



# Ενεργειακή Μετάβαση: Ρυθμιστικές προκλήσεις για την ολοκλήρωση της αγοράς ηλεκτρισμού στην Κύπρο

**Δρ. Ανδρέας Πουλλικκός**

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

**Πρόεδρος Ρυθμιστικής Αρχής Ενέργειας Κύπρου**

**[apoulikkas@cera.org.cy](mailto:apoulikkas@cera.org.cy)**

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- **Cyprus current electricity system** – system characteristics
- **Challenges of energy transition in island systems** – solutions to isolated systems
- **Long term energy strategy for Cyprus** – towards hydrogen economy

# EU energy strategy

## Energy transition towards 2050

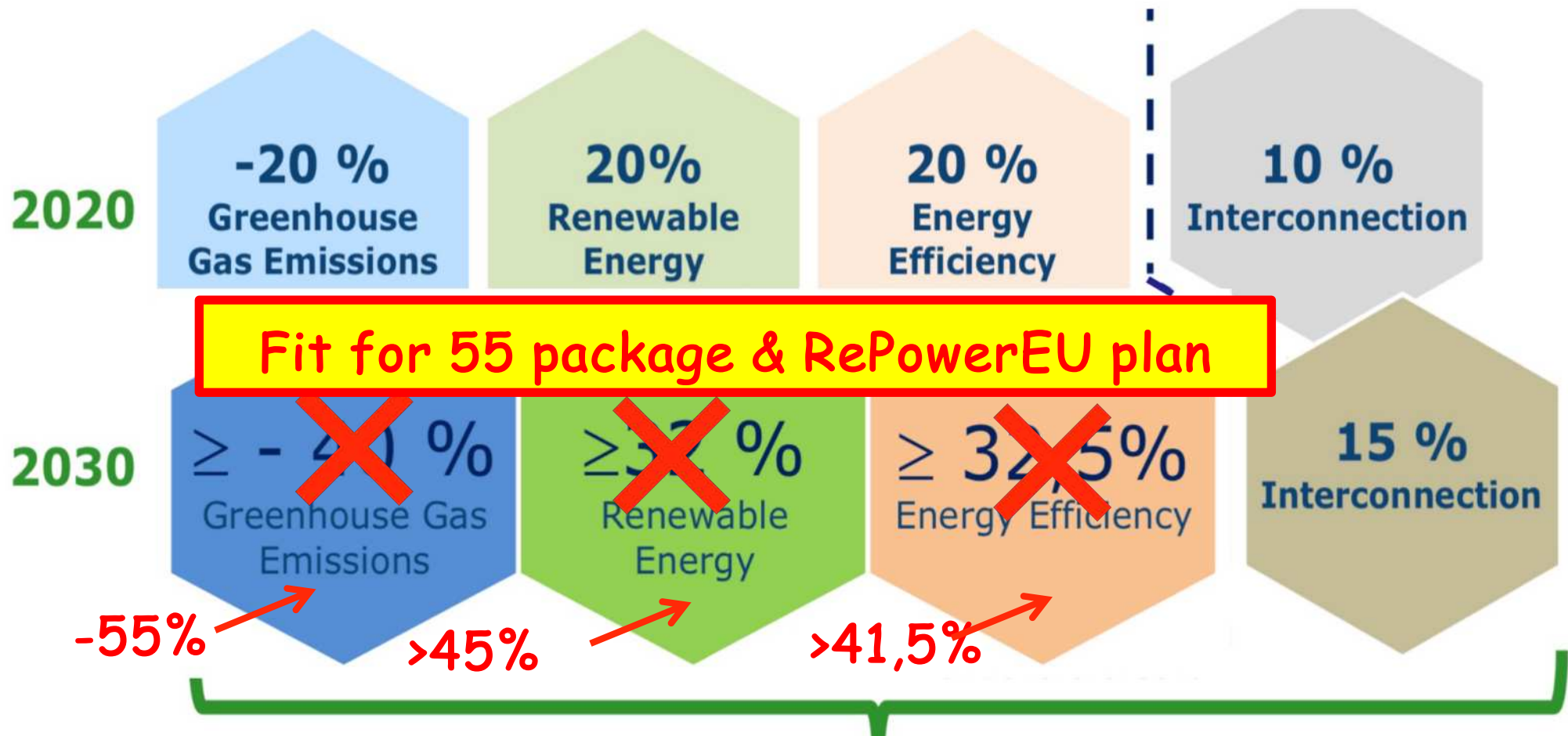
# Energy transition

- **greenhouse gas reduction**
  - EU: climate neutral by 2050
- **sustainable production and consumption**
- **third energy revolution**
- **competition in electricity and natural gas markets**
- **security of supply**





# EU medium and long term targets

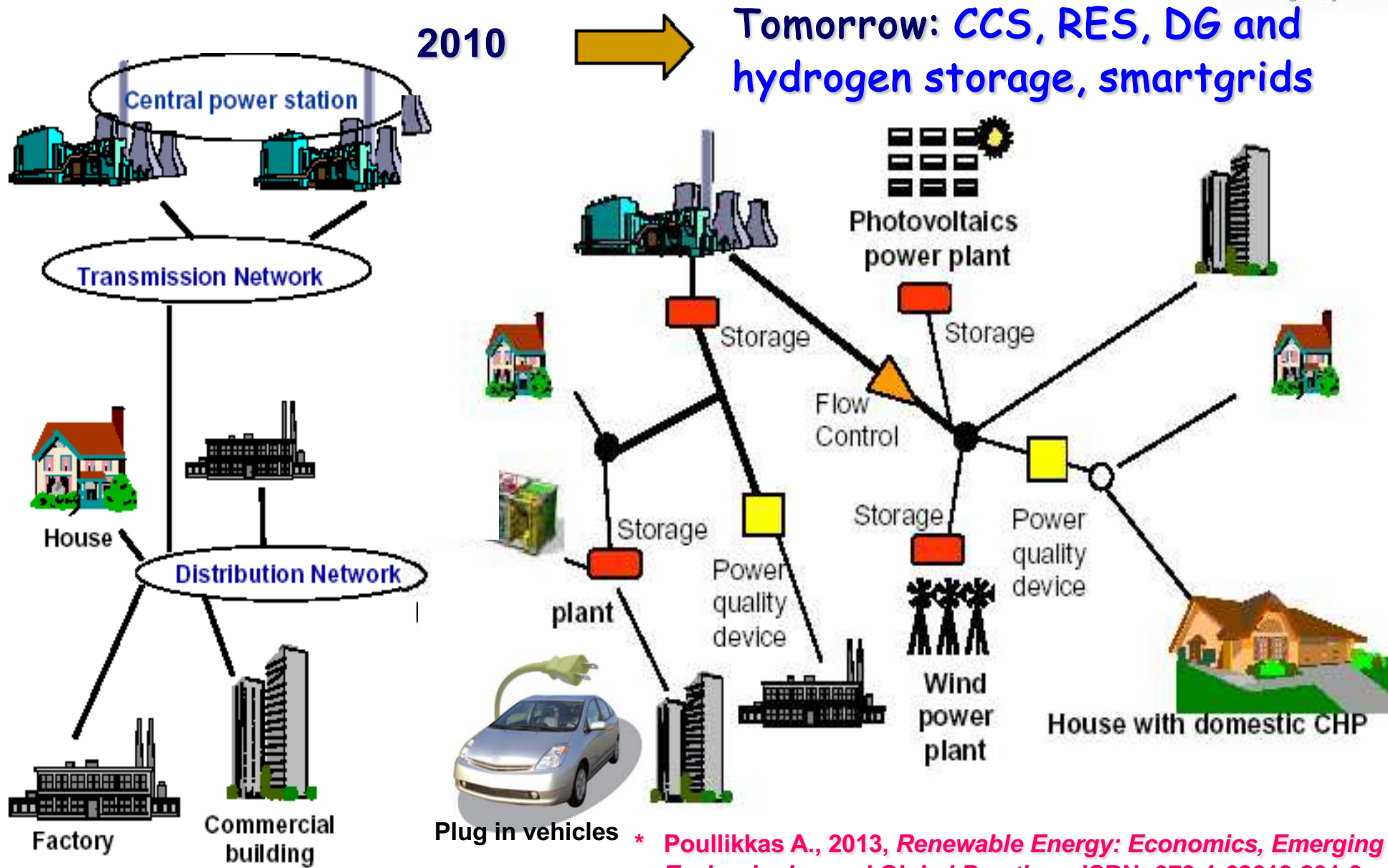


2050

**Climate-Neutral**

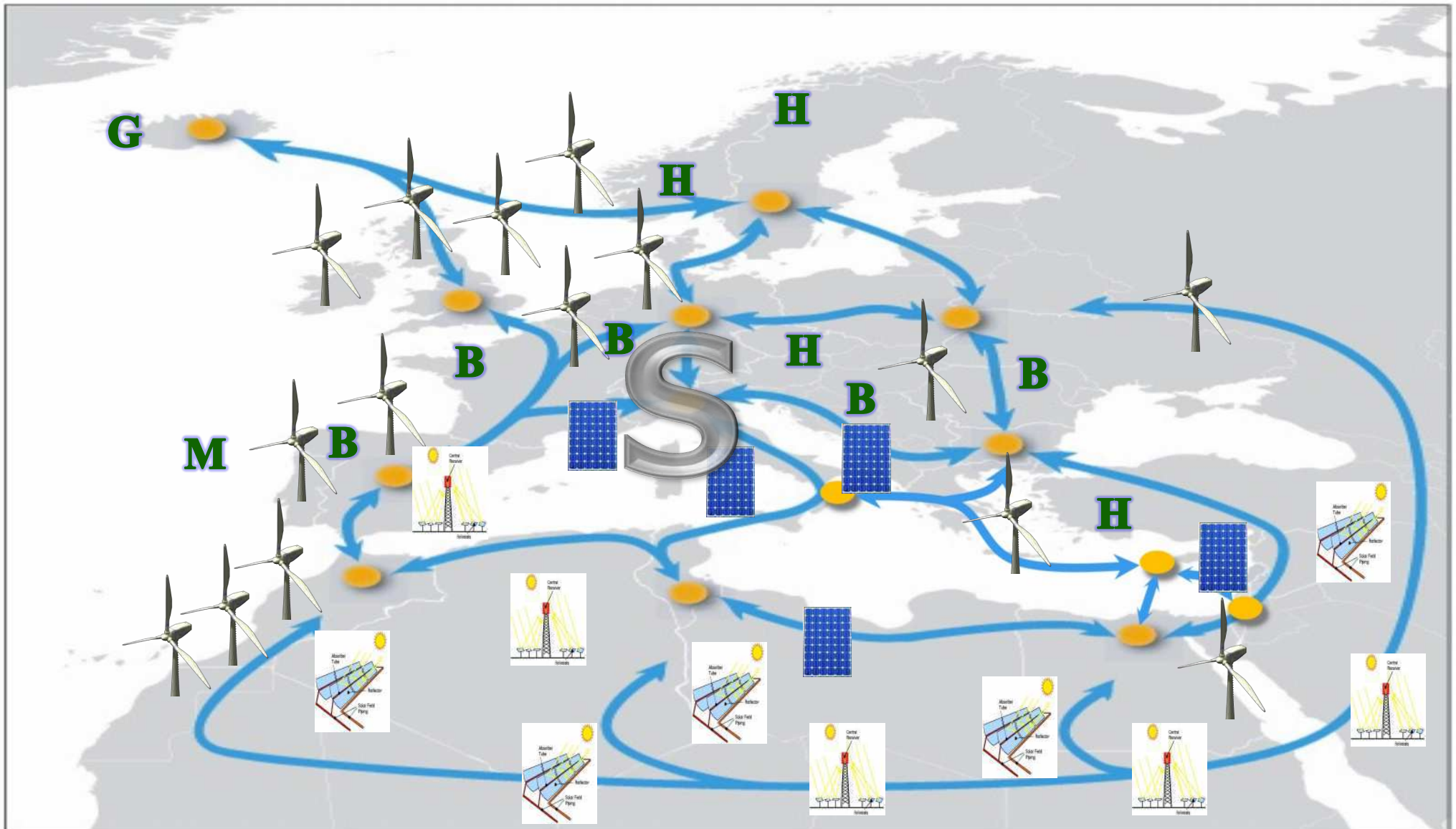
(an economy with net-zero greenhouse gas emissions)

# Future power systems\*



\* Poullikkas A., 2013, *Renewable Energy: Economics, Emerging Technologies and Global Practices*, ISBN: 978-1-62618-231-8

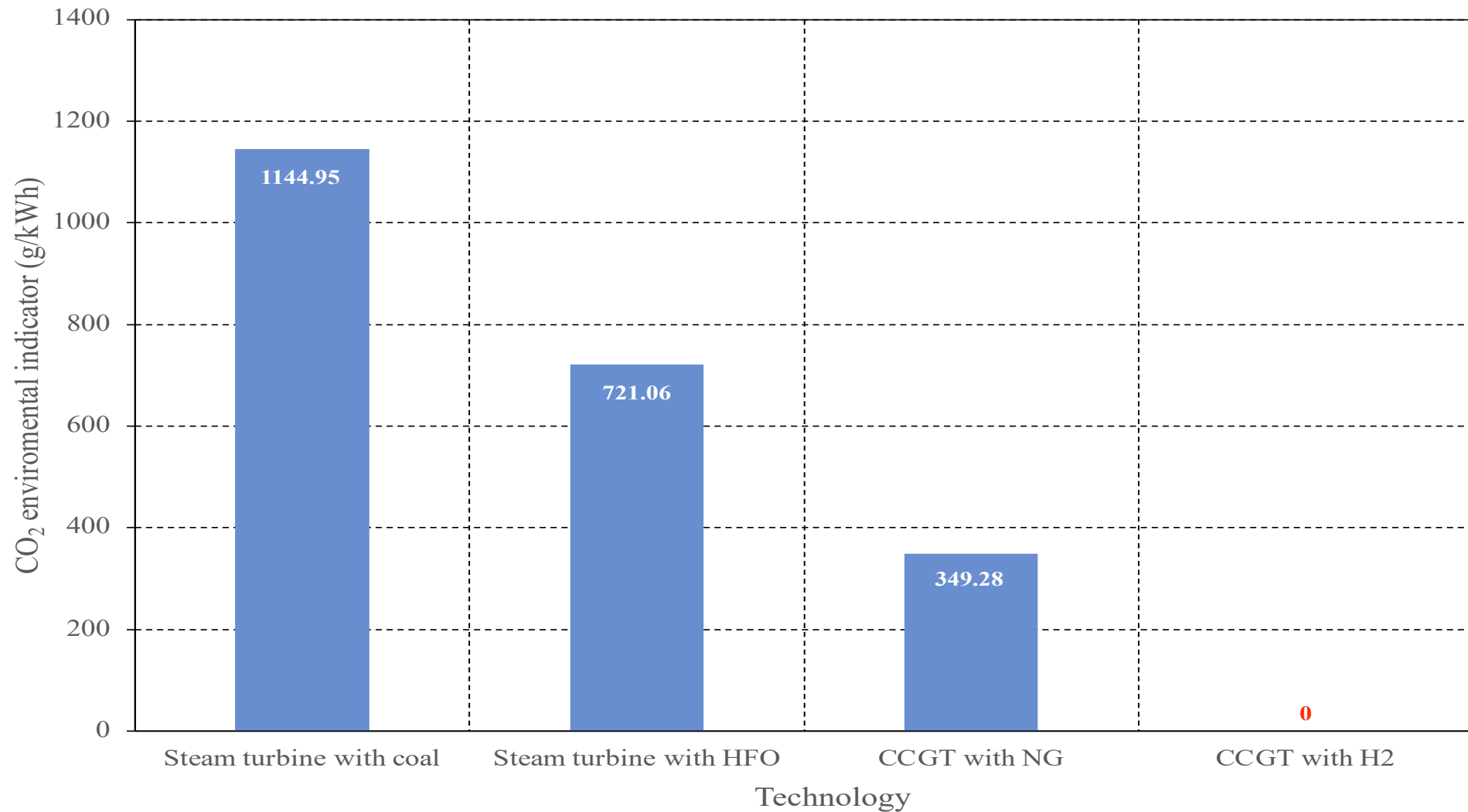
# The Super Smart Grid after 2050\* (may allow for 100% RES)



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

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# CO<sub>2</sub> emissions from green hydrogen power generation\* (cont.)



\* Nicolaidis P., Poullikkas A., 2023, “Power-to-hydrogen concepts for 100% renewable and sustainable energy systems”, *Hydrogen Economy*

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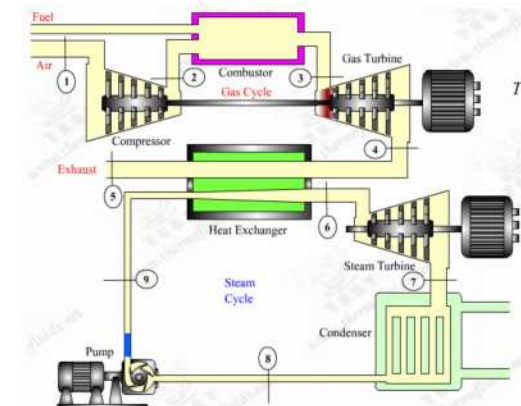
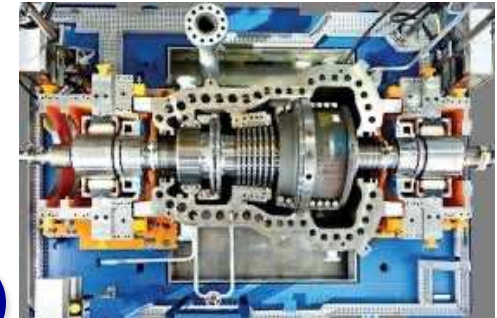
# Cyprus current electricity system

## System characteristics



# Existing power generation system

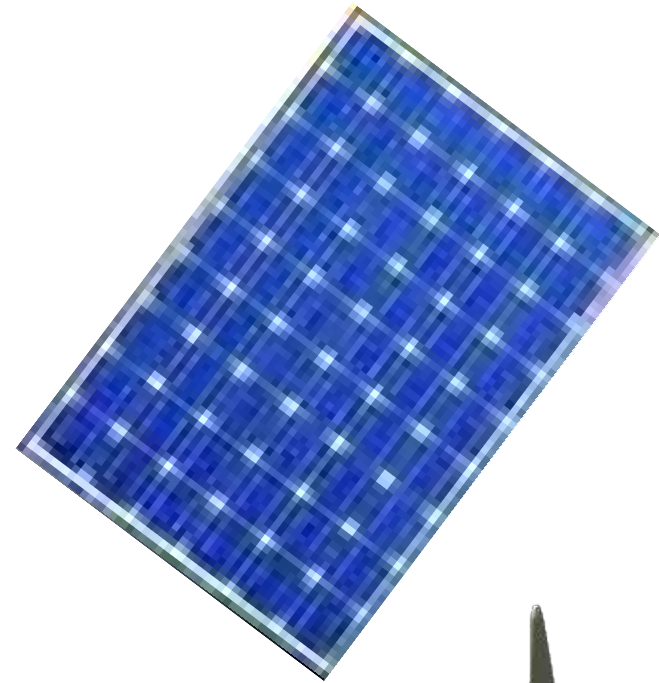
- **Steam turbine units (HFO)**
  - Dhekelia power station 6x60MWe
  - Vasilikos power station 3x130MWe
- **Internal combustion engines (HFO)**
  - Dhekelia power station 6x17.5MWe
- **Combined cycles (Diesel)**
  - Vasilikos power station 2x220MWe
- **Gas turbine units (Diesel)**
  - Moni power station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



# Existing power generation system (cont.)

- **Renewables**

- **PVs: 522MWe**
- **Wind: 157MWe**
- **Biomass: 13MWe**

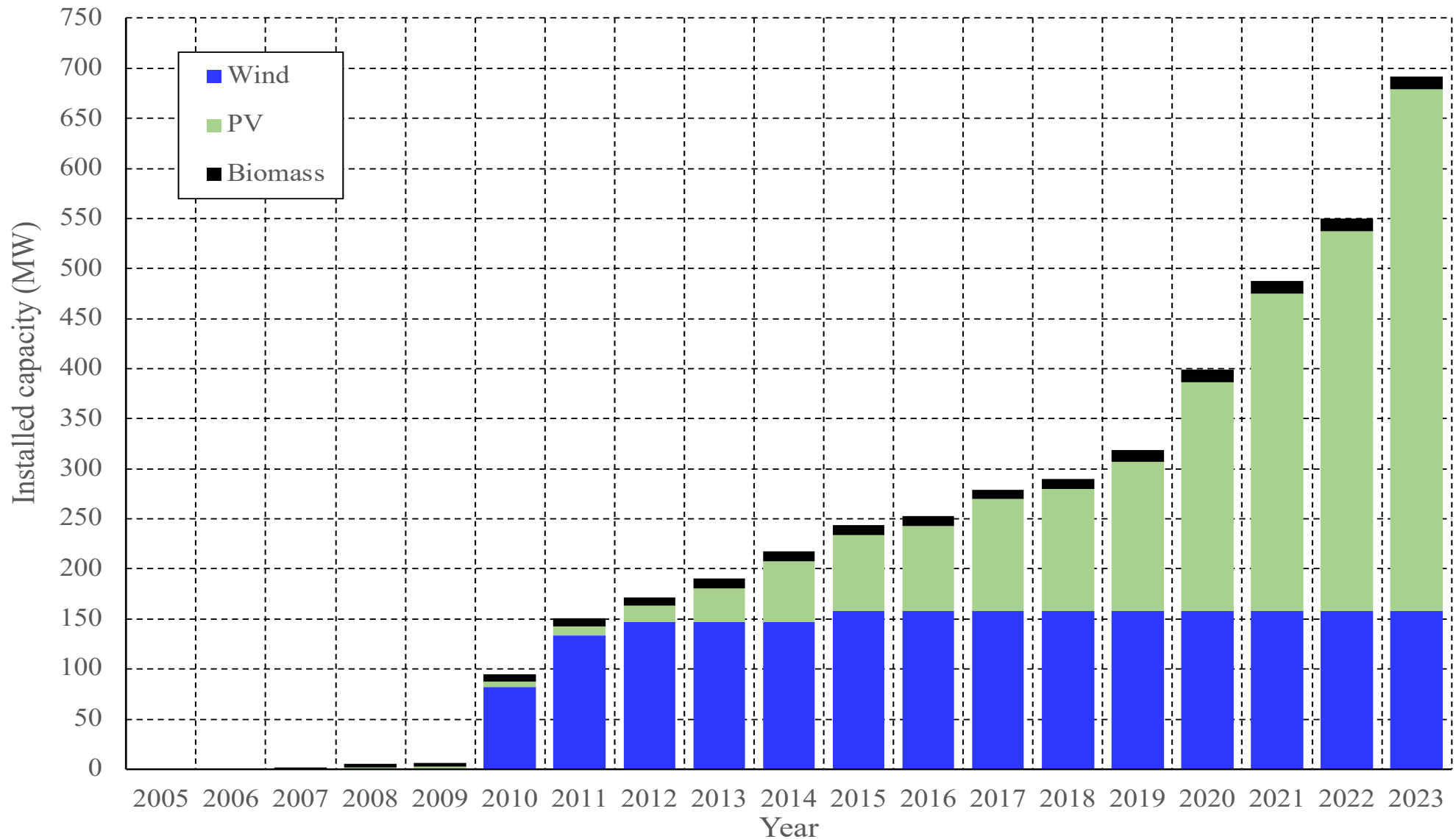


- **Total installed capacity:**

- **Conventional: 1483MWe**
- **Renewables: 692MWe**

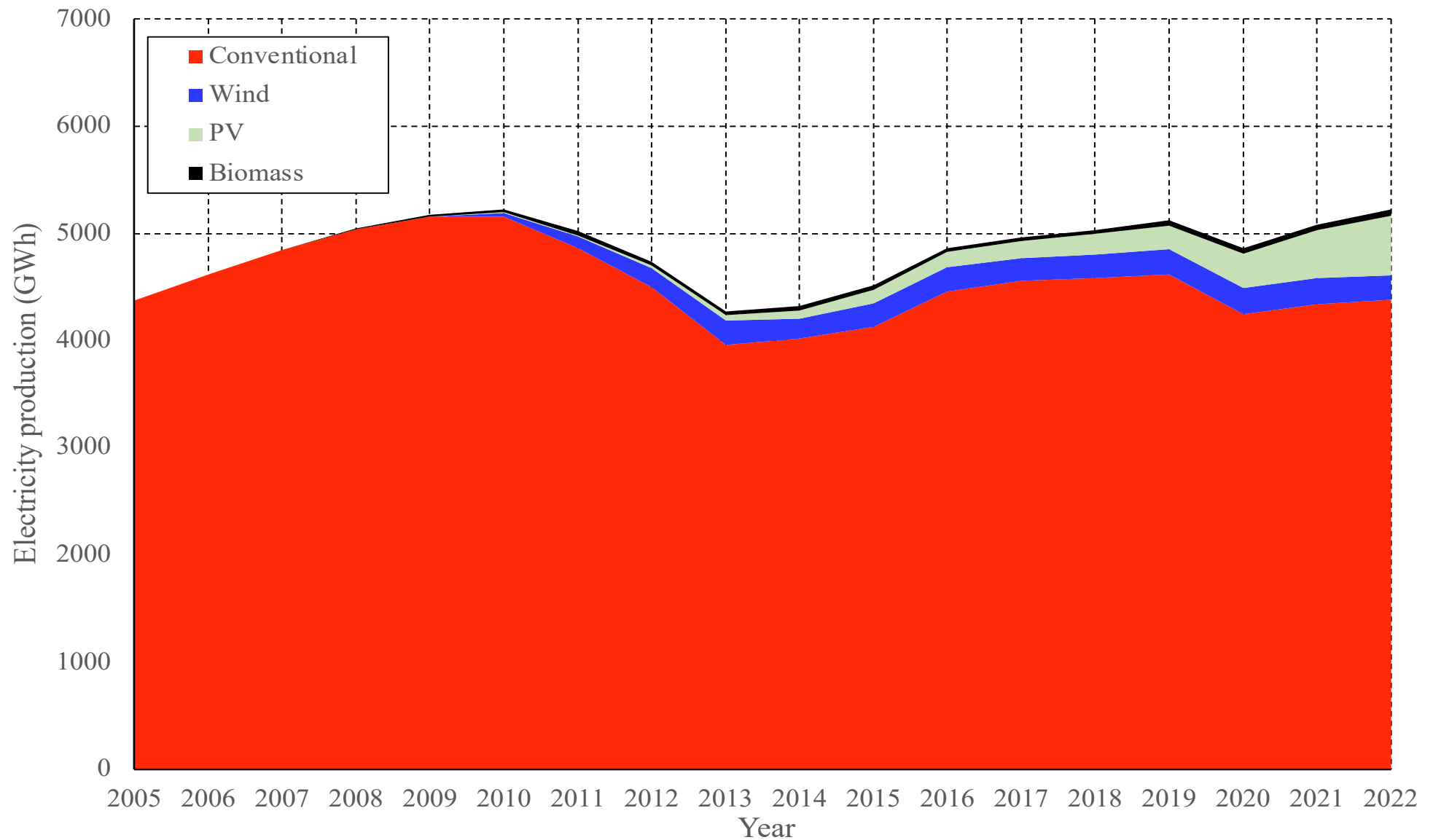


# RES-E installed capacity\*



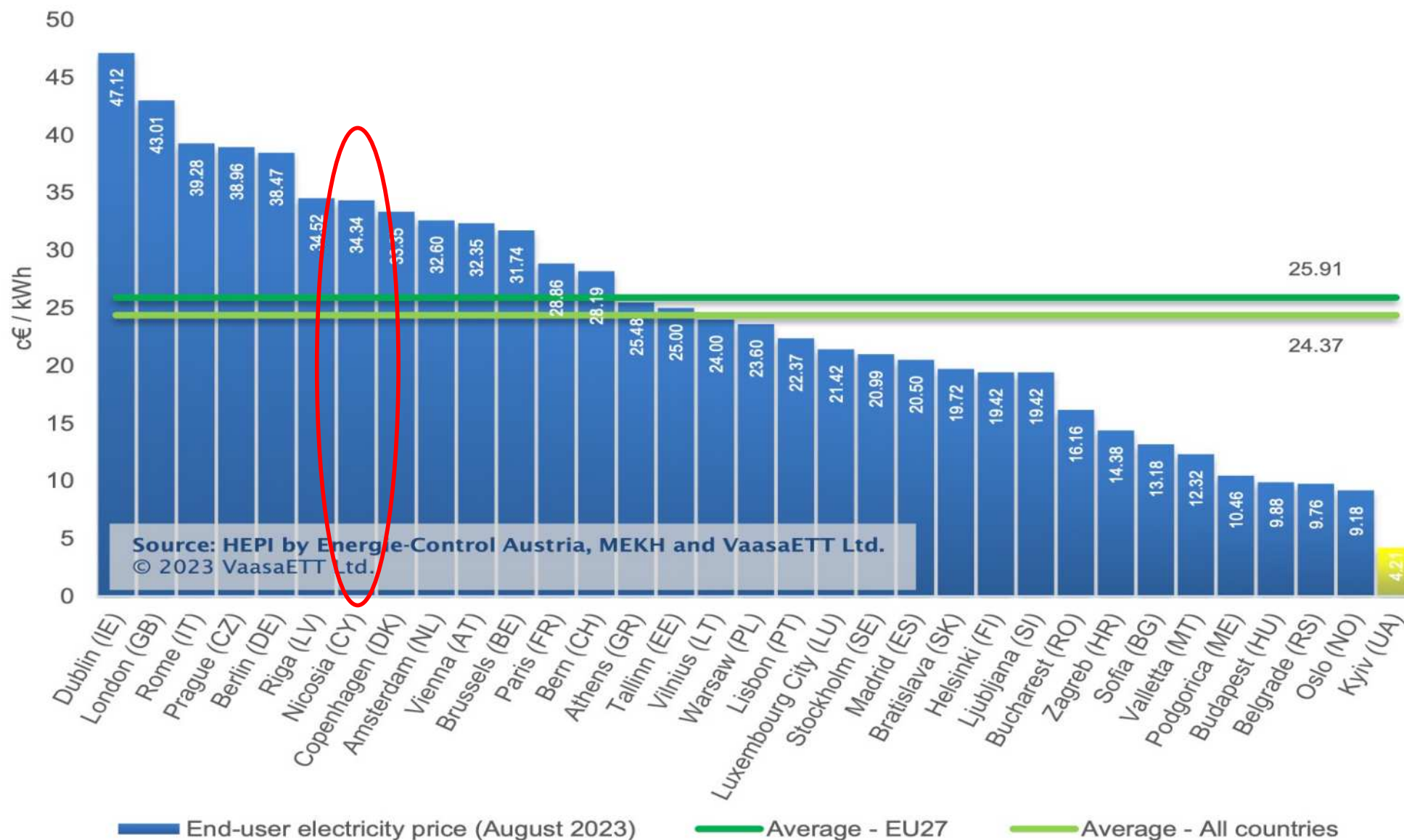
\* [www.cera.org.cy](http://www.cera.org.cy)

# Total electricity production per year\*



\* [www.cera.org.cy](http://www.cera.org.cy)

# EU statistics (Aug 2023)\*

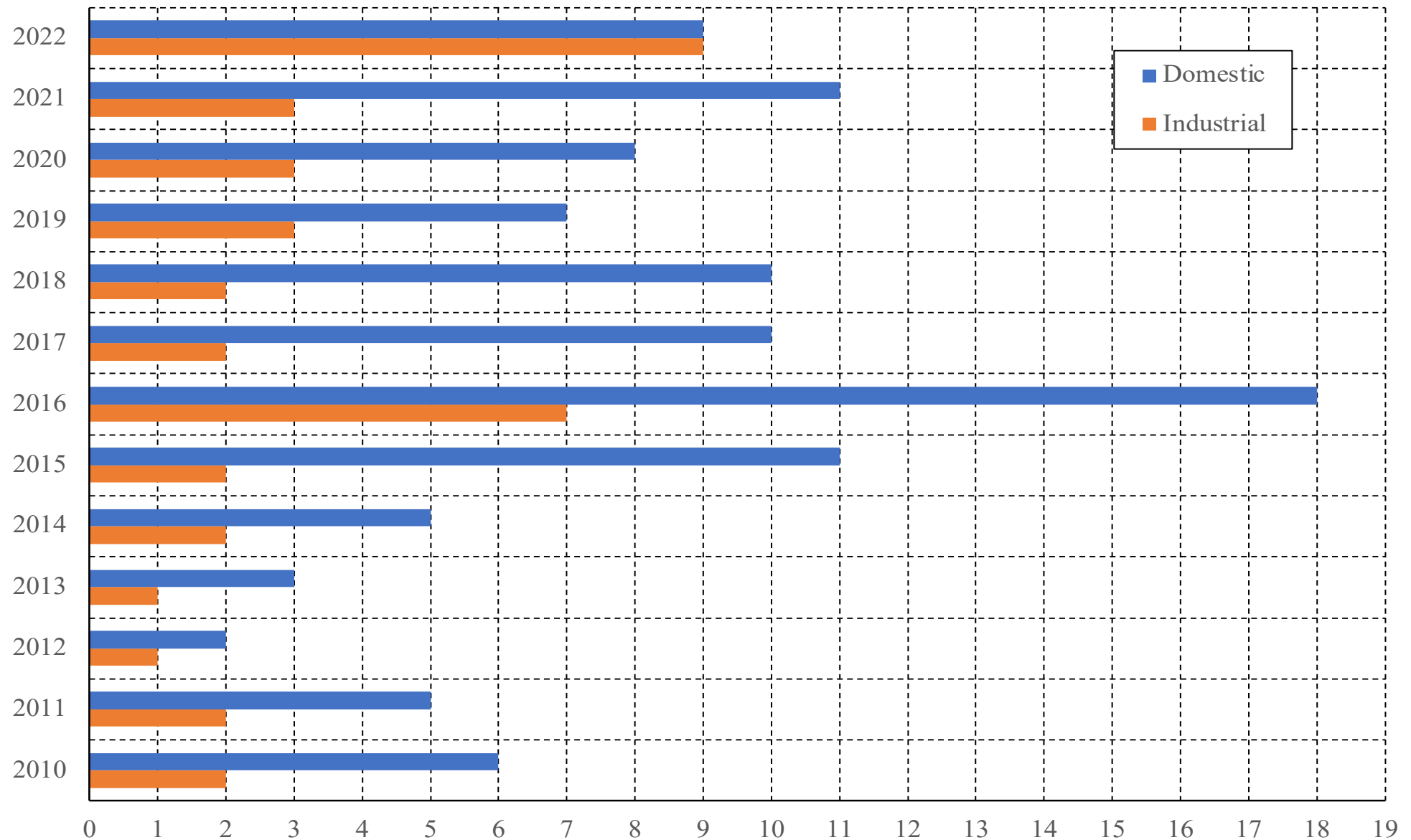


## \* Household Price Index

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# Electricity price - Position of Cyprus in EU\*

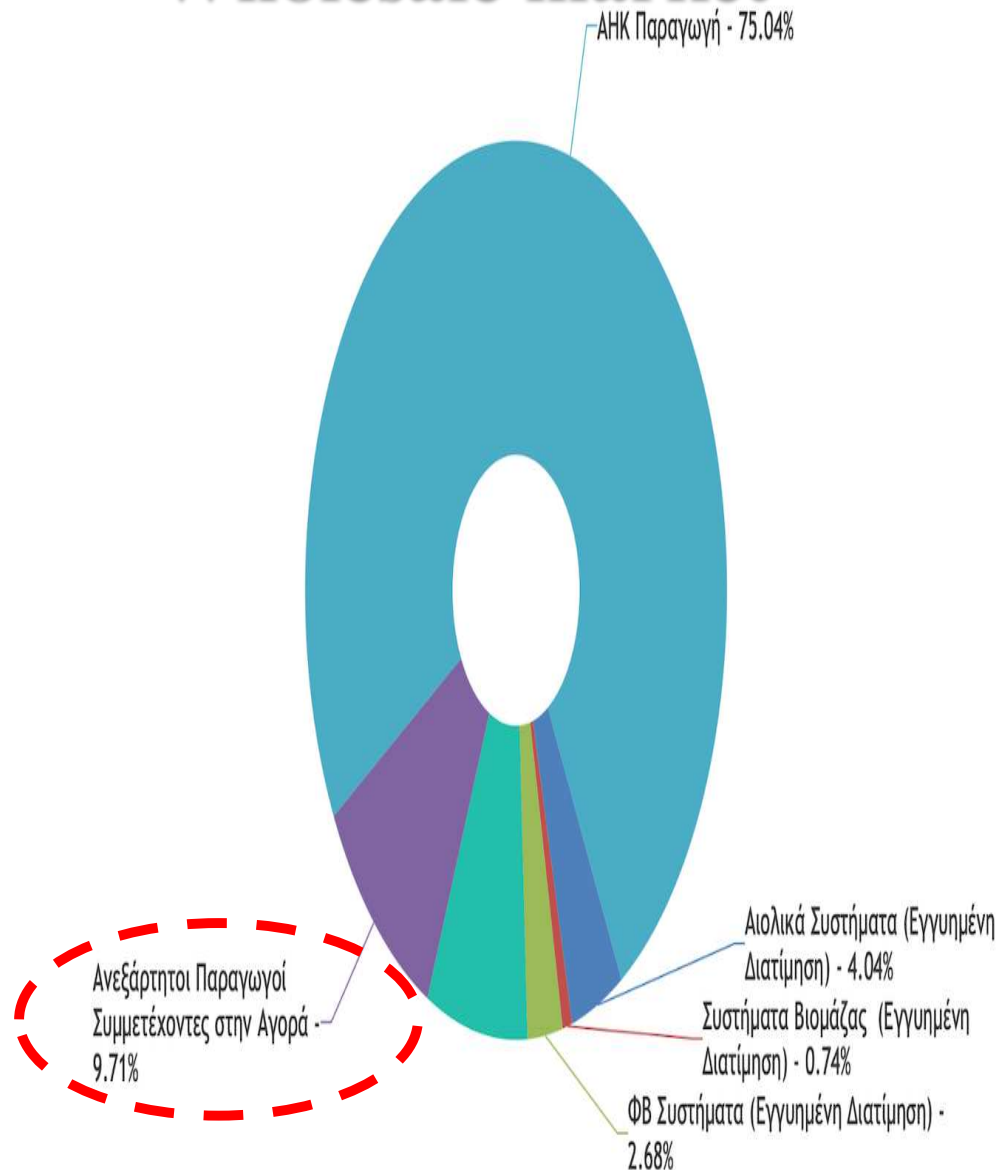


\* Eurostat

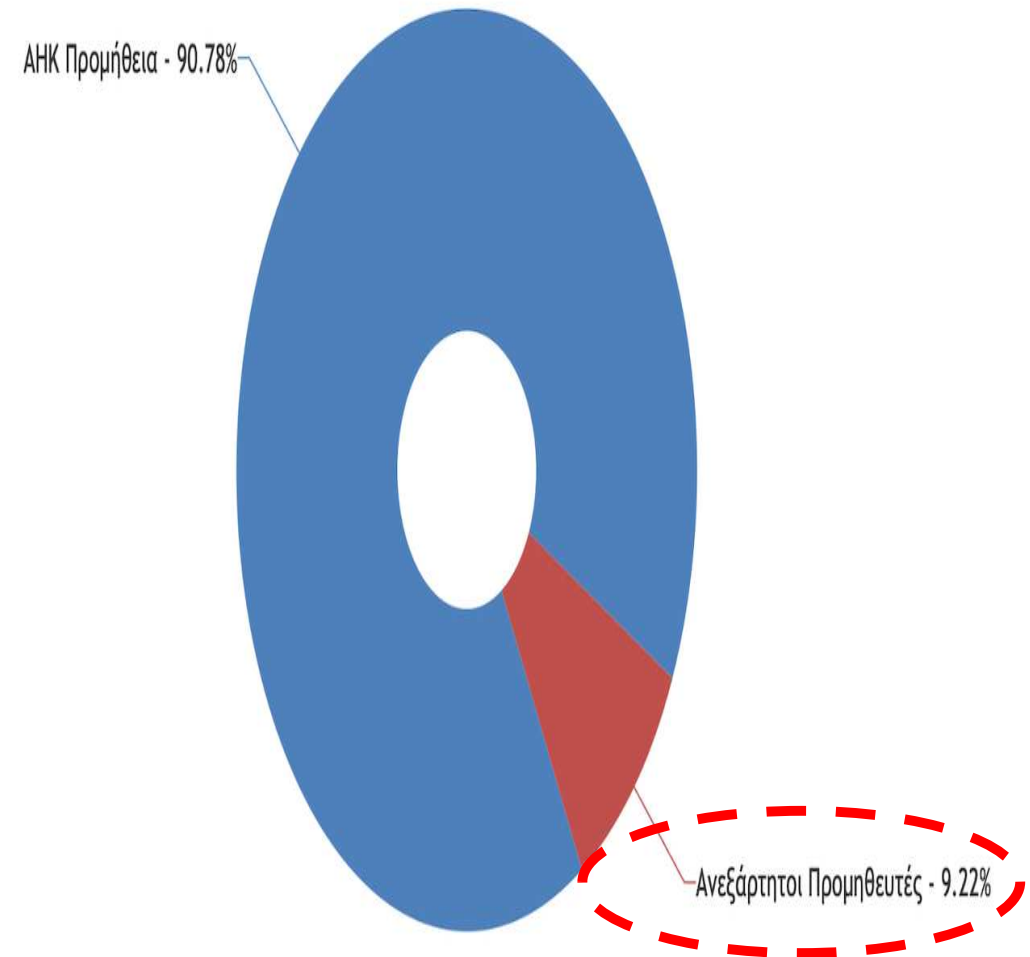
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# Market share (June 2023)

## Wholesale market



## Retail market



# Challenges of energy transition in island systems

## Solutions for isolated systems

# Characteristics of isolated electricity systems\*



- **High fuel costs**
  - ~ use of oil derivatives
  - ~ high CO<sub>2</sub> 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**

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

# The solution\*

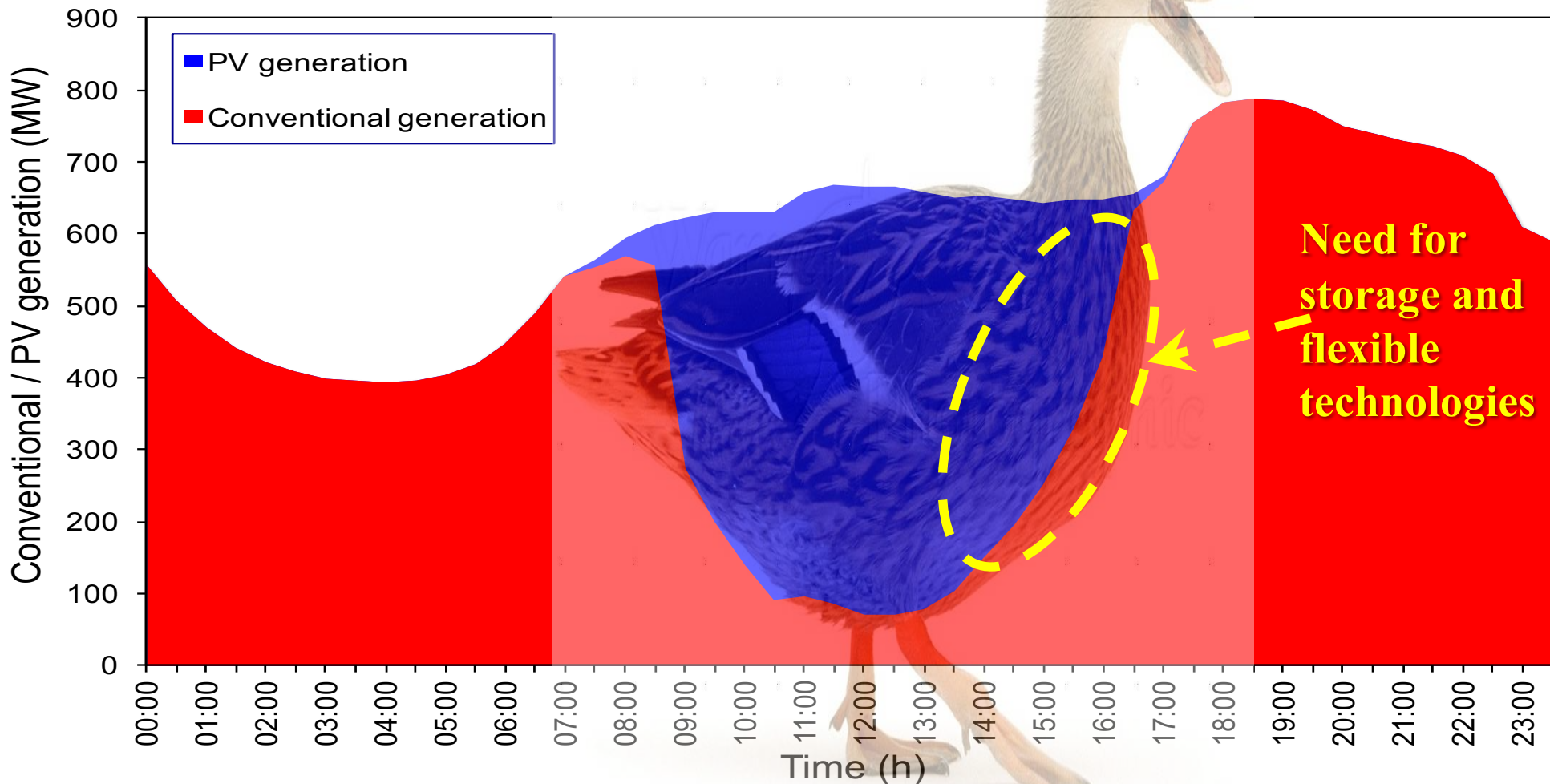
- **Increase system flexibility**
  - ~ integrate RES into electricity market
  - ~ use natural gas, storage and RES for power generation
  - ~ promote e-mobility (V2G technology - bidirectional flow of electricity between the electric car and the grid)
- **Establish electricity interconnections**
  - ~ 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

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

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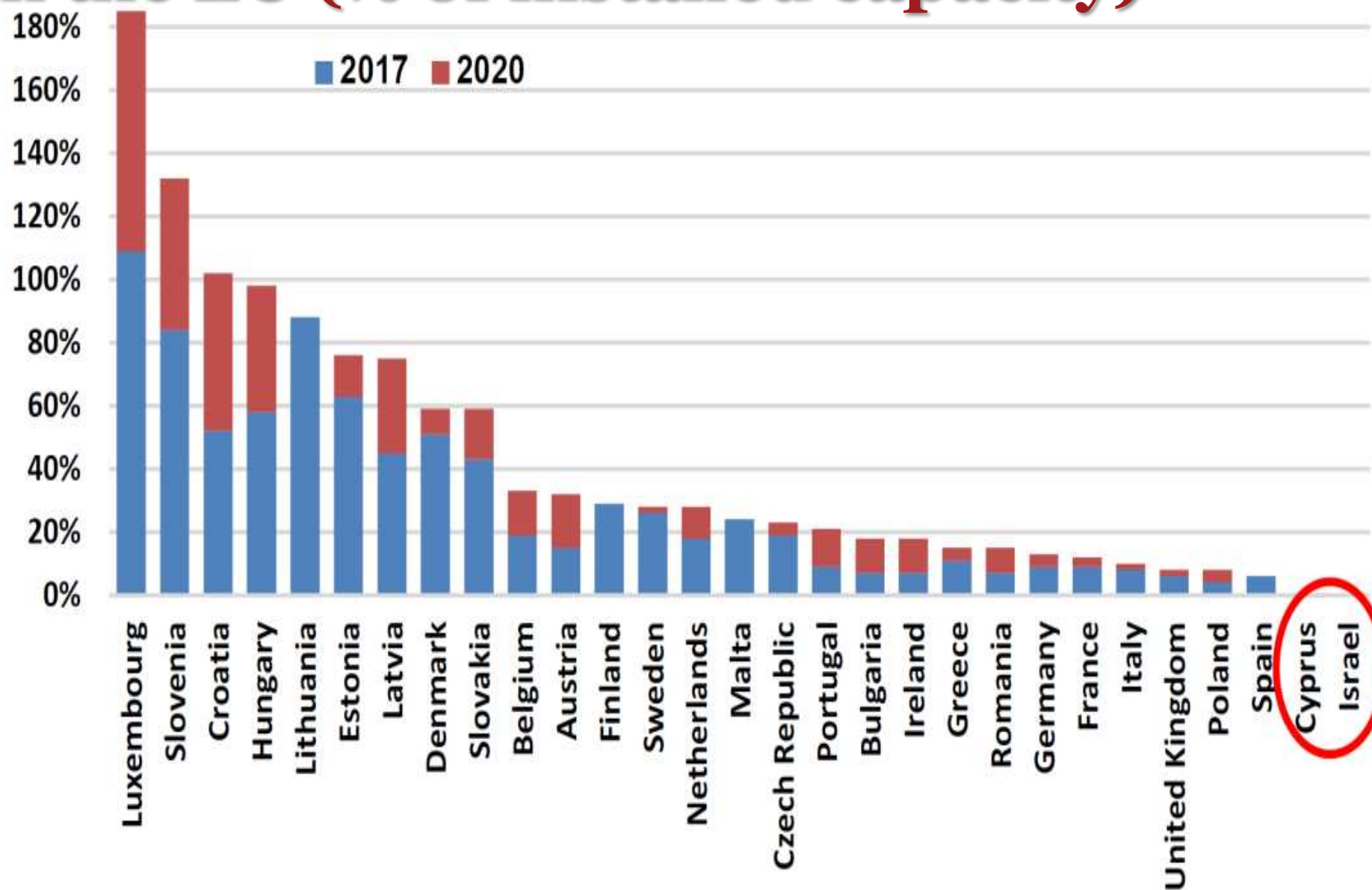


# Effect of PV generation on load curve (the 'duck curve')\*



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

# Interconnection between countries in the EU (% of installed capacity)



# CEEA 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**

# Long-term energy strategy for Cyprus towards hydrogen economy



# Target-setting for Cyprus' transition to hydrogen economy\*

Target	Year		
	2030	2040	2050
Greenhouse gases	-30%	-75%	-100%
Renewable energy sources	30%	75%	100%
Electrical interconnections	50%	65%	80%

**Cyprus could set a long-term goal of reducing greenhouse gas emissions by 100% by 2050 !**

\* Poullikkas A., 2020, *Long-term Sustainable Energy Strategy: Cyprus' Energy Transition to Hydrogen Economy*, ISBN: 978-9925-7710-0-4

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