on electric systems with increasing solar power", *Accountancy*

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

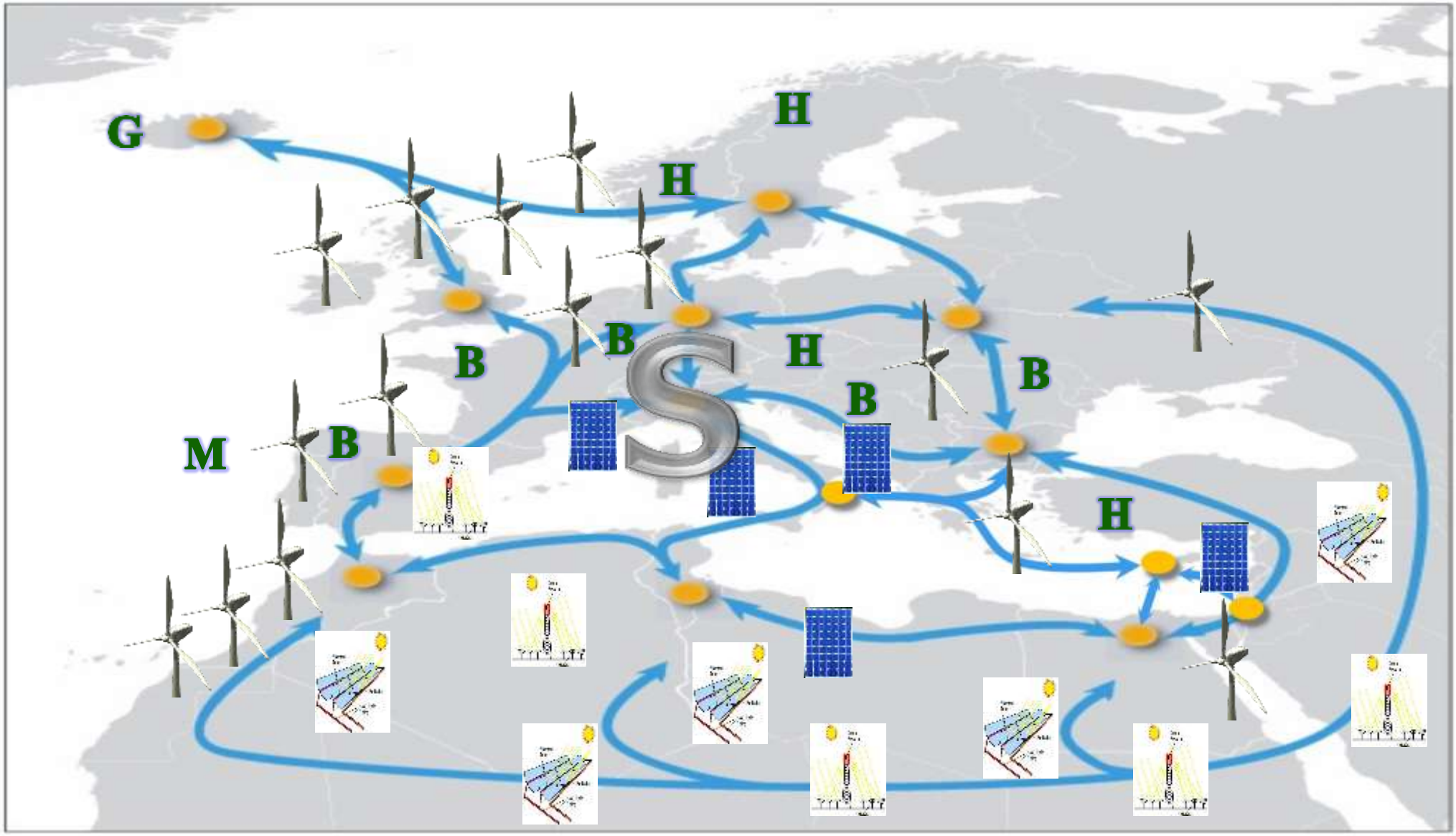
Flexible technologies

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 (ΚΔΠ 34/2017): A detailed schedule for the implementation of EU electricity market target model**
- **Regulatory Decision 02/2018 (ΚΔΠ 259/2018): The mass installation of an Advanced Metering Infrastructure including smartmeters to all electricity consumers**
- **Regulatory Decision 02/2019 (ΚΔΠ 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 (ΚΔΠ 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**

CERA 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
- …

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