

Storage & Renewables Electrifying Cyprus' SREC

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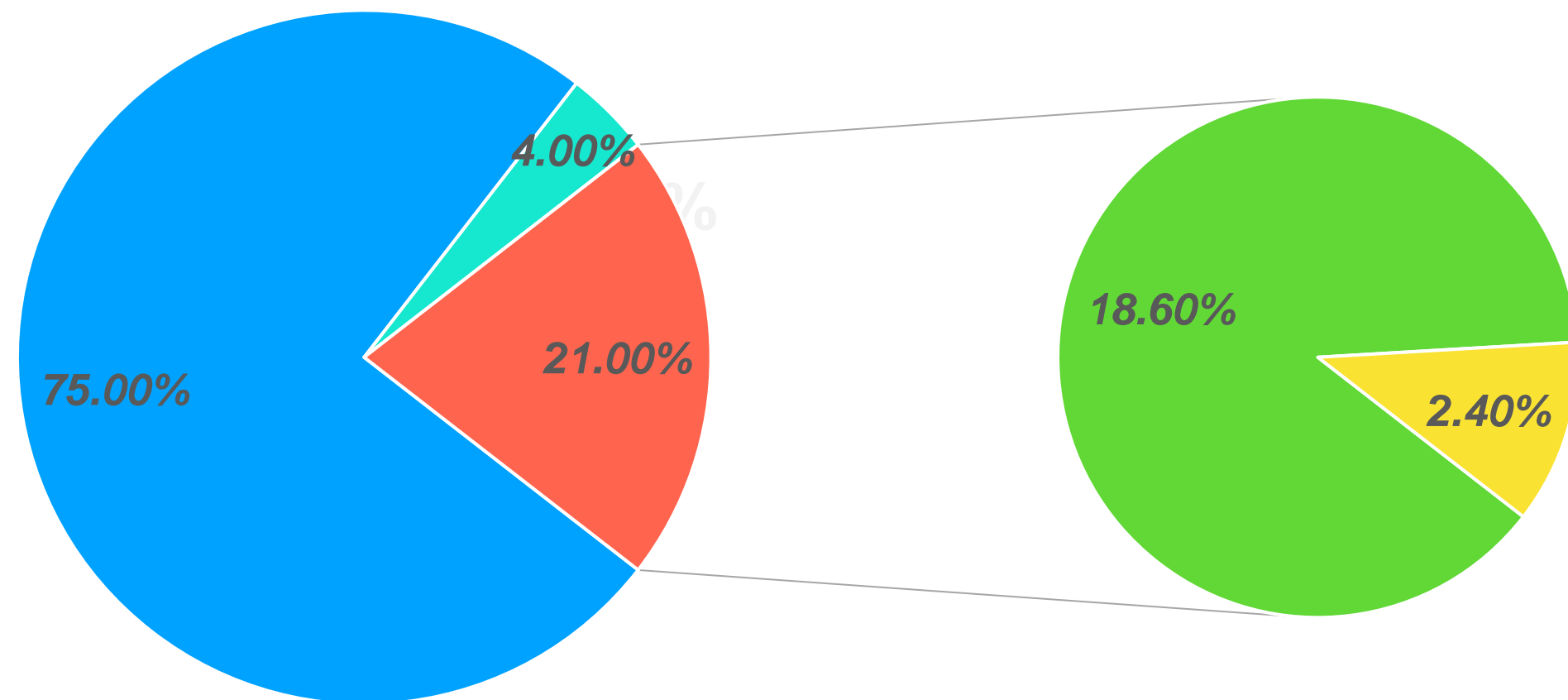
Thursday, 18 November 2021 10:30 AM - 13:30 PM



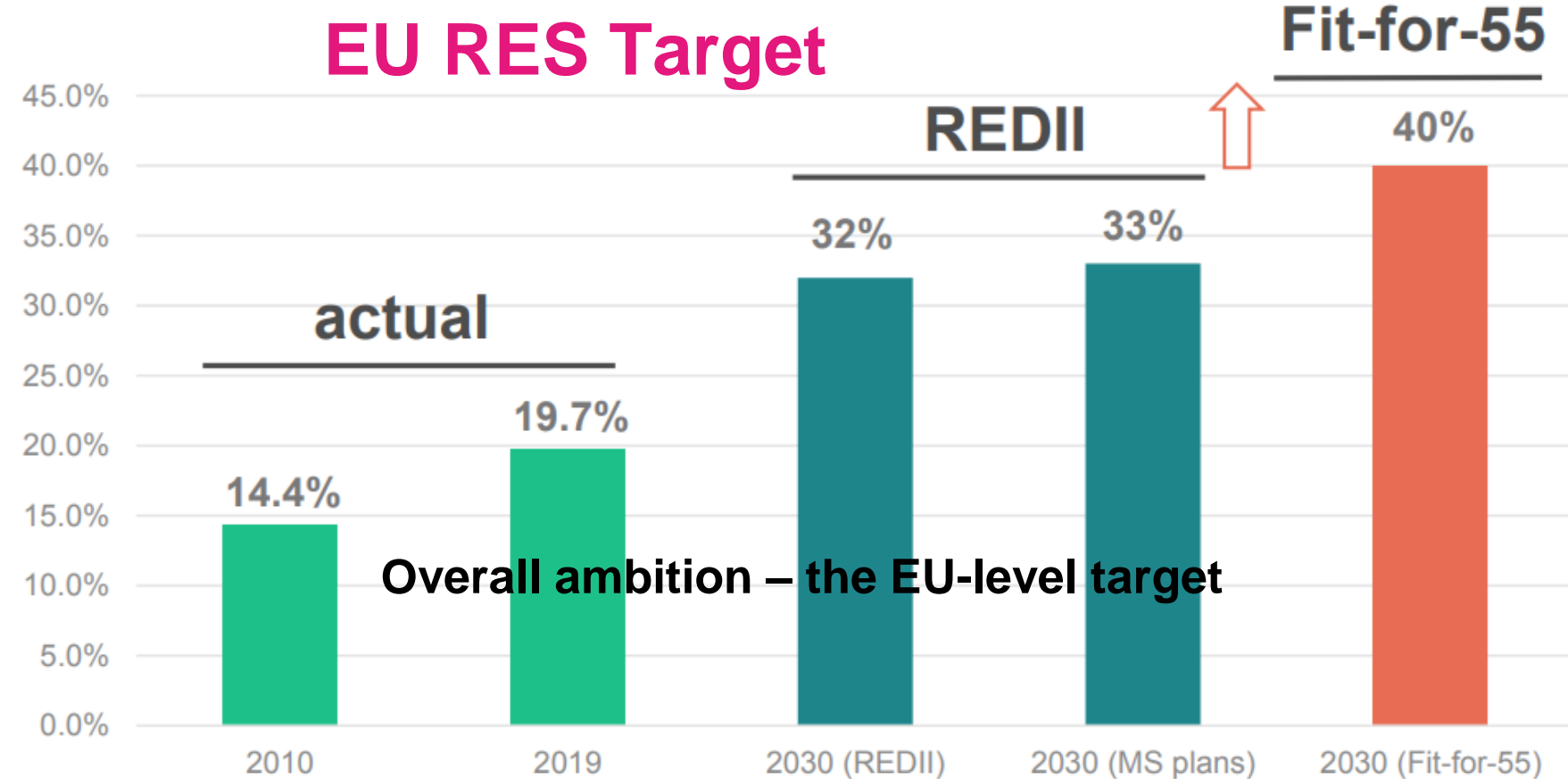
RES TARGETS IN 2030 (CY – EU)




Existing RES Shares per sector 2030




■ H&C ■ Transport ■ Electricity ■ Elec Transport






Photovoltaics
Wind
Biomass



Solar Thermal
Heat Pumps
Wood
Biogas
Geothermal

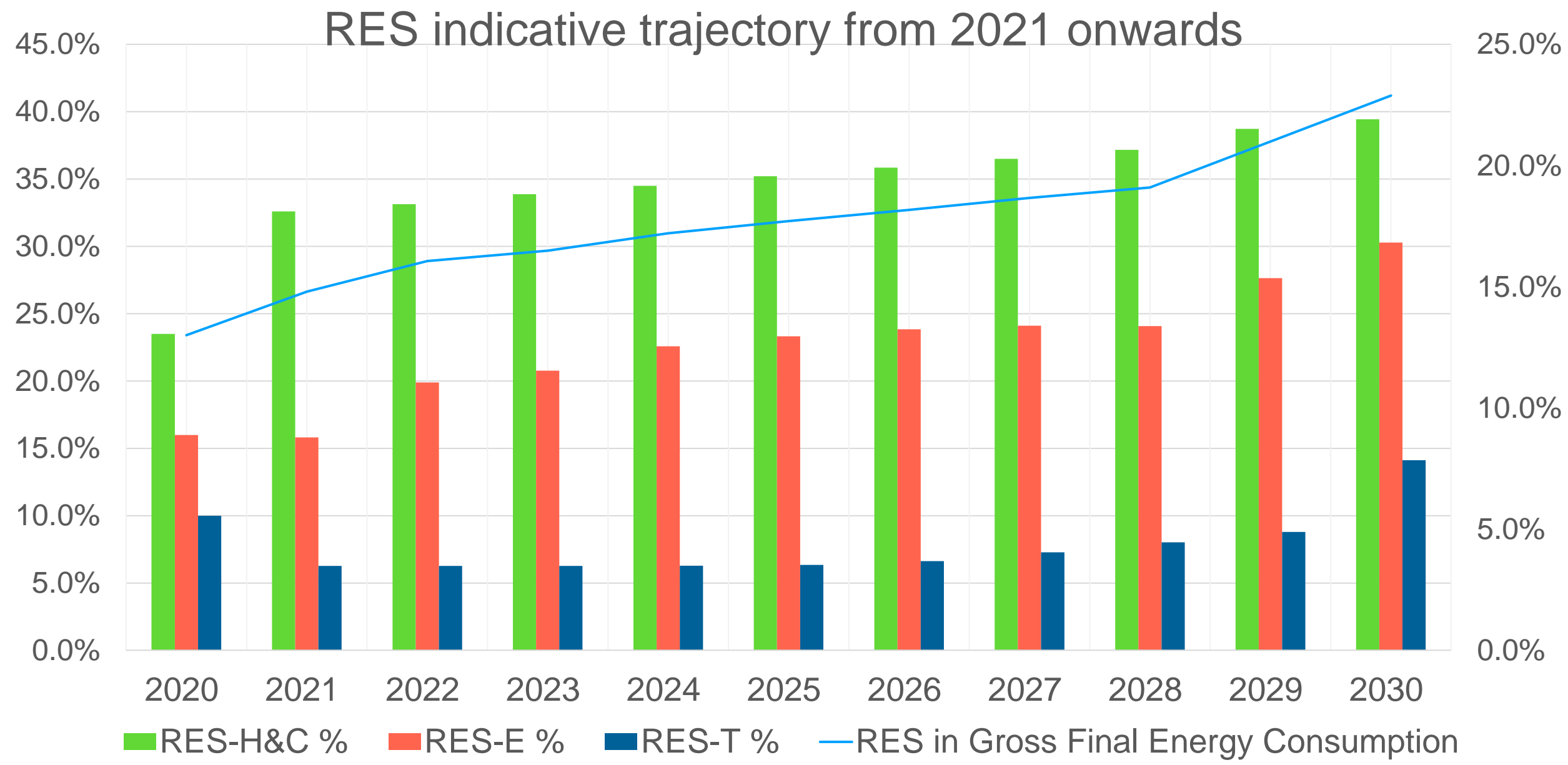


Biofuels
RES
Electricity

2020	16%	23,5%	10%	13%
2030	30%	39%	14%	23%
2019	9,8%	35,1%	3,3%	13,8%

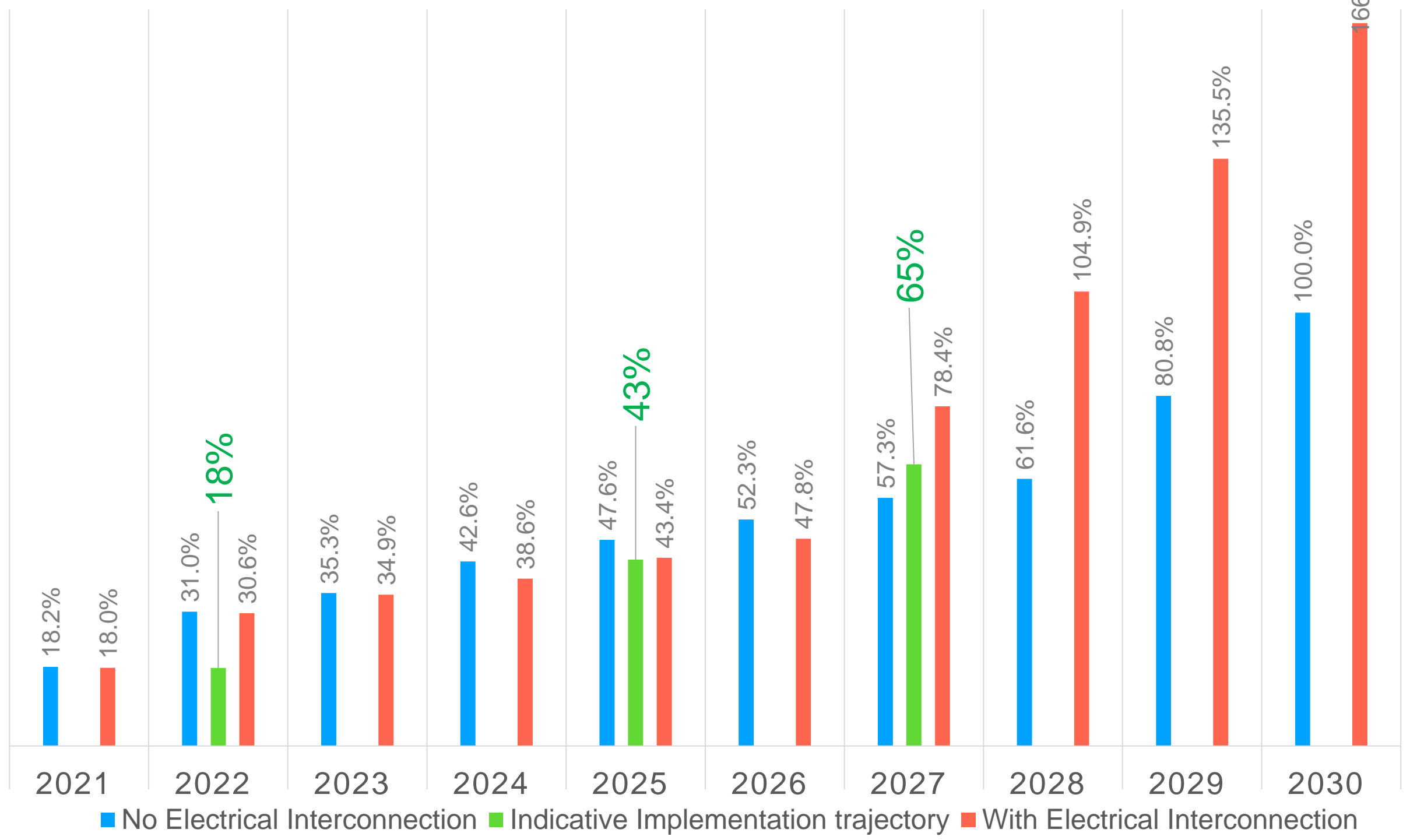


CY RES Targets per Sector toward 2030

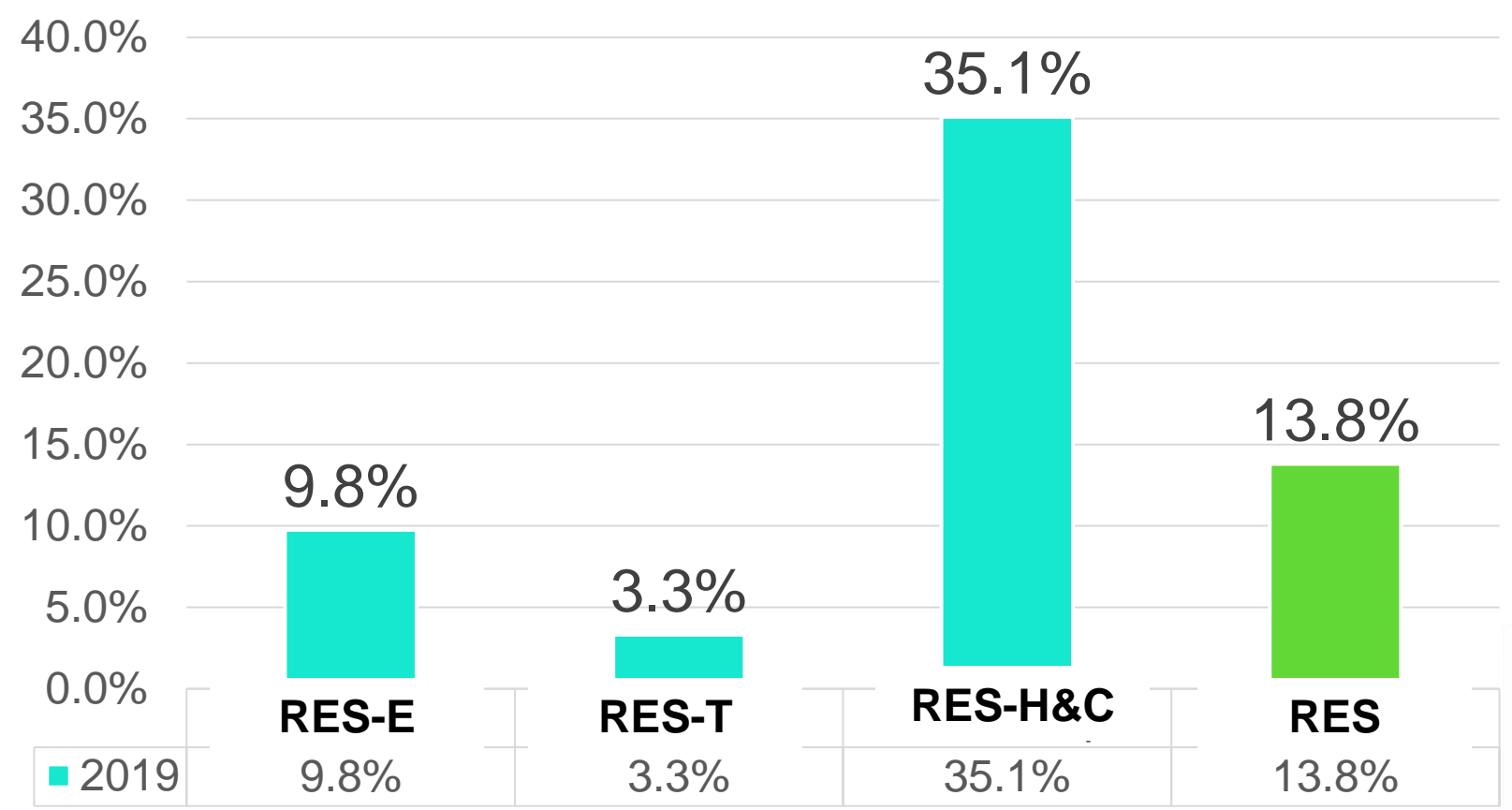


2030	Capacity(MW)
Wind	198
PVs	806
Biomass	58
CSP (Storage)	50

RES INDICATIVE TRAJECTORY TOWARDS 2030, IN TWO SCENARIOS



2019 RES Status in all Sectors



Priorities

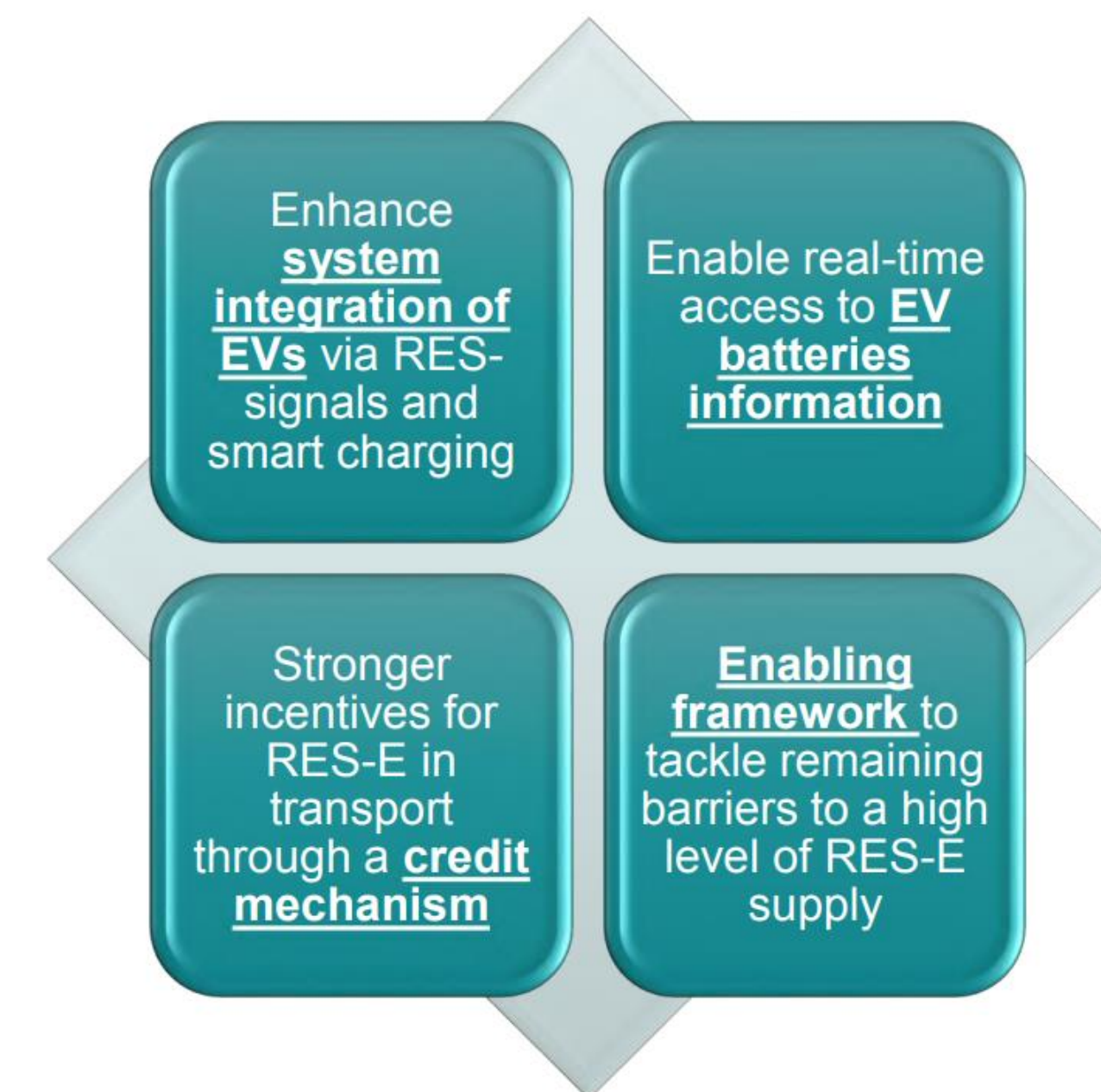
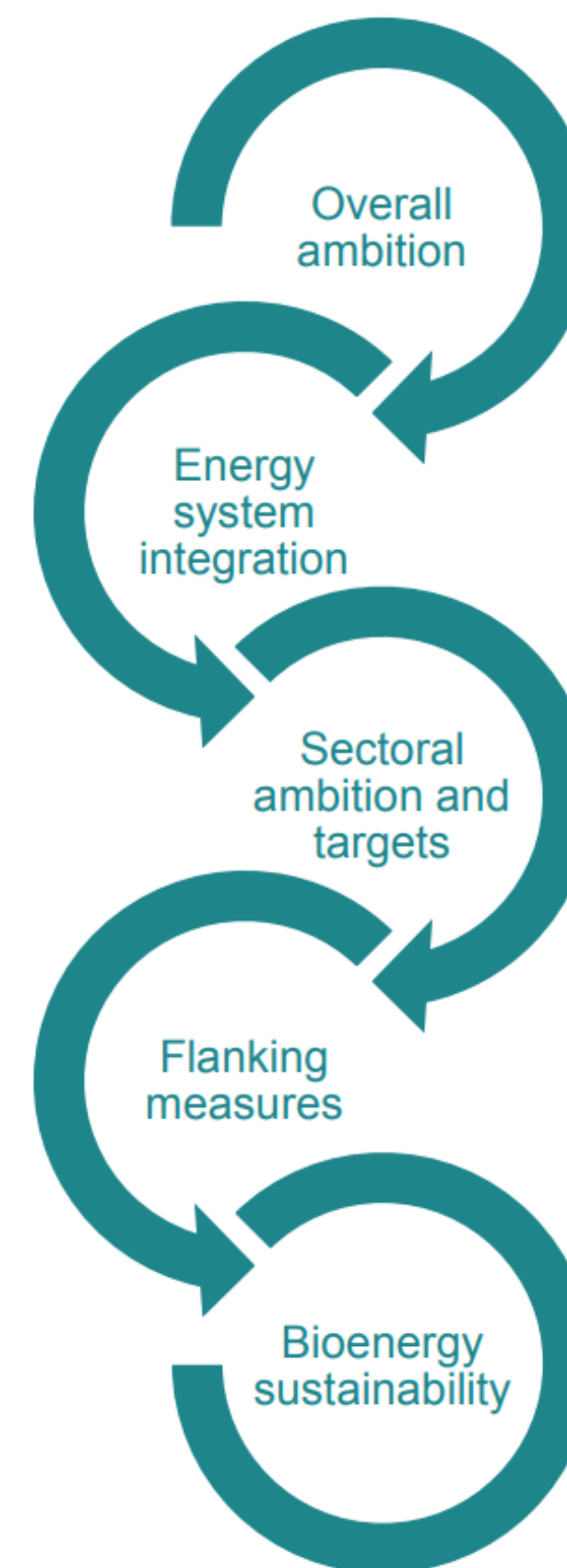


Harmonization with all related EU – Directives

- RES Directive
- Electricity Directive and Regulation
- R&D Projects

Priorities

- One Stop shop for RES projects
- Renewable Energy Communities
- Strategic Environmental Impact Assessment for the Spatial Planning of RES projects
- Updated / enhanced framework for the self Consumption Scheme
- Energy Storage Roadmap



**Electrification:
Energy System
Integration**



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MECI PARTICIPATION IN R&D PROJECTS



The national funded project “BUS-FUEL-SAVING” , aims to integrate innovative green technologies on existing public transportation buses for achieving 5% - 30% fuel savings. The project’s task is to increase the existing buses’ engine efficiency by integrating onto the existing engines an innovative, green technology, namely the **HHO gas generator**. This technology creates a complete (perfect) burn, ultimately leading to the reduction of the fuel needed for the same output power, due to the increase of the engine’s efficiency

EMPOWER brings together all the key stakeholders of the electric energy sector in Cyprus with an ambitious goal to develop sustainable and intelligent technologies and tools for the electric power system of Cyprus. EMPOWER aims at improving the effectiveness of the Cypriot Research, Technological Development, and Innovation through research activities, technological development, and innovation, focusing on the priority area of energy. A major goal of EMPOWER is the **smart and green evolution of the Cyprus power system infrastructure**, which will result to a great socio-economic impact for the entire country *using Energy Storage*.

SREC aims to identify existing storage & hybridization technologies, suitable for applications in the Grid and the demand needs of Cyprus, to examine the applicability of smart Grid storage at various scales and activity levels, and to quantify the implications of these technologies at all levels. Finally aims to set up, at ready-to-built level, two medium scale demonstration storage/hybrid plants suitable to attract investors who will built and operate them.

The main objective of the project is to fuse together extensive interdisciplinary scientific research in the field of grid integration of renewable energy sources (RES) and to target the major challenges and barriers to boost the integration of RES, by covering the whole research and innovation (R&I) wide spectrum of enabling **dynamic, automated and cost-effective management of smart distribution grids**. The aim of the project is to pave the way for increased penetration of distributed generation (DG) systems to be integrated and optimally managed at the distribution grid



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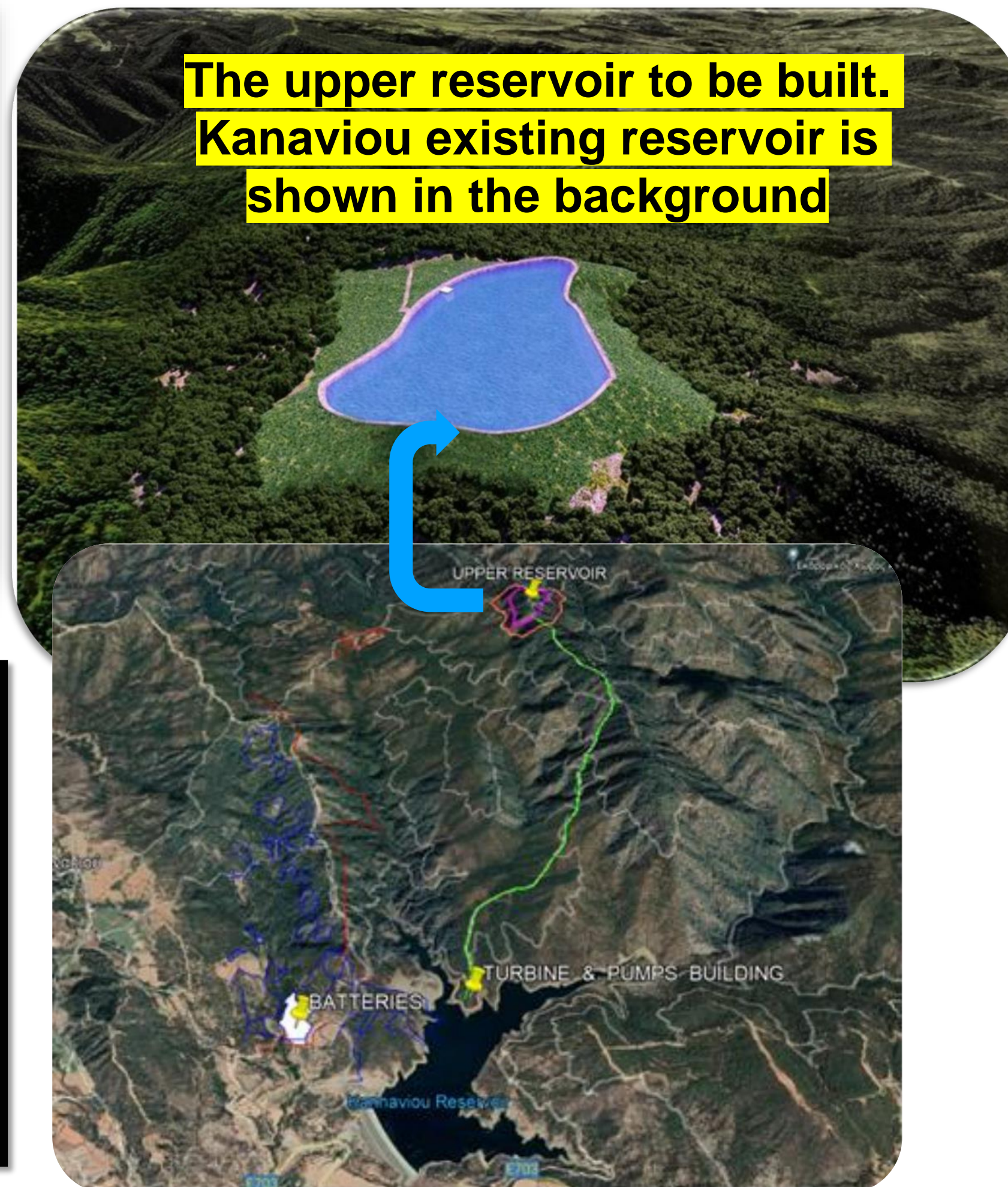
SREC (SNAPSHOTS)



The Turbine/Pump building near the existing Kanaviou reservoir.



The batteries storage plant.



The upper reservoir to be built. Kanaviou existing reservoir is shown in the background

Simulation of an isolated system behavior at high RES penetration coupled with storage

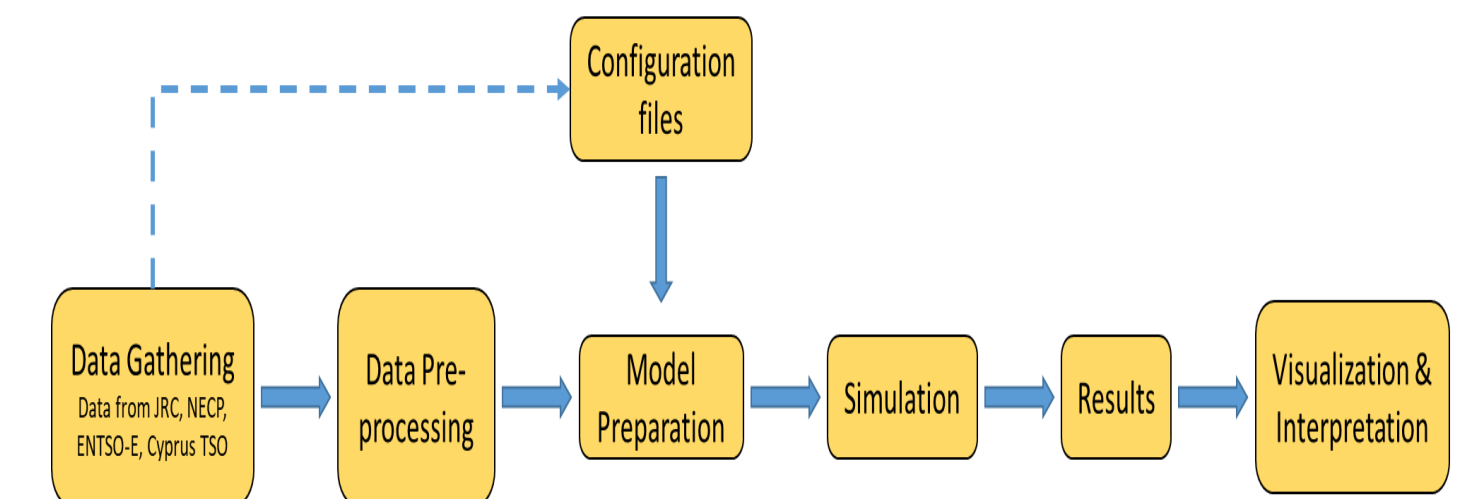
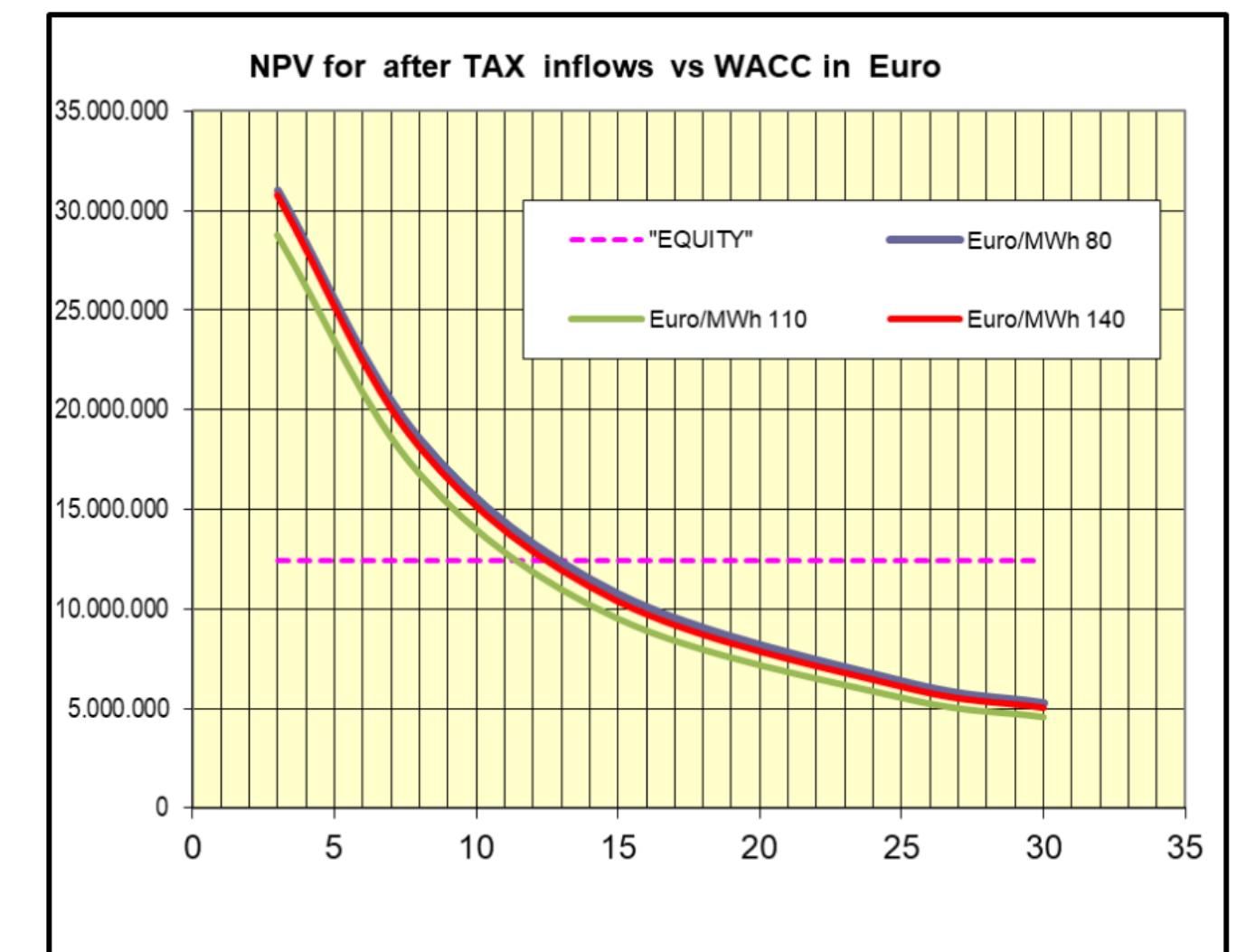


Figure 2: Methodology

EUROASIA INTERCONNECTOR

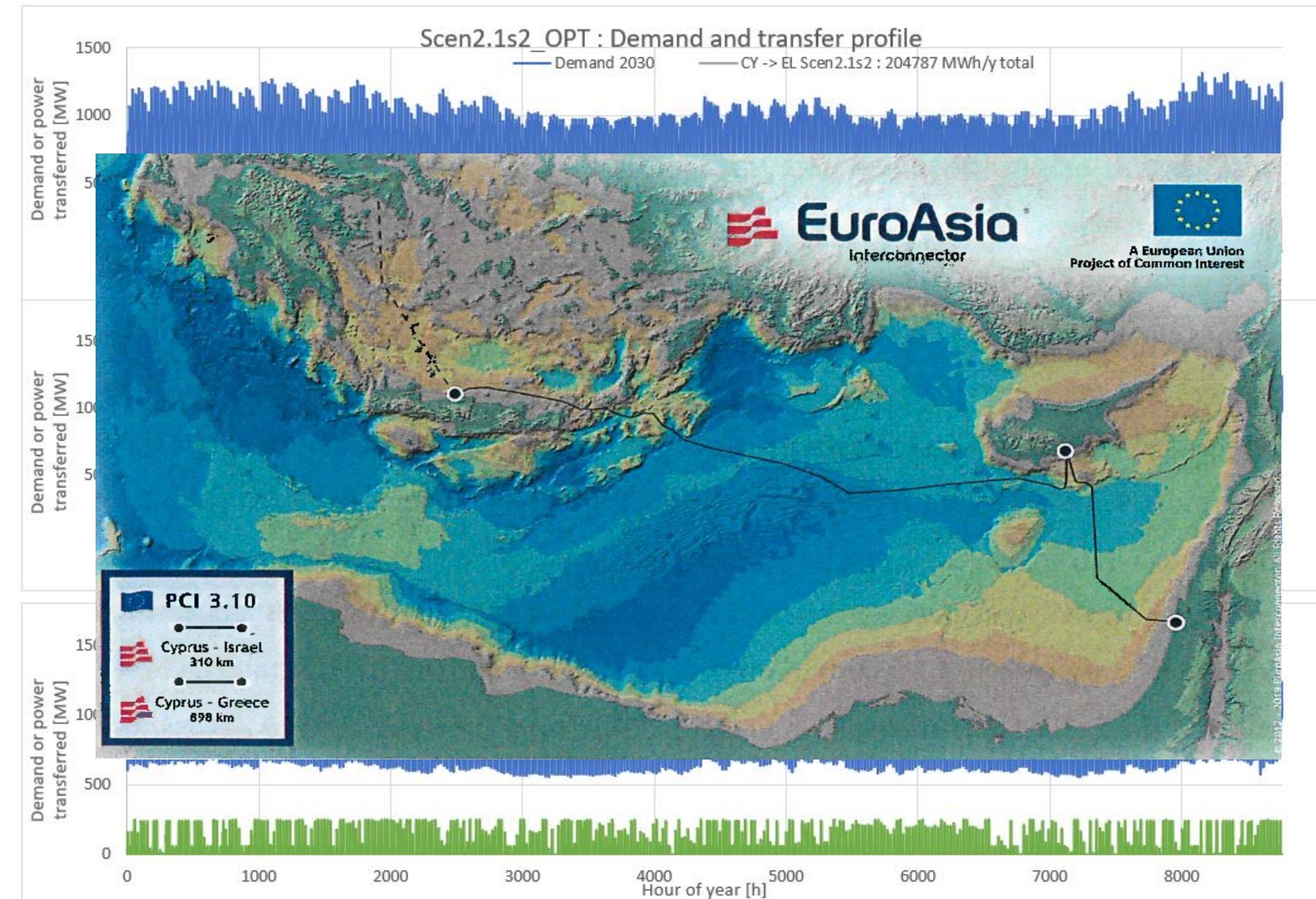


Treat the interconnection as an energy carrier with the following characteristics:

- ✓ Transferred energy to/from Cyprus is imposed by using predefined hourly profiles
- ✓ Priority is given to such transfers (100% satisfied), while the optimization has to balance the dispatch of the conventional and RES/storage facilities for covering demand effectively
- ✓ Transferred MWh bare no cost.
- ✓ There is no transmission cost or congestion event.

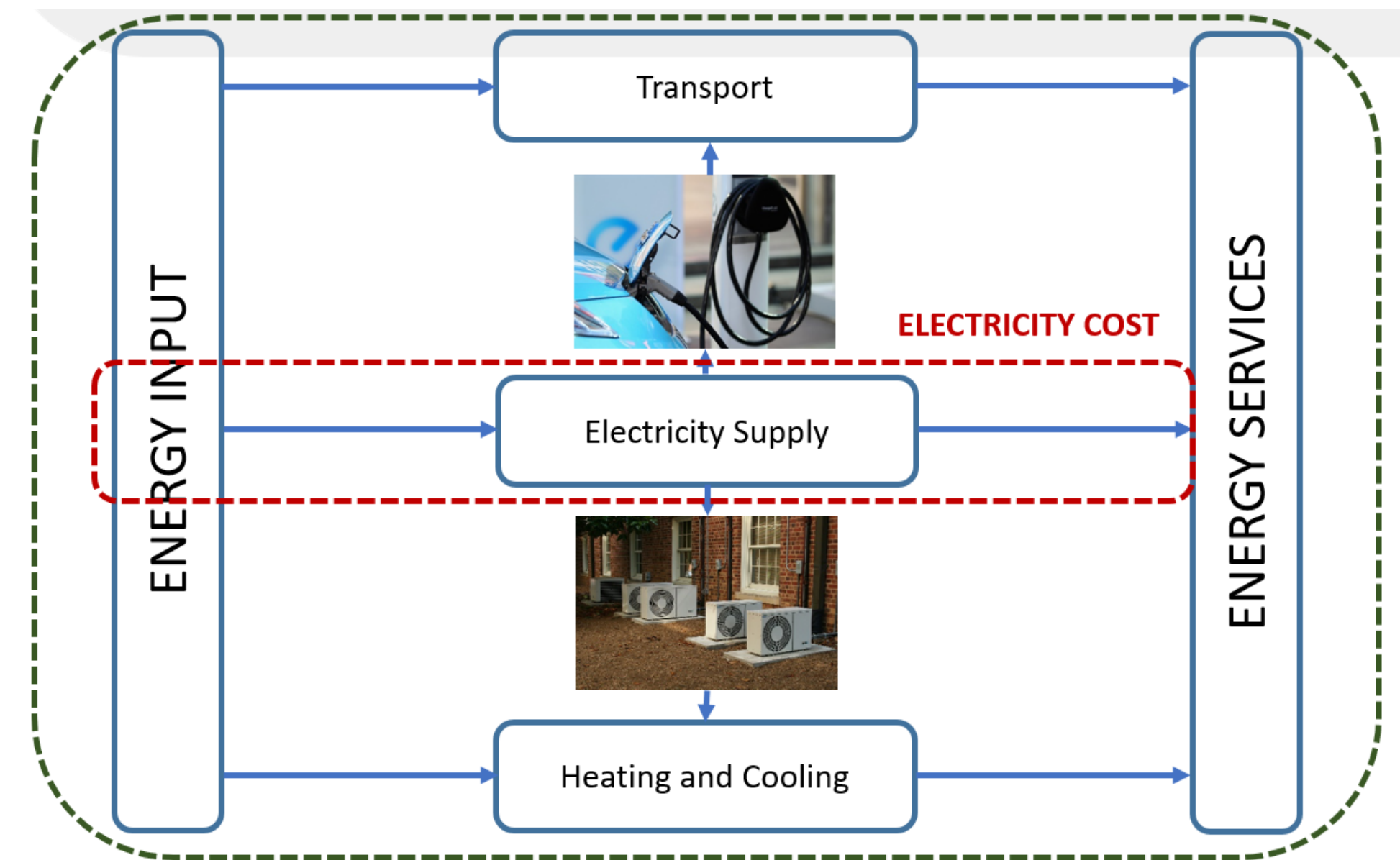
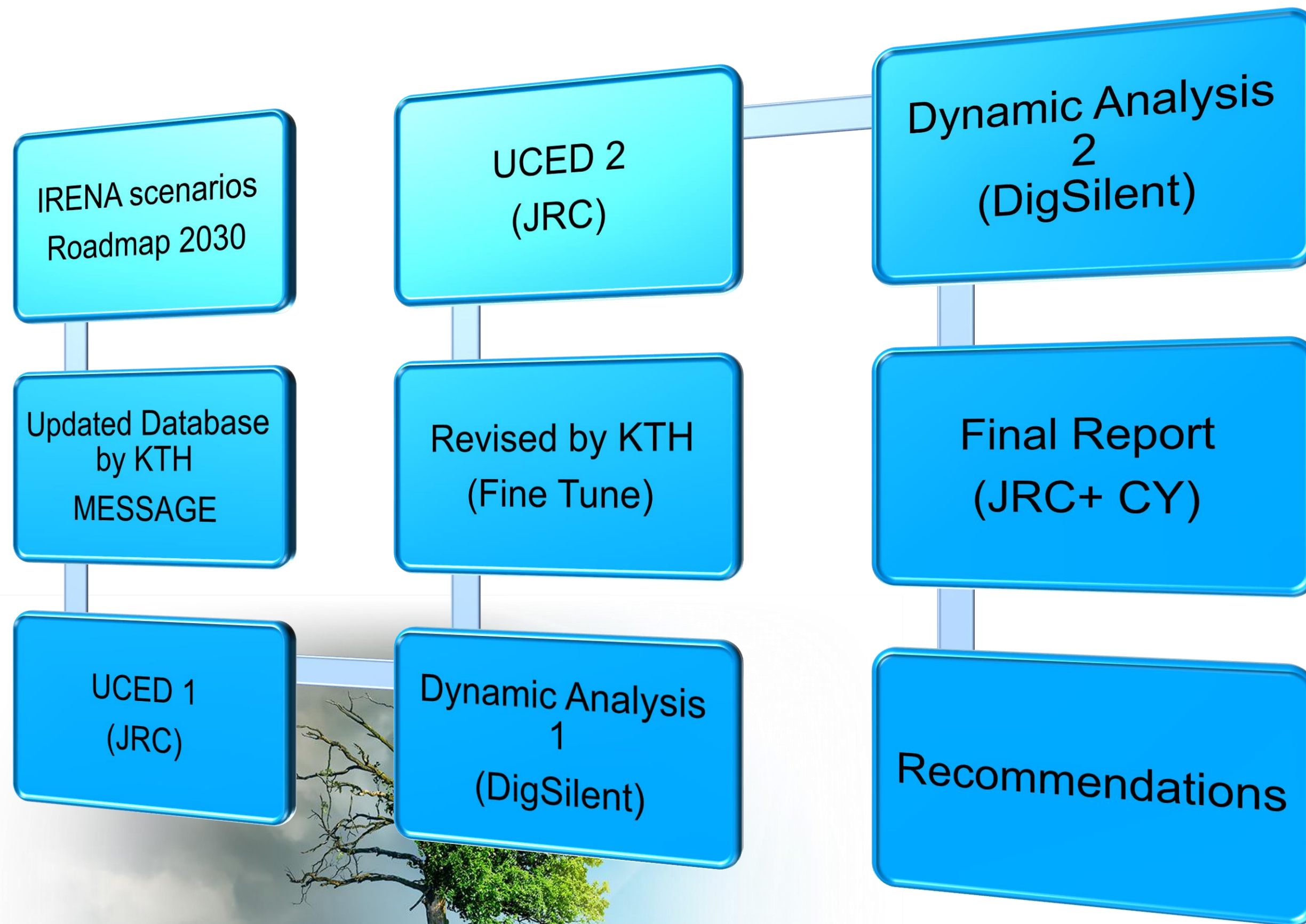
Further assumptions:

- ✓ Transfer will be capped at 500MWh-h, not allowing for possible congestion.
- ✓ The Greece-Italy 2015 transfer profile adopted for some of the simulations. Two variations of the profile accounting for about 1GWh/y transfer to or from Cyprus.



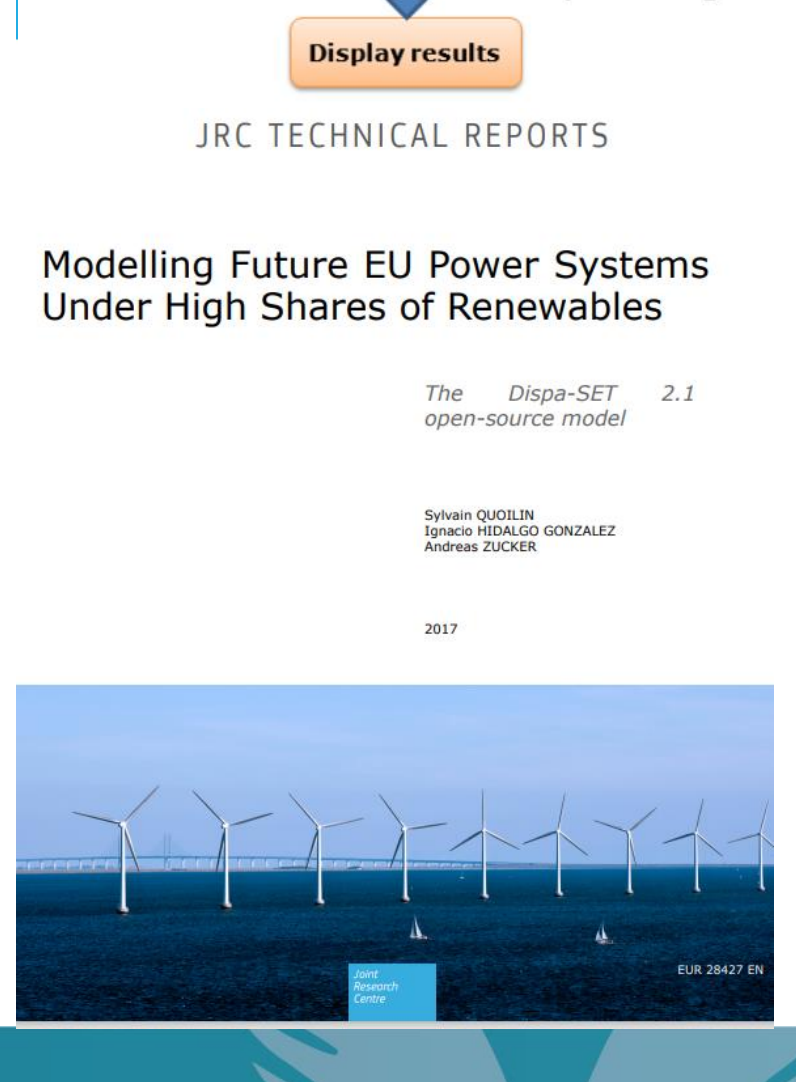
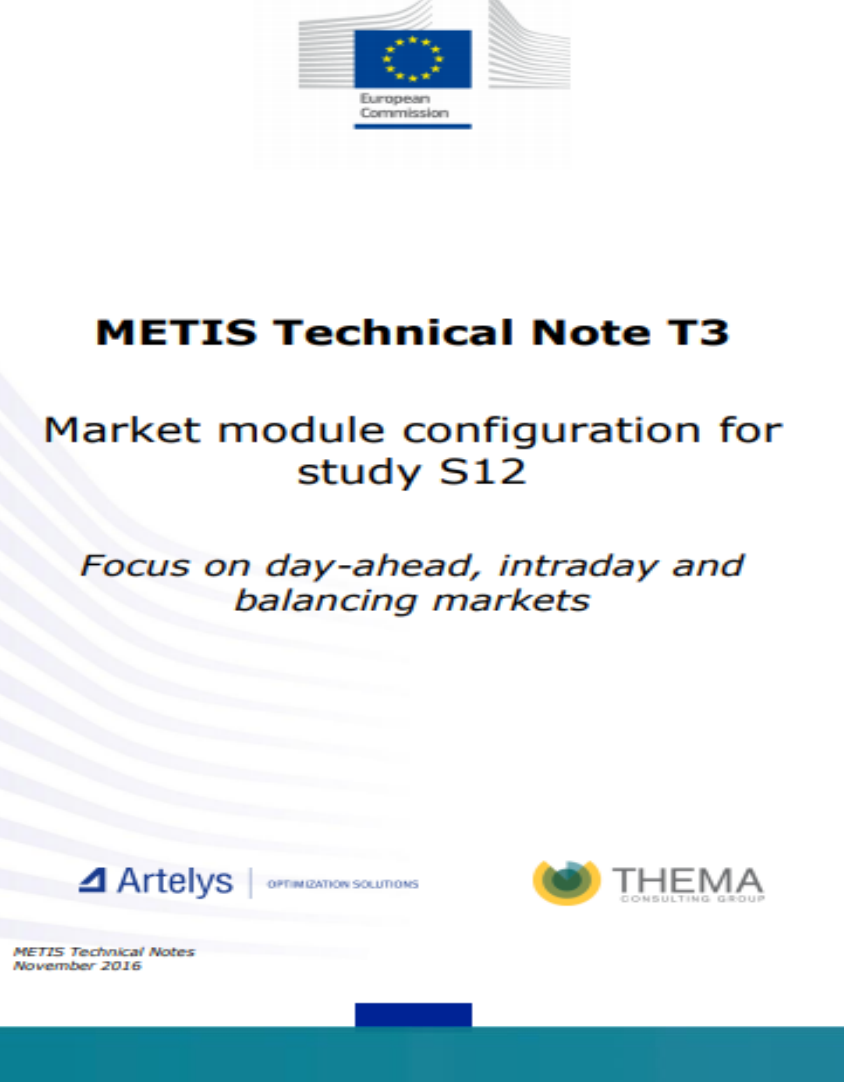
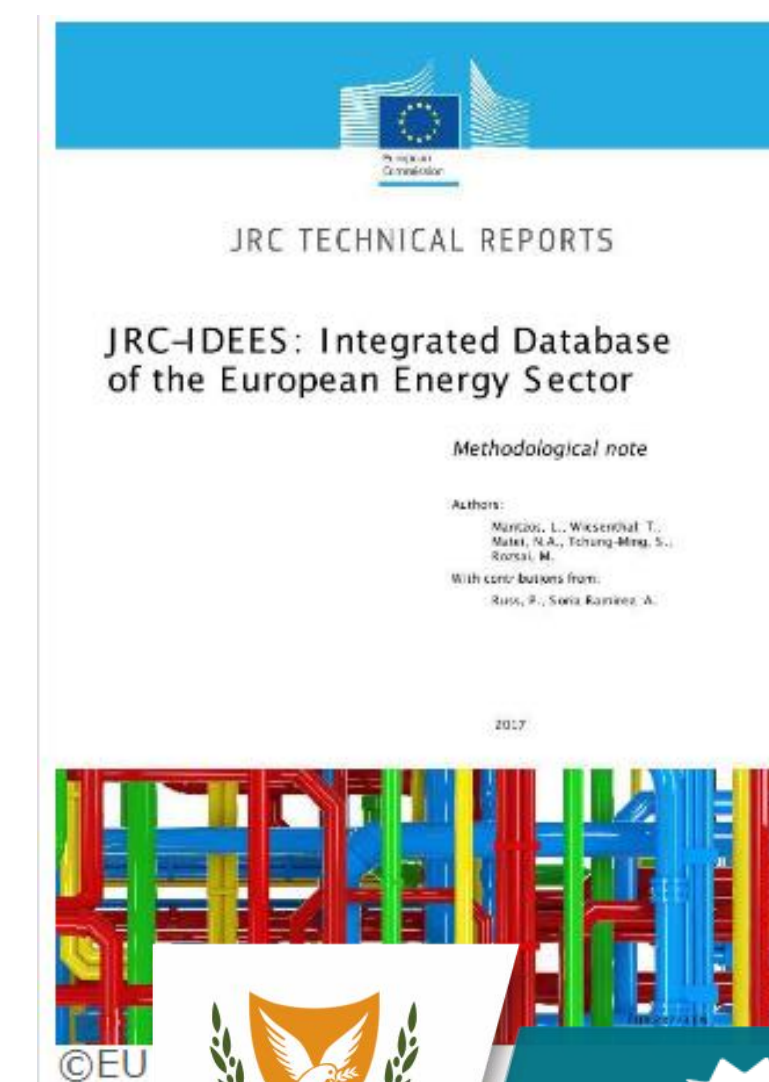
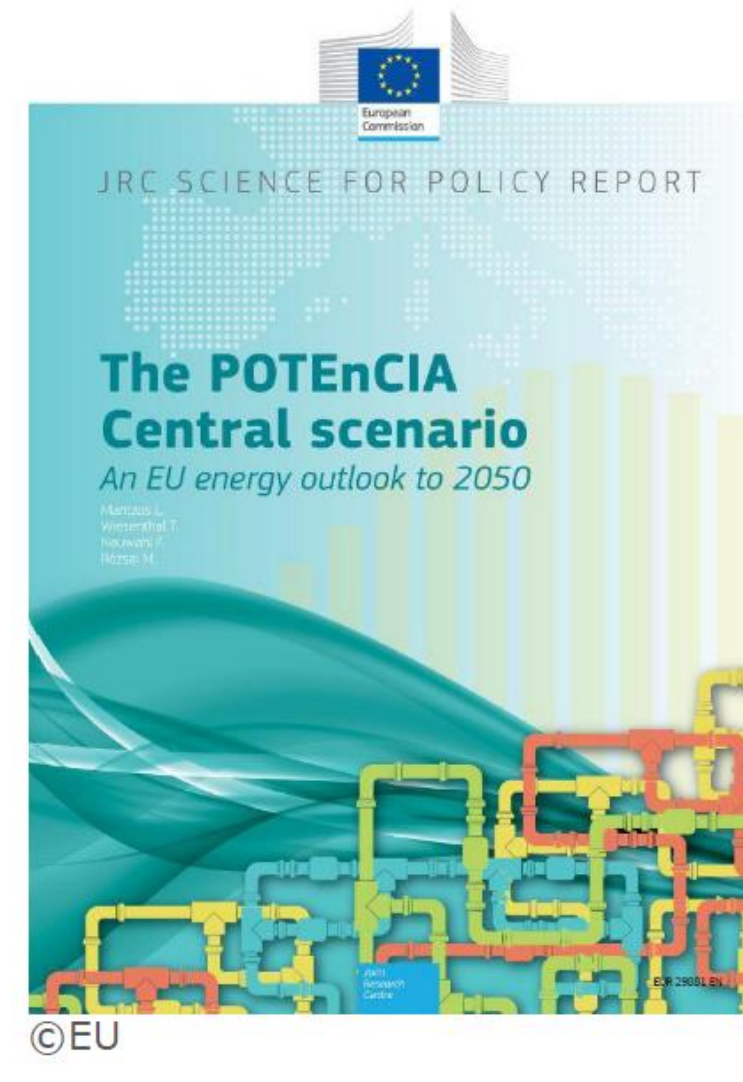
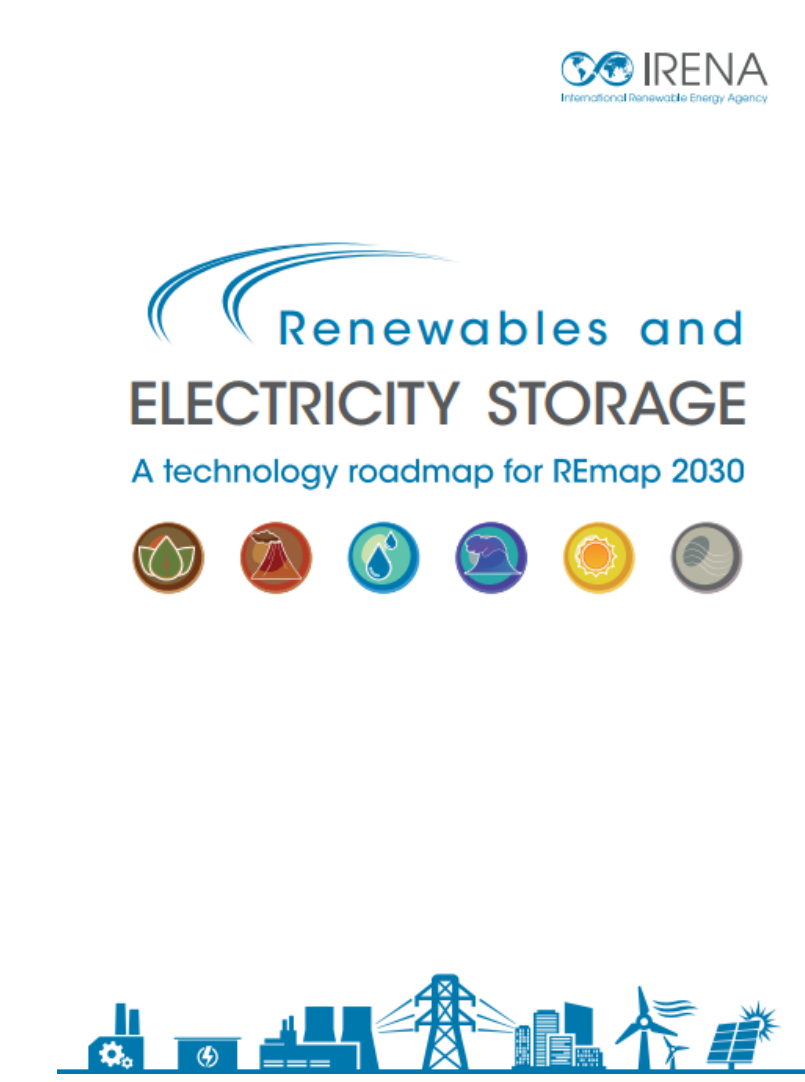
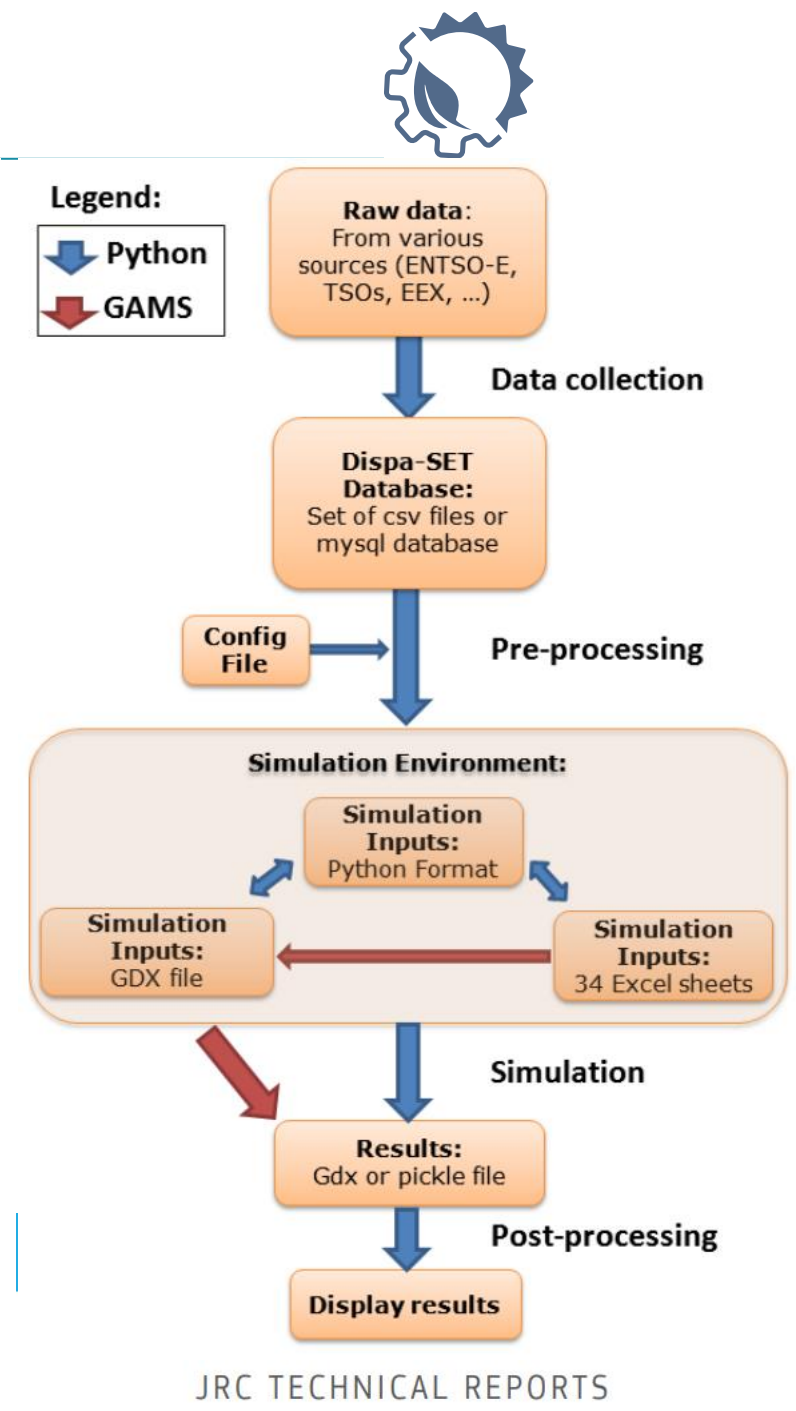
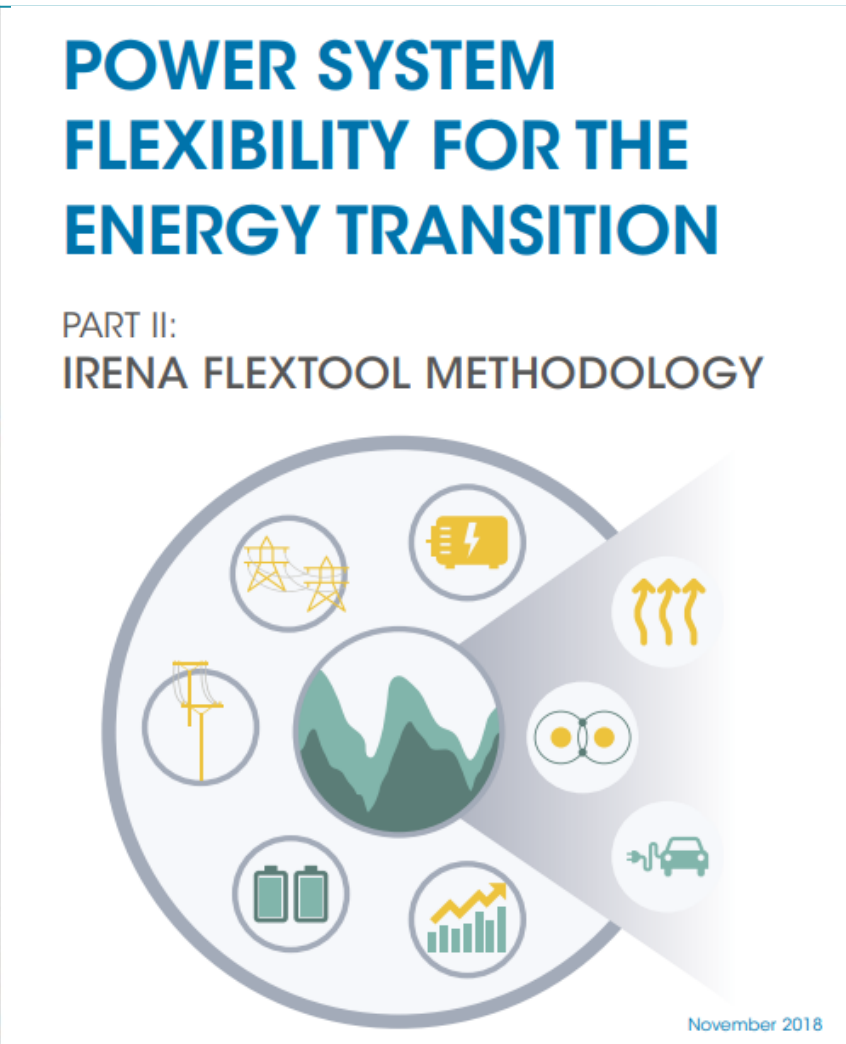
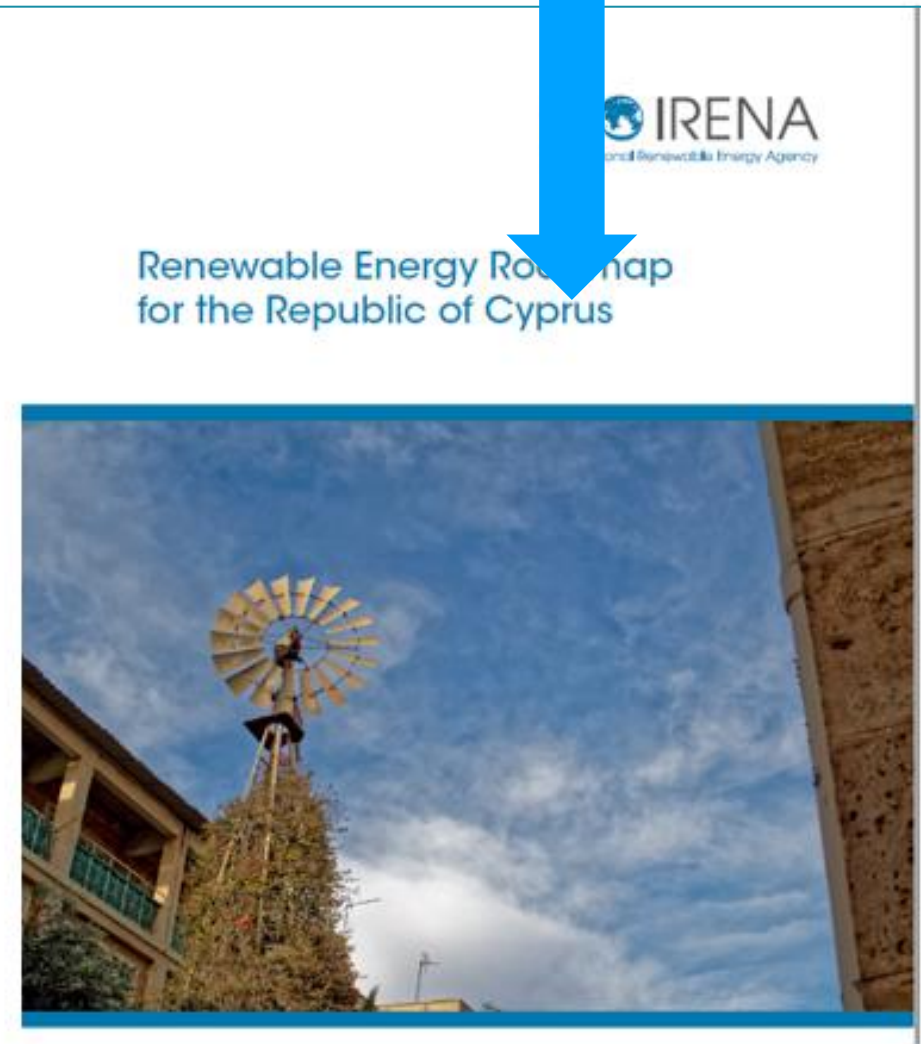
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Cyprus Energy Modelling

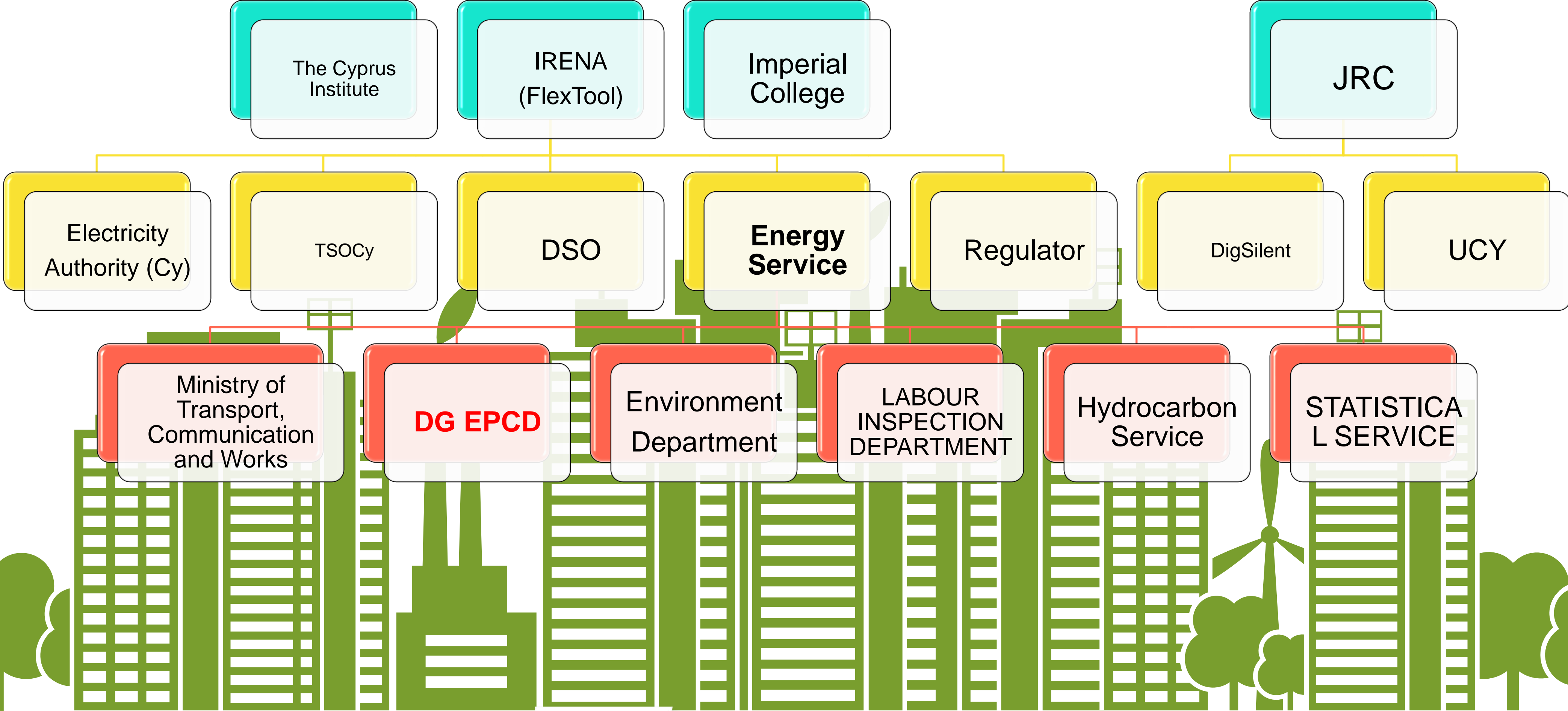


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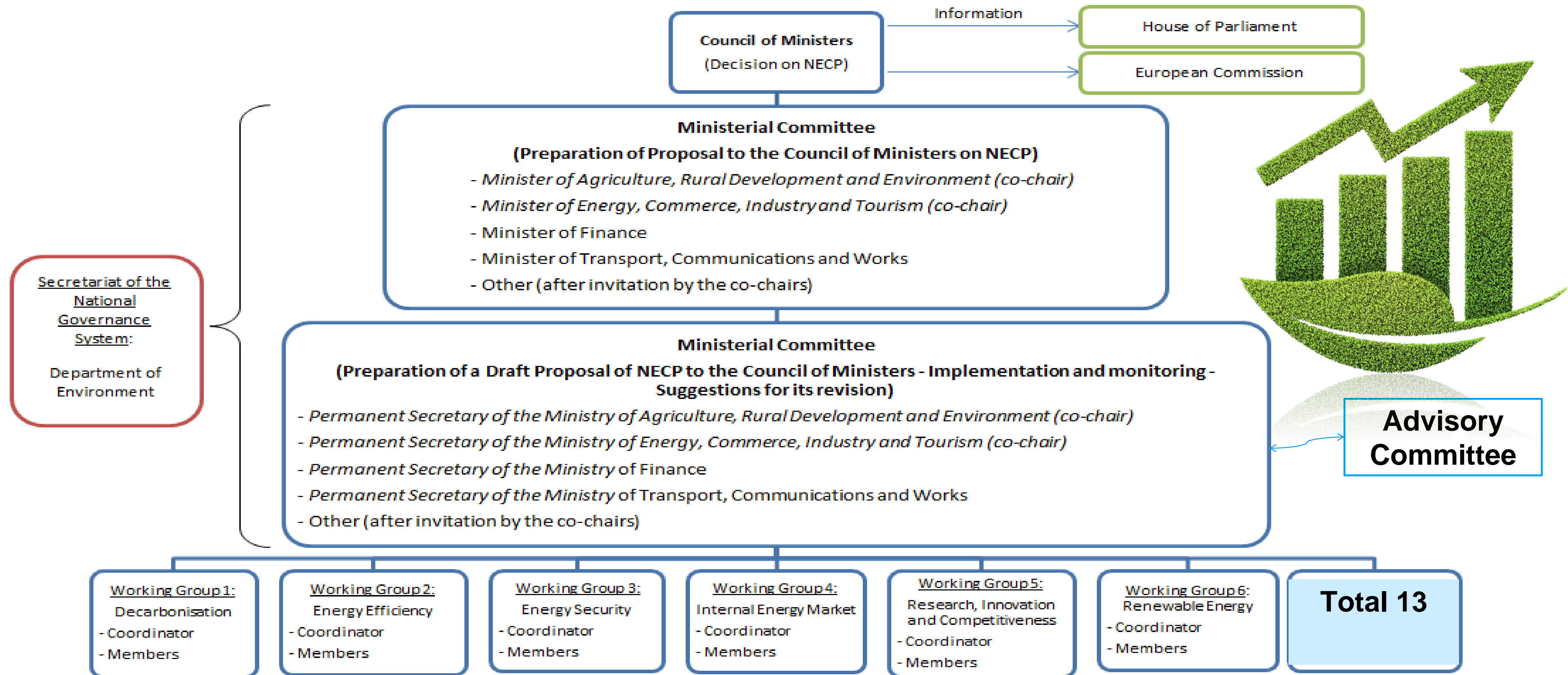
VARIOUS STUDIES THAT WILL CONTRIBUTE TO CLIMATE NEUTRALITY



Stakeholders



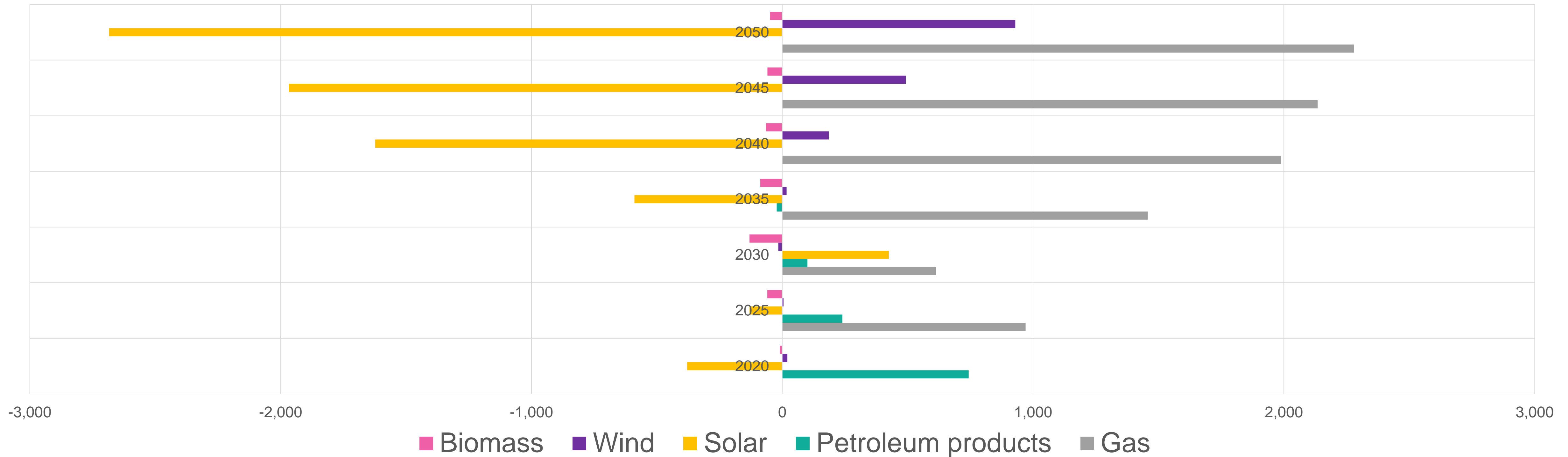
Governance mechanisms



RES DIFFERENCES (PPM & EU REF)



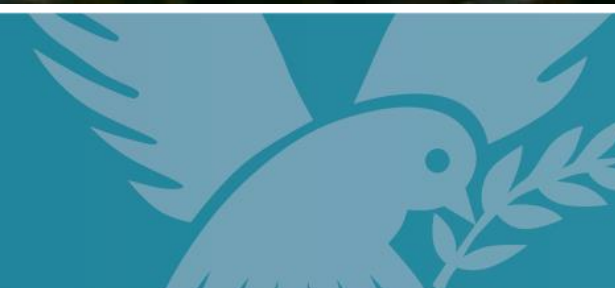
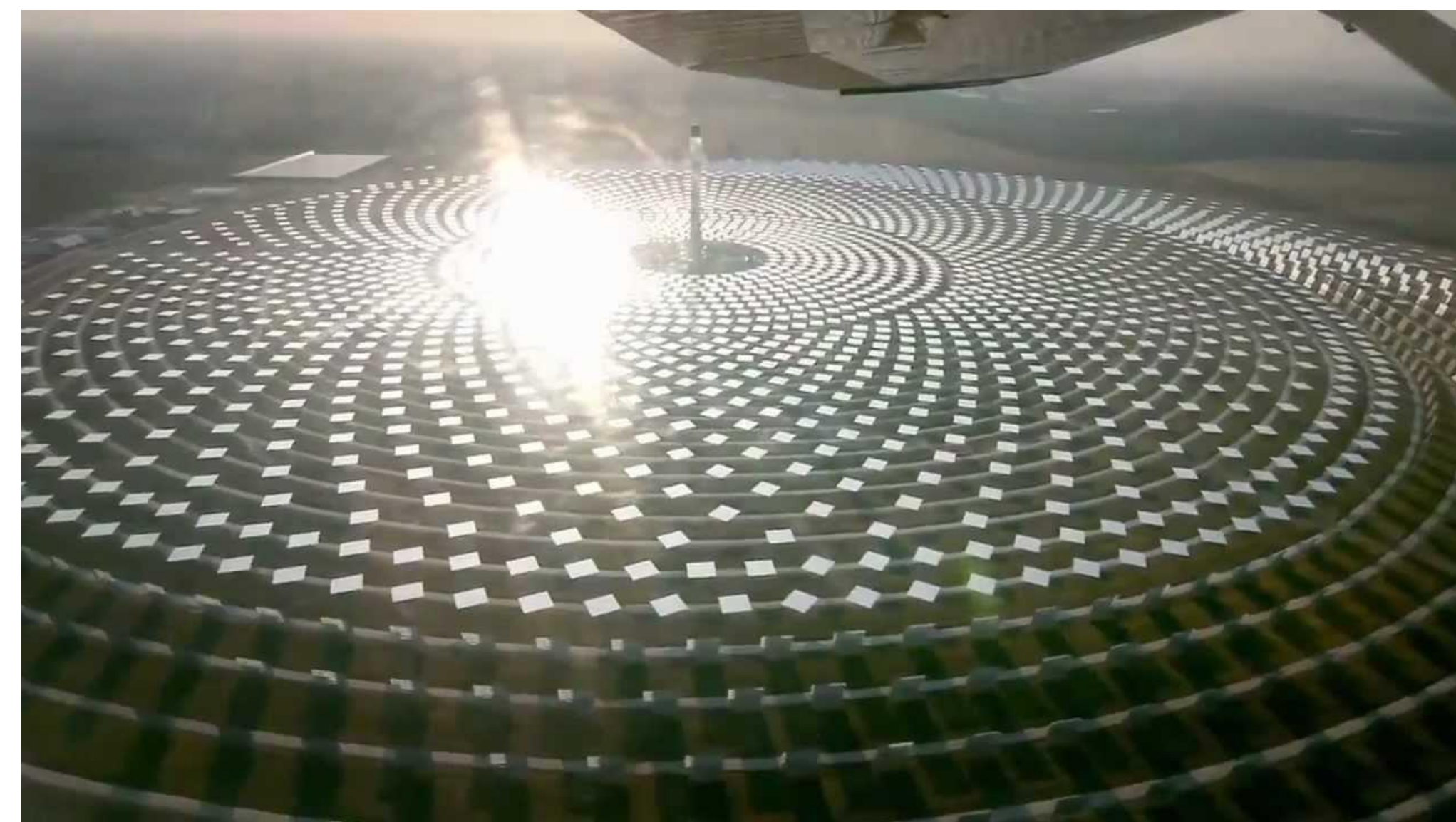
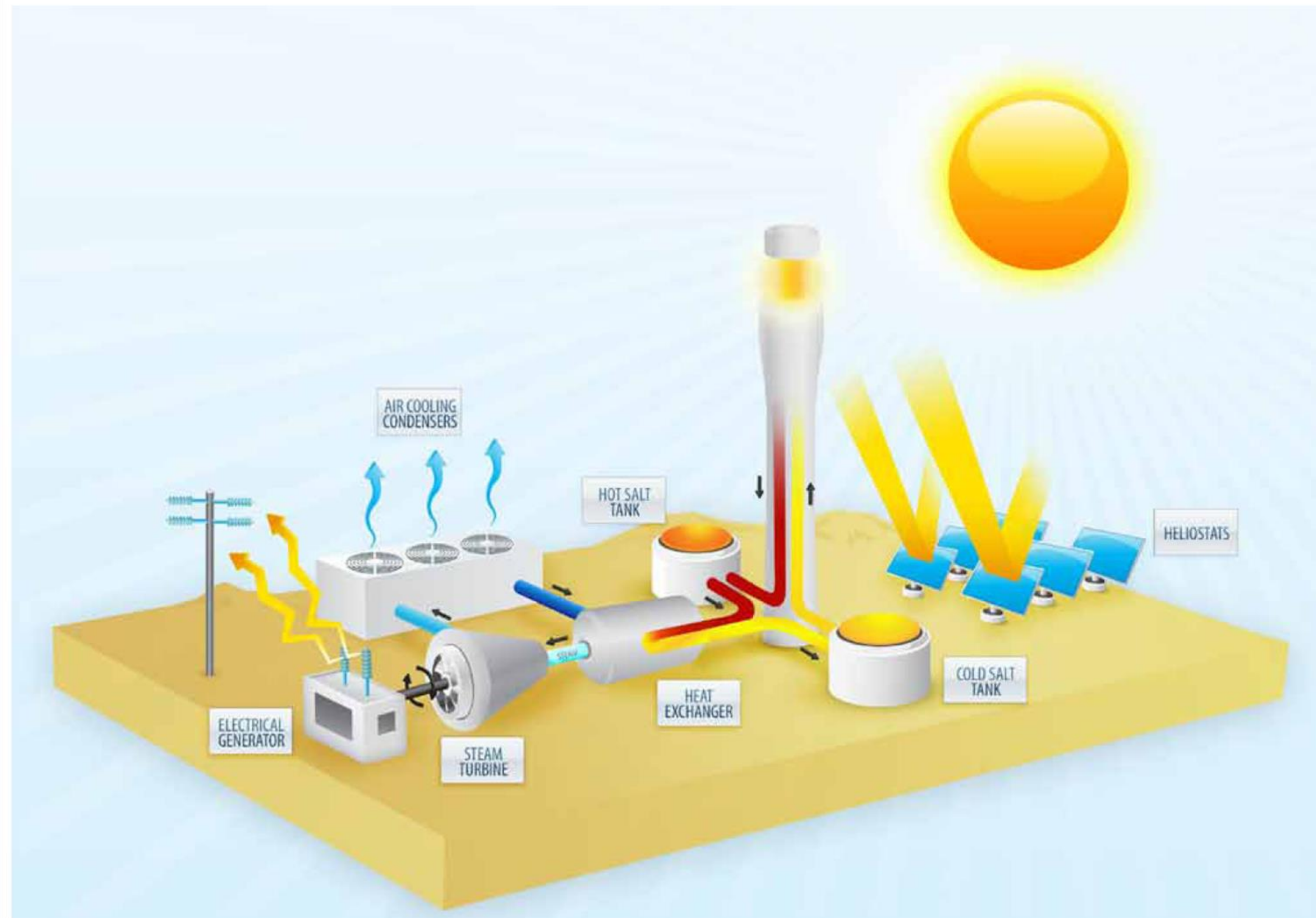
Difference in GWh μεταξύ EU REF & PPM



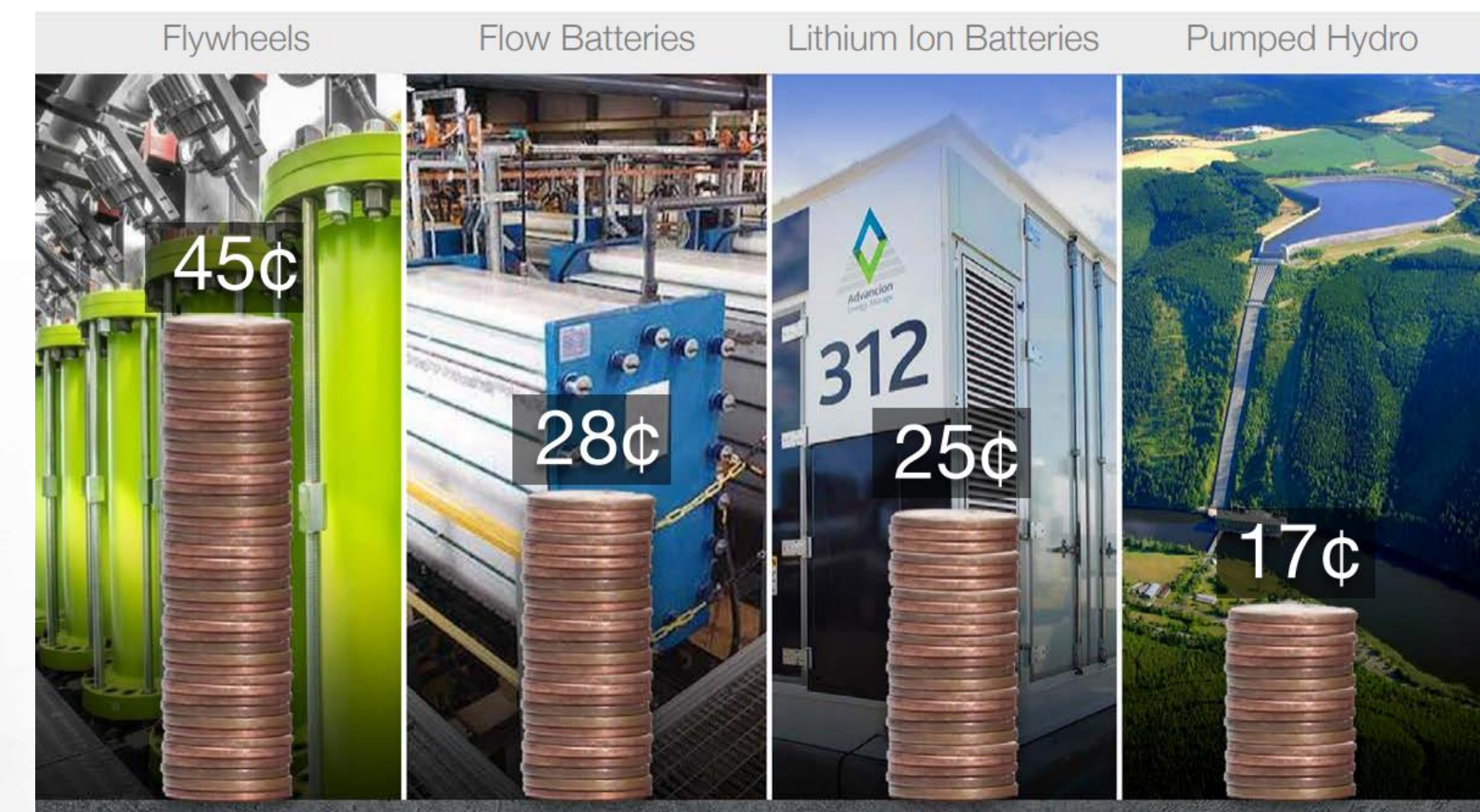
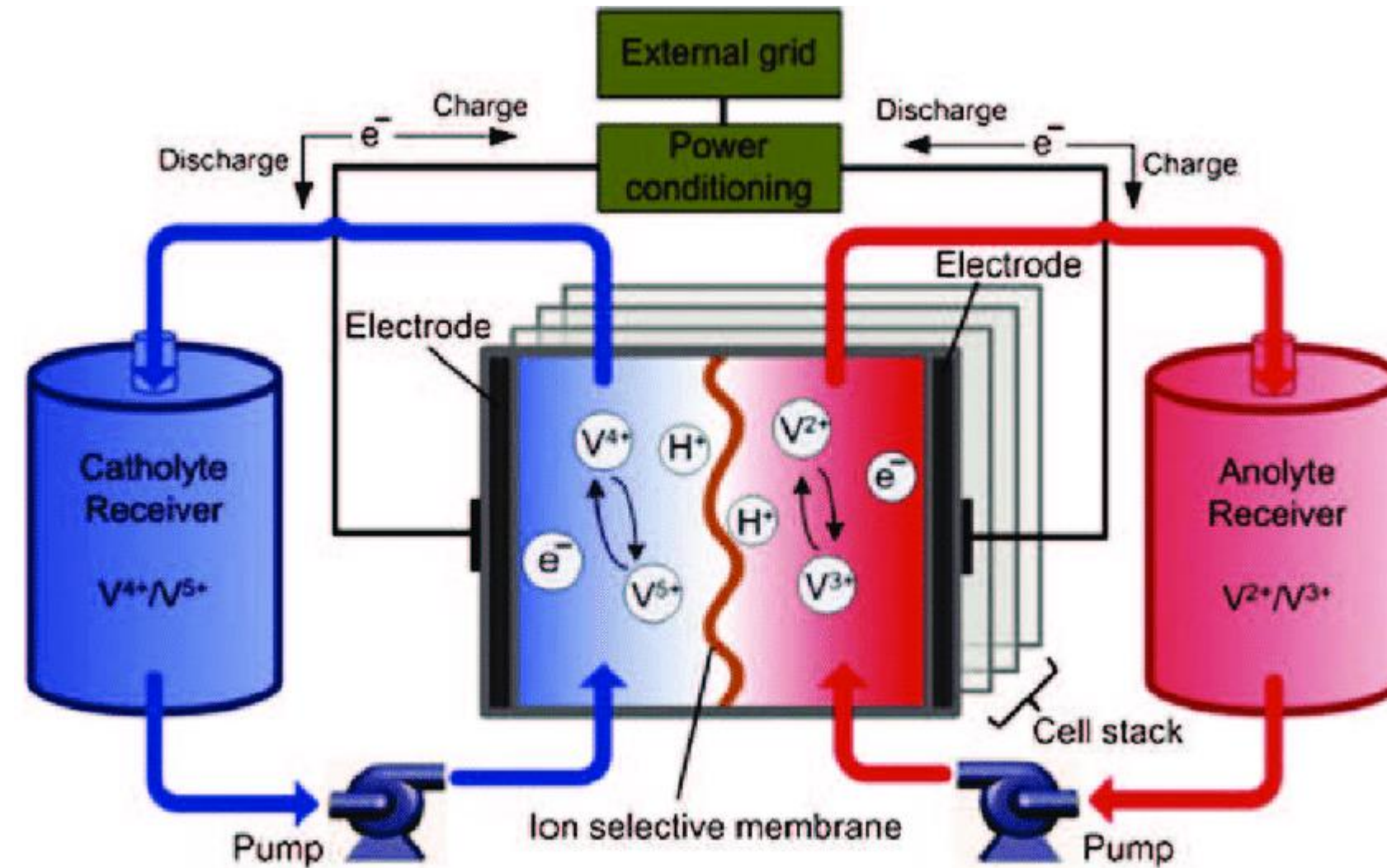
		2020	2025	2030	2035	2040	2045	2050
Storage Difference (MW)	Pumped Storage	0	0	0	-130	-130	-130	-130
	Batteries	0	0	390	279	138	420	451
	Total	0	0	390	149	8	290	321



STORAGE – THERMAL -

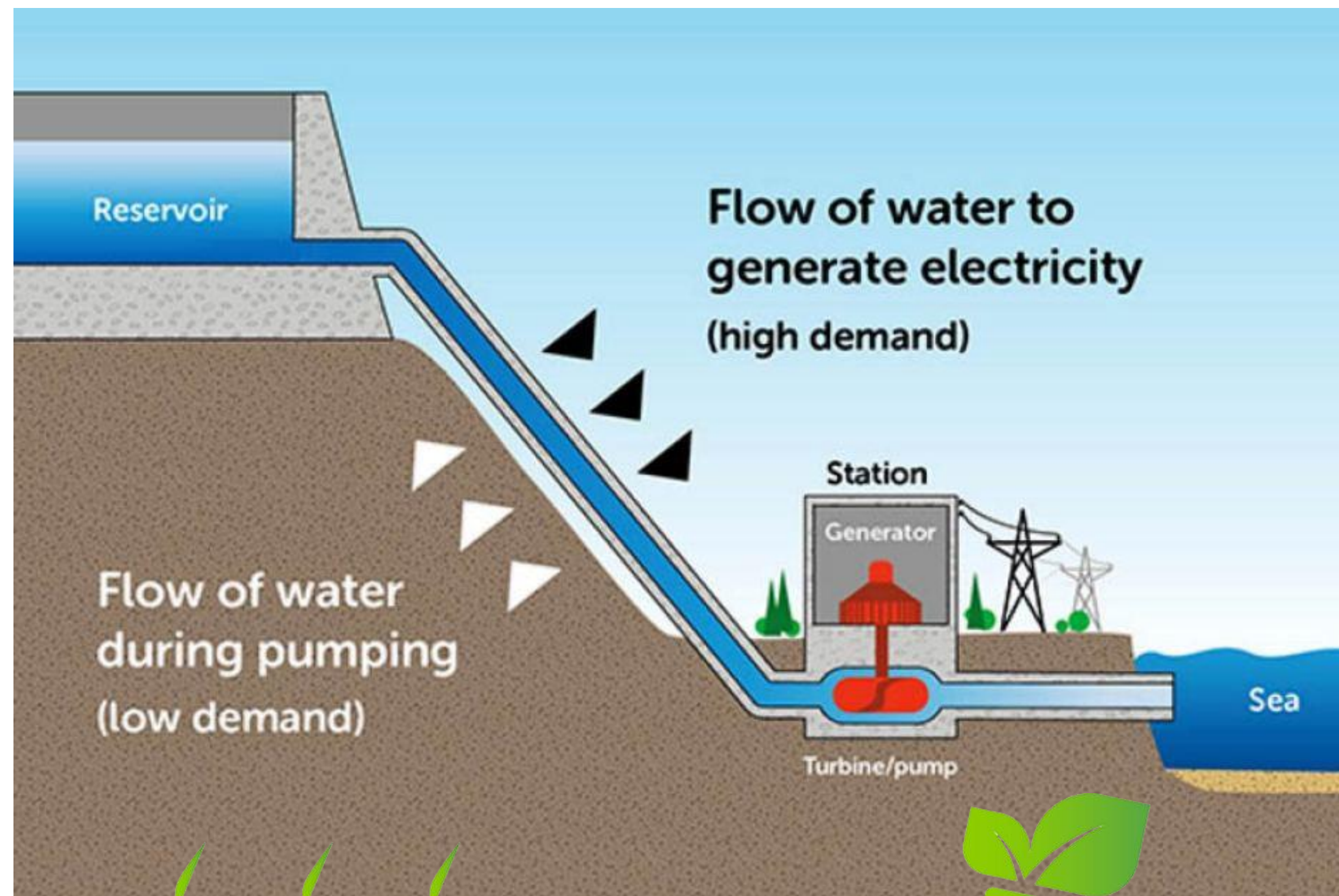


STORAGE – CHEMICAL -



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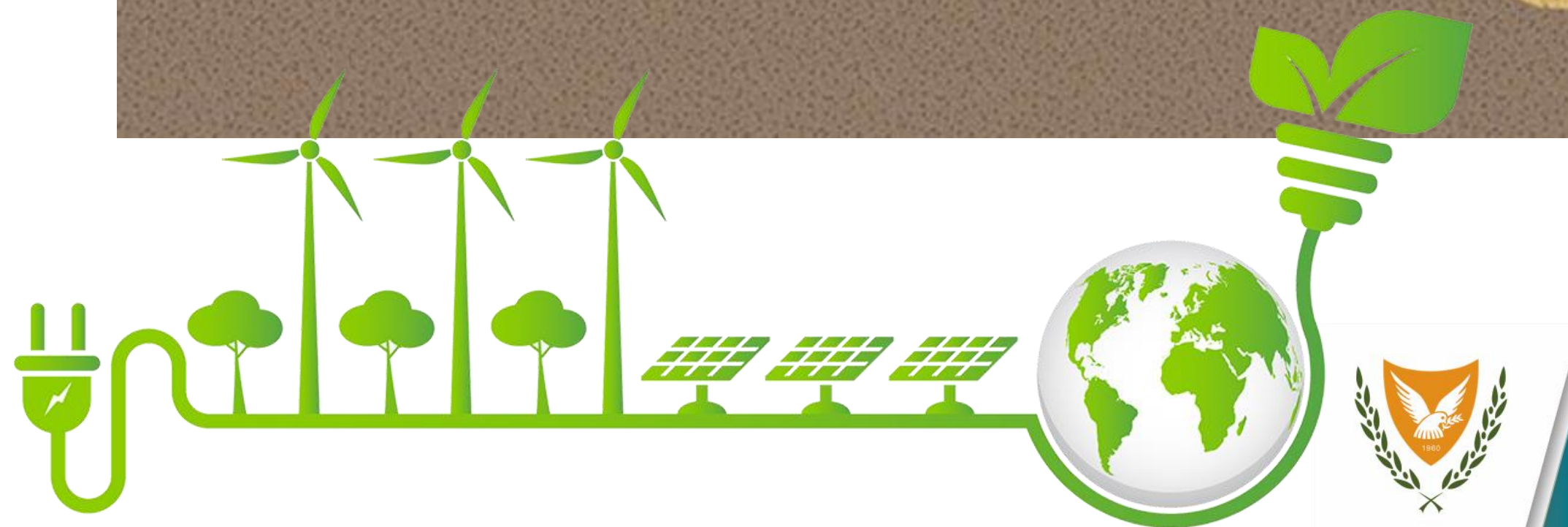
STORAGE – GRAVITY- MECHANICAL

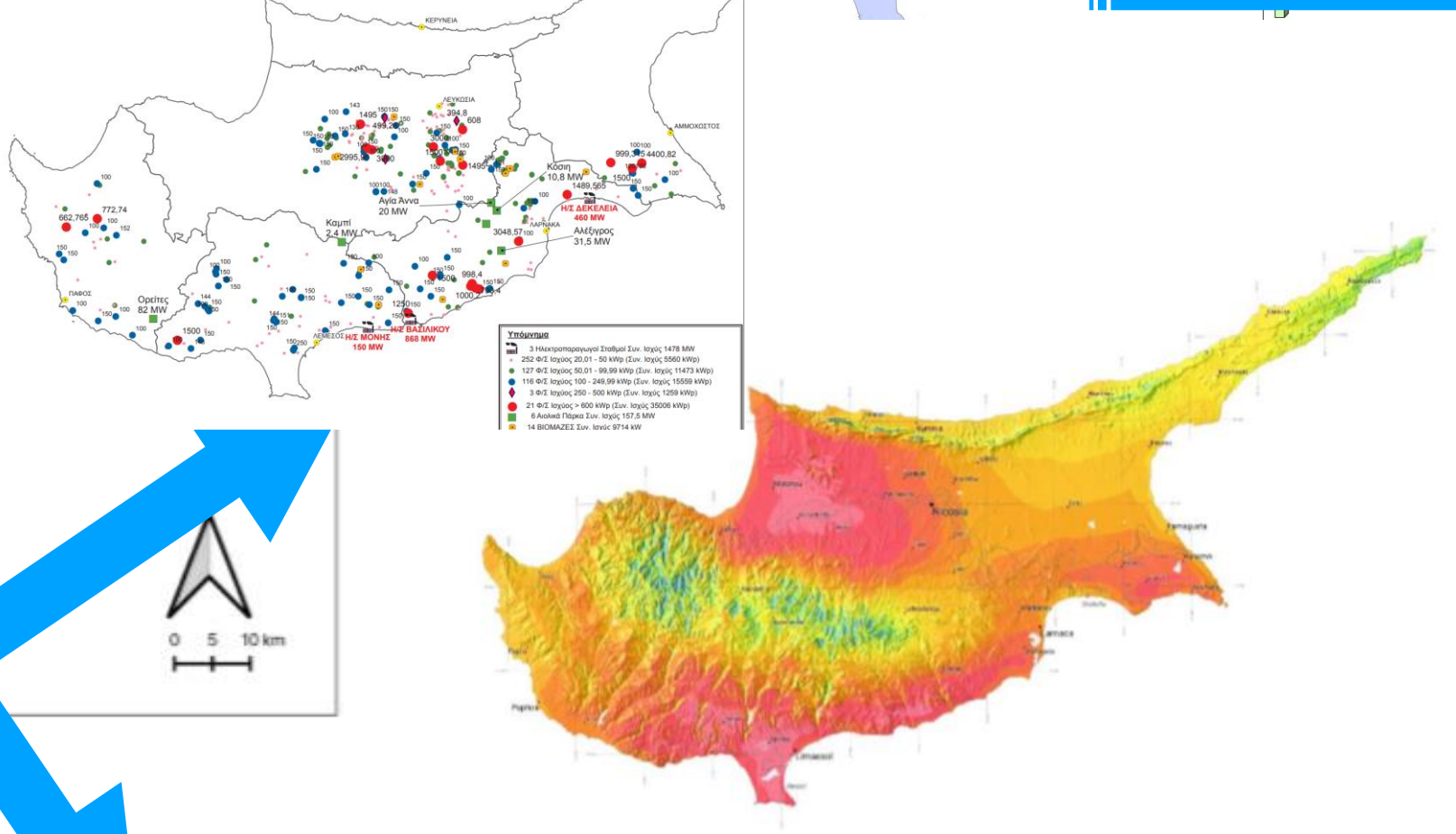
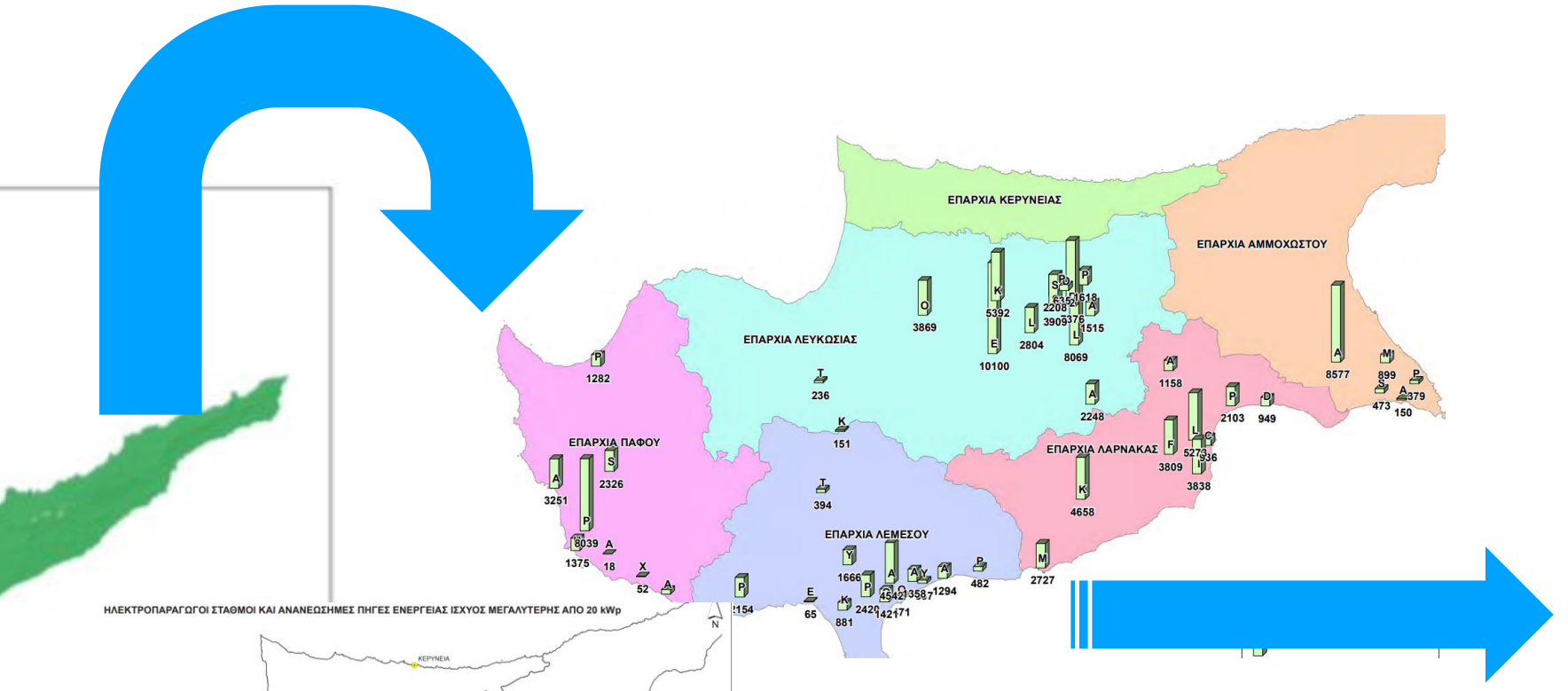
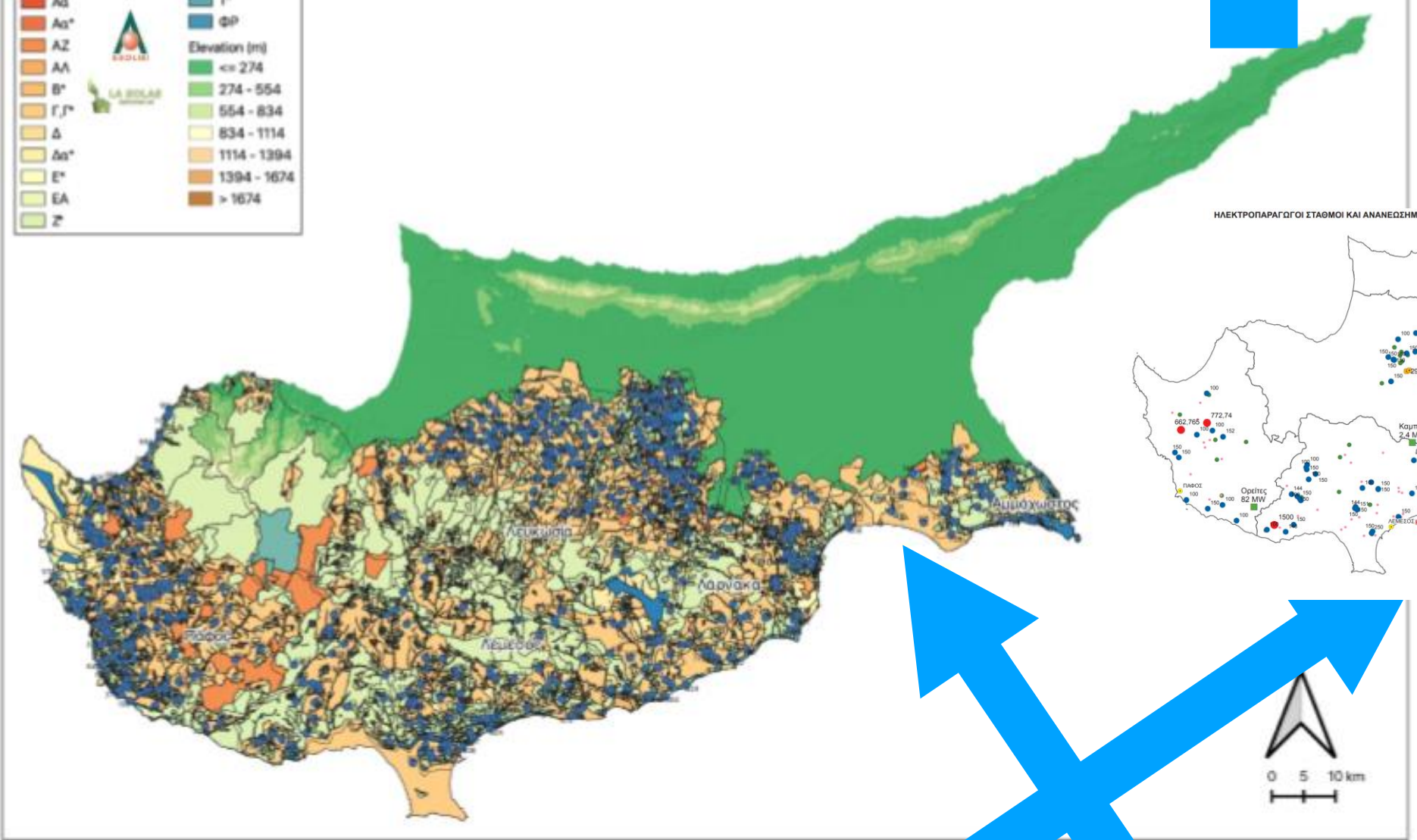
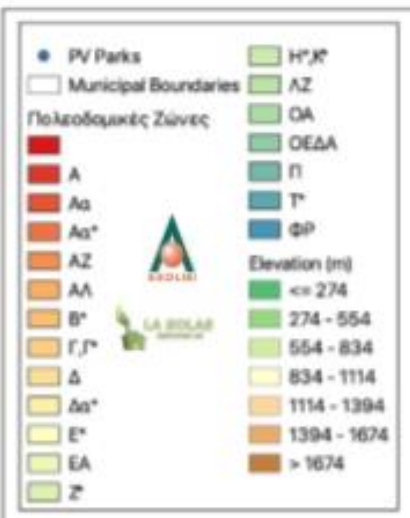


Energy Vault is the breakthrough that finally enables us to replace...

Fossil Fuels	with Clean Energy
	Solar PV (\$0.023 cents) + Energy Vault (\$0.035 cents) = < Fossil Fuel For 1 st time

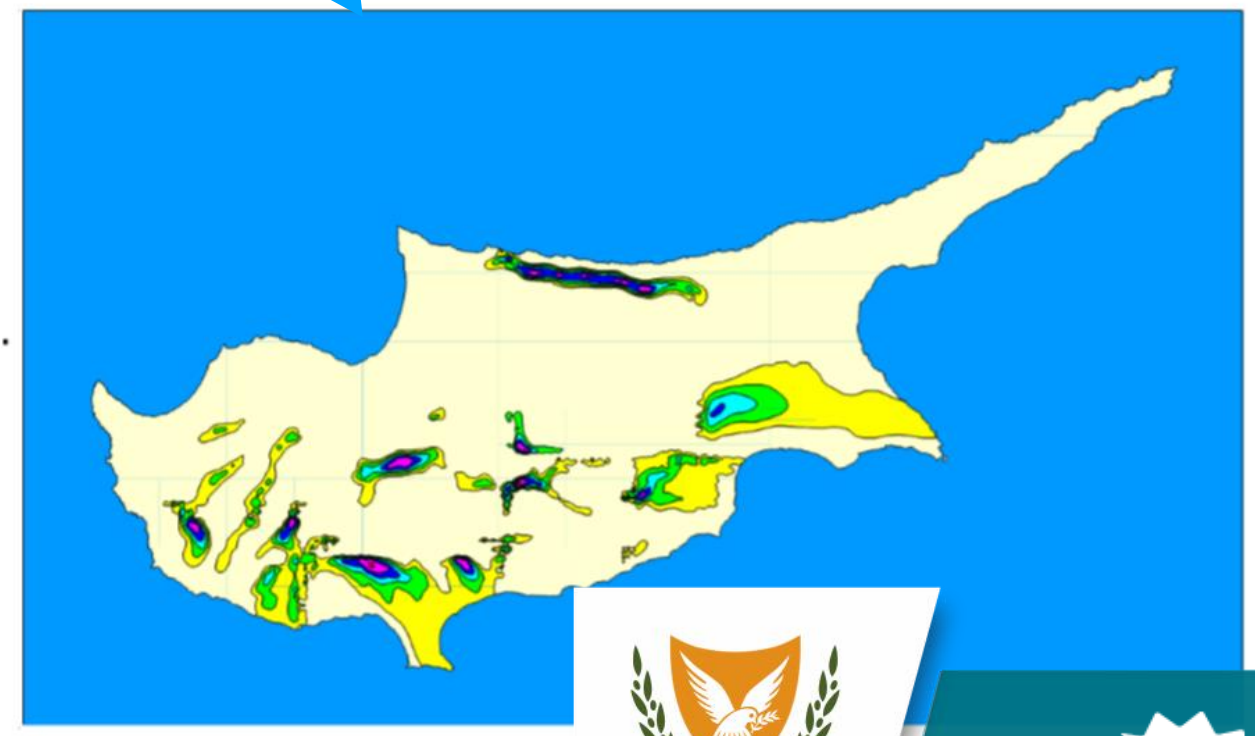
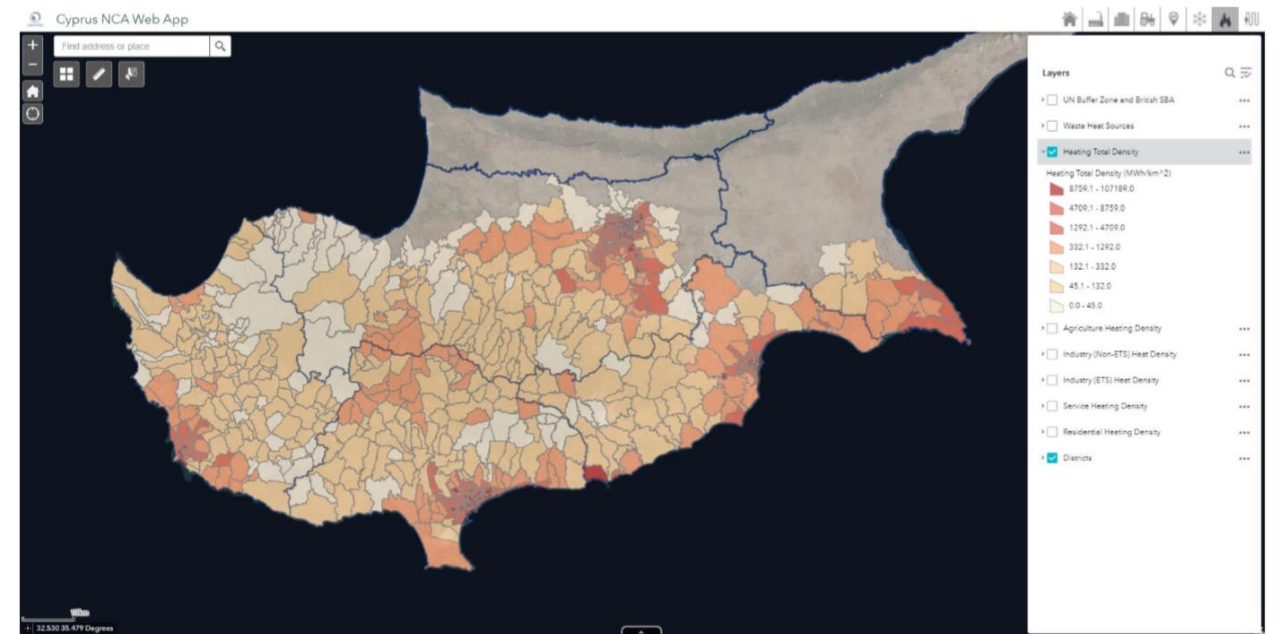
ENERGY VAULT





- Identify substation capacity
- Identify available lands and plots
- Technical Potential (Demand and Supply)
- Optimization per node using Advance tools (FlexTool or other Dispatch models)
- Correlation Map -> Signal to Investors
- Double Capacity with minimal Cost

A2 Total Heating Density for Republic of Cyprus (excl. Sanitary Hot Water)



OSeMOSYS
Open Source Energy Modelling System

IRENA
FlexTool



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Financing Tools



Recovery and Resilience Plan

- Public buildings, business , homes,
- Hospitals, Army camps, Schools
- Water Pumping Stations, Water Processing
- Upgrading of Public Housing Projects mitigating Energy Poverty
- Charging Stations



Just Transition Fund

- EAC Generation (part. Dhekelia Plant)
- Desalination
- Cement Industries, pottery, glass
Pharmaceutical industry
- Synergies with Natural gas (e.g Cooling)



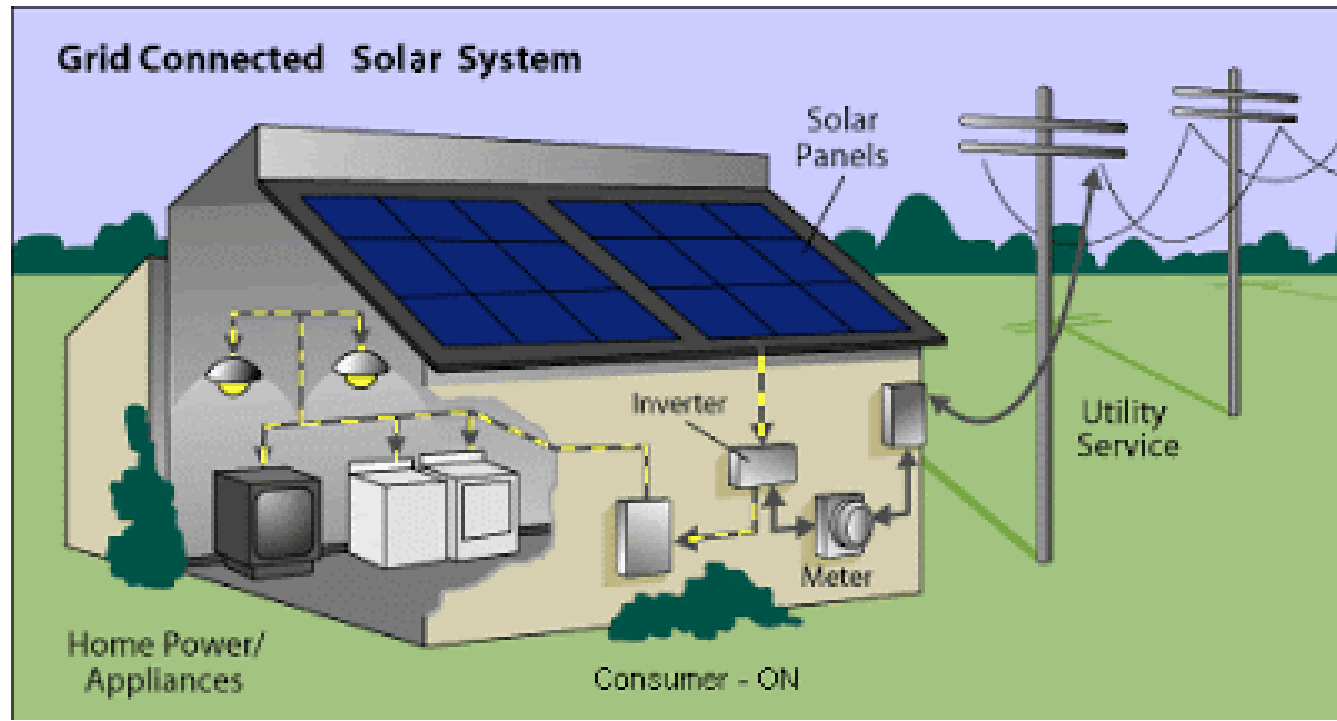
Research Projects and Structural Funds

- Energy Conservation and Building Energy Upgrading for Households
- Energy Conservation and Building Energy Upgrading for Businesses
- Research Projects for Hydrogen in Transport and Storage Sector
- Solar Thermal

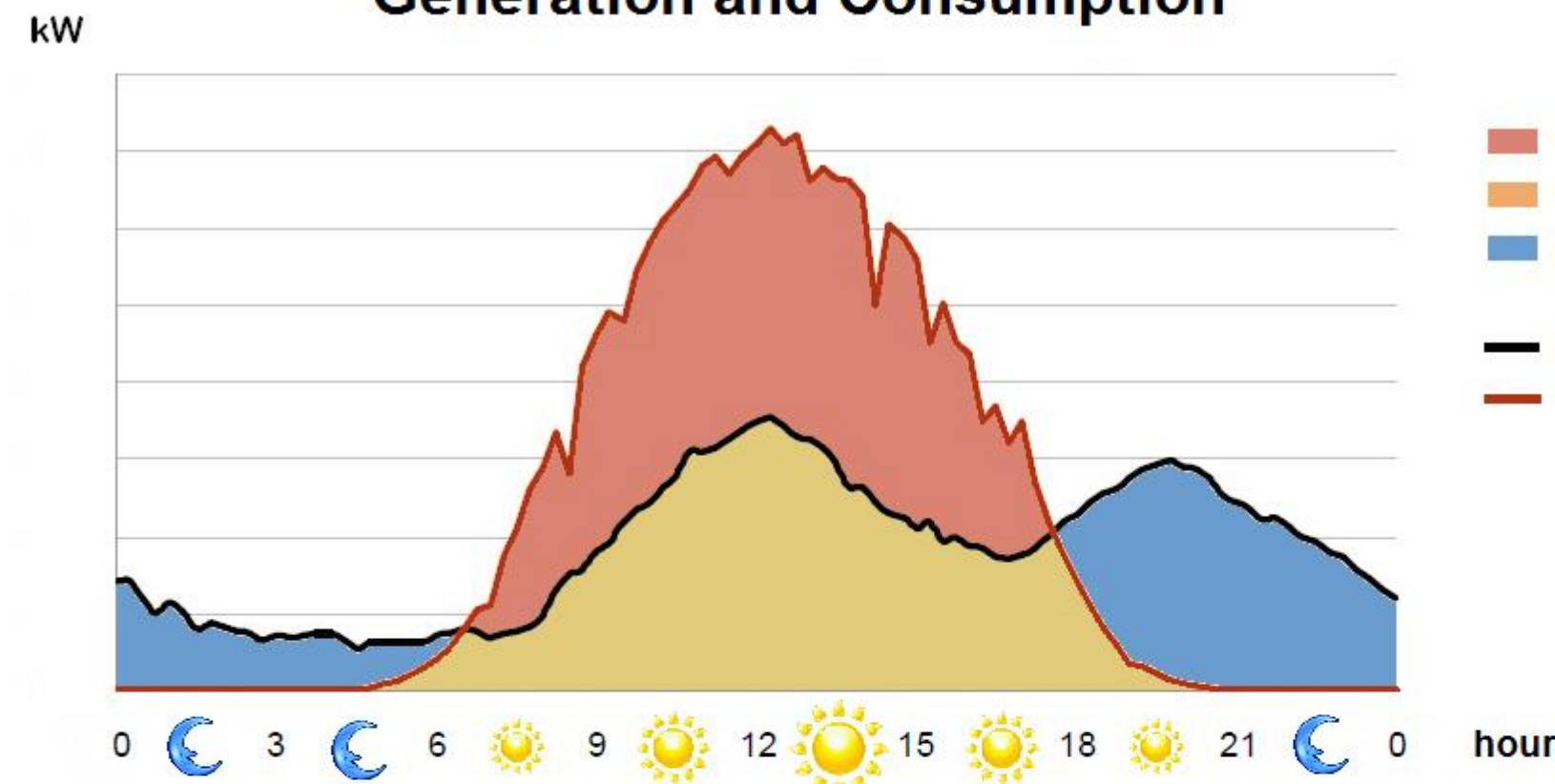


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Ongoing Support Schemes (Net-Metering)

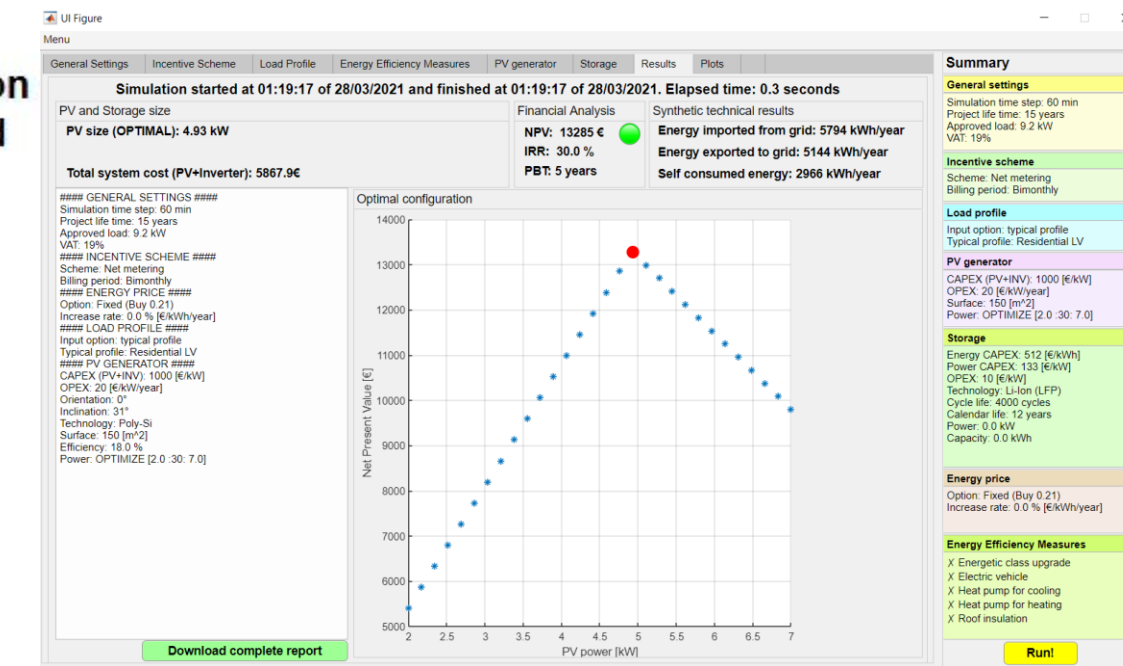


Generation and Consumption

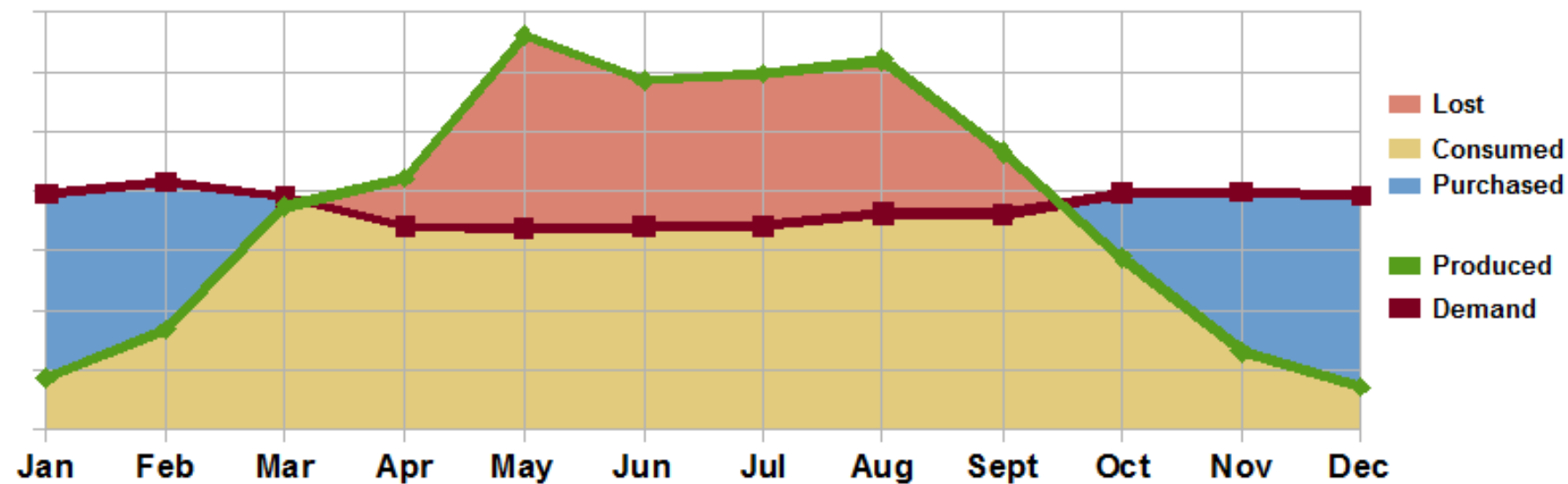


- excess energy
- energy consumed
- purchased from grid
- electricity consumption
- solar power produced

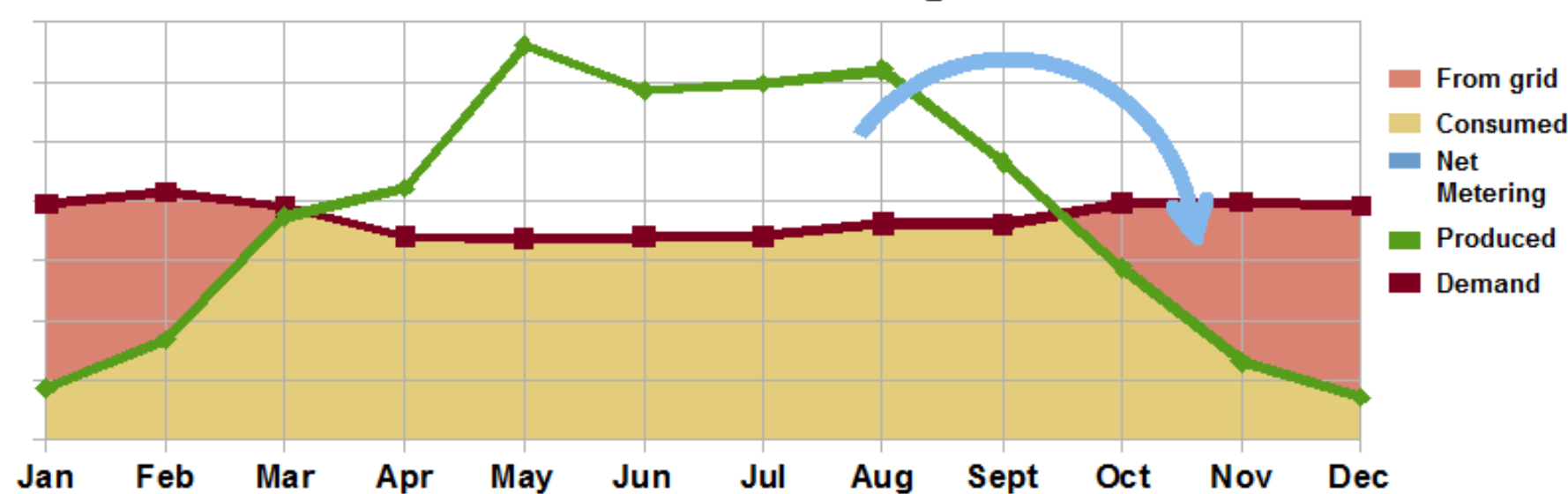
Tool Available for optimizing the size of PV System



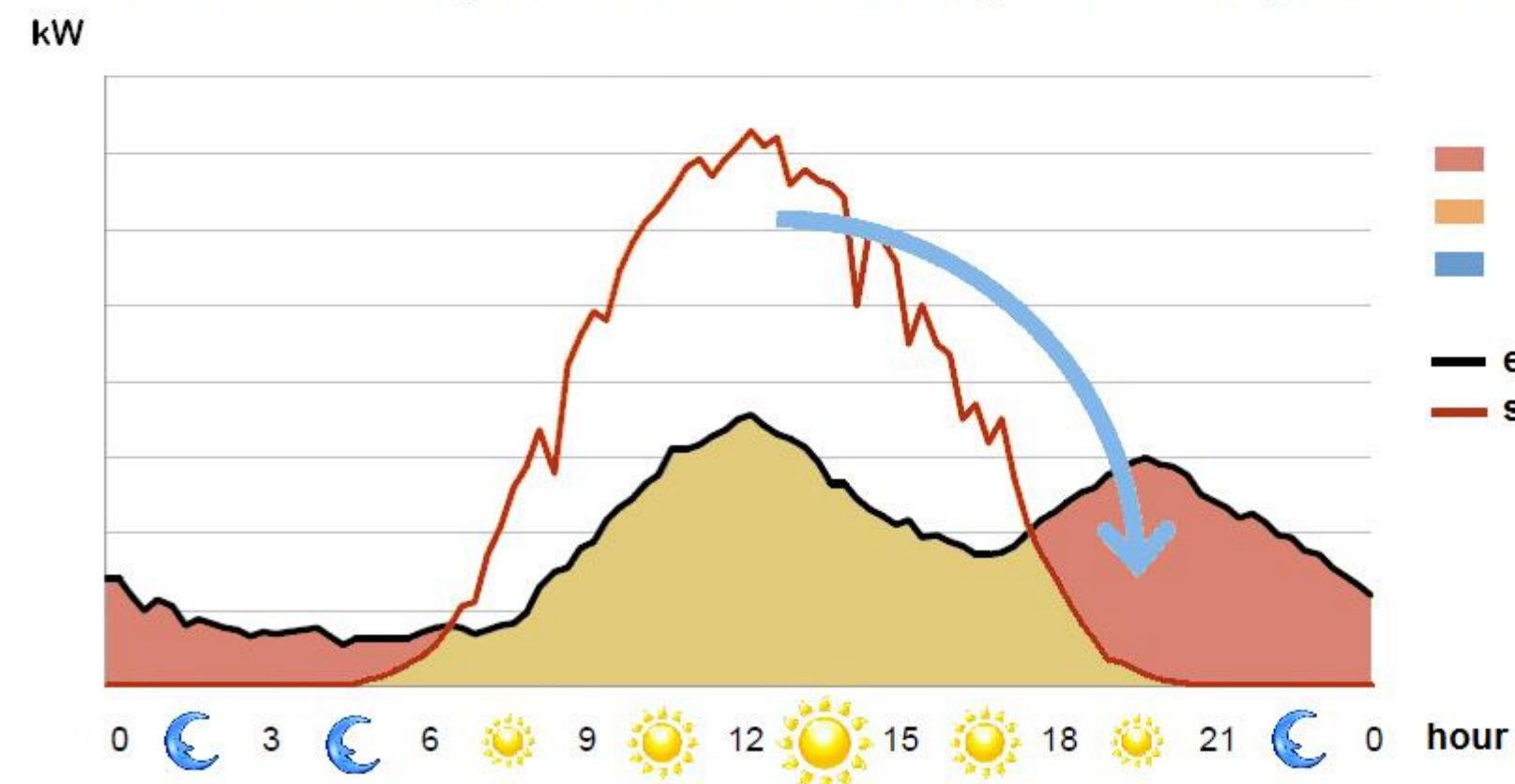
Without Net Metering



With Net Metering



Net Metering Allows Electricity Consumption When Needed



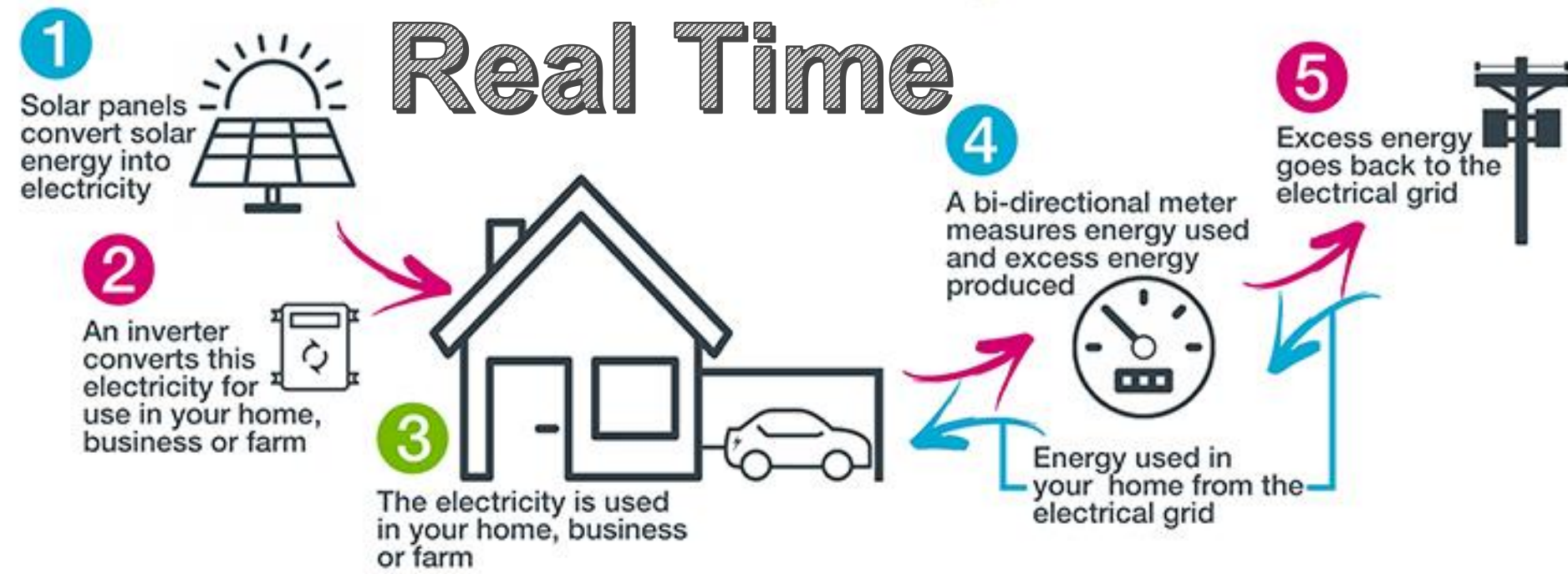
- energy from grid
- energy consumed
- net metering
- electricity consumption
- solar power produced



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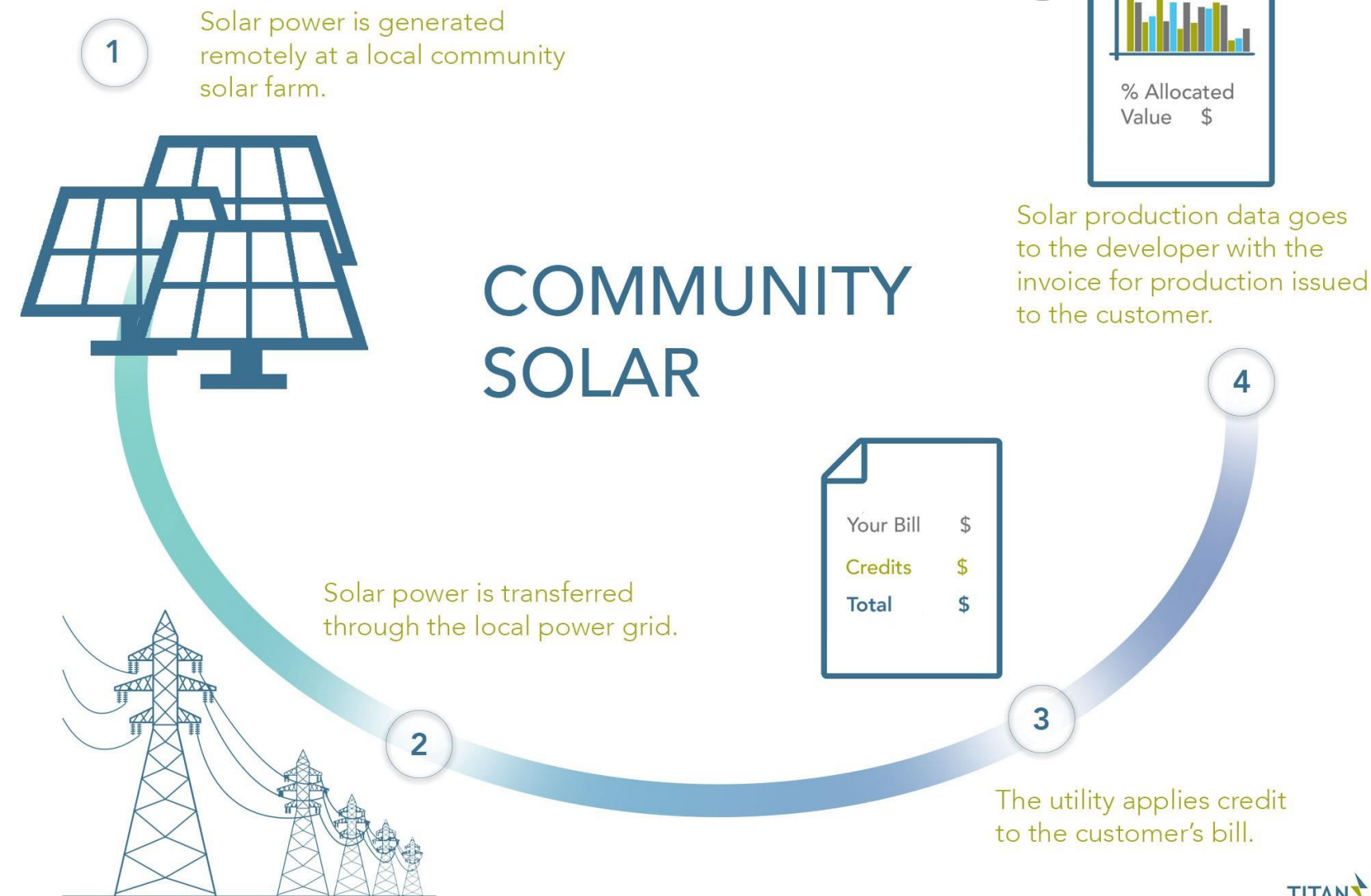


How Solar Net Billing Works

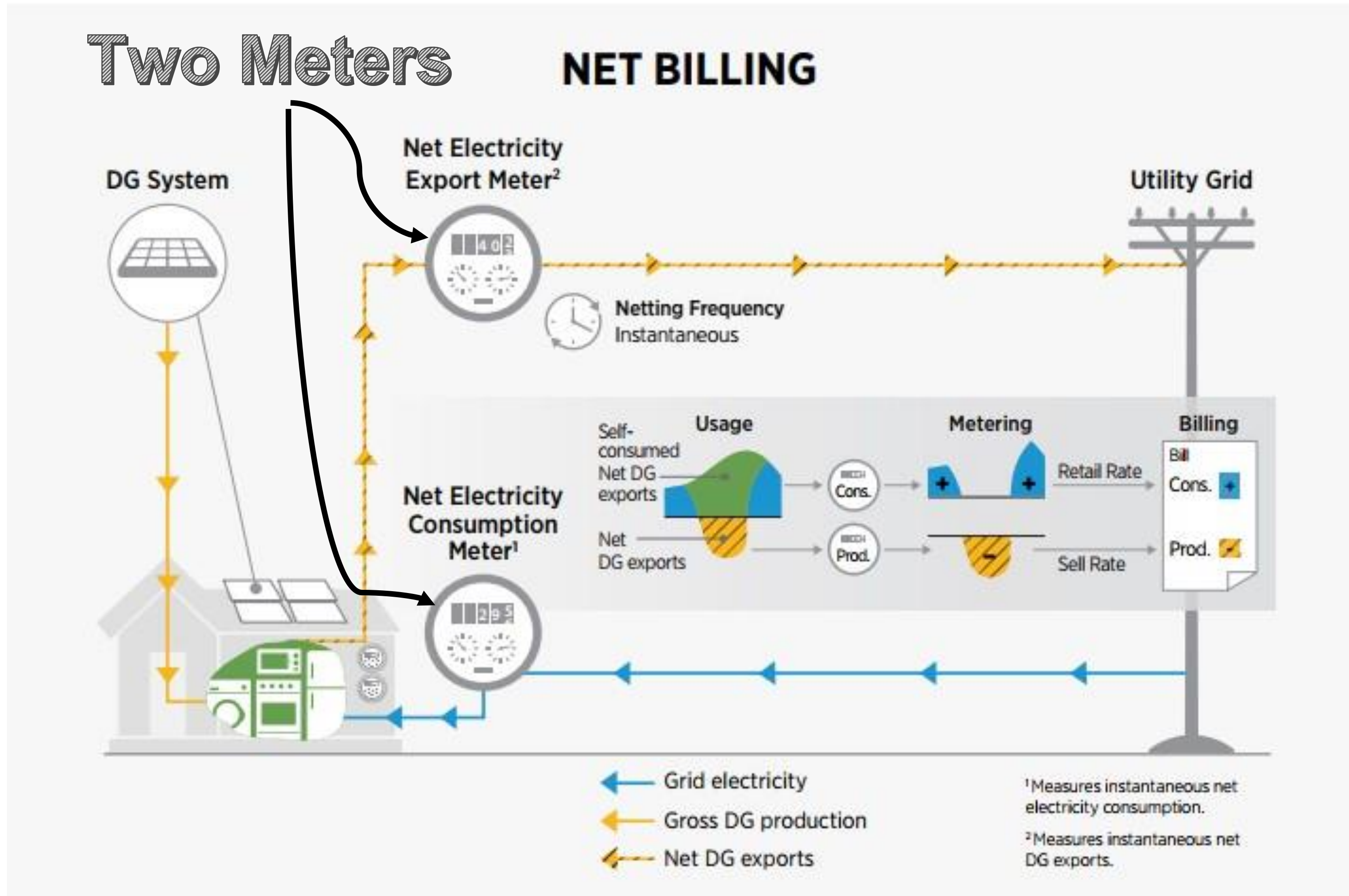


Real Time

Virtual – Net Billing



Two Meters NET BILLING



Support Scheme to Energy Storage Options



Storage System in front of the Meter at the level of Medium or High Voltage Transmission

Support Net-Billing scheme with Storage systems and increase the **self-consumption.**

Storage Systems to support forecasting Generation for existing or new RES Projects



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SUPPORT SCHEMES



In order to accommodate future needs, the **Danish** Government has established a fund supporting development and demonstration projects on energy storage. The fund's size is 128 million DKK and it was in December 2019 granted to two Power-to-X projects

Finland: The Energy Aid government investment programme provides co-financing for projects that (among others) promote the transition towards a low-carbon energy system. Storage is eligible if they involve investments in renewable energy production or energy efficiency. Energy-storage-related costs of a project may not exceed 50% of total costs.

Germany Electricity used for power-to-gas is exempted from charges and levies if hydrogen is transformed directly into electricity again.

Greece: Non-interconnected islands, hybrid facilities are compensated based on a regulated combination of capacity payment for the storage component, plus a feed-in tariff for the energy from the storage, plus a feed-in-tariff for the energy from the renewable generation.

Public Support

- Different from Country to Country

Permitting

- Similar with RES procedure

Energy Markets and Capacity Mechanisms, Ancillary Services, Grid

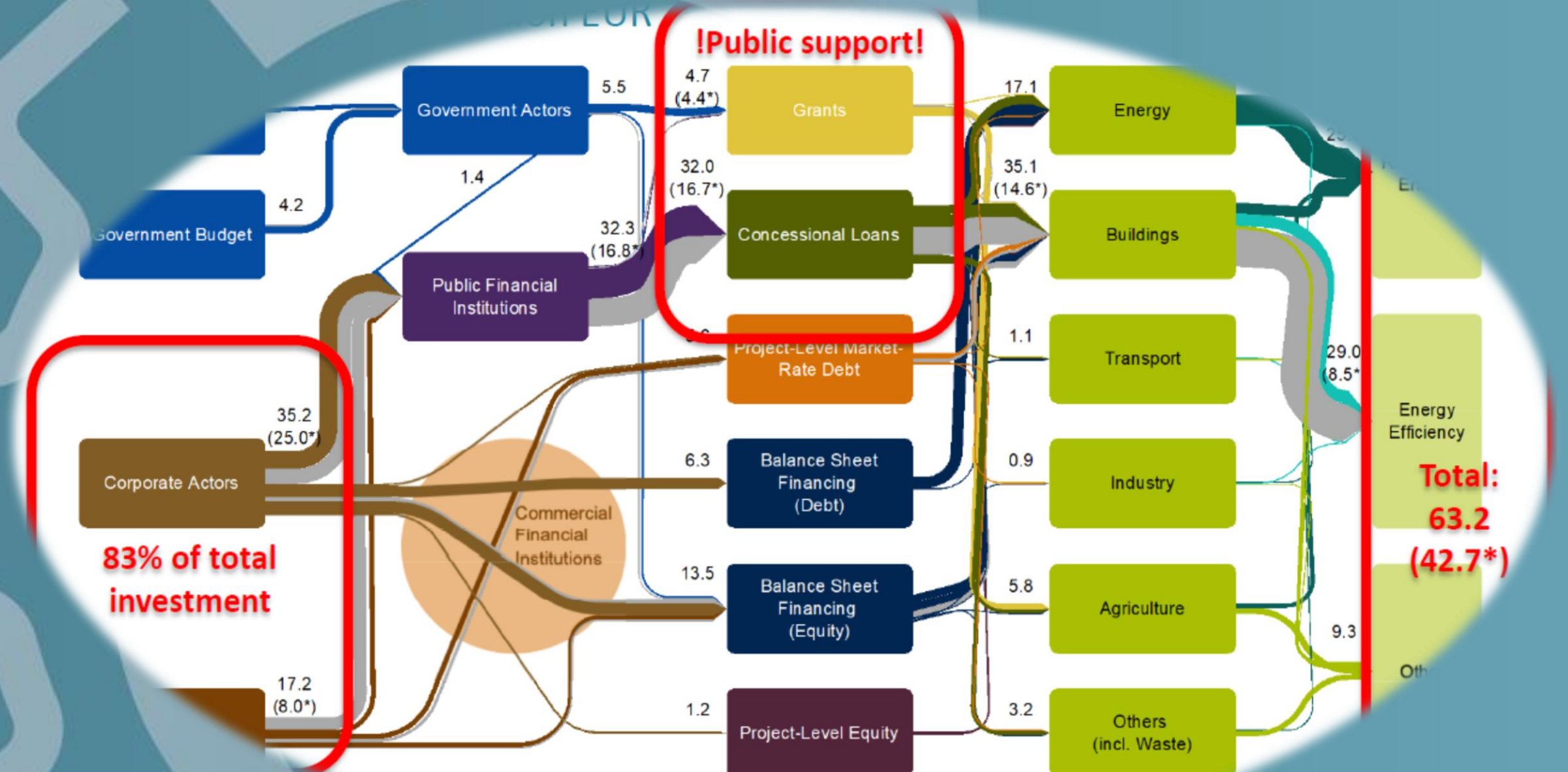
Taxes & Levies

Barriers



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Thank you for your Attention



... INVESTMENT (CAPITAL EXPENDITURE) incl public support into GHG reduction and increase of carbon sinks (thus, no guarantees, the compensation payments from the gov budget to suppliers of RE electricity under the feed-in tariff, etc.).

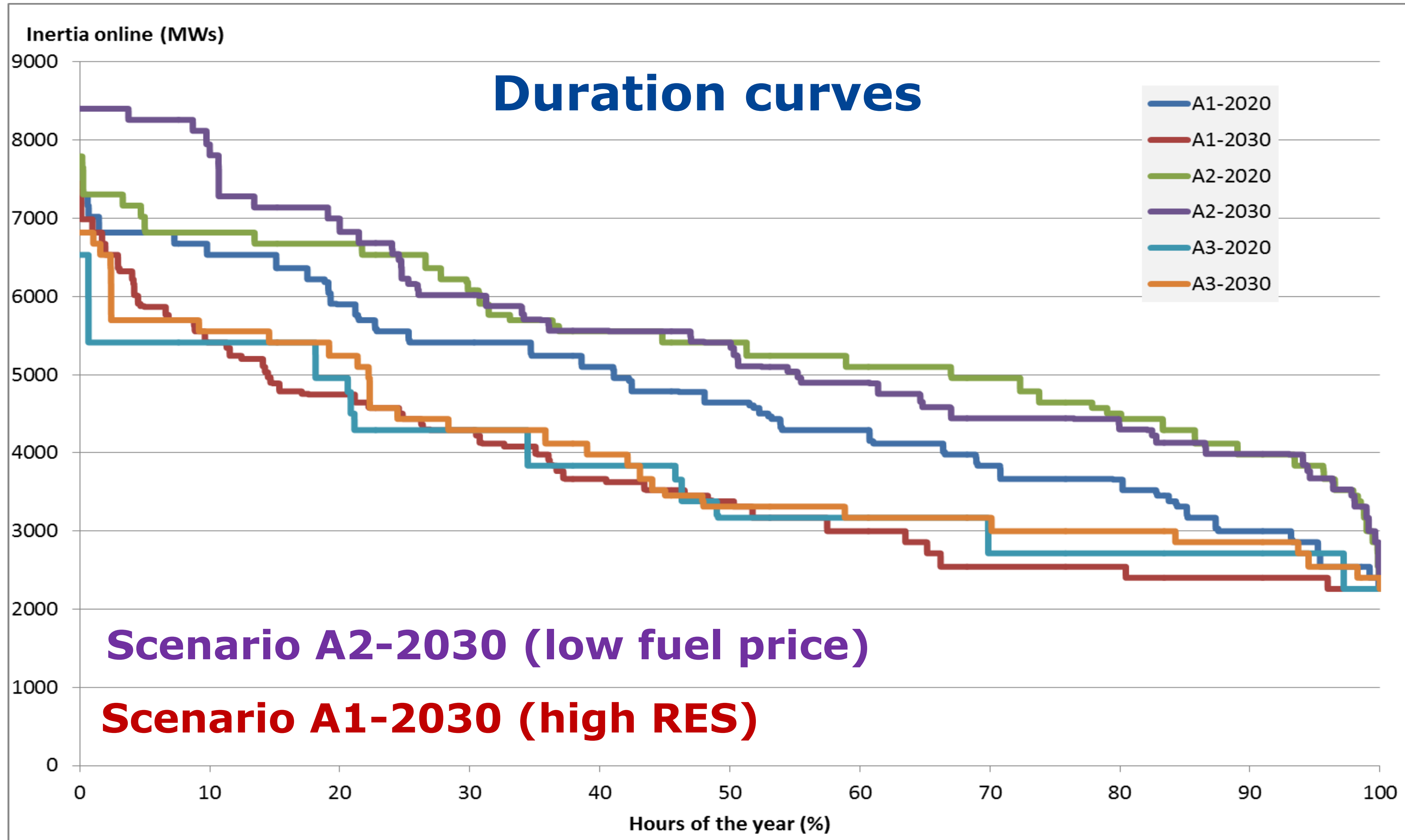
... efficiency of buildings. The incremental figures are STARRED IN BRACKETS.

... public procurement, no admin costs.

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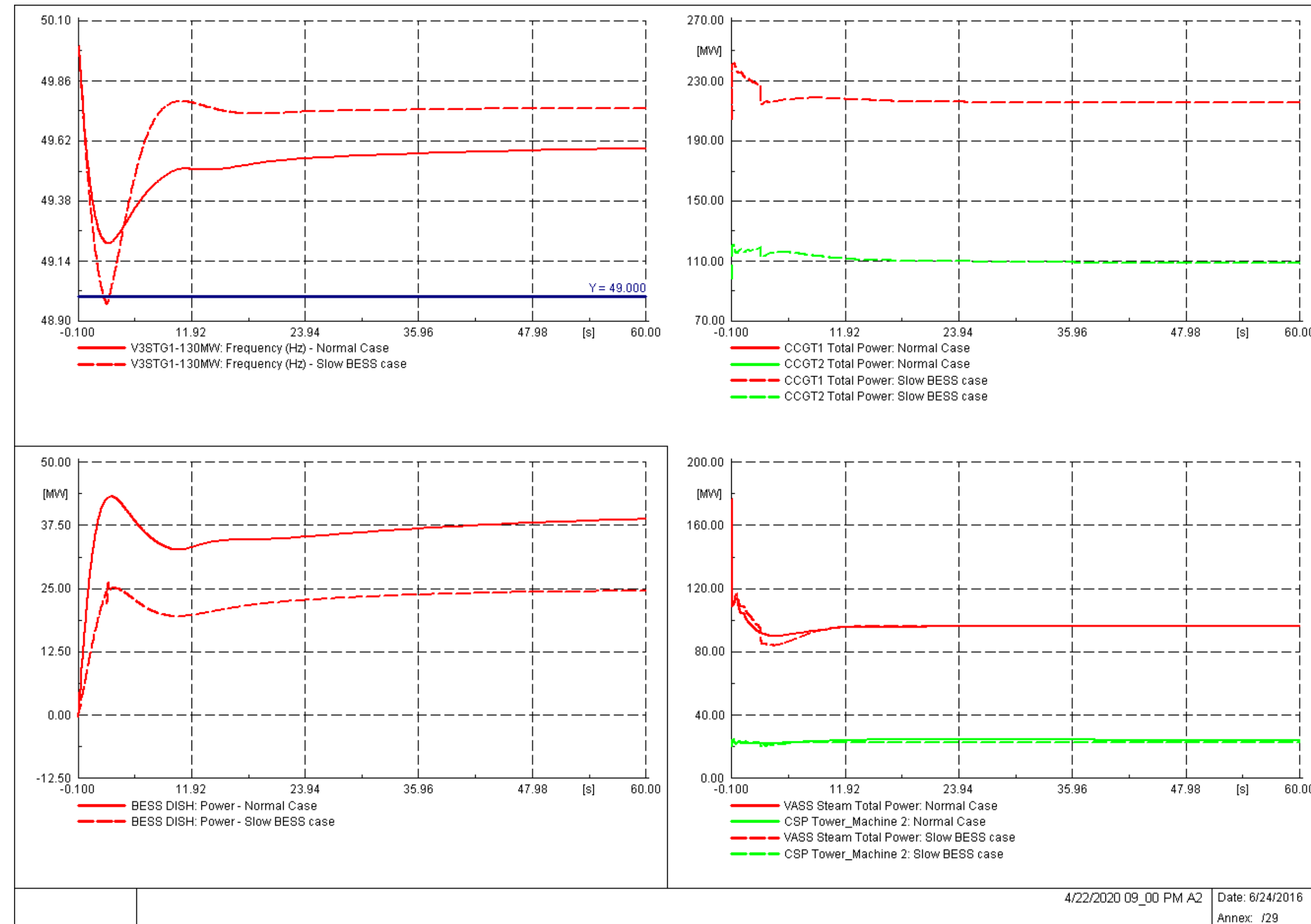
TOTAL INERTIA RESPONSE



DYNAMIC ANALYSIS

LOSS OF LARGEST INFEED

BESS Enhanced Frequency Response important for compliance



4/22/2020 09_00 PM A2 Date: 6/24/2016
Annex: /29

22/04/2020 21:00, Scenario A2.
Total Load: 510,5MW. Loss of 88.1MW (17,2%)