



INDEPENDENT POWER TRANSMISSION OPERATOR



Towards an Interconnected Future in SE Europe



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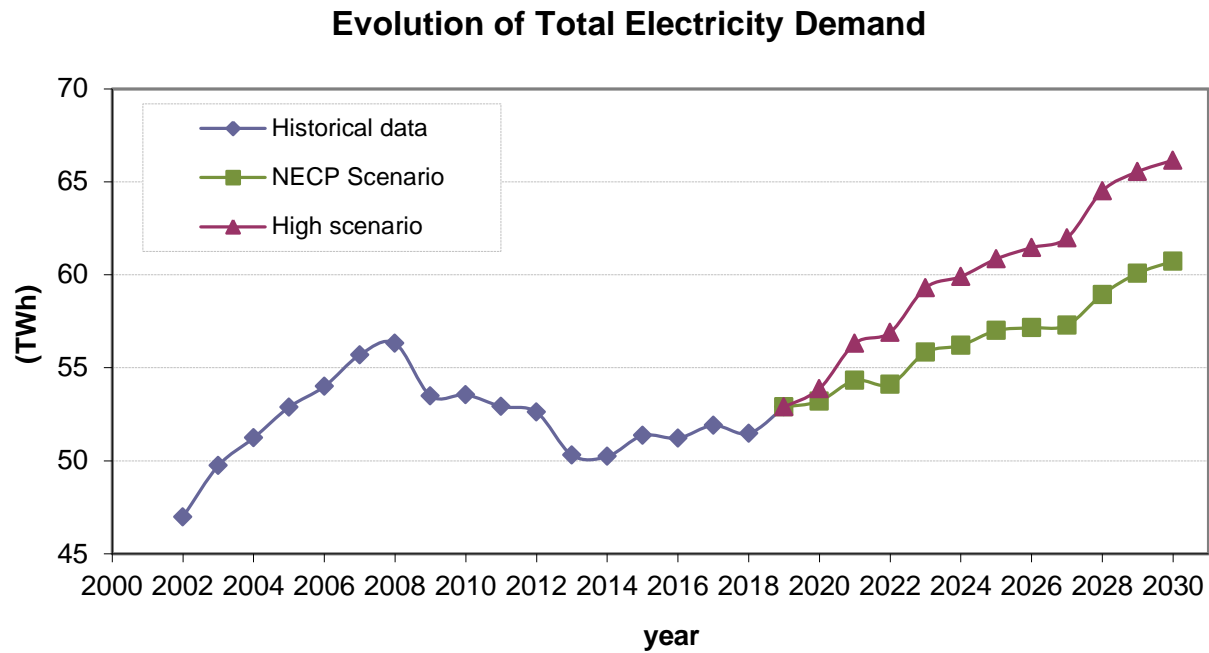
DEVELOPMENT OF THE HETS

MAIN DRIVERS AND CRITERIA

Besides the needs for demand supply, the main drivers and criteria for the development of the Hellenic Electricity Transmission System are:

- Enhancement of RES integration with respect to the European and National energy and climate targets (NECP) for 2020 & 2030 and the consequent contribution to the reduction of CO₂ emissions
- Interconnection of Greek islands
- Increase of transfer capacity with neighboring transmission systems in order to promote market integration
- Reduction of transmission system losses
- Facilitation for connection of new generation
- Mitigation of environmental and social impact

EVOLUTION OF THE TOTAL ELECTRICITY DEMAND SERVED BY THE HETS



* Refers to the HV loads, excluding pumping load.

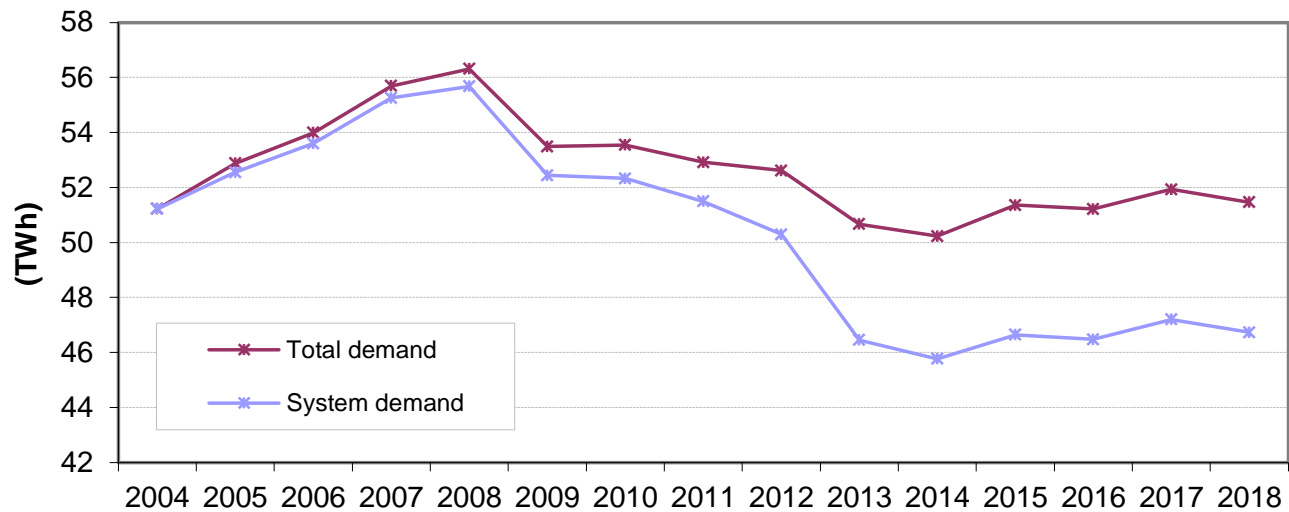
Demand met by dispersed generation connected to the Distribution System is not included.

Transmission System losses are included.

ELECTRICITY DEMAND

IMPACT OF DISPERSED GENERATION

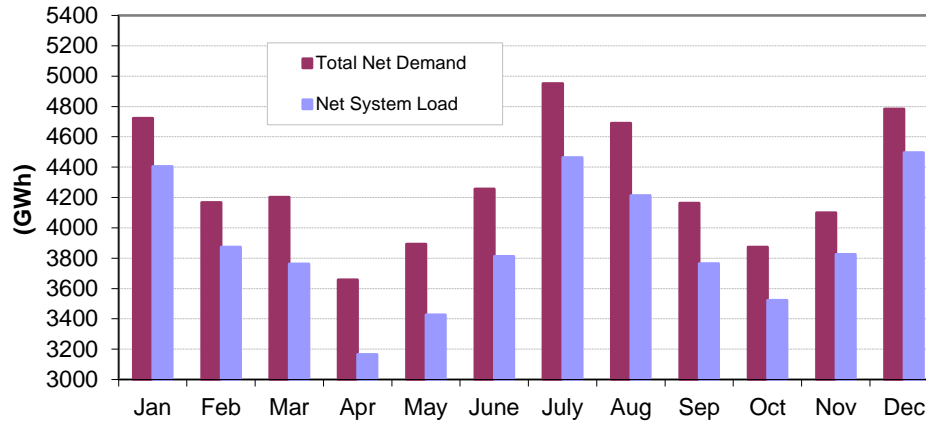
Impact of dispersed RES generation on Demand



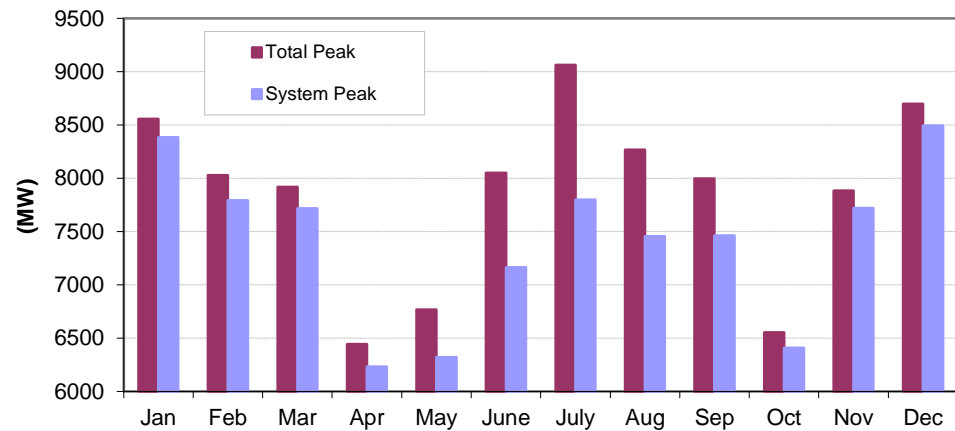
ELECTRICITY DEMAND

MONTHLY EVOLUTION (2018)

Monthly Electricity Demand for 2018



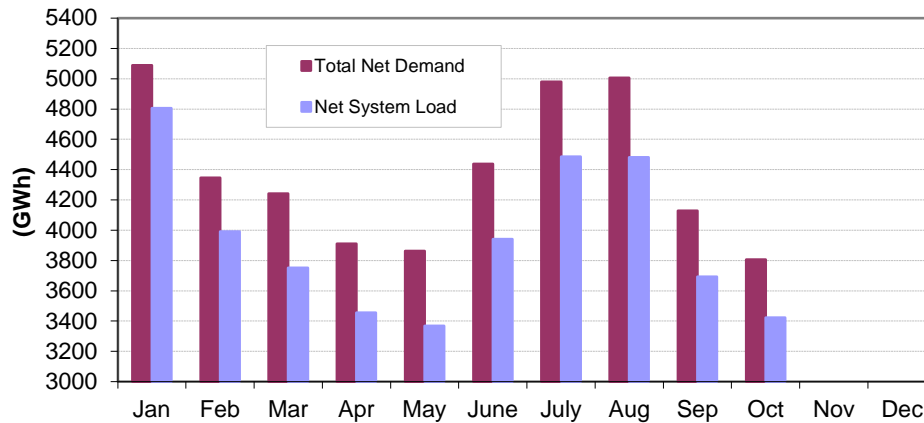
Monthly Peak Loads for 2018



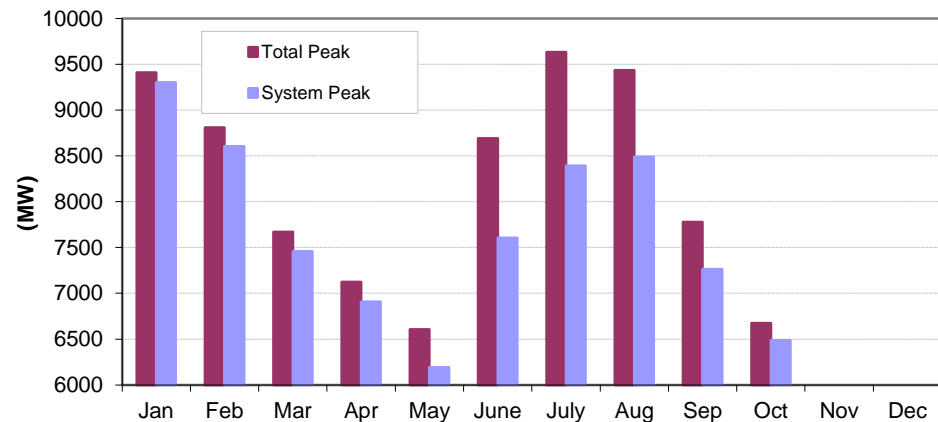
ELECTRICITY DEMAND

MONTHLY EVOLUTION (2019 - UP TO OCTOBER)

Monthly Electricity Demand for 2019



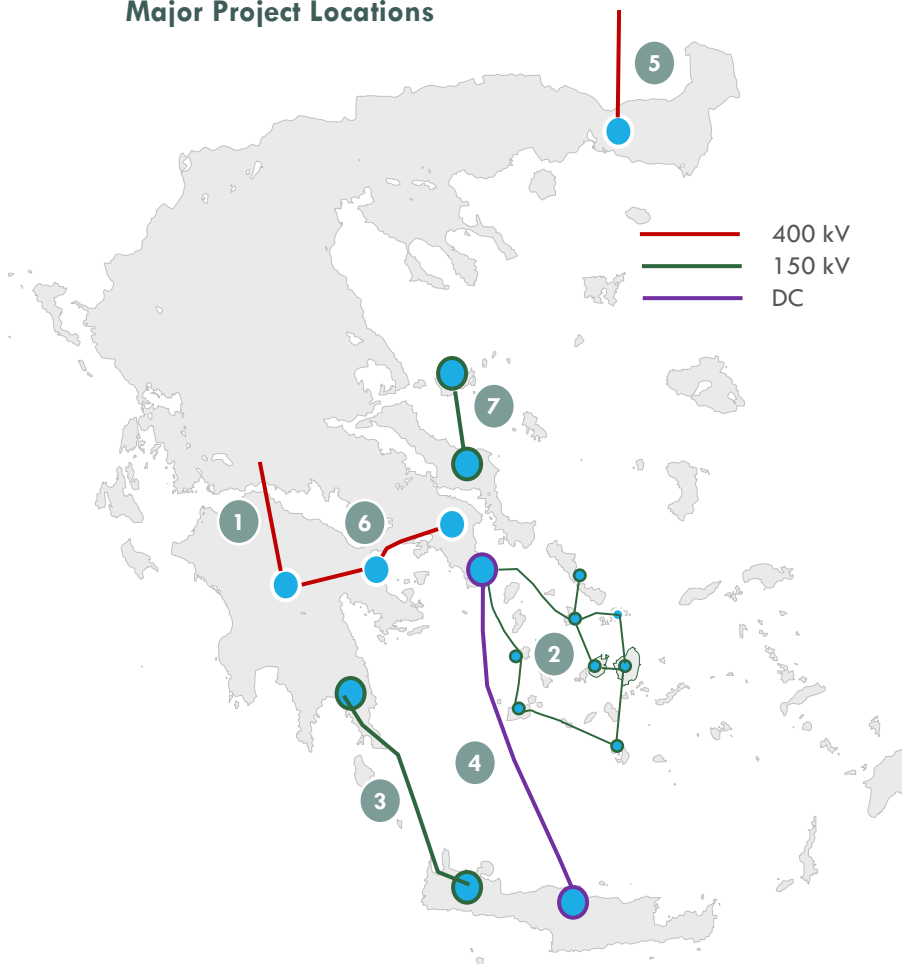
Monthly Peak Loads for 2019



TYNDP 2021 – 2030

MAJOR PROJECTS

Major Project Locations



Key Projects - Beginning of Works Before the End of 2023

ID	Project Description	Expected Commissioning Year	Total Project Cost (€ mn)
1	First 400 kV branch to Peloponnese (Megalopoli - Patras - Acheloos - Distomo)	2020	148
2	Cycladic Islands interconnection (Phases B and C) and Evia - Andros - Tinos Islands	2020 Adros-Livadi cable commissioned	178
	Cycladic Islands interconnection (Phase D)	2024	386
3	Crete interconnection (Phase I)	2020	364
4	Crete interconnection (Phase II) ΑΡΙΑΔΝΗ INTERCONNECTION Α.Ε.Ε.Σ.	2023	1000
5	New 400 kV interconnector to Bulgaria N. Santa (GR) - Maritsa (BG)	2023	8
6	Second 400 kV branch to Peloponnese (Megalopoli - Korinthos - Koumoundouros)	2024	105
7	Skiathos Island interconnection	2021	56
8	Equipment Renovation	2023	104

INTERCONNECTION OF THE ISLANDS

MAIN OBJECTIVES

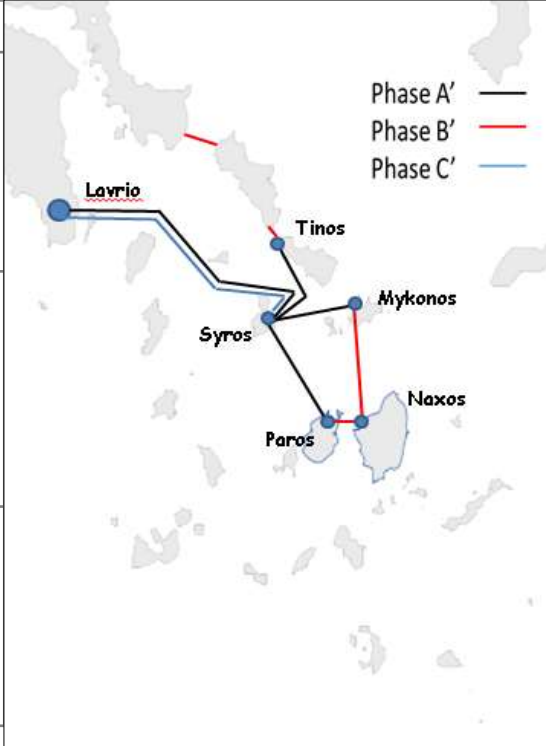
- **Increase of security of supply** for the islands electricity system
- **Drastic reduction of electricity generation cost** in the islands
 - Substitution of oil units with RES plants and imports from the mainland
- **Reduction in the annual cost for “Public Service Obligation”**
 - More than 300 M€/year due to the electricity supply of Crete and 50 M€/year for the Cycladic islands, from high cost oil-fired units
- **Environmental benefits** for the islands
 - Most of the local old oil-fired units are located near residential and tourist areas
 - They will be set in “cold reserve” status after the interconnection
- **Enhancement of RES integration in the islands** (very rich wind and solar potential)
 - The majority of the energy needs will be met by RES, while the rest will be imported from the mainland
 - Reduction of energy dependence on imported fuels
 - The achievement of the major 2021 energy goals of the country, in terms of enhancing RES penetration and reducing CO₂ emissions
- **Integration of the national electricity market in terms of interconnecting the islands with the continental Transmission System.**

INTERCONNECTIONS OF ISLANDS *(INCL. IN TYNDP 2021 - 2030)*

INTERCONNECTION OF THE NORTHERN CYCLADIC ISLANDS

- Interconnection of the Northern Cycladic Complex
 - Syros, Mykonos, Paros and Naxos
- The project is implemented in three phases (A, B, C)
 - Estimated total budget c. 428 M€

Project Phases

	Description / Timing	Technical Characteristics	
A	Radial Interconnection of Syros Island to the mainland (Lavrio EHV SS), Paros, Mykonos and Tinos Islands <i>Commissioning: 2018</i>	Phase A of Cycladic Islands interconnection ensures the power transmission of up to 170 MW (normal conditions) and up - to 120 MW (in case of major contingencies)	
B	Interconnection of Naxos Island to Paros and Mykonos Islands (close loop Syros - Mykonos - Naxos - Paros) Reinforcement of the existing interconnections Andros - Evia and Andros - Tinos Islands <i>Expected commissioning: 2020</i> <i>Andros-Evia cable commissioned in 2019</i>	Phase B of Cycladic Islands interconnection will ensure the power transmission of up - to 170 MW (under both normal conditions and major contingencies)	
C	Construction of second submarine cable between Lavrio and Syros Island <i>Expected commissioning: 2020</i>	Phase C of Cycladic Islands interconnection will ensure the reliability of power transmission under both normal conditions and major contingencies	

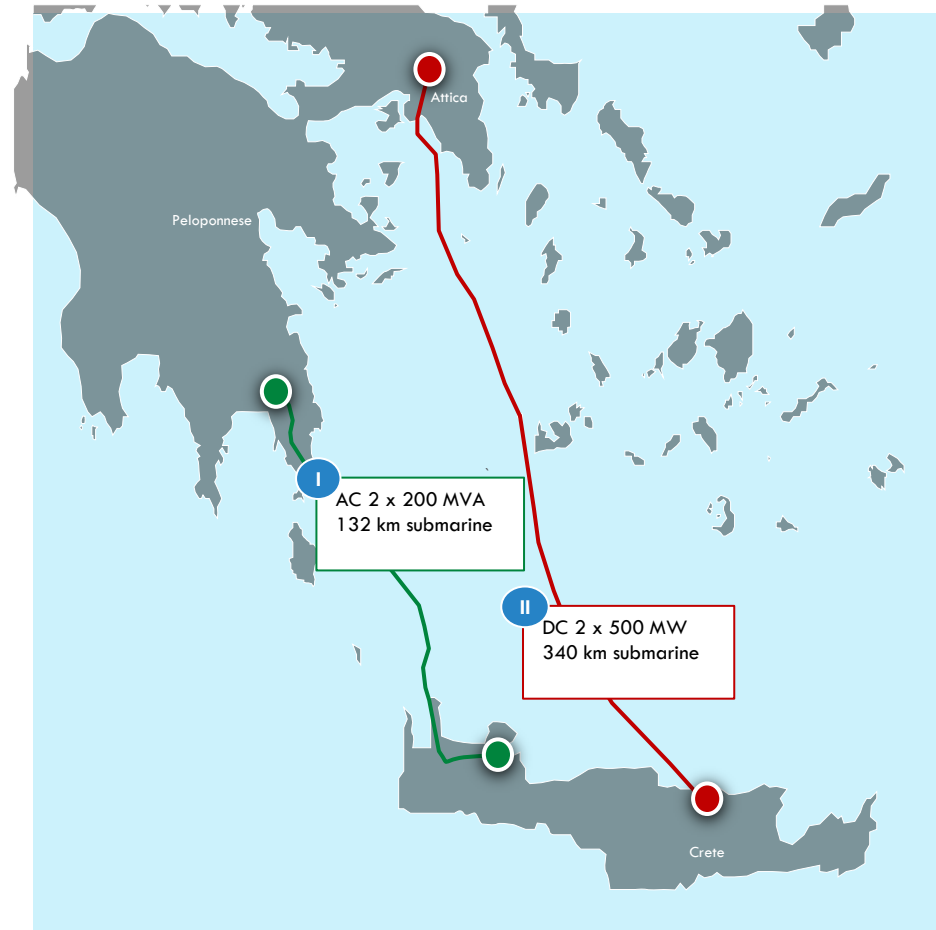
INTERCONNECTIONS OF ISLANDS *(INCL. IN TYNDP 2021 - 2030)*

INTERCONNECTION OF CRETE

- Interconnection of Crete to the mainland through **two distinct links**
- The project is implemented in two phases (I, II)
 - Estimated budget for Phases I and II is c. 364 M€ and c. 1000 M€, respectively

Project Phases

	Description/Timing	Technical Characteristics
I	Connection to Peloponnese <i>Expected commissioning: 2020</i>	A 2 x 200 MVA capacity AC link consisting of two 132 km submarine cable circuits and additional underground (at both sides) and overhead lines (in Peloponnese)
II	Connection to Attica (Ariadne Interconnection) <i>Expected commissioning: Q1 2023</i>	A 2 x 500 MW capacity DC link consisting of two 340 km submarine cables and additional underground (at both sides) and overhead lines (in Crete)

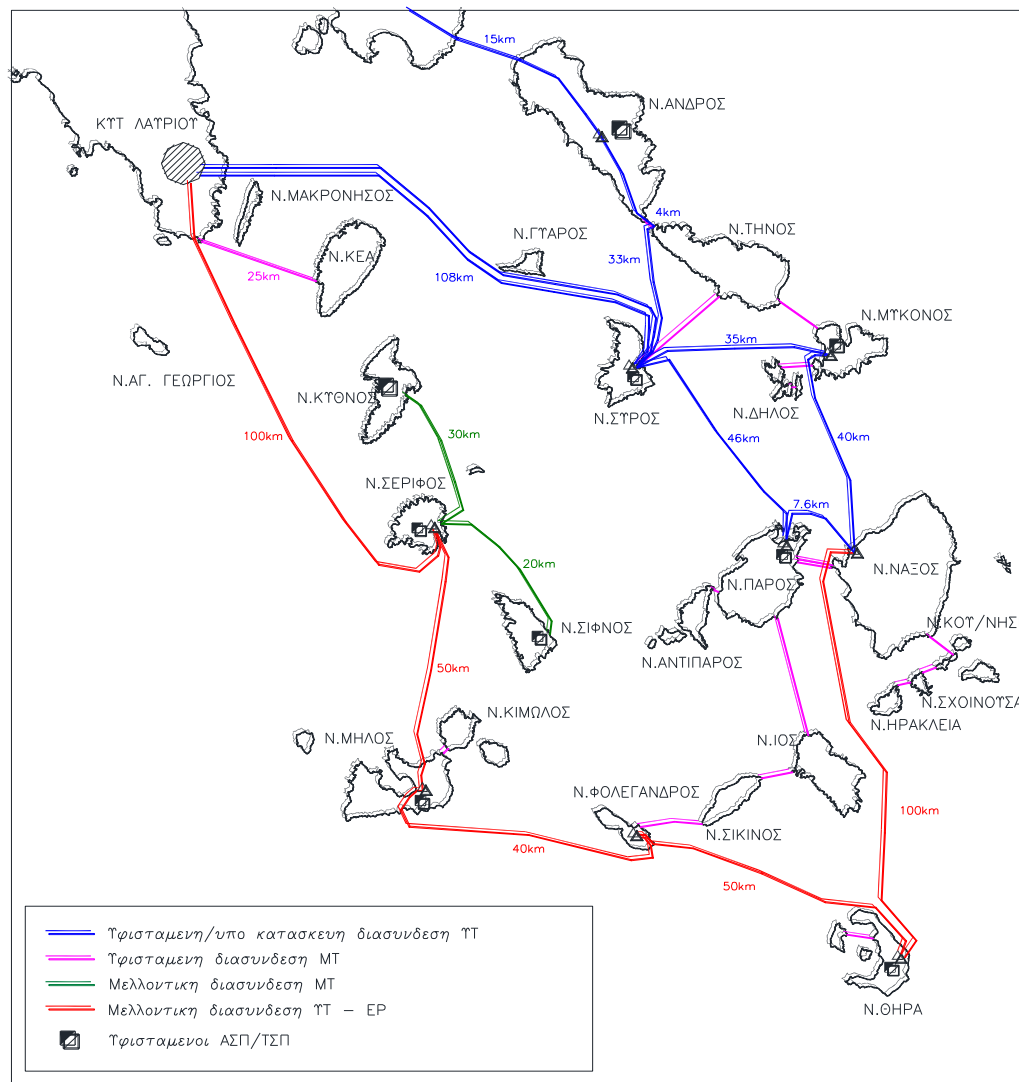


INTERCONNECTIONS OF ISLANDS (INCL. IN TYNDP 2021 - 2030)

INTERCONNECTION OF THE WESTERN AND SOUTHERN CYCLADIC ISLANDS (PHASE D)

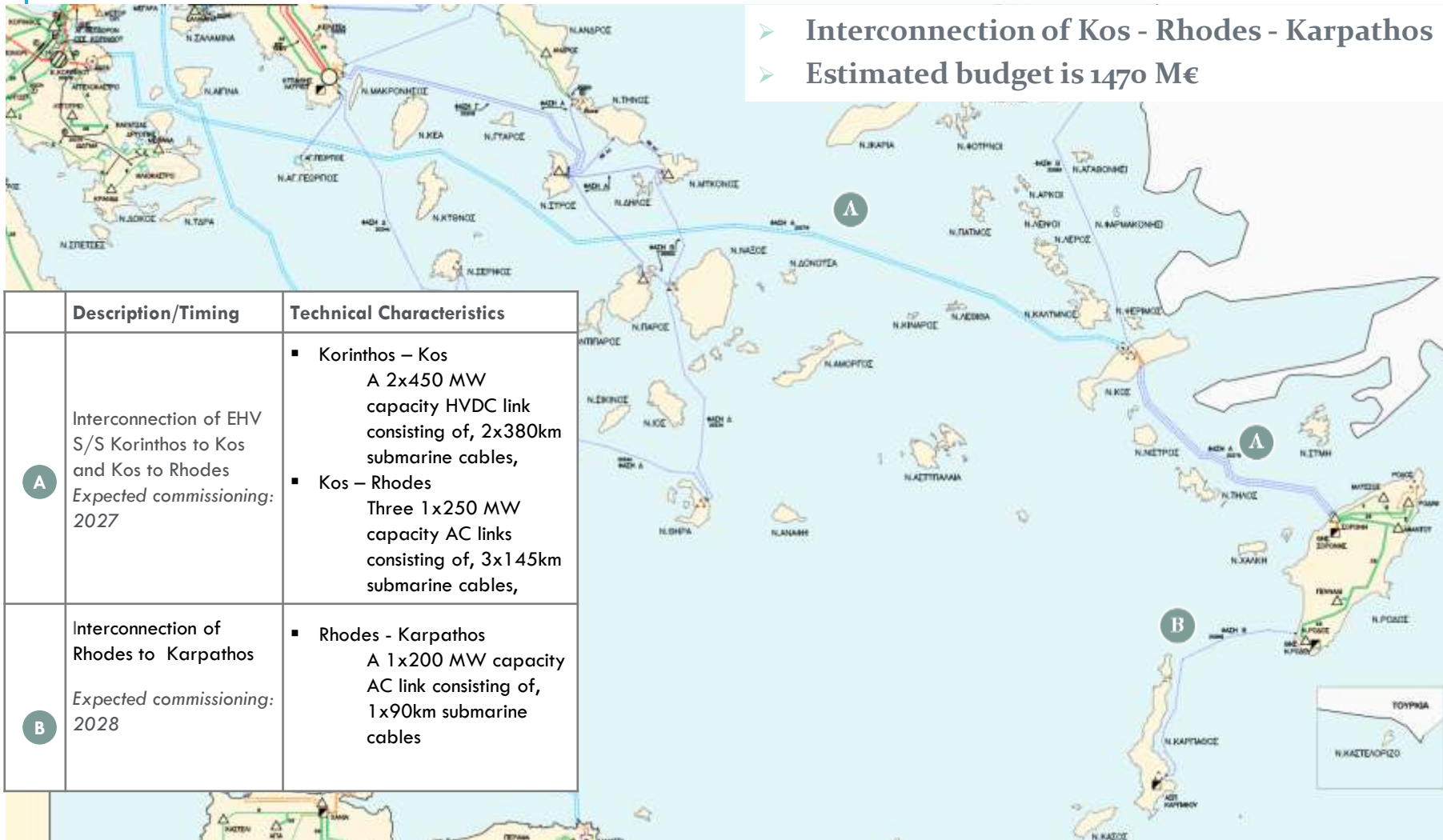
- Interconnection of Lavrio - Serifos - Milos - Folegandros - Thira - Naxos
- Estimated budget for Phase D is 386 M€

Description/Timing	Technical Characteristics
Interconnection of Thira, Folegandros, Milos, and Serifos with Naxos and HETS	Five (5) 1x200 MW capacity AC links (340km submarine cables total)
<i>Expected commissioning: 2023-2024</i>	<ul style="list-style-type: none"> ➤ Naxos – Santorini ➤ Santorini– Folegandros ➤ Folegandros – Milos ➤ Milos – Serifos ➤ Serifos – Lavrio



INTERCONNECTIONS OF ISLANDS (INCL. HE TYNDP 2021 - 2030)

INTERCONNECTION OF THE DODECANESE ISLANDS



INTERCONNECTIONS OF ISLANDS (INCL. IN TYNDP 2021 - 2030)

INTERCONNECTION OF THE NORTHEAST AEGEAN ISLANDS

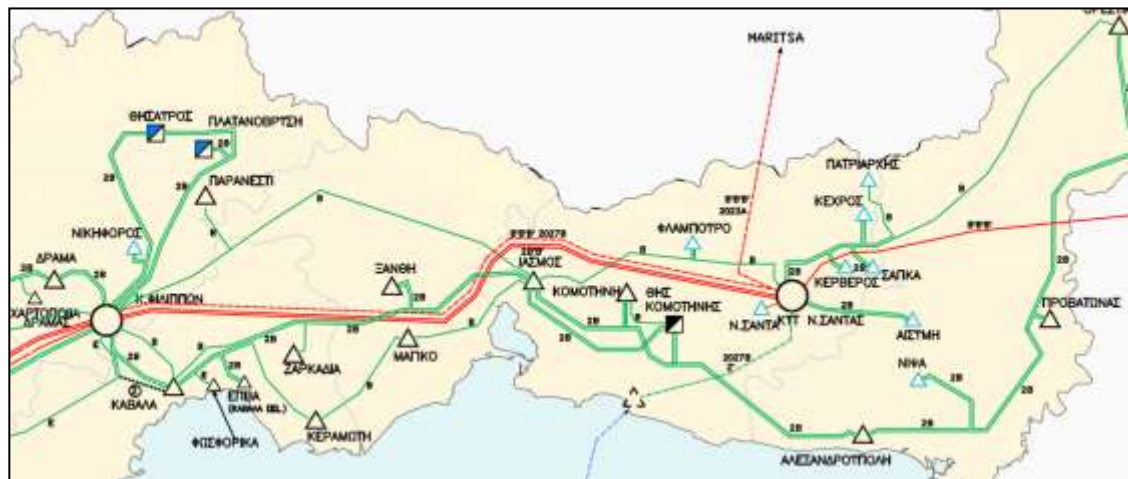
- Interconnection of the Northeast Aegean Islands to the mainland via EHV N. Santa and Aliveri
- The project is implemented in three phases (A,B and C)
- Estimated budget for all phases € 940 M€

	Description / Timing	Technical Characteristics
A	Interconnection of EHV S/S N. Santa to Lemnos and Lemnos to Lesvos Expected Commissioning: 2027	<ul style="list-style-type: none"> EHV S/S N. Santa to Lemnos ✓ An 1x250 MW capacity OHL, 150 kV, 38km ✓ A 1x250 MW capacity AC link consisting of, 1x123 km submarine cable Lemnos to Lesvos ✓ A 1x250 MW capacity AC link consisting of 1x141km submarine cable.
B	Interconnection of EHV S/S Aliveri to Skiros, Lesvos to Chios and Kos-Samos Expected commissioning: 2028	<ul style="list-style-type: none"> EHV S/S Aliveri to Skiros ✓ An 1x250 MW capacity OHL, 150 kV, 28km ■ A 1x250 MW capacity AC link consisting of 1x48 km submarine cable . Kos-Samos ✓ A 1x200 MW capacity AC link consisting of, 1x90km submarine cables
C	Interconnection of Lesvos to Skiros and Chios to Samos Expected commissioning: 2030	Two 1x 250 MW capacity AC link consisting of 1x232 km submarine cable (in total).



INTERNAL INTERCONNECTIONS *(INCL. IN TYNDP 2021 - 2030)* REINFORCEMENT OF 400 KV TRANSMISSION SYSTEM IN EAST MACEDONIA & THRACE

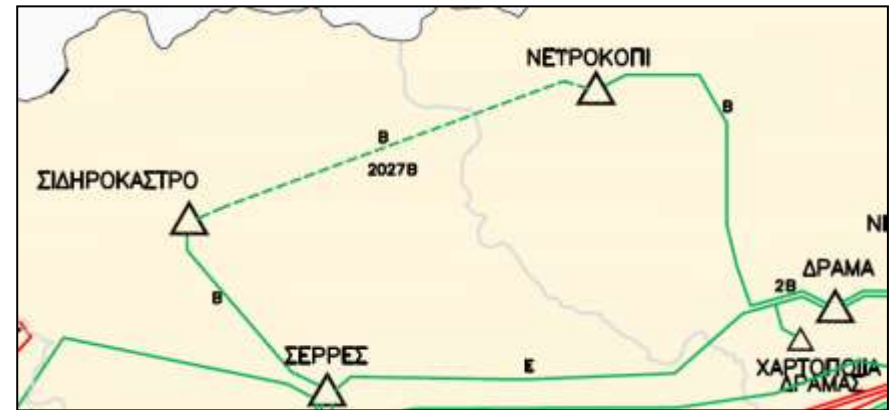
- New 400 kV OHL Nea Santa – Philippoi of 140 km length
- Estimated budget 41.2 M€
- Expected commissioning 2027
- Expected benefits:
 - Increases the production capacity of wind farms in the area of Thrace.
 - As a prerequisite for the implementation of future interconnections between the Greek Transmission System and those of Turkey and Bulgaria
 - Enhances the node of Nea Santa, one of the connection points of the Northeast Aegean islands to the HETS



INTERNAL INTERCONNECTIONS (INCL. IN TYNDP 2021 - 2030)

ELIMINATION OF RADIAL CONNECTIONS IN 150 KV LEVEL

- 7 S/S with radial connection in 150 kV
 - ✓ Kassandra
 - ✓ Doliانا
 - ✓ Nevrokopi
 - ✓ Sidirokastro
 - ✓ Agia
 - ✓ Axioupoli & OSE Polikastrou
- Expected commissioning : 2024-2027
- Expected benefits:
 - Redundancy to fulfill N-1 criterion
 - Ensure safe and reliable operation under normal and emergency conditions



INTERNAL INTERCONNECTIONS *(INCL. IN TYNDP 2021 - 2030)*

UPGRADE OF INTERCONNECTIONS IN IONIAN ISLANDS

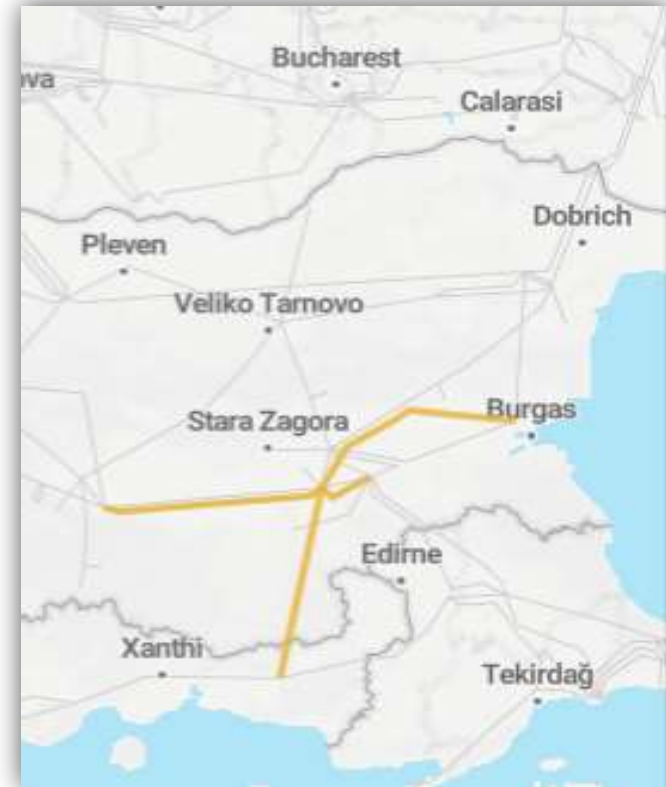
- Restoration of 3rd connection of Kerkira to mainland
- Reinforcement of existing connections (oil-filled cables):
 - Lefkada – Kefalonia
 - Zakynthos – Kilini
 - XLPE cables 200 MVA
- Expected commissioning : 2023-2025



INTERNATIONAL INTERCONNECTIONS *(INCL. IN TYNDP 2021 - 2030)*

2ND INTERCONNECTION GREECE - BULGARIA

- New 400 kV tie - line Nea Santa (GR) - Maritsa East (BG), of 151 km length (122 km in BG and 29 km in GR)
- Project of Common Interest (PCI) 3.7.1
- Project promoters: ESO EAD (BG) and IPTO (GR)
- Current progress: Environmental Impact Assessment (EIA) Approval - Land acquisition has started
- Estimated commissioning: 2023
- Expected benefits:
 - Relieves congestions in the South part of the Balkan peninsula transmission network, increasing thus the cross border transfer capacity in the predominant North - South direction
 - Expected increase in the cross border transfer capacity between BG and GR is 600 MW



EXISTING INTERNATIONAL INTERCONNECTIONS

- The Greek Transmission System operates synchronously with the interconnected European System under the coordination of ENTSO-E.
- The synchronous operation of the Greek System with the European System is mainly achieved through Overhead Lines 400 kV, with the Systems of Albania, Bulgaria, North Macedonia and Turkey.
- In addition, the Greek System is asynchronously connected (via a 400 kV submarine HVDC connection) to Italy



EXISTING INTERNATIONAL INTERCONNECTIONS

Greece - North Macedonia

- a single circuit 400 kV OHL, 1400 MVA nominal capacity, between EHV S/S Thessaloniki and Dubrovo
- a single circuit 400 kV OHL, 1400 MVA nominal capacity, between EHV S/S Meliti and Bitola

Greece - Albania

- a single circuit 400 kV OHL, 1400 MVA nominal capacity, between EHV S/S Kardia and Zemblak
- a single circuit 150 kV OHL, 138 MVA nominal capacity, between S/S Mourtos and Bistrice

Greece - Bulgaria

- a single circuit 400 kV OHL, 1400 MVA nominal capacity, between EHV S/S Thessaloniki and Blagoevgrad.

Greece - Turkey

- a single circuit 400 kV OHL, 2.000 MVA nominal capacity, between EHV S/S Nea Santa and Babaeski.

Greece - Italy

- a 400 kV DC submarine cable, 500MW nominal capacity between EHV S/S Arachthos- Galaitina



INTERNATIONAL INTERCONNECTIONS

UNDER CONSIDERATION

➤ **Upgrade (re-conductoring) of existing 400 kV OHL Melite – Bitola**

The project has been included in ENTCO-E Ten-Year Development Plan (TYNDP) 2018 as a project under consideration with implementation horizon beyond 2030. The project will increase the nominal capacity of the existing OHL to 2745MVA.

➤ **2nd Greece-Turkey interconnection**

Studies carried out by joint working group between Greek, Bulgarian and Turkish TSOs, revealed the possibility of future interconnections between the European and Turkish Transmission Systems, which will increase the transmission capacity between the Systems. The necessary feasibility studies for the selection of projects to be included in ENTSO Ten-Year Development Plan (TYNDP) will be elaborated in the next period.

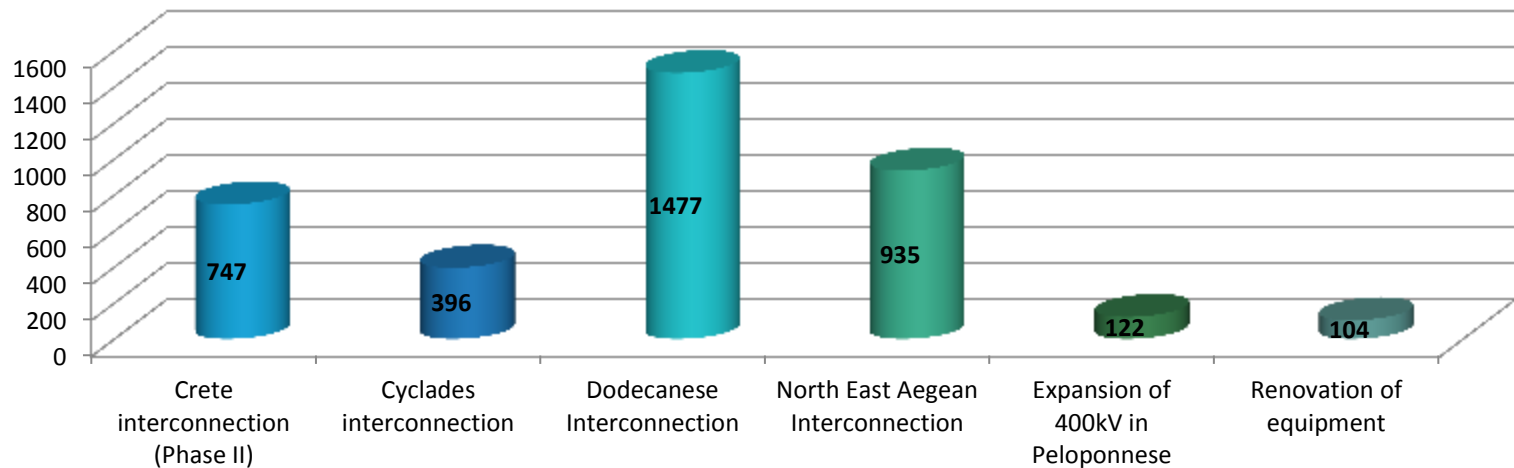
➤ **Greece - Cyprus - Israel interconnection**

The project concerns the implementation of the interconnection of the Greek-Cypriot and Israeli transmission systems with completion horizon in 2023.

In the new list of European Projects of Common Interest (PCI) the project “EuroAsia Interconnector” includes sections 3.10.1 of the Israel-Cyprus interconnection and 3.10.2 of the Cyprus-Greece (Crete) interconnection with DC connections. As it is known the section of Attica - Crete interconnection that was formerly part of the aforementioned PCI is no longer part of it and will be implemented by the special purpose company “ARIADNI INTERCONNECTION SA”.

ESTIMATION OF TYNDP CAPITAL INVESTMENT TOTAL PLANNING PERIOD (2021 - 2030)

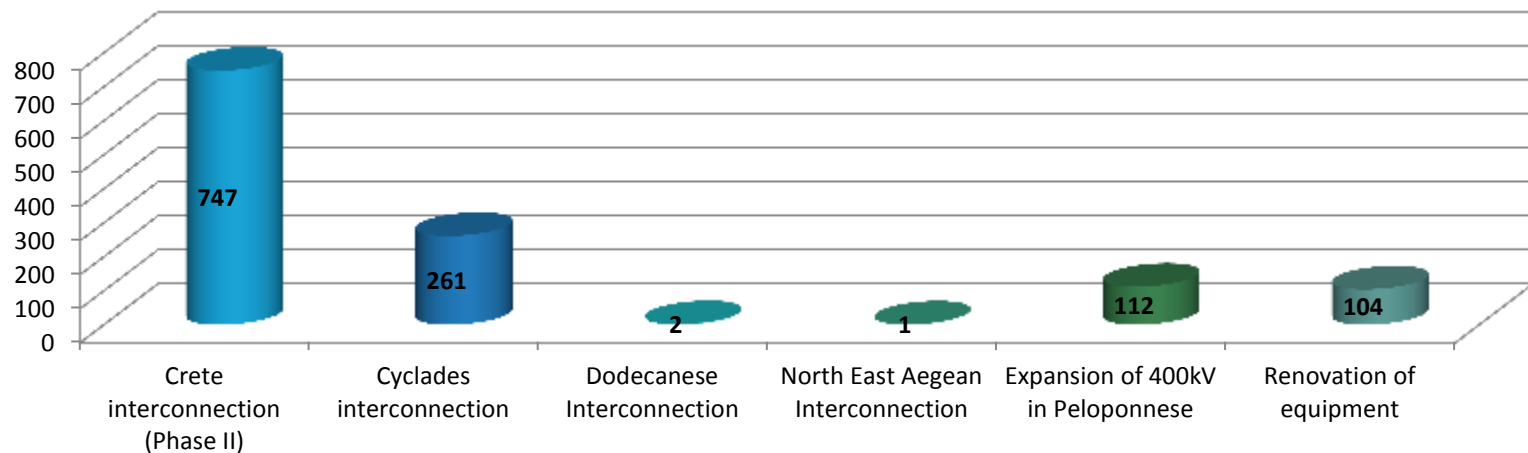
**Estimation of TYNDP capital investment (in million €)
for the period 2021 - 2030**



10-year Investment Plan: ~ 4.4 billion €

ESTIMATION OF TYNDP CAPITAL INVESTMENT FIRST 4-YEAR PERIOD (2021 - 2024)

**Estimation of TYNDP capital investment (in million €)
for the period 2021 - 2024**



4-year Investment Plan: ~ 1.6 billion €

Thank you for your attention!

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