



• Vol.20

Outlook of the Greek Energy Sector towards 2030



Special issue from COP28



COP 28
GREECE

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COP²⁸
UAE



Side Event by HAEE | Greek Pavilion Dubai, UAE

“Outlook of the Greek Energy Sector towards 2030”

Blue Zone

Dubai Expo City

5 Dec

13:30 - 15:00 GST

We are all about Energy Economics

HAAE is an interdisciplinary forum for the exchange of ideas and experiences among energy experts



HAAE Energy Transition Symposium

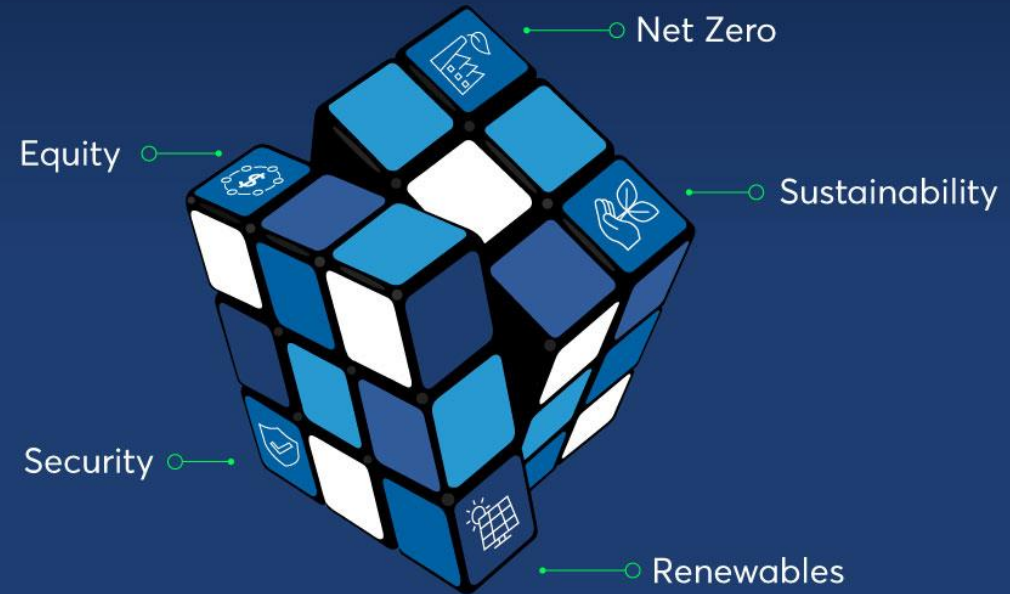
— 8TH HAAE —
**ENERGY
TRANSITION
SYMPOSIUM**

Rethinking Energy:

The new state of play
for a secure and
sustainable future

27-29 SEPTEMBER 2023
FRENCH INSTITUTE OF GREECE

HAAE HELLENIC ASSOCIATION for ENERGY ECONOMICS
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Greek Energy Market Report

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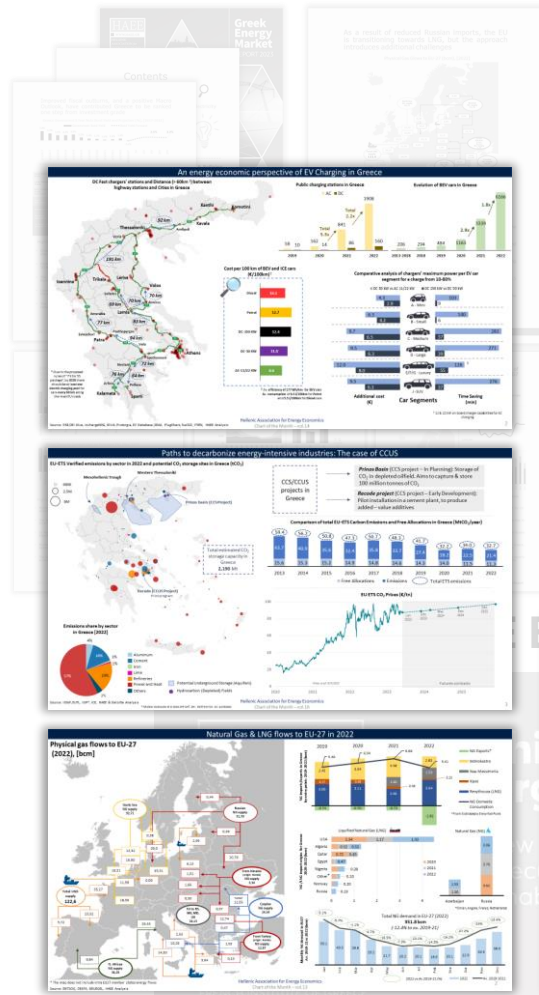
Greek Energy Market Report

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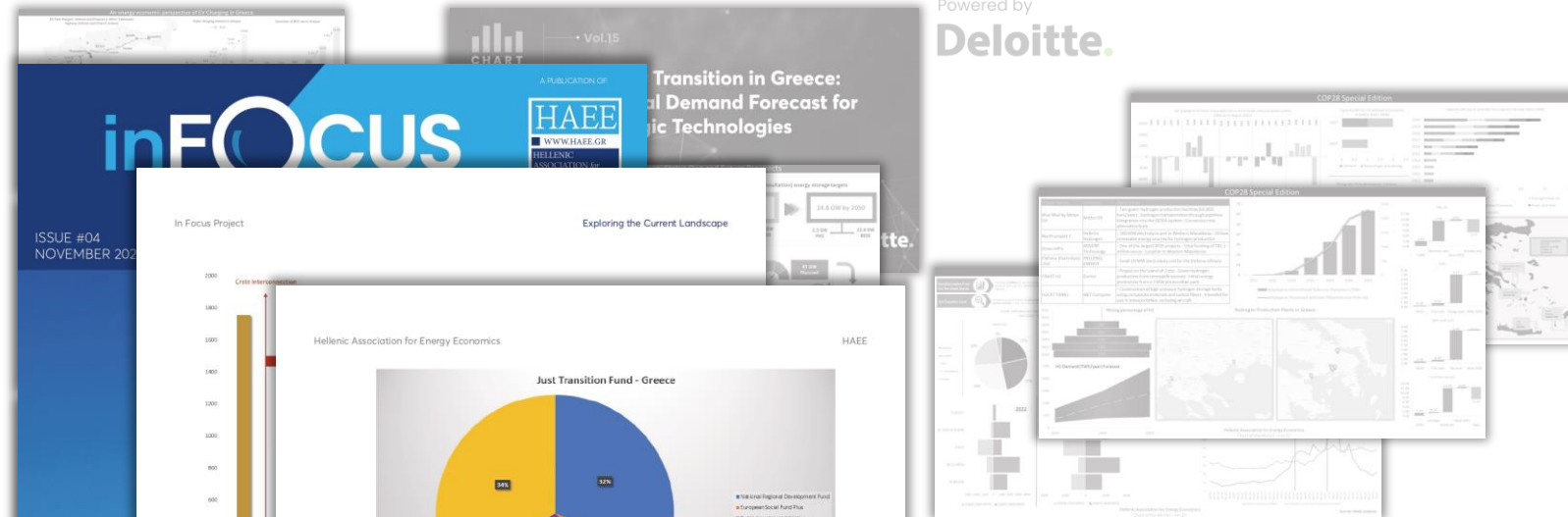
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HAAE Energy Transition

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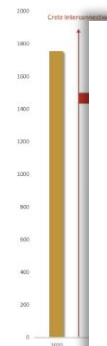
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Security

In Focus Project

Exploring the Current Landscape



Figure

The previous im overall goal of in the connection of mainland grid, November 2021. interconnected by installed power (units), 2291 GWh 676.4 MW annual of such an intere from Figure 2, whi of Crete the ins units of the NIS

Hellenic Association for Energy Economics

HAAE

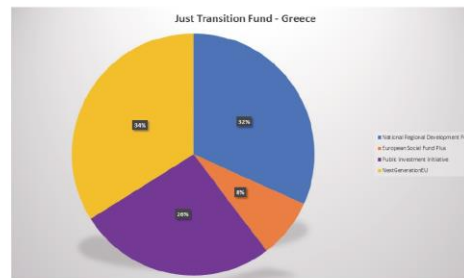


Figure 13. JTF Contribution per Financing Source

The JTF of ~€14 billion will also support the decarbonization efforts of Western Macedonia and Megalopolis (+ adjacent municipalities) through an accumulation of 535€:

- €436.1 million from the National Regional Development Fund
- €109 million from ESF+
- €363.4 million from Public Investment Initiative
- €466.5 million from the NextGenerationEU

Eligibility is based on a broader analysis of the territories, potentially facing socio-economic challenges during the transition. As part of this analysis, the highest priority locations were determined to be the ones with higher dependency on fossil fuels. In the case of Megalopolis (Peloponnese), there was heavy consideration of the transition impact on regional employment.

Currently 1,600/6,000 inhabitants are facing employment risk (direct & indirect) due to carbon neutrality policies and efforts. Redirecting the scope to Crete and the Aegean, once again, there is a heavy reliance on Fossil Fuel, however, for power production. Given the high-RES potential, the Greek Government has committed to phase out fossil fuels through investing in the development of RES infrastructure and interconnectors with the mainland and between the islands, optimizing the use of renewable energy.⁵³ Funding from the JTF will be used for:

- The deployment of technology and infrastructures for affordable clean energy, in GHG emission reduction, energy efficiency and renewable energy.
- The upskilling and reskilling of workers.

53 Just Transition Plan Approval - Greece
54 NSRF 2021-2027 Just Transition Funds
55 European Commission - Just Transition Fund Eligibility

Greek Energy Market Report

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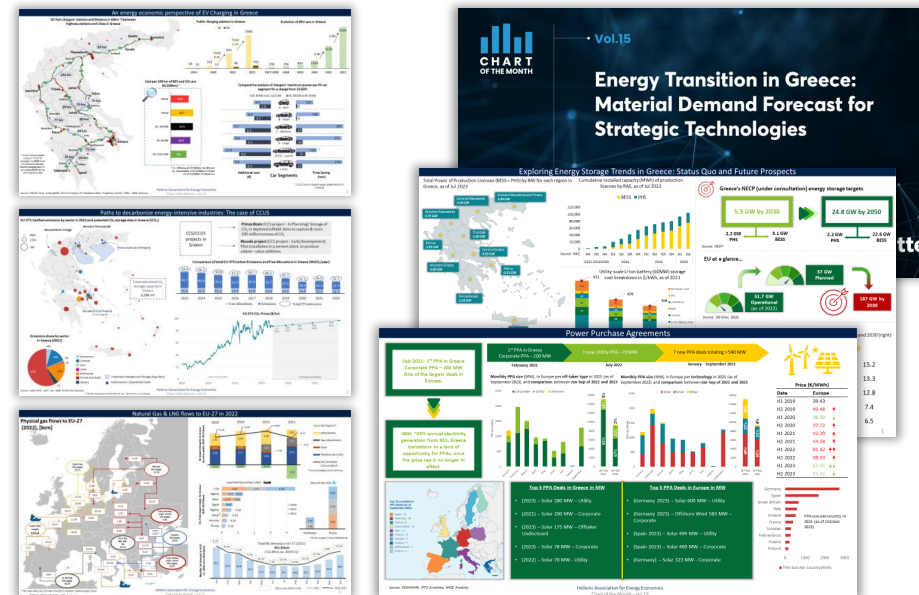
NATIONAL BANK OF GREECE



Chart of the Month

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HAAE Energy Transition Symposium

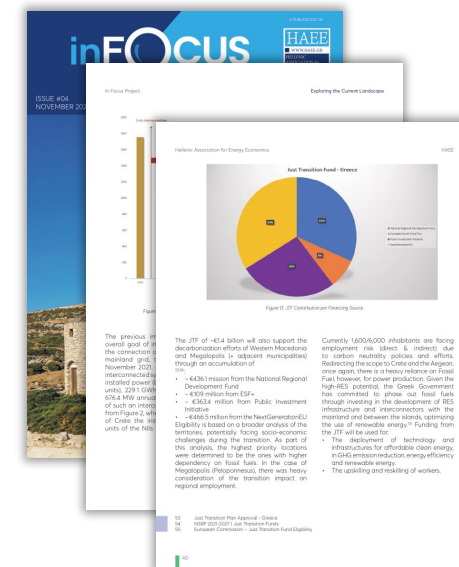
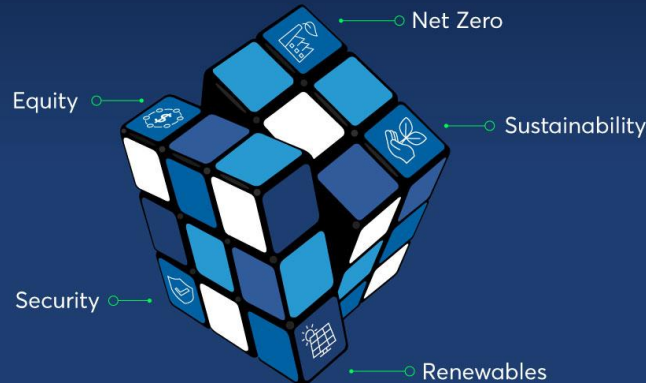
— 8TH HAAE —
ENERGY TRANSITION SYMPOSIUM

Rethinking Energy:

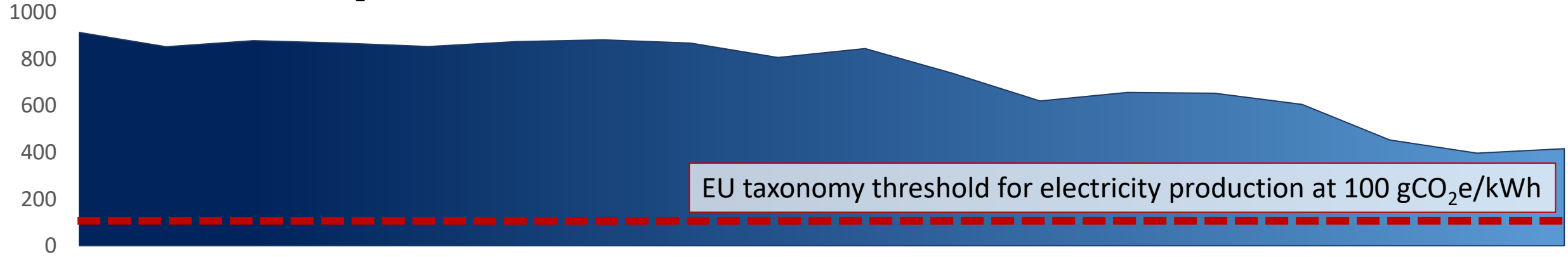
The new state of play for a secure and sustainable future

27-29 SEPTEMBER 2023
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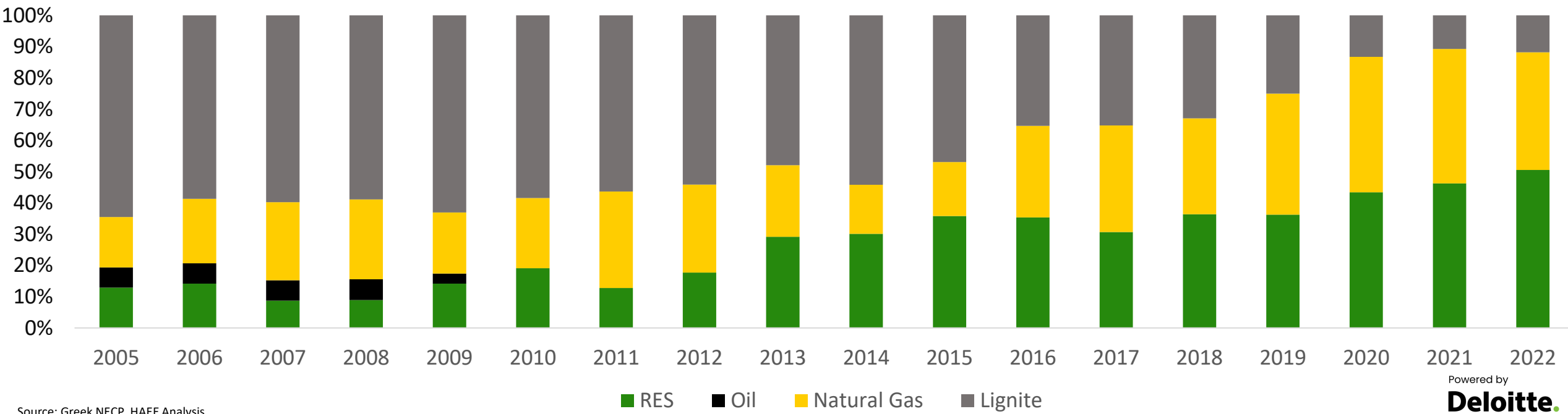
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Carbon Intensity (gCO₂e/kWh)

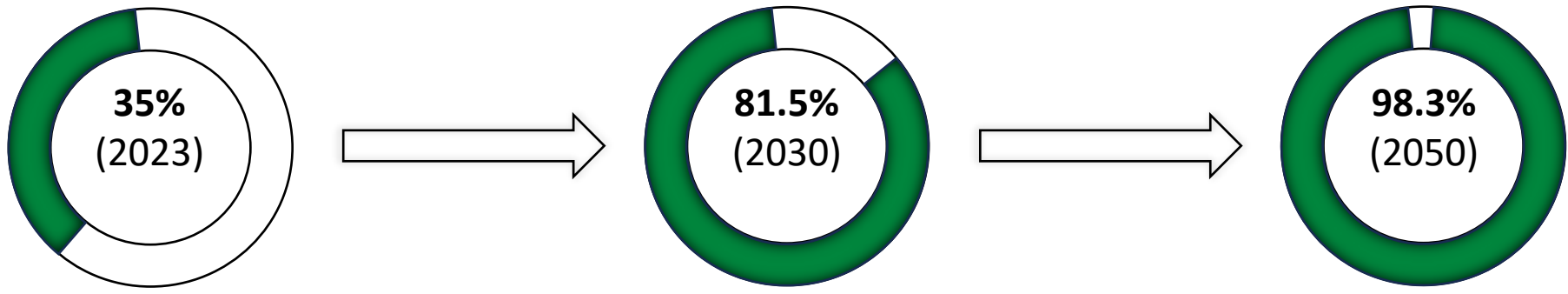


Present Greek Electricity Mix 2005 - 2022



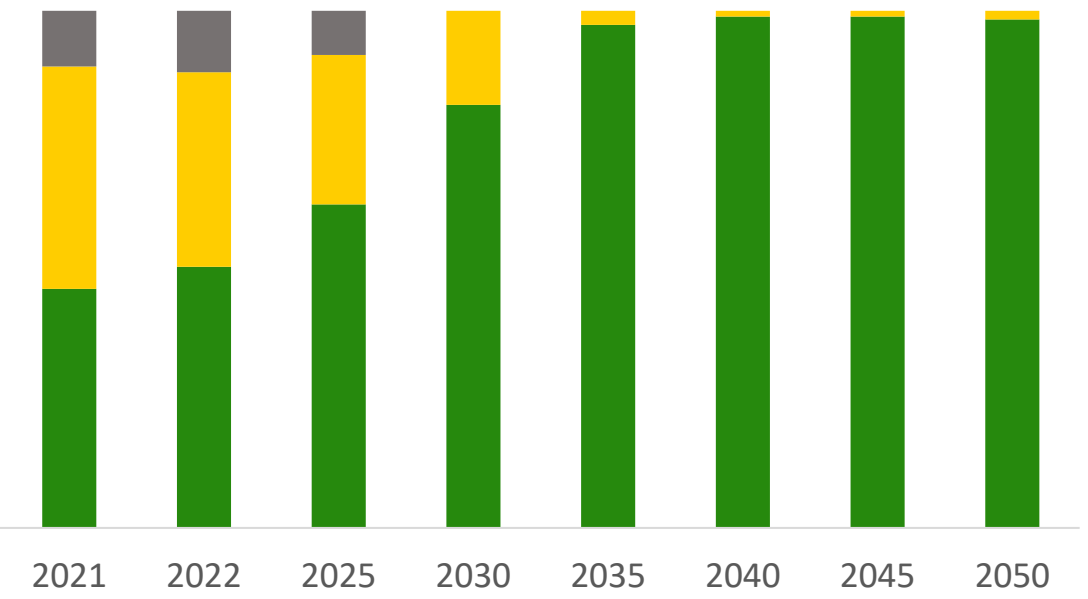
Source: Greek NECP, HAAE Analysis

NECP Targets for RES Share in Electricity Generation

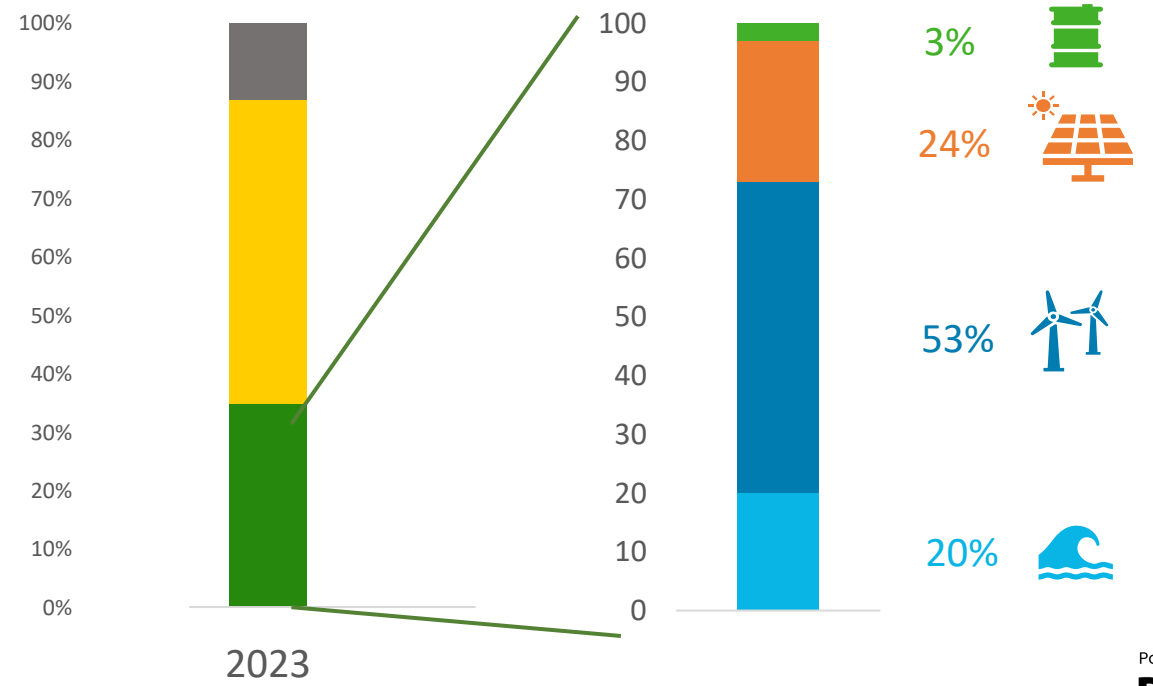


The Greek electricity system is expected to be fully decarbonised by 2050, meeting the EU's goals for the energy transition.

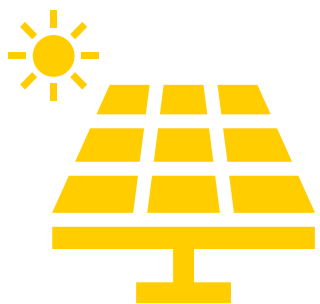
Future Greek Electricity Mix 2025 - 2050



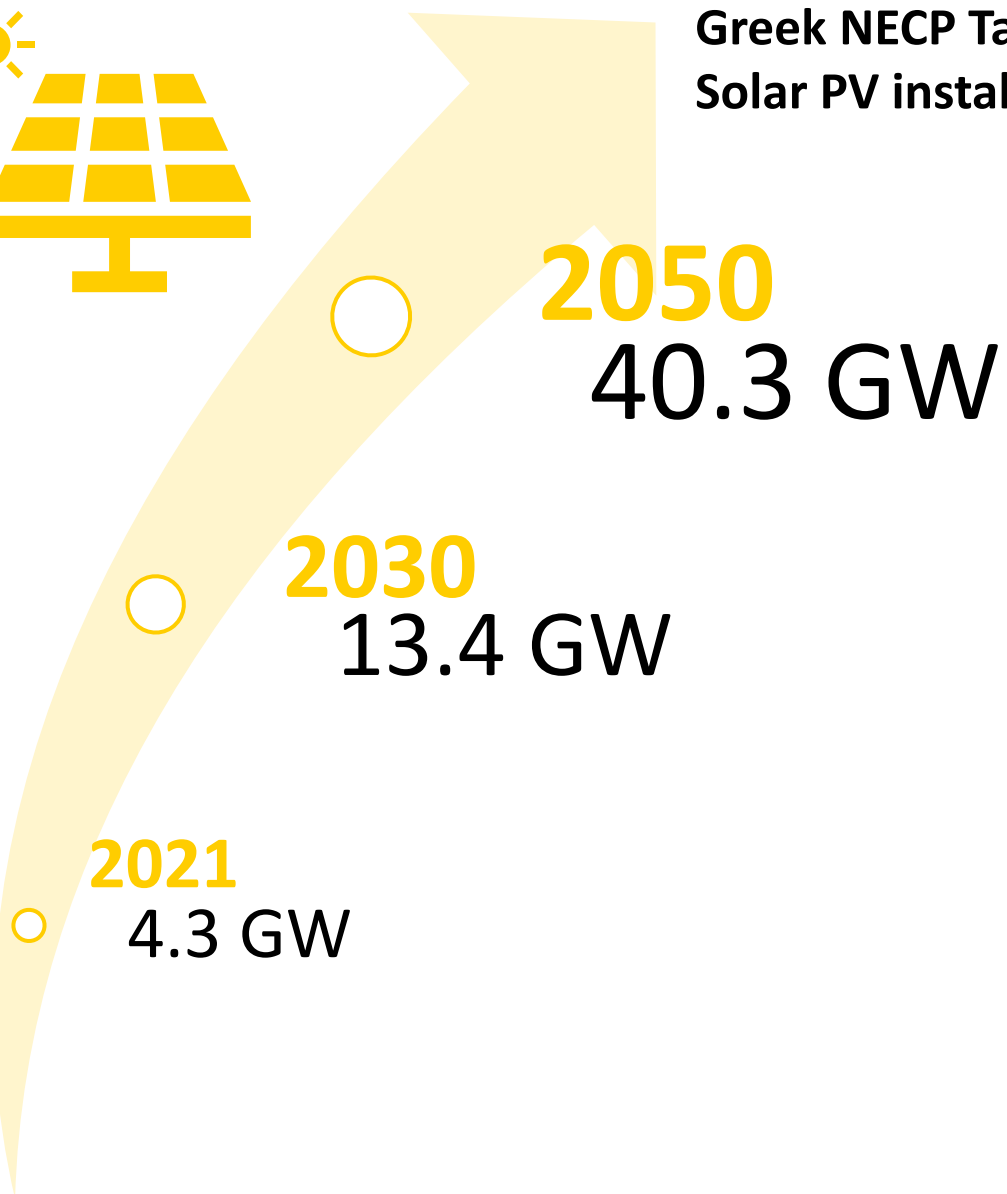
RES & Hydro Breakdown



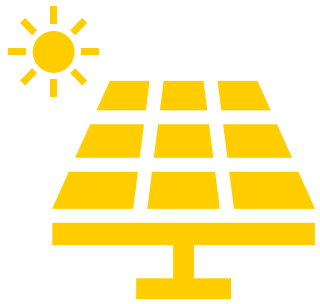
Source: Greek NECP, HAAE Analysis



Greek NECP Targets for Solar PV installed capacity



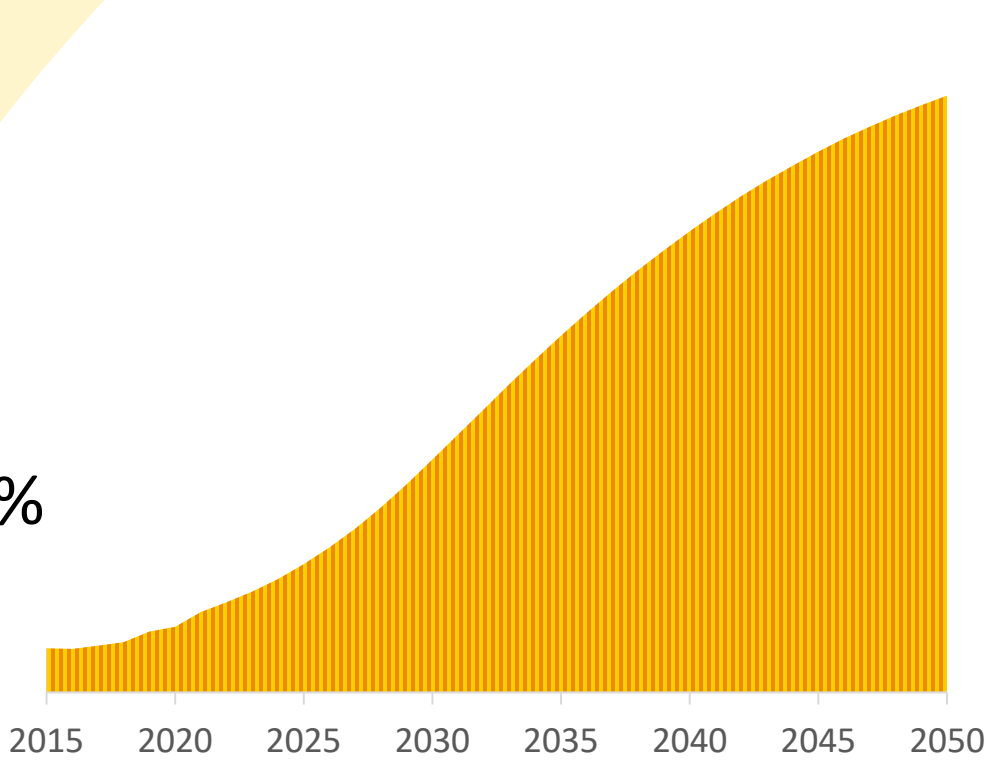
According to the **NECP** the **Solar PV installed capacity** is expected to increase by almost **10 times** in 30 years-time, reaching **40.3 GW (2050)** from **4.3 GW (2021)**.



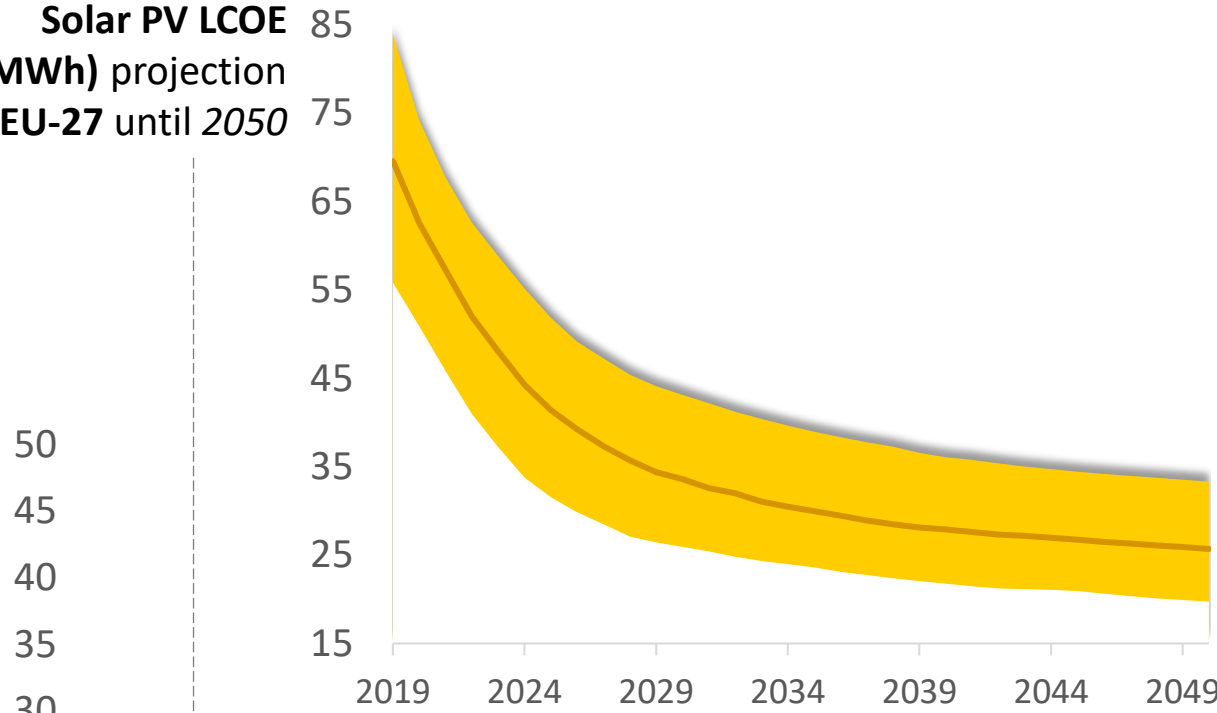
EU-27 Targets for Solar PV share in energy consumption

2030
42.5%

2021
21.8%



Solar PV LCOE (€/MWh) projection for EU-27 until 2050



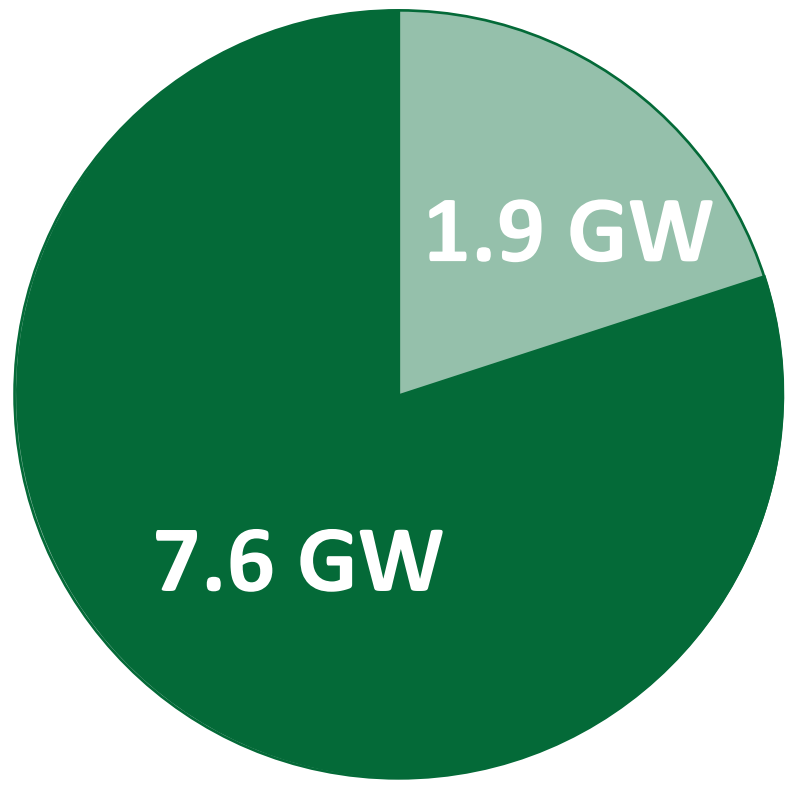
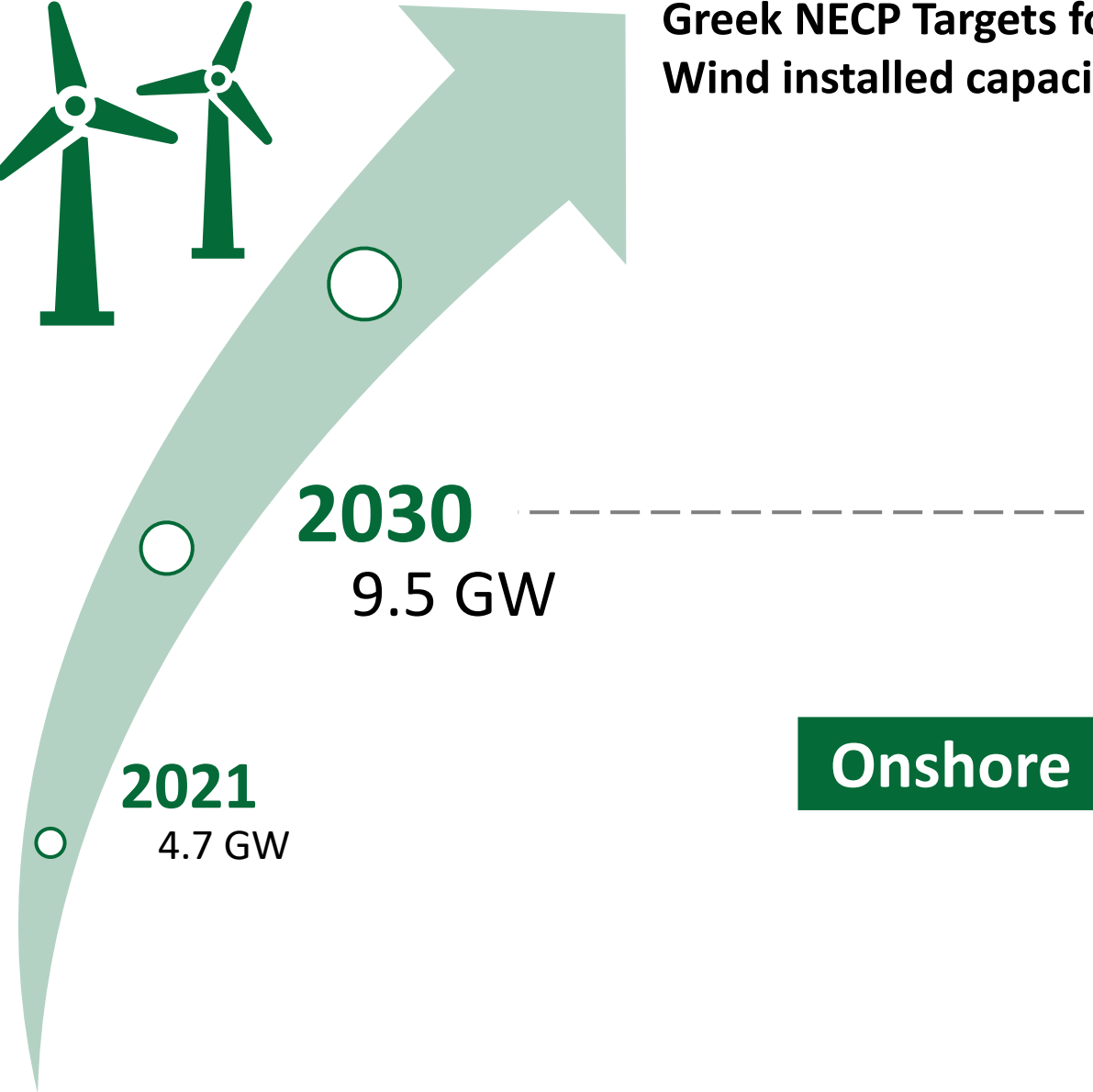
Expected **Share (%)** of **Solar PV** in the power generation mix of **EU-27**

Solar power is expected to reach a share of **45%** in **EU-27's** electricity mix, while **LCOE** is expected to be **reduced by 64%** is expected **by 2050**.

Source: Eurostat, [Nijssse, F.J.M.M. et al.](#), HAAE Analysis



Greek NECP Targets for Wind installed capacity

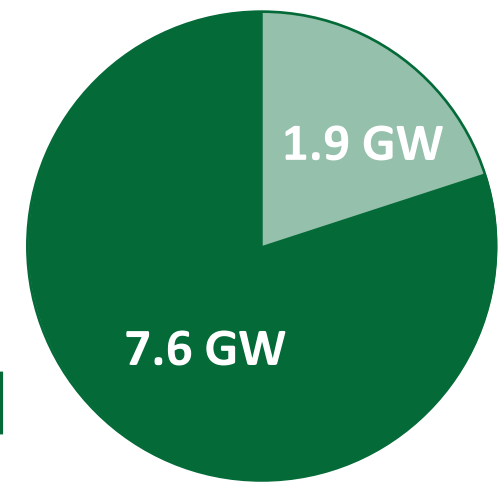
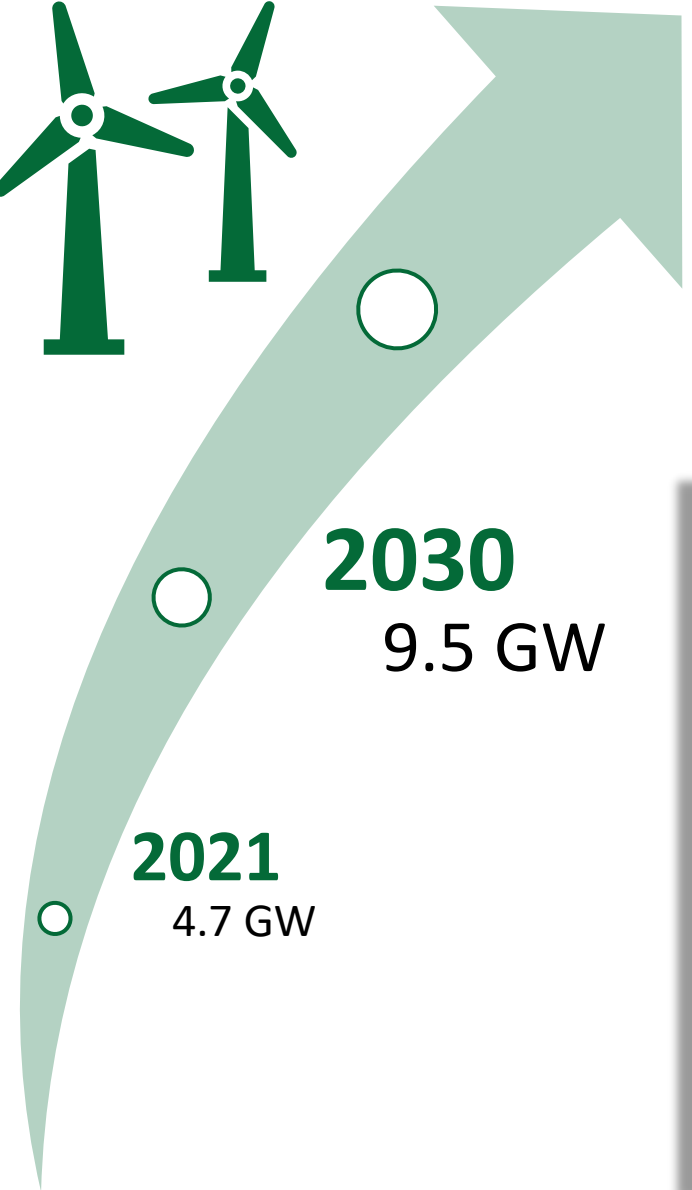


Onshore

Offshore



Greek NECP Targets for Wind installed capacity



According to the **NECP** the **Wind installed capacity** is expected to **double** by **2030**, reaching **9.5 GW** from **4.7 GW** in **2021**.

Out of the **9.5 GW** in **2030**, **7.6 GW (80%)** are expected to be **onshore** while the rest **1.9 GW (20%)** offshore.

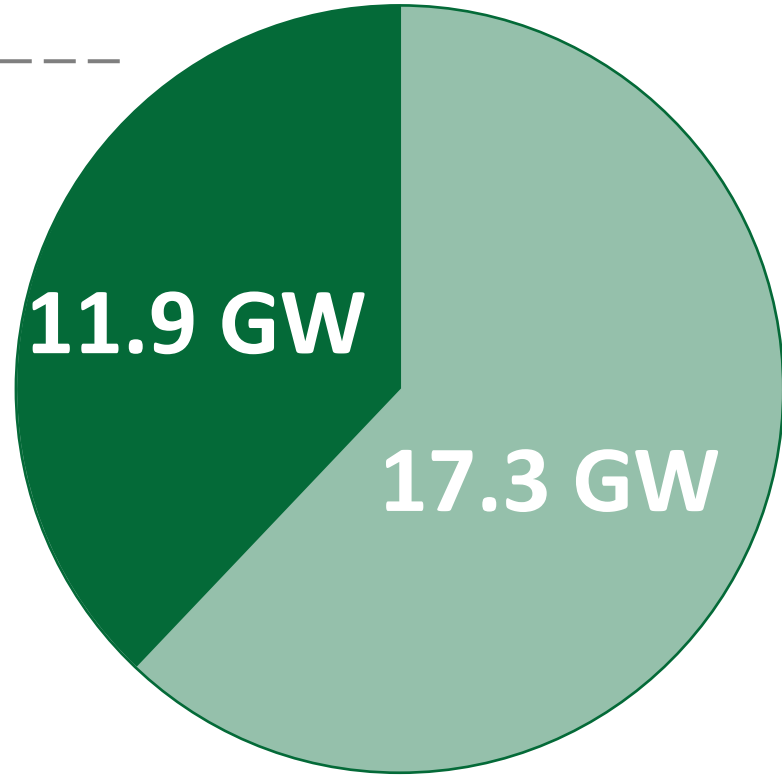


Greek NECP Targets for Wind installed capacity

2050
29.2 GW

2030
9.5 GW

2021
4.7 GW



Onshore

Offshore

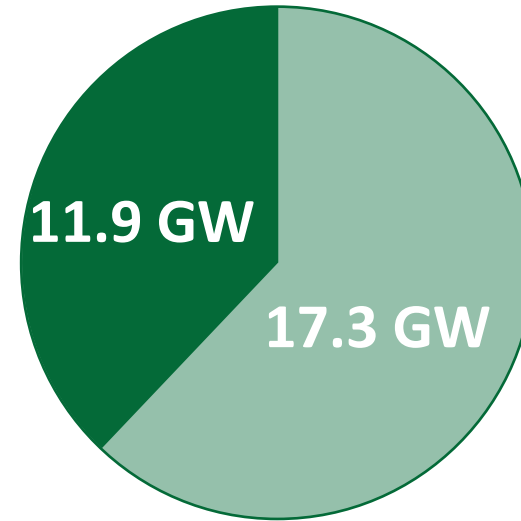


Greek NECP Targets for Wind installed capacity

2050
29.2 GW

2030
9.5 GW

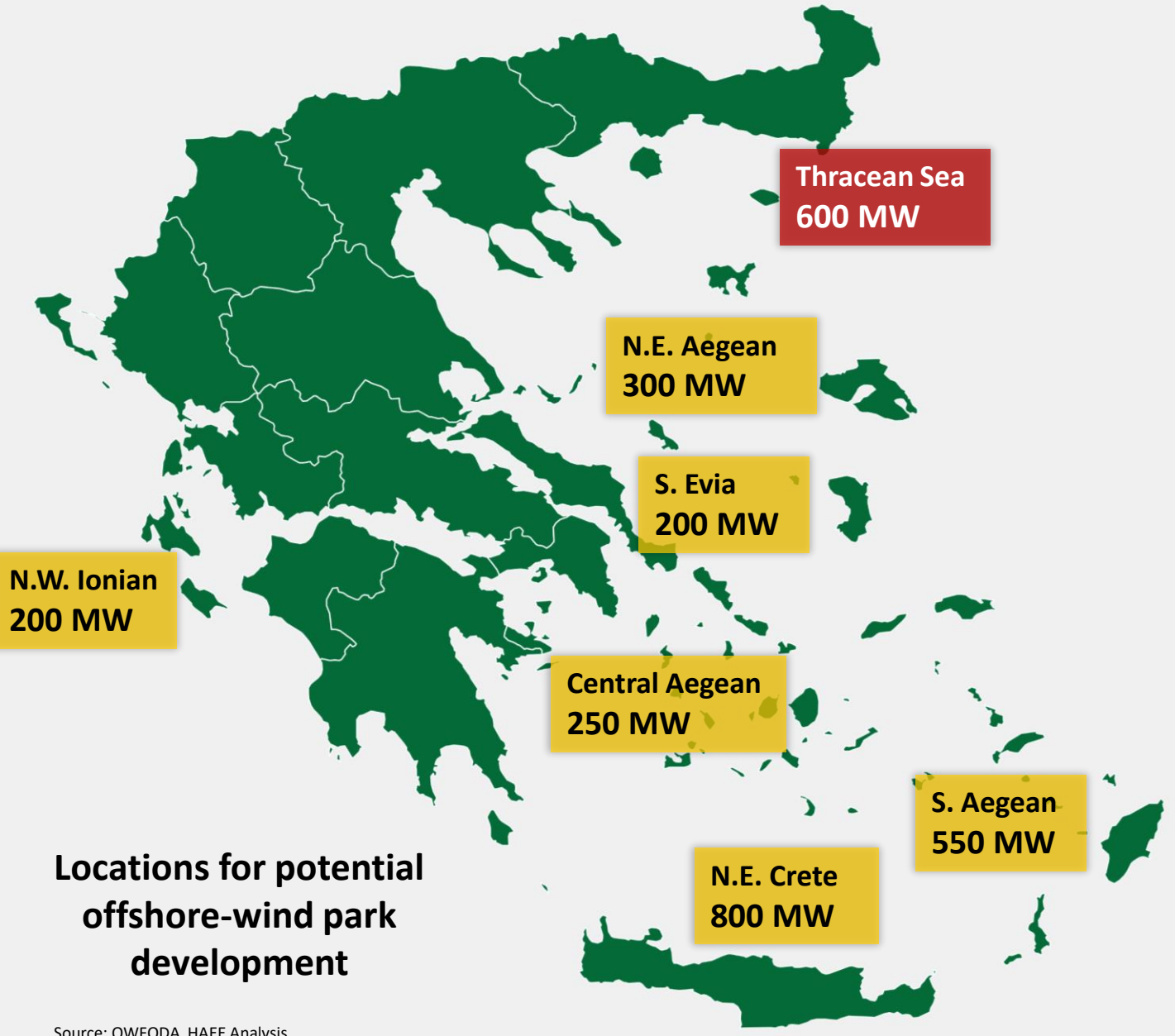
2021
4.7 GW



Onshore

Offshore

According to the **NECP** the **Wind installed capacity** is expected to further **increase** by **2050**, reaching **29.2 GW**. Out of the **29.2 GW** in **2050**, **11.9 GW (41%)** are expected to be **onshore** while the rest **17.3 GW (59%) offshore**.



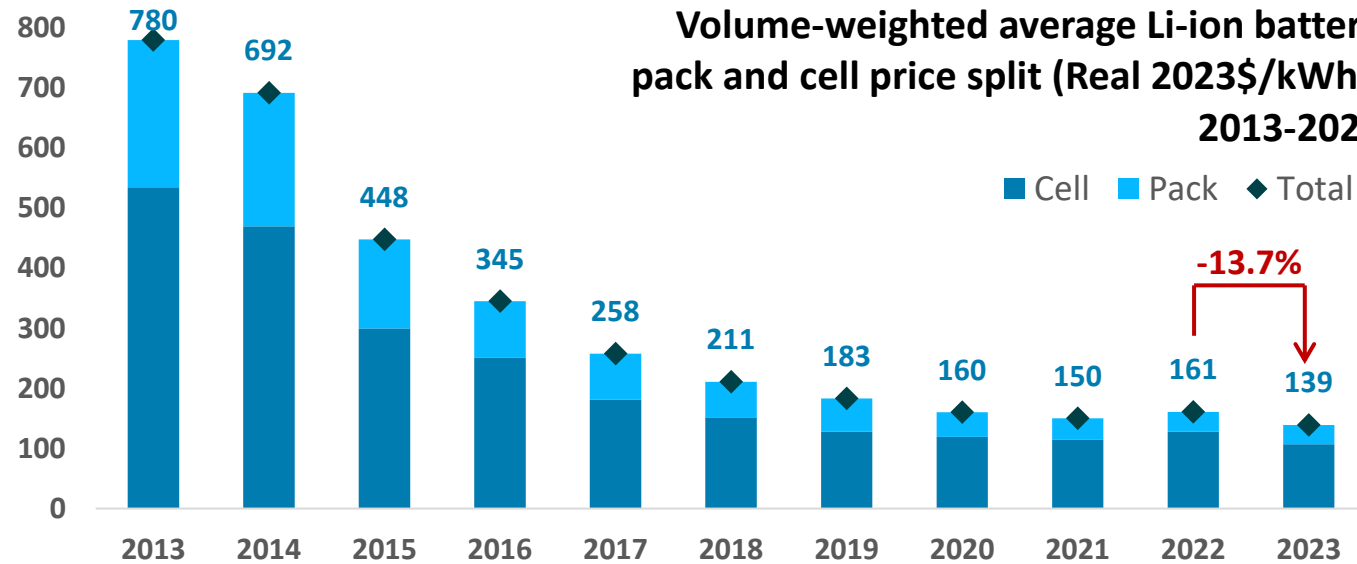
Locations for potential offshore-wind park development

Source: OWFODA, HAAE Analysis

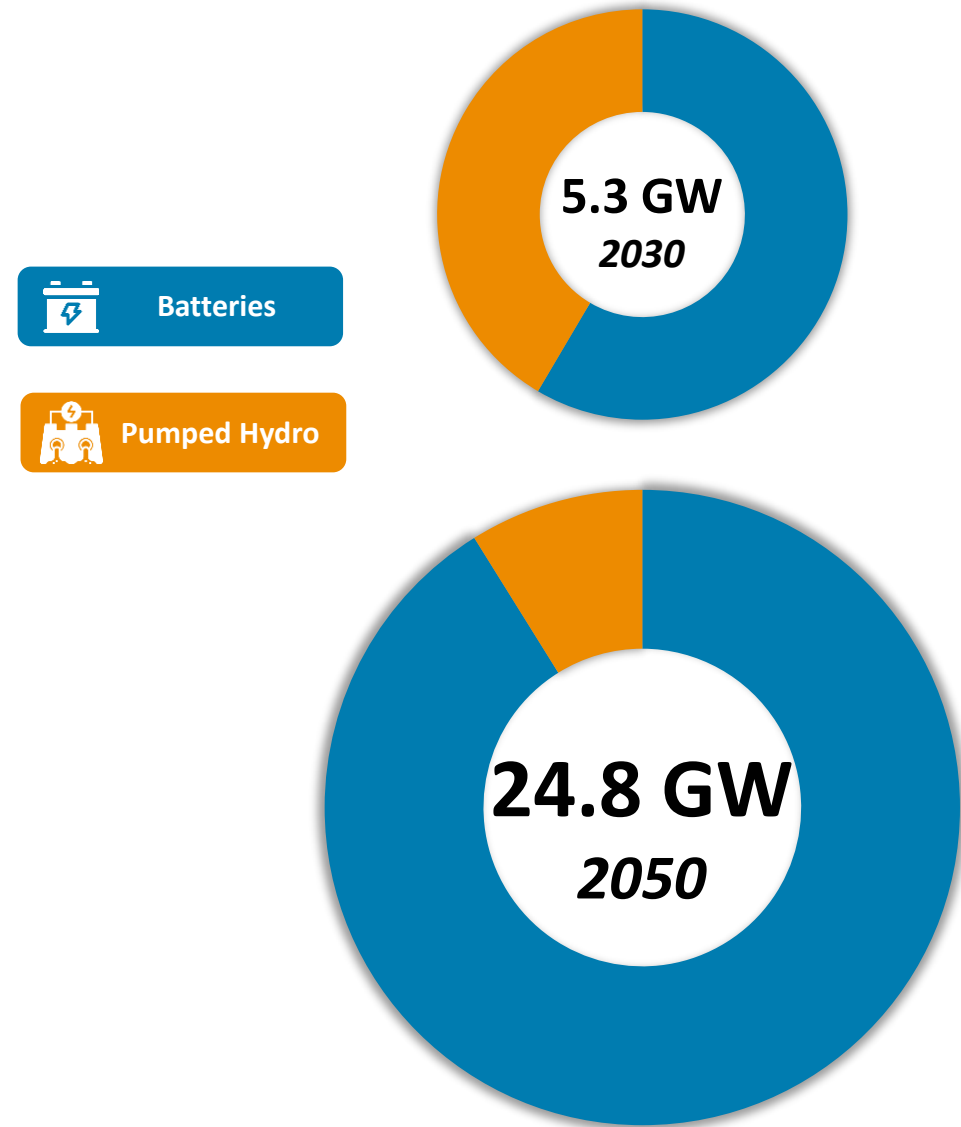
EXPANDING NATIONAL WINDPOWER BY INTRODUCING OFFSHORE WIND INSTALLATIONS

- 25 identified regions (2712 km²) in the Aegean and Ionian Seas for potential developments, and 1 region licensed for pilot projects.
- Capacity of 2.3 GW in identified regions (with future potential for 12.4 GW) and 600 MW pilot.

Volume-weighted average Li-ion battery pack and cell price split (Real 2023\$/kWh), 2013-2023



NECP Targets for Energy Storage for 2030 and 2050

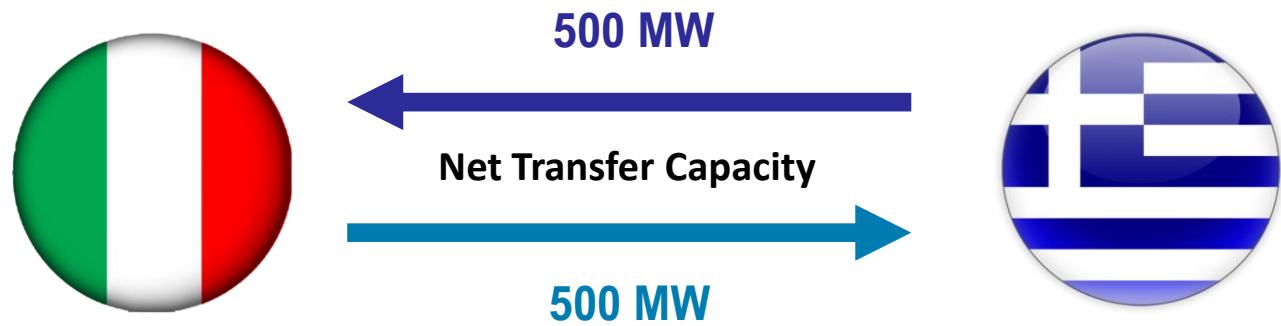


Total installed storage capacity is expected to reach **5.3 GW** in 2030, with **42%** coming from **Pumped Hydro** systems and **52%** from **Battery** systems.

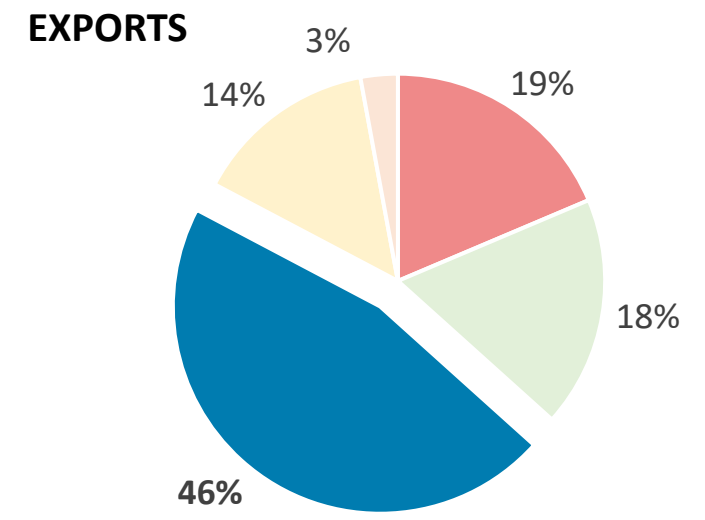
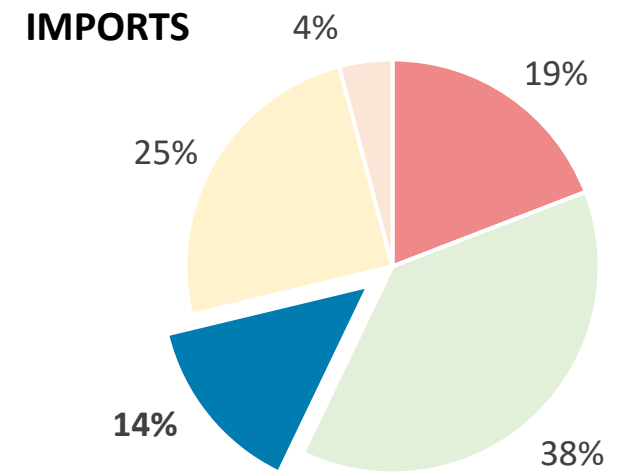
While by **2050** storage is expected to reach **24.8 GW**, with only **9%** coming from **Pumped Hydro** systems and the **Battery** systems dominating the market with **91%** from **total capacity**.

The **cost of Li-ion batteries** has been **decreasing** over the last decade, while further reductions are anticipated.

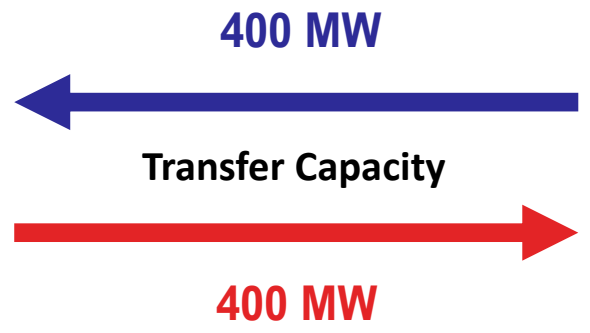
2023 - 2030



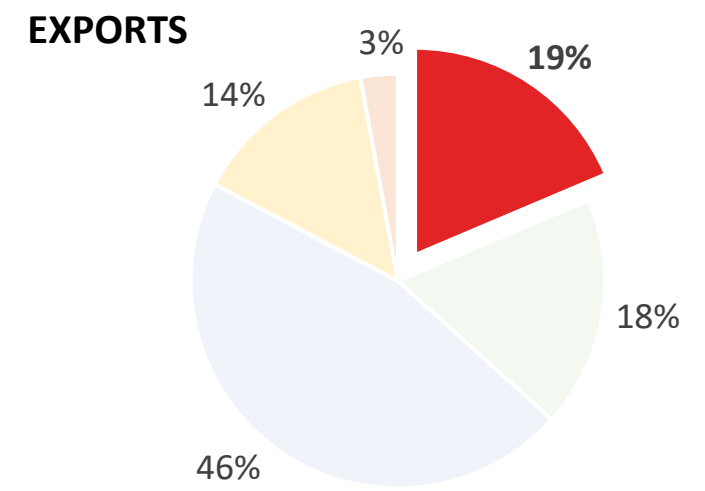
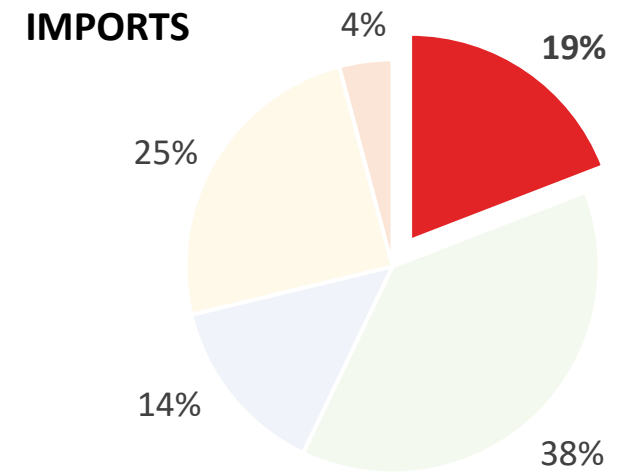
Greek Interconnection Dynamics [Jan 2022 – Sept 2023]



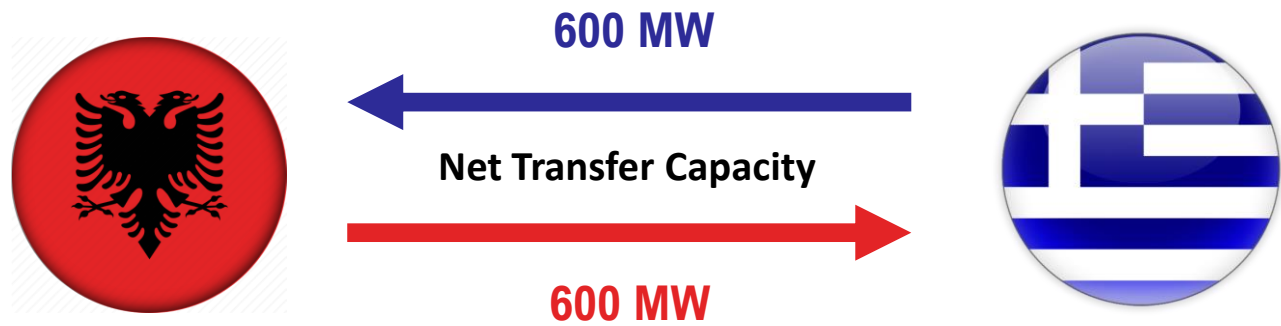
2023



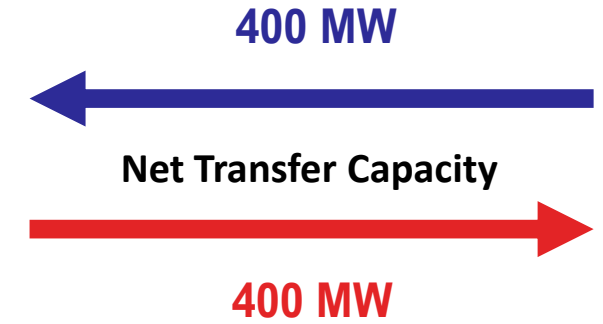
Greek Interconnection Dynamics [Jan 2022 – Sept 2023]



2030

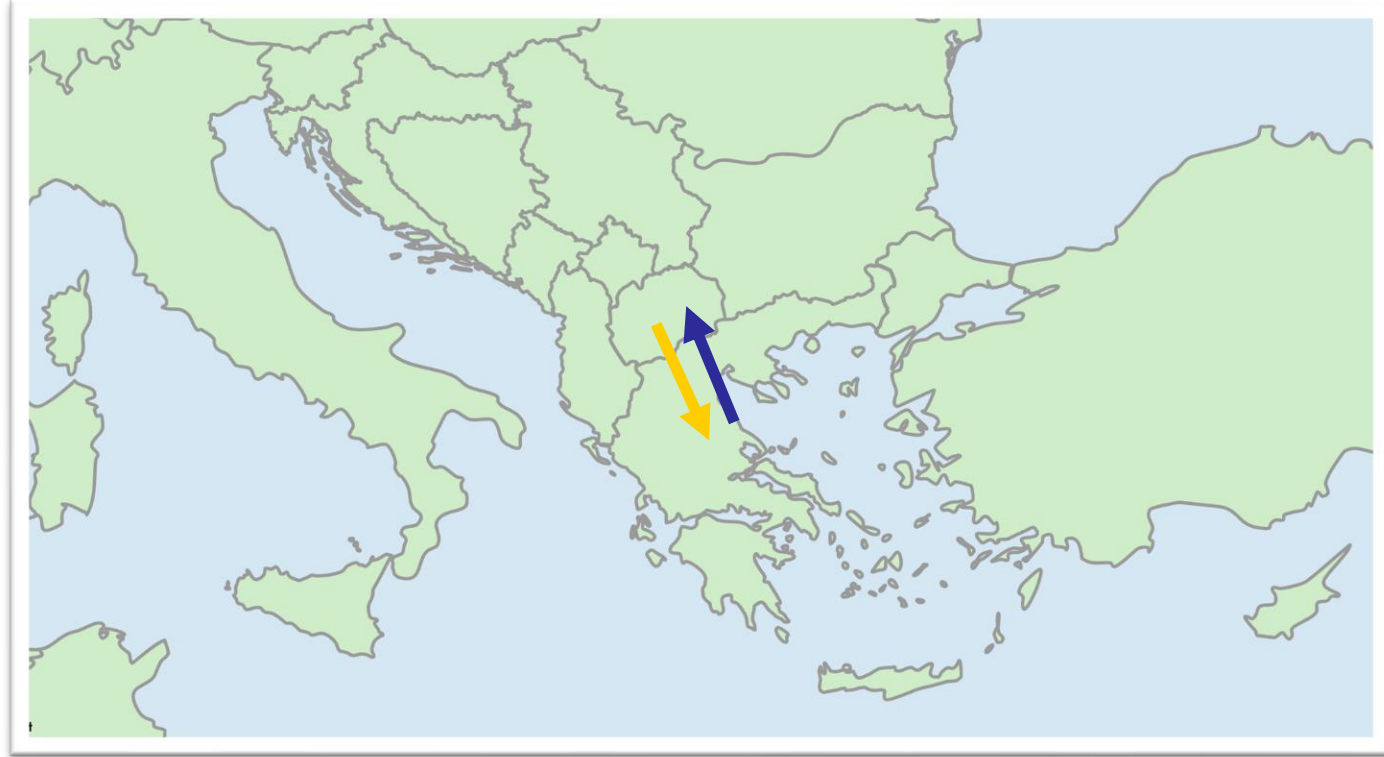


2023

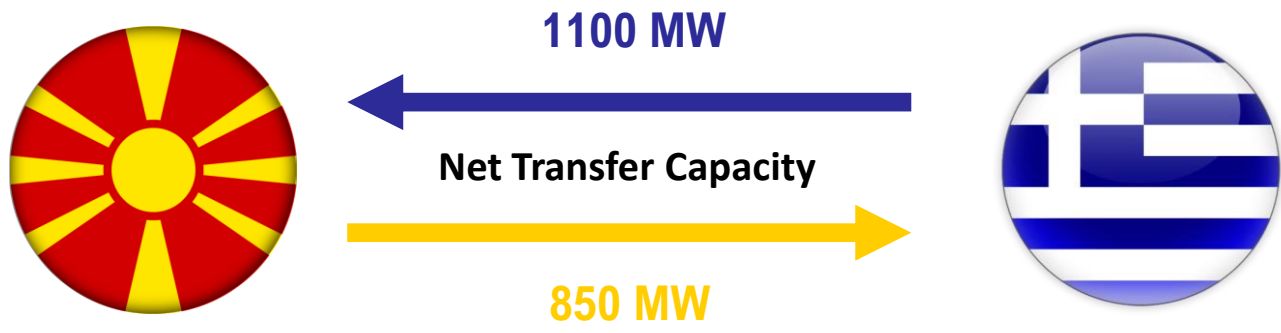
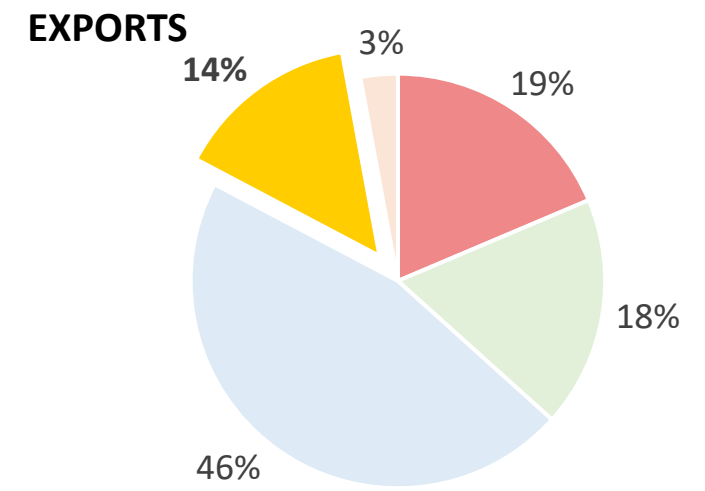
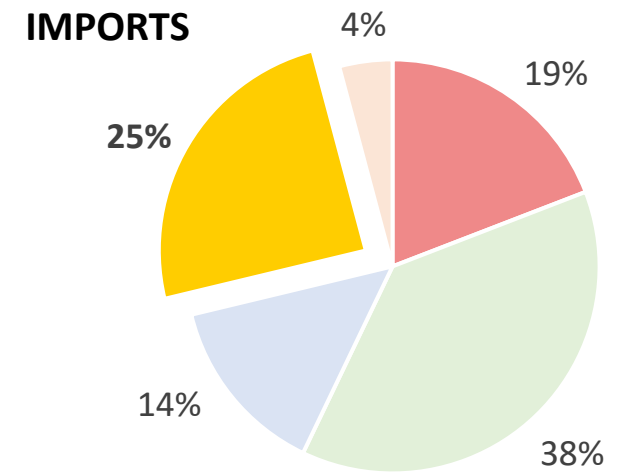


The Greek-Albanian interconnection is planned to **increase by 50%** between 2025-2030 in **both importing and exportin capacity.**

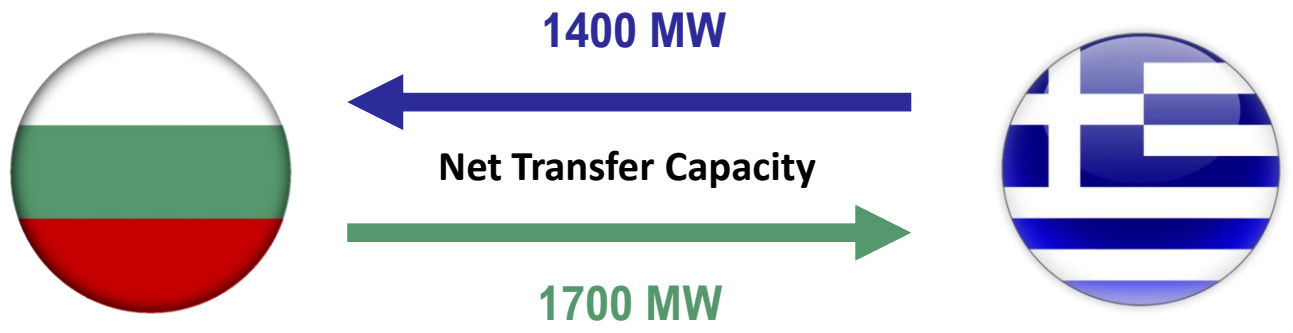
2023 - 2030



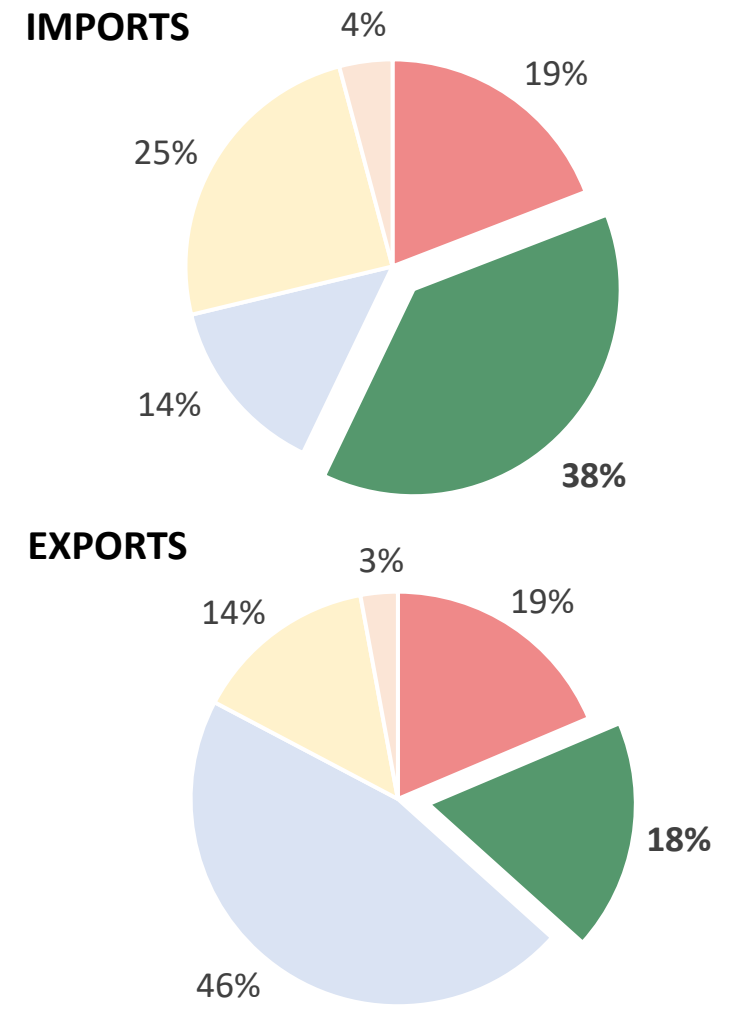
Greek Interconnection Dynamics [Jan 2022 – Sept 2023]



2023 - 2030



Greek Interconnection Dynamics [Jan 2022 – Sept 2023]



2023



280 MW



Net Transfer Capacity

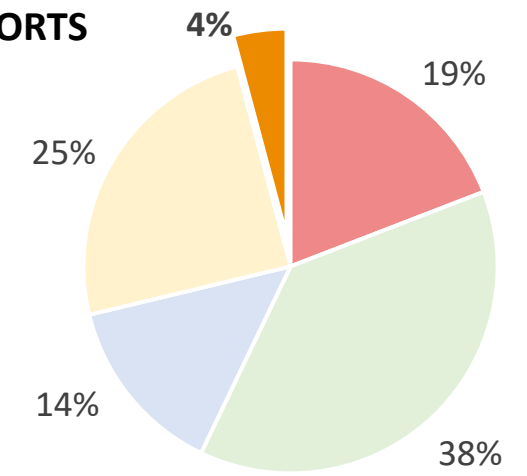


166 MW

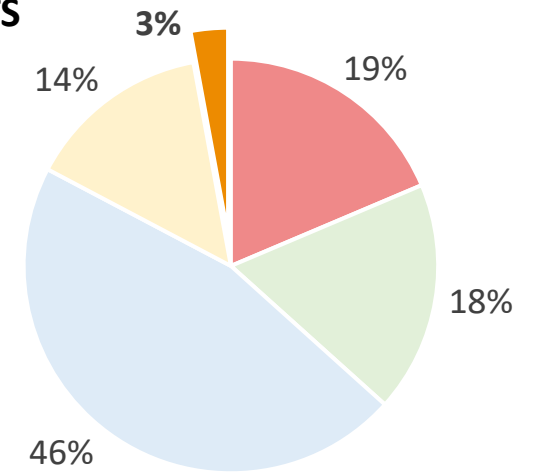


Greek Interconnection Dynamics [Jan 2022 – Sept 2023]

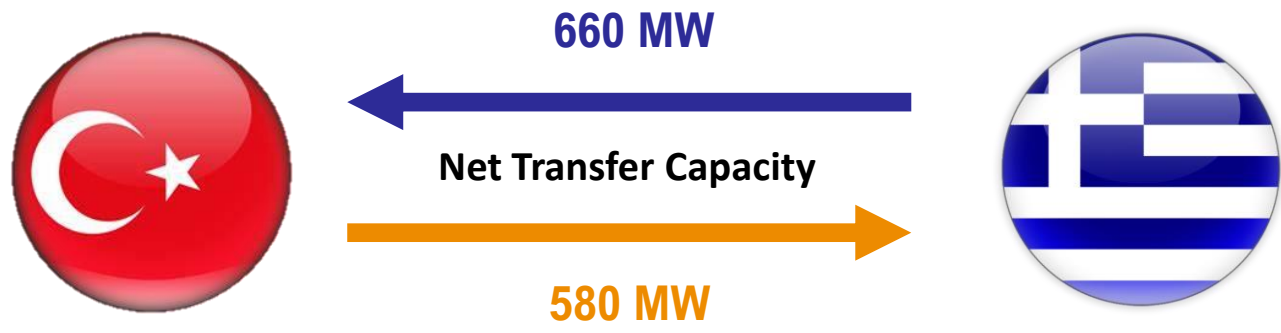
IMPORTS



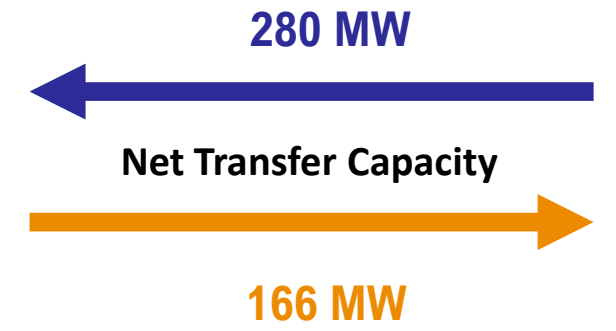
EXPORTS



2025

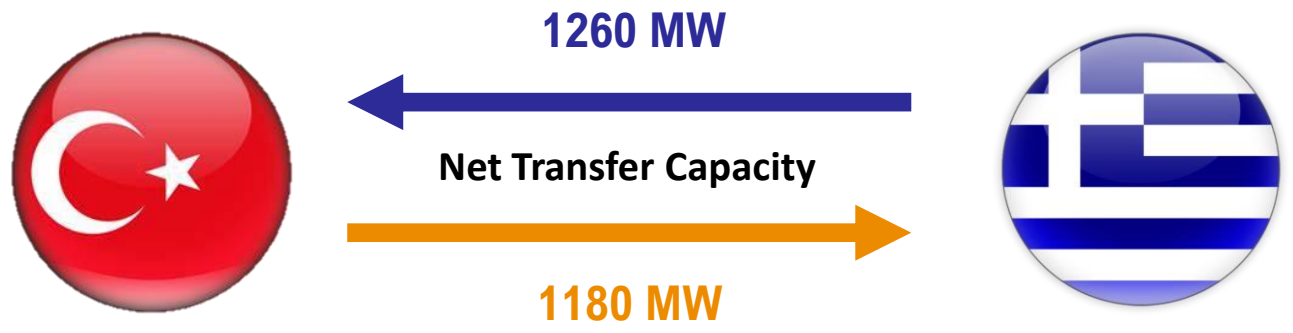


2023 - 2025

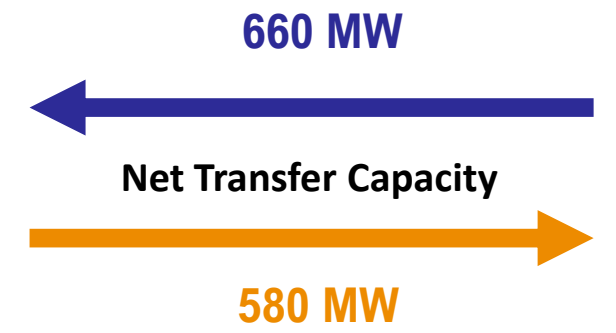


The Greek-Turkish interconnection is planned for a **NTC increase of 136% for exports** and **249% in imports** between 2023 - 2025

2030

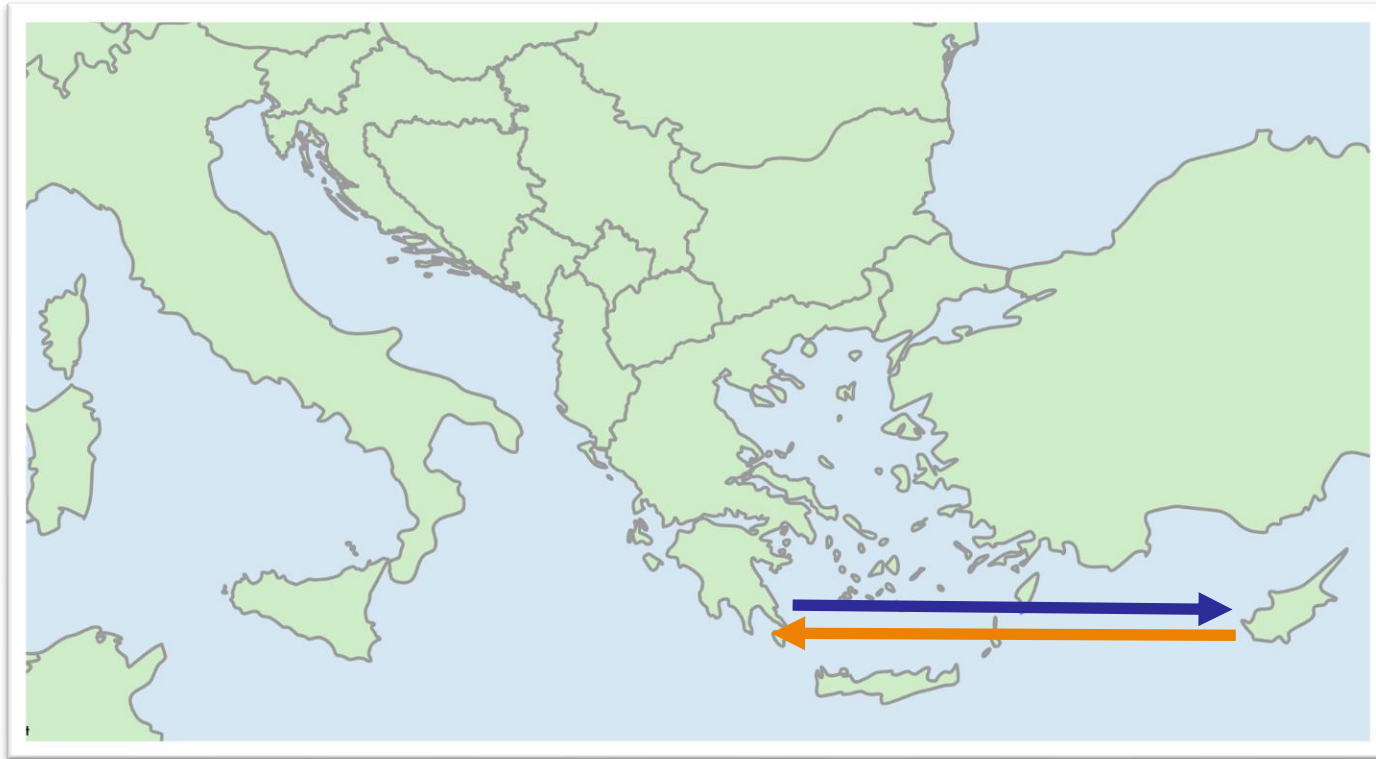


2025 - 2030



The Greek-Turkish interconnection is planned for a **NTC increase of 91% for exports** and **103% in imports** between 2025 - 2030

2023 - 2030



GREAT SEA (formerly EUROASIA) INTERCONNECTION

ENERGY TRANSMITTED: total of 2,000 MW out of which 1,000 MW will be the NTC of the Greek-Cypriot Interconnection.

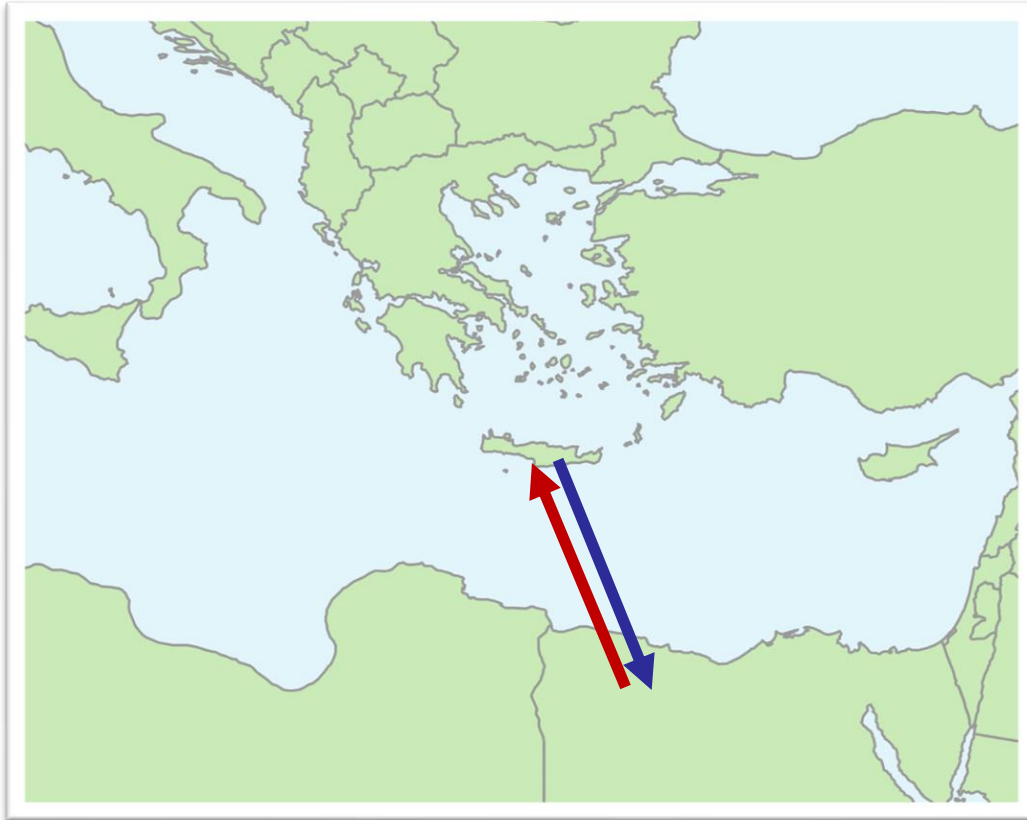
BUDGET: 1.9 BILLION EUROS

COUNTRIES CONNECTED: Greece, Israel, Cyprus

SCOPE: Project of Common Interest (PCI) connecting the national electricity grids of Israel, Cyprus and Greece.

Source: energypress.gr, HAAE Analysis

ADDITIONAL PLANNED INTERCONNECTIONS



Project of Common Interest (PCI)

→ Electricity produced in Egypt and/or other N. African countries to be carried in Europe.

BUDGET
€3.5 BILLION

GREGY INTERCONNECTION

Greece – Egypt

ENERGY TRANSMITTED → 3,000 MW

- 1,000 MW, for Greece
- 1,000 MW, for exports in the EU
- 1,000 MW, to produce green H₂ in Greece

REPLACING:

- 4.5 bcm of Natural Gas
- Up to 26 TWh of electricity from fossil fuels

REDUCING:

- 10 mil. tones of CO₂ emissions

2023

Total Imported Net
Transfer Capacity
→ **3.616 GW**

Total Exported Net
Transfer Capacity
→ **3.618 GW**

2025

Total Imported Net
Transfer Capacity
→ **4.03 GW**

Total Exported Net
Transfer Capacity
→ **4.06 GW**

2030

Total Imported Net
Transfer Capacity
→ **5.83 GW**

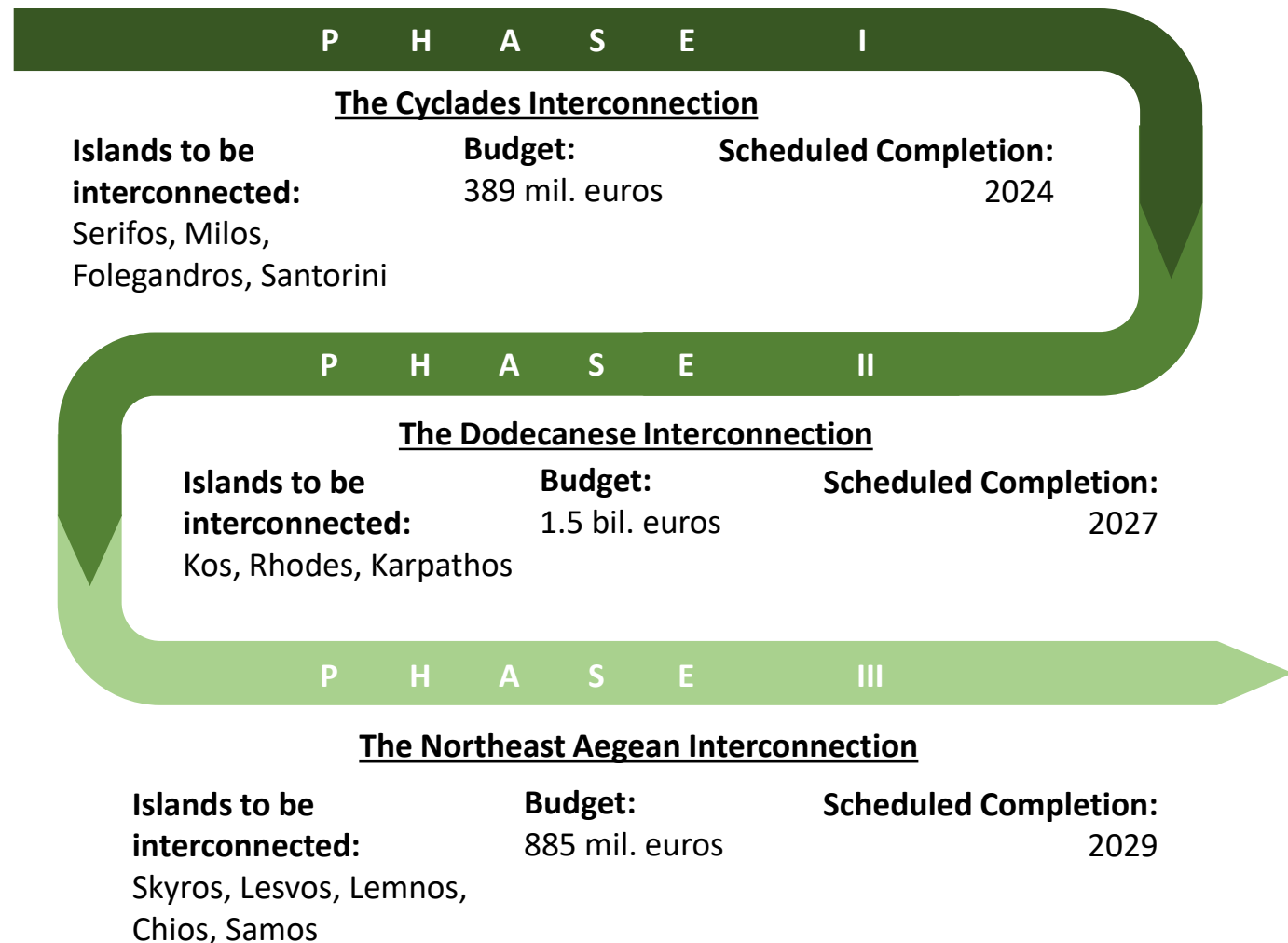
Total Exported Net
Transfer Capacity
→ **5.86 GW**

CONNECTING GREEK ISLANDS TO THE MAIN GRID

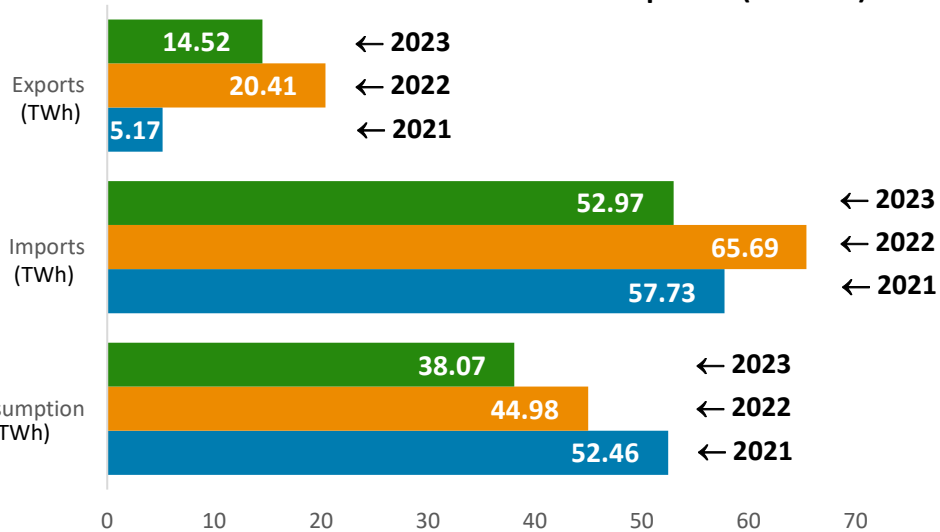
DRIVING VALUE AND EFFICIENCY IN THE GREEK ENERGY GRID

Interconnecting Greek Island's Power Grids:

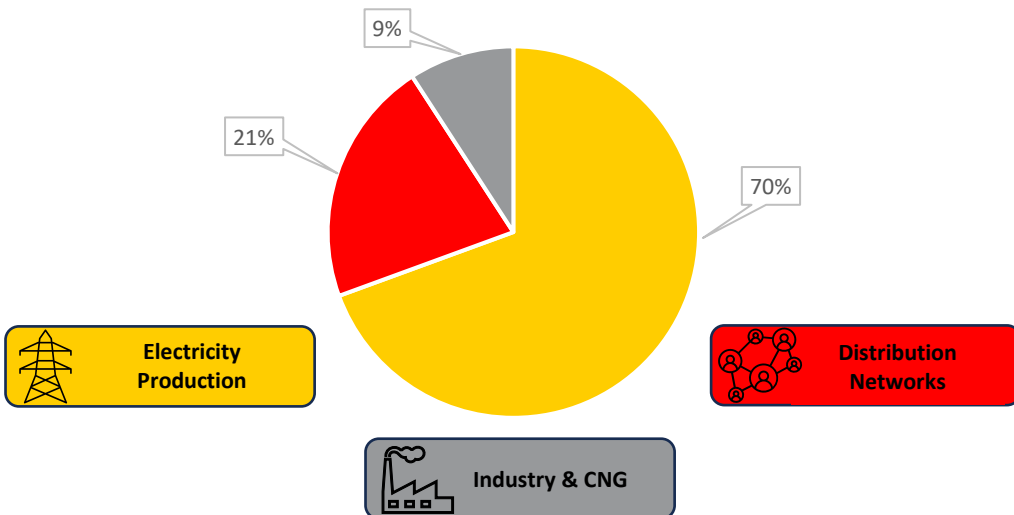
- Three-Phase interconnection plan
→ **Estimated Budget \cong €2.8 billion**
- Funding Bodies:
 - Decarbonization Fund
 - Just Transition Fund (JTF)
 - Recovery and Resilience Facility (RRF)
 - GR-Eco Islands



Greek Market data for the 9-month period (Jan-Nov)



Natural Gas Consumption Breakdown

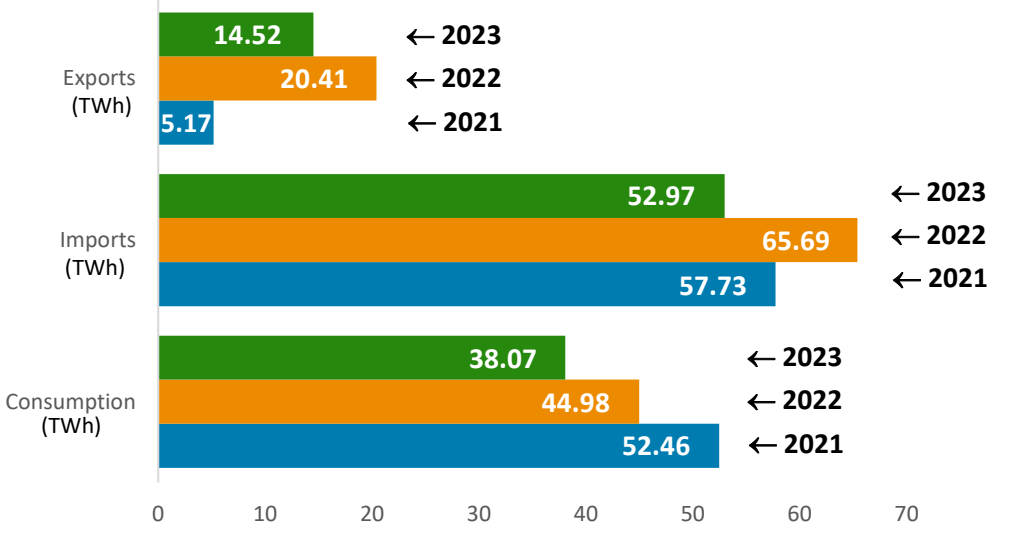


2023

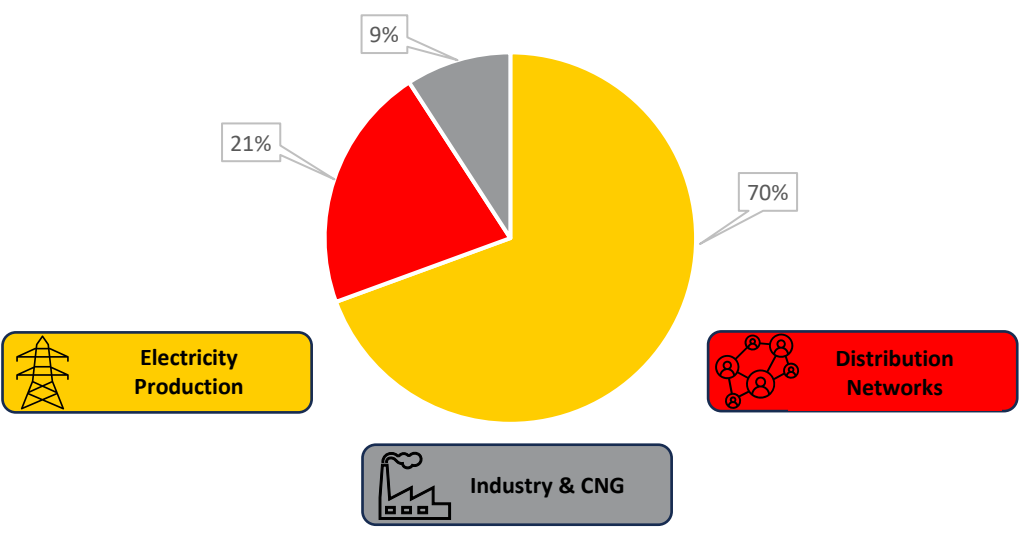


- Agia Triada supplied almost half of the national NG imports, with 47.75% share.
- 15.38% reduction in domestic consumption of Natural Gas between Jan-Sep 2023
- 15.21% increase in NG used for electricity production

Greek Market data for the 9-month period (Jan-Nov)



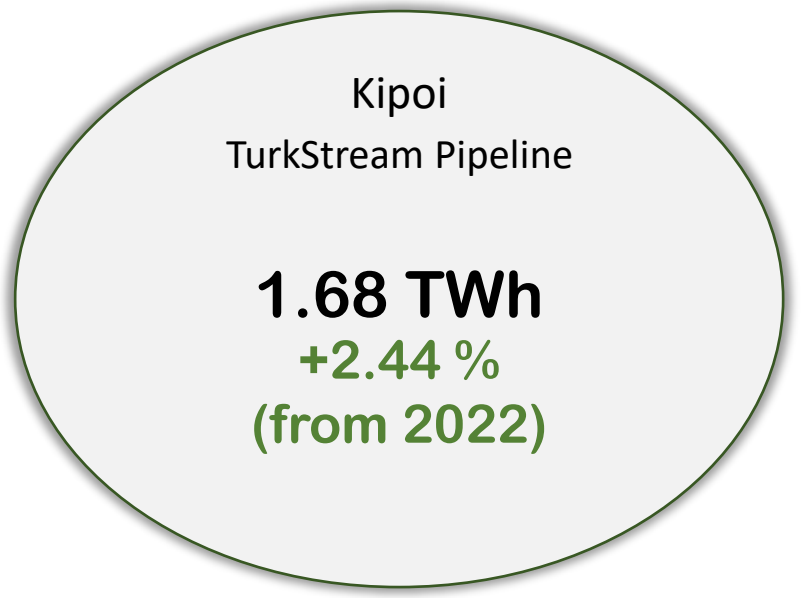
Natural Gas Consumption Breakdown



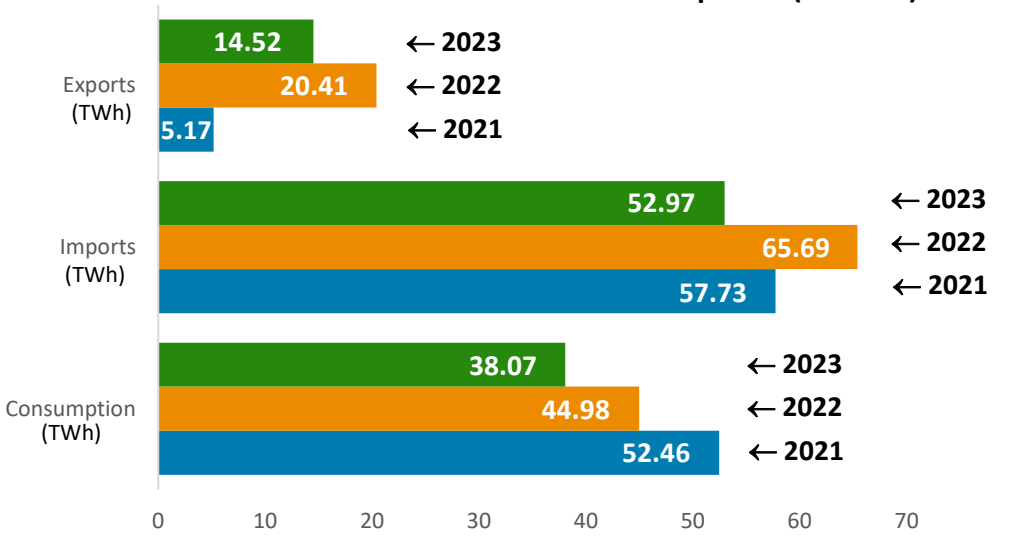
2023



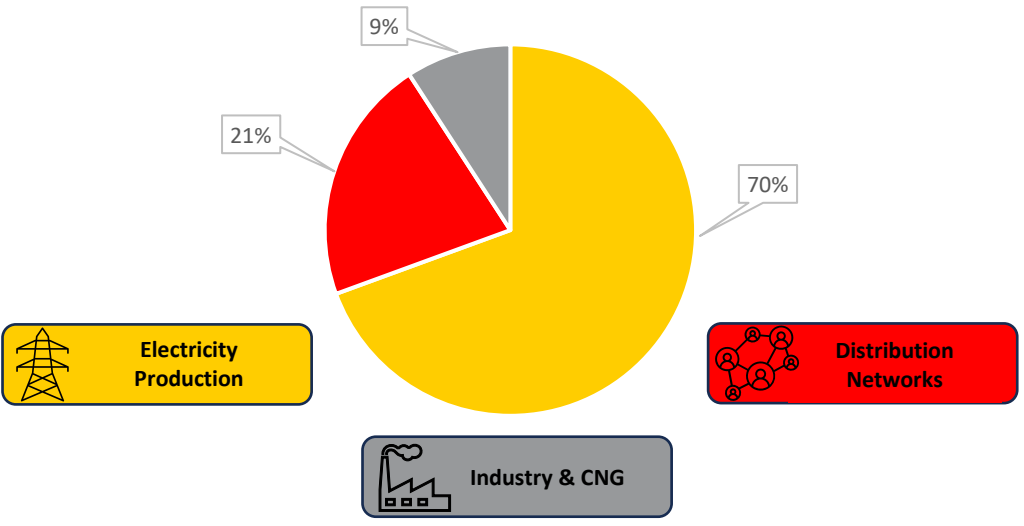
IMPORTS Q1 – Q3



Greek Market data for the 9-month period (Jan-Nov)



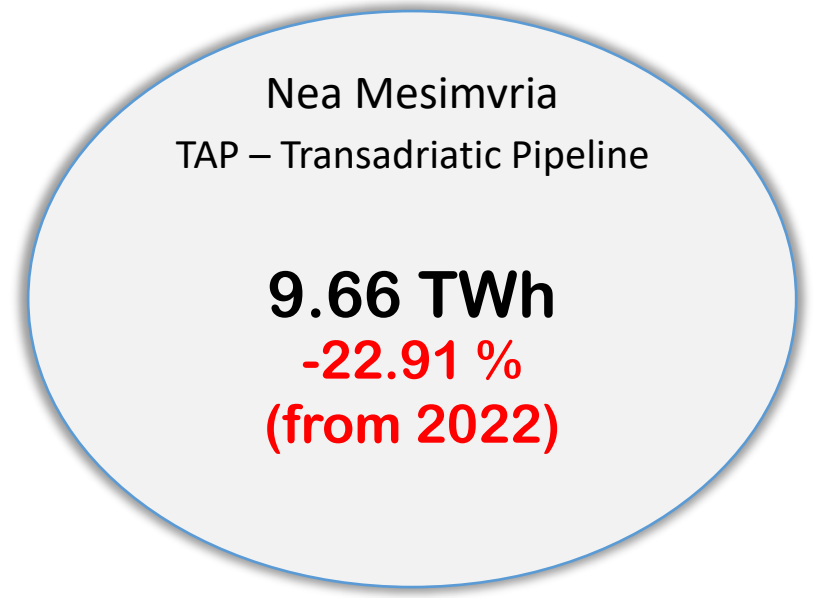
Natural Gas Consumption Breakdown



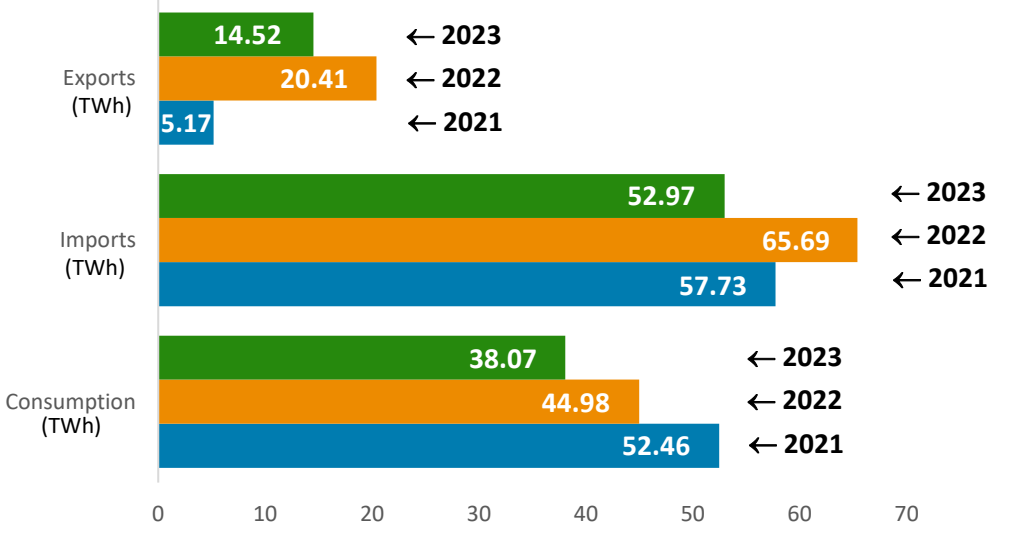
2023



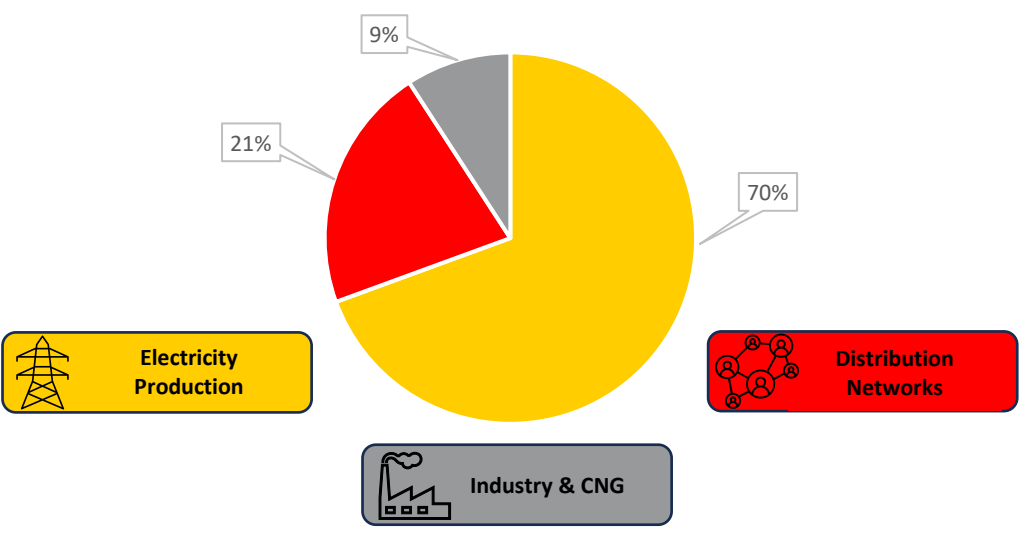
IMPORTS Q1 – Q3



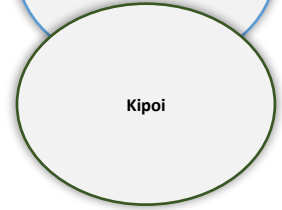
Greek Market data for the 9-month period (Jan-Nov)



Natural Gas Consumption Breakdown



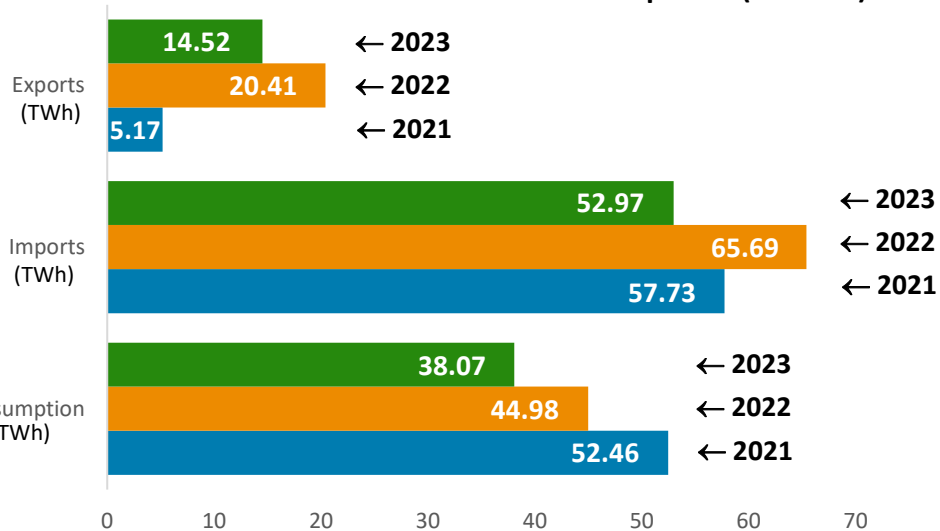
2023



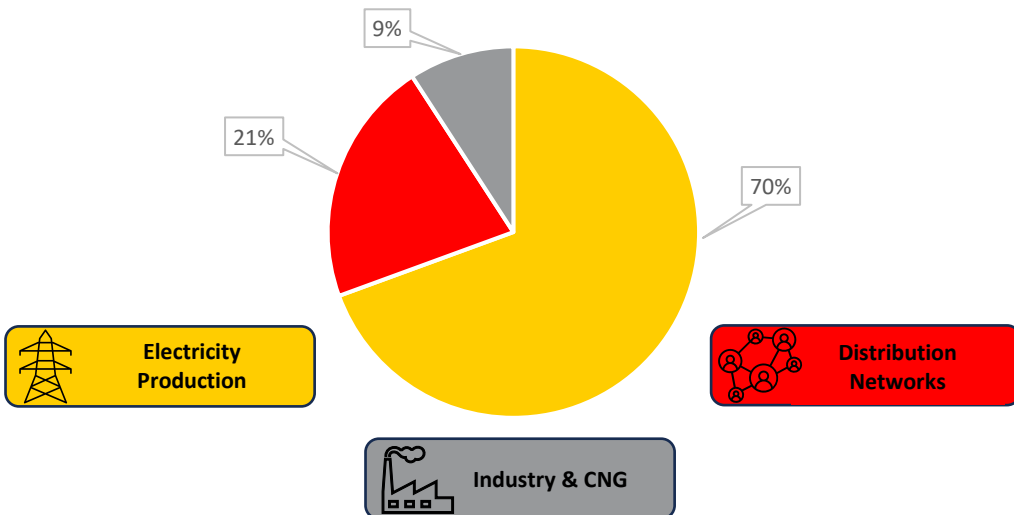
IMPORTS Q1 – Q3



Greek Market data for the 9-month period (Jan-Nov)



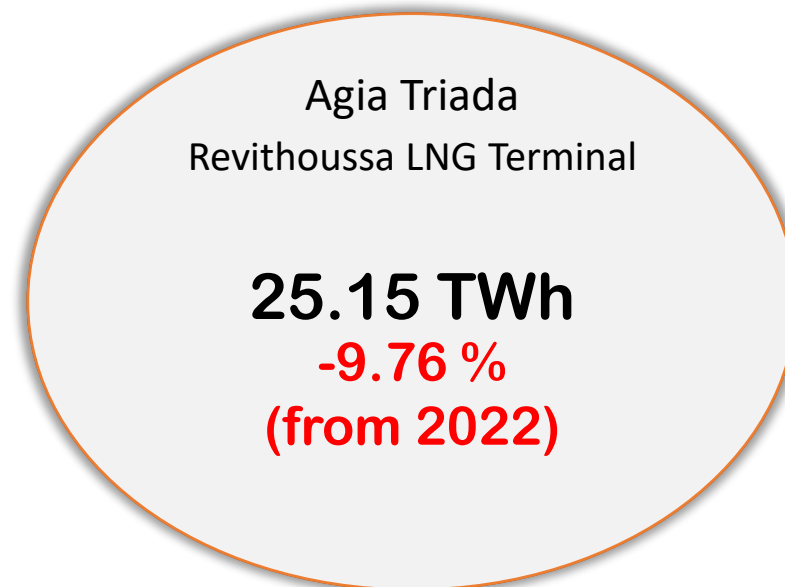
Natural Gas Consumption Breakdown



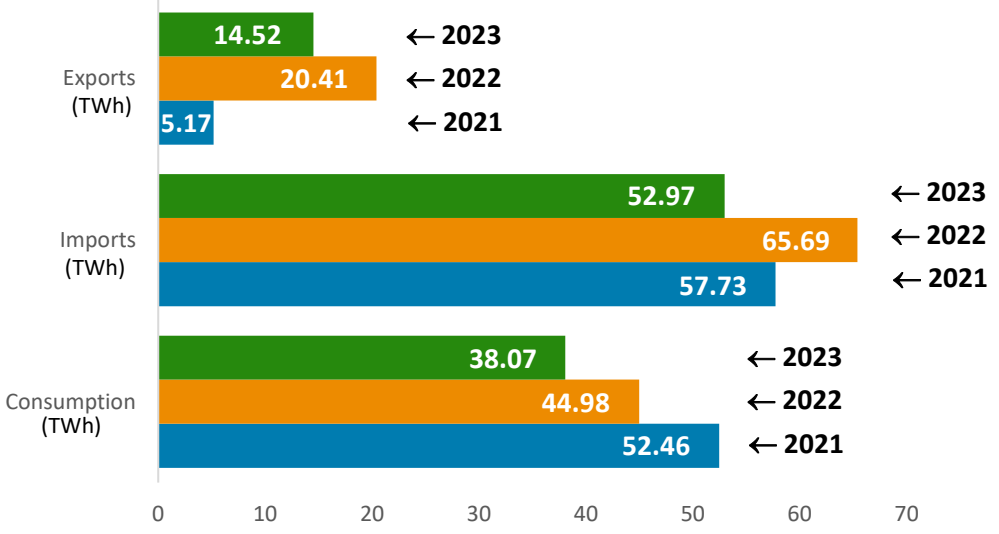
2023



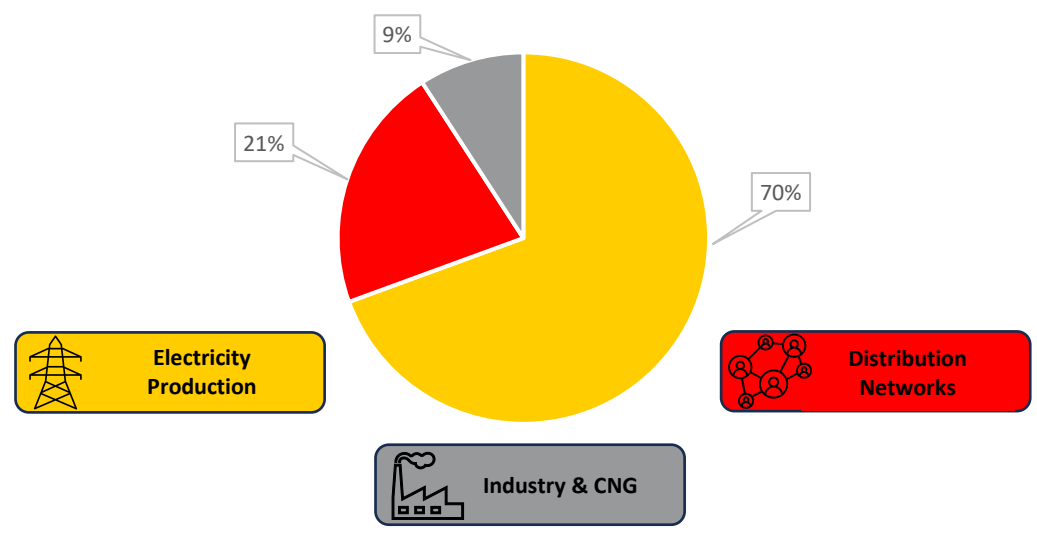
IMPORTS Q1 – Q3



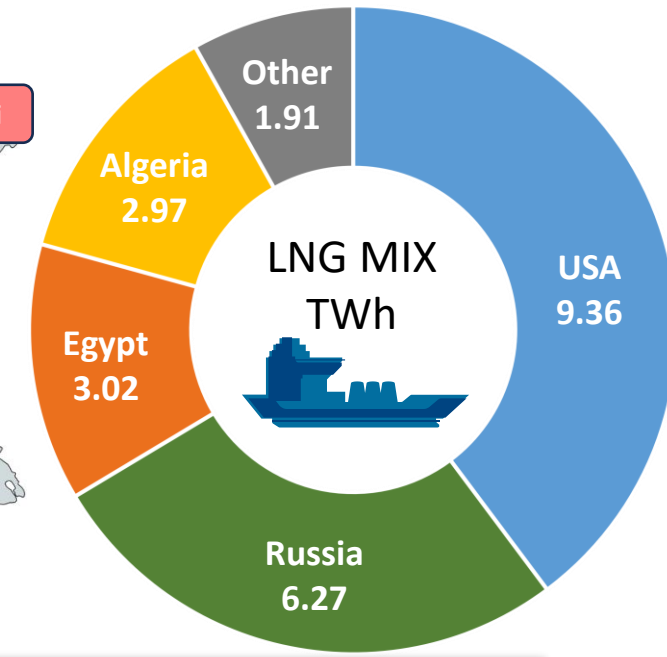
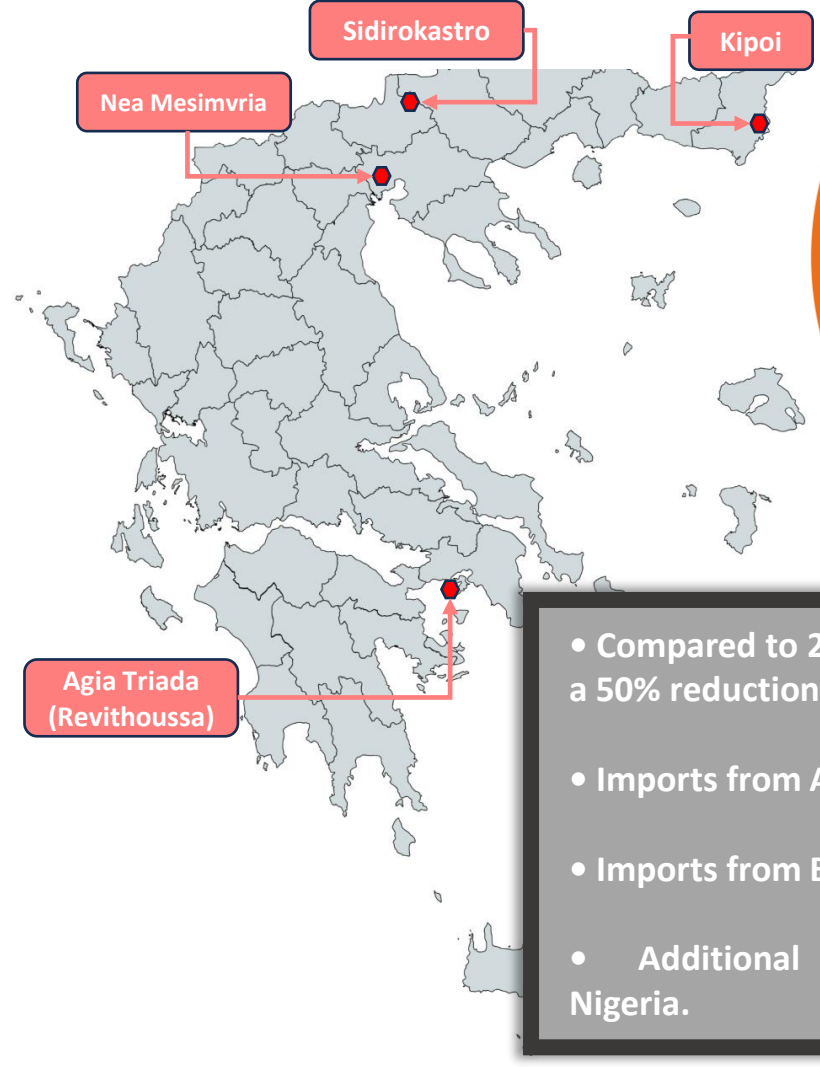
Market data for the 9-month (Jan-Nov) period



Natural Gas Consumption Breakdown

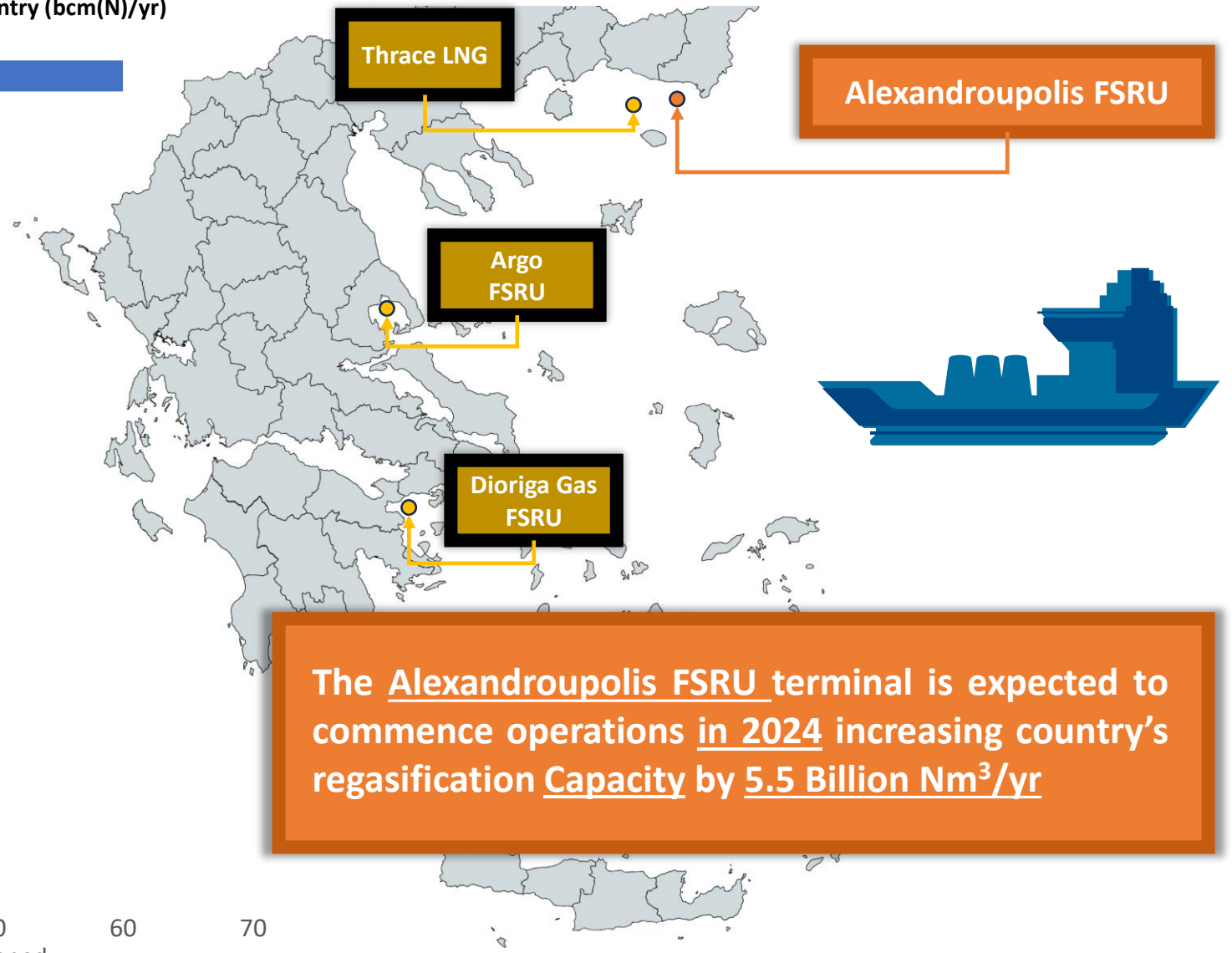
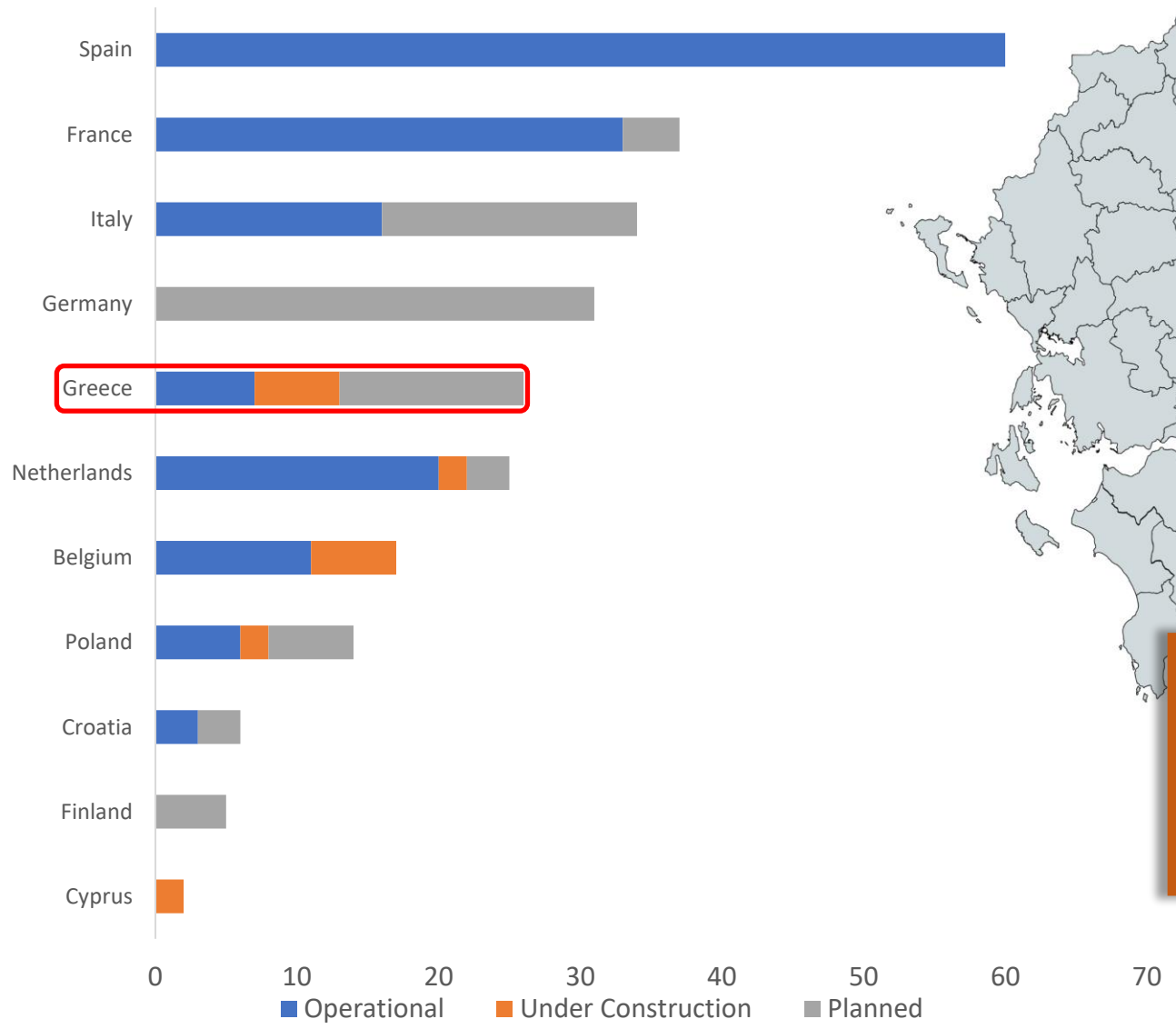


2023



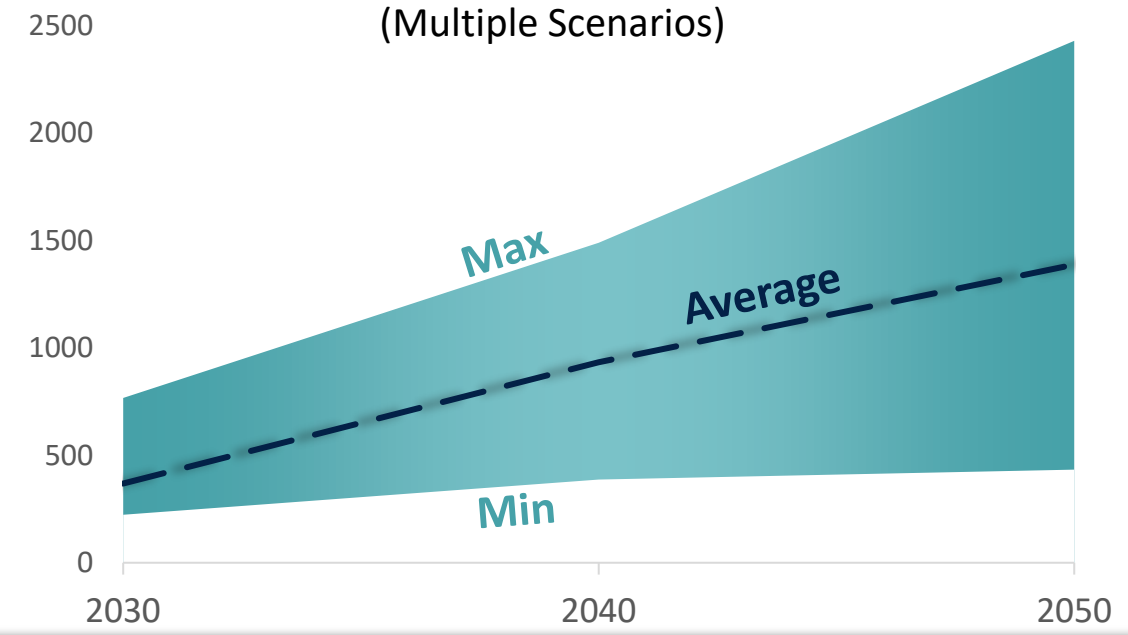
- Compared to 2022, Greece's LNG mix shows a 50% reduction in imports from the USA.
- Imports from Algeria were reduced by 25%
- Imports from Egypt are increased by 51%
- Additional imports from Norway and Nigeria.

Annual Regasification Capacity of LNG large scale import terminals per country (bcm(N)/yr)



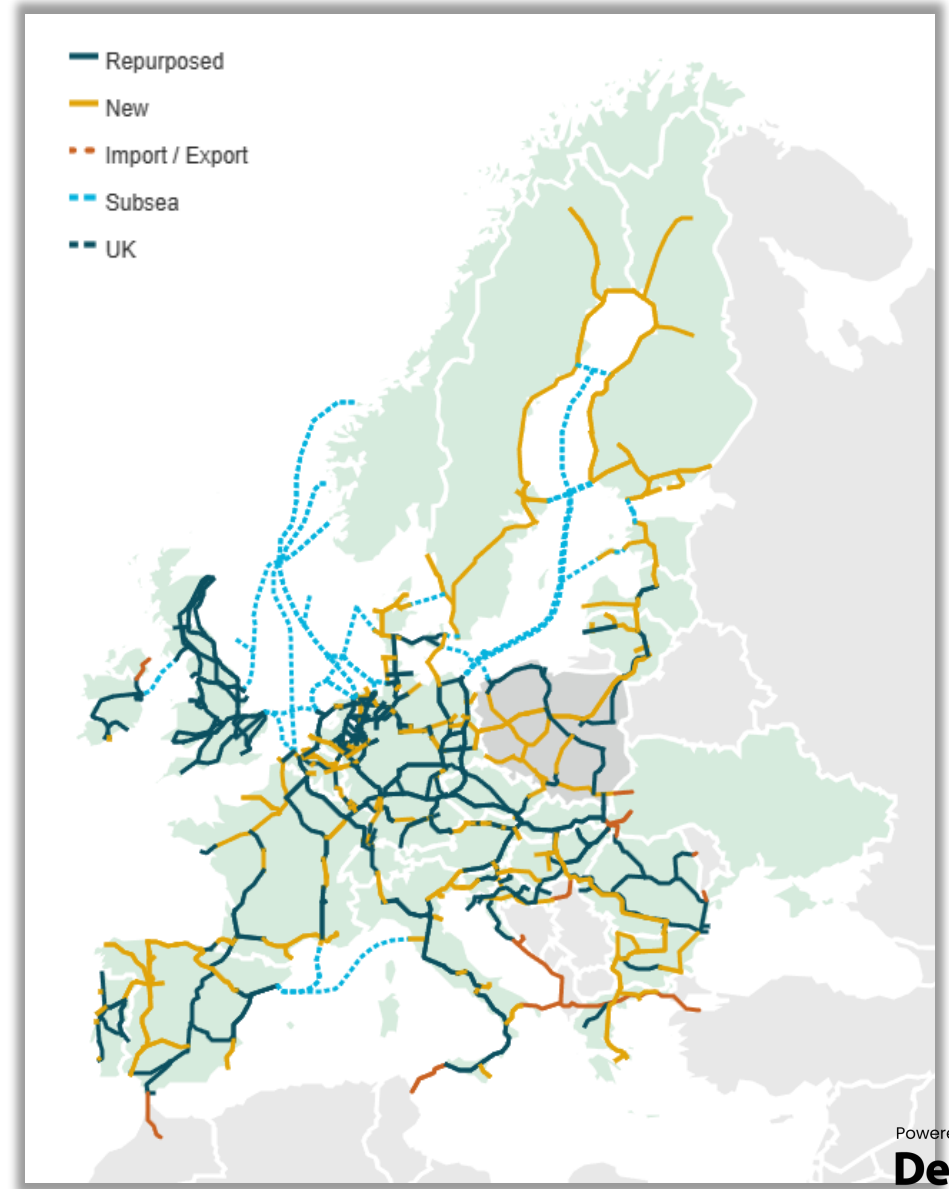
The Alexandroupolis FSRU terminal is expected to commence operations in 2024 increasing country's regasification Capacity by 5.5 Billion Nm³/yr

H2 Demand (TWh/year) Forecast in Europe
(Multiple Scenarios)

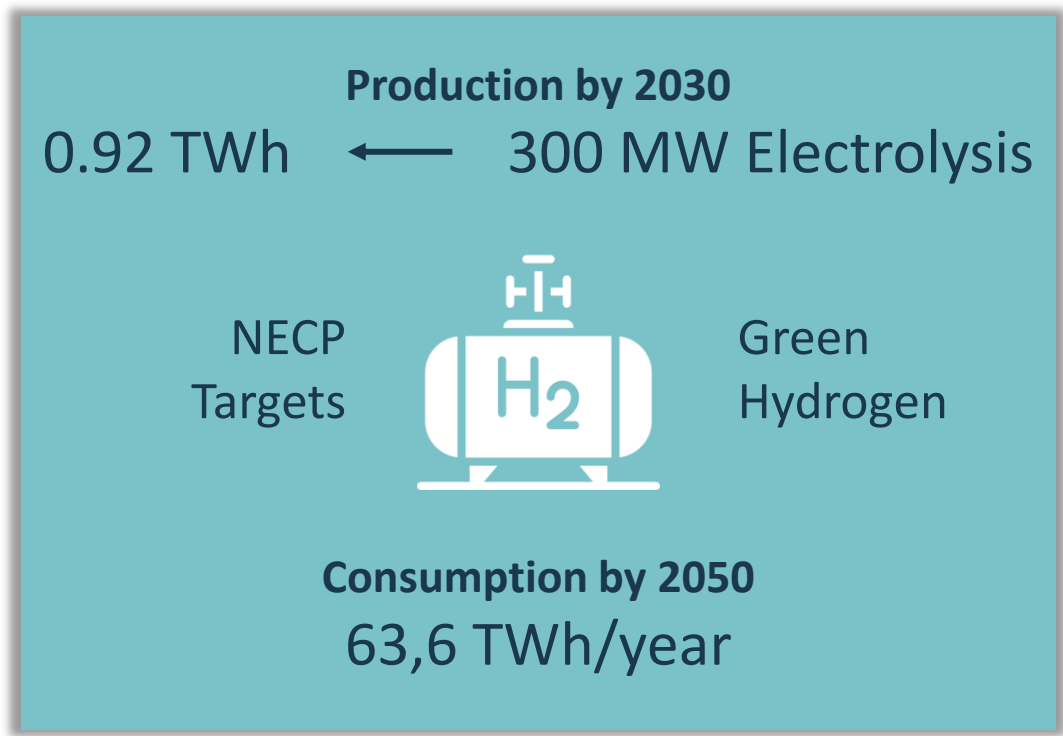


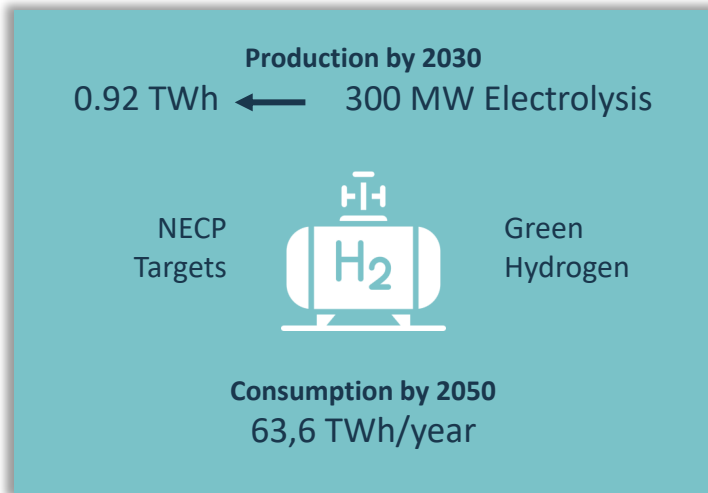
Hydrogen demand is expected to increase by almost **3 times** by **2050**, across Europe. In response, developments in **distribution infrastructure** are also planned.

Planned Hydrogen Distribution Infrastructure in Europe until 2040



Planned Hydrogen Distribution Infrastructure in Greece until 2040





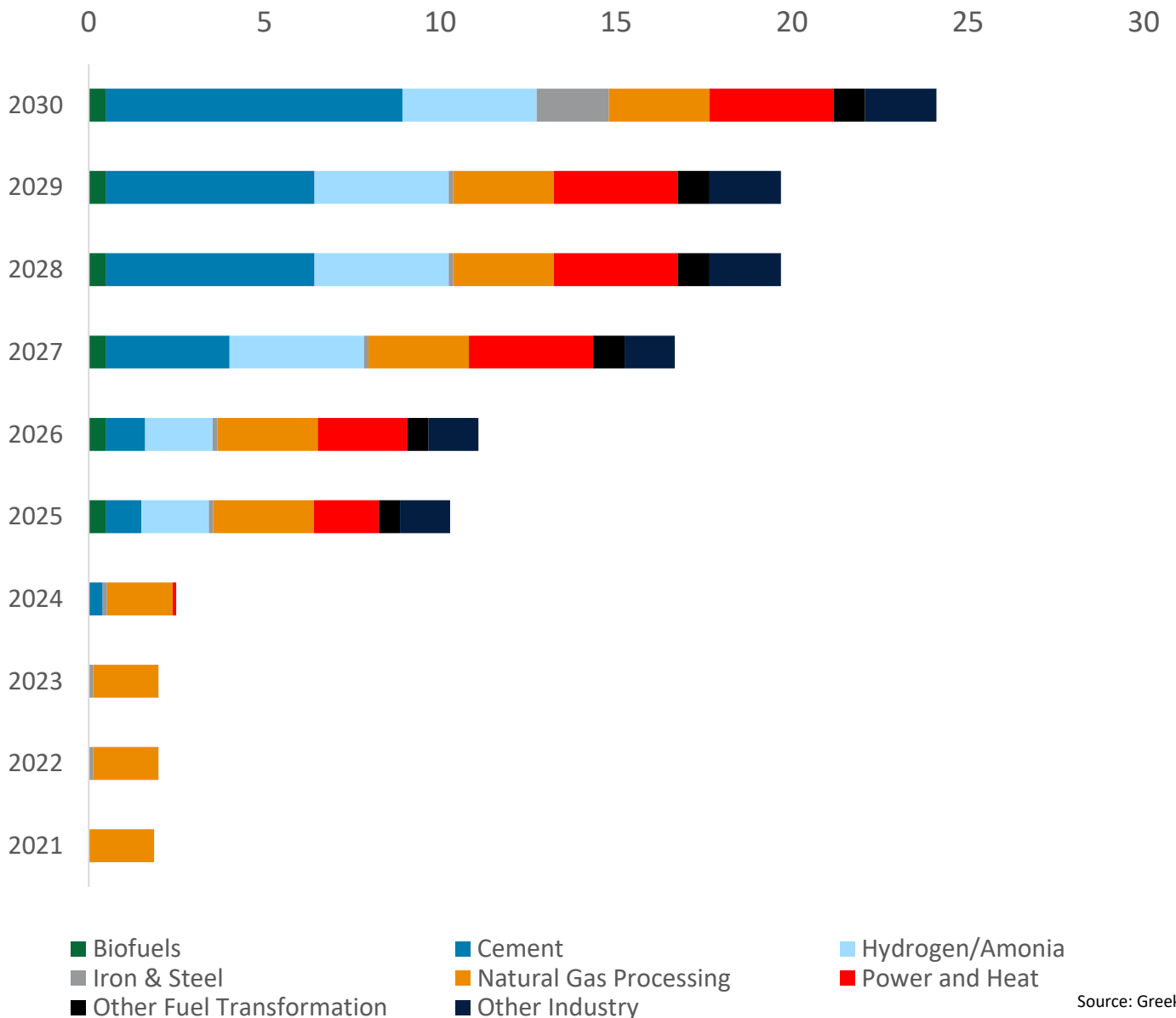
Planned Hydrogen Distribution Infrastructure in Greece until 2040



Green Hydrogen production in Greece is expected to reach **0.92 TWh** by **2030**.

While the estimated **consumption** is expected to reach **63.6 TWh** by **2050**.

Capacity (Mt CO₂) of planned CCS projects in Europe [2021-2030]

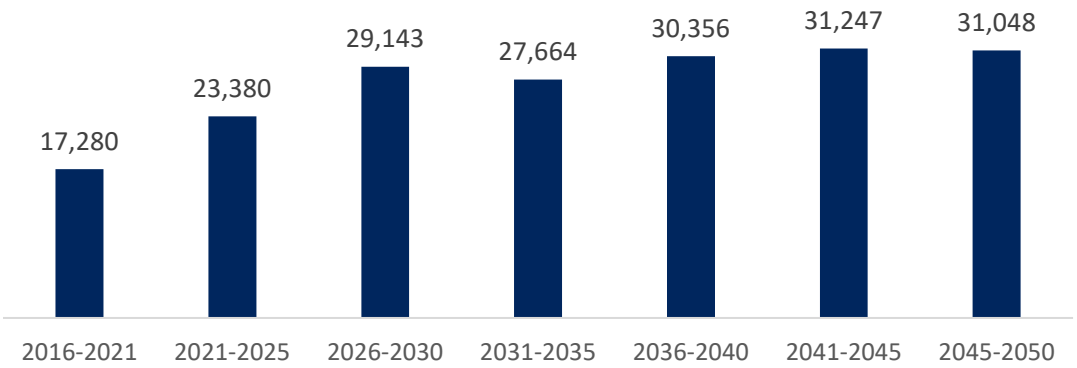


Carbon Capture and Storage (CCS) projects are planned across Europe and are expected to reach a total capacity of **24 Mt CO₂ by 2030**. Specifically in Greece, **2 Mt CO₂ annual CCS capacity** are expected to be operational by 2030, mostly attributed to the “Prinos” field.

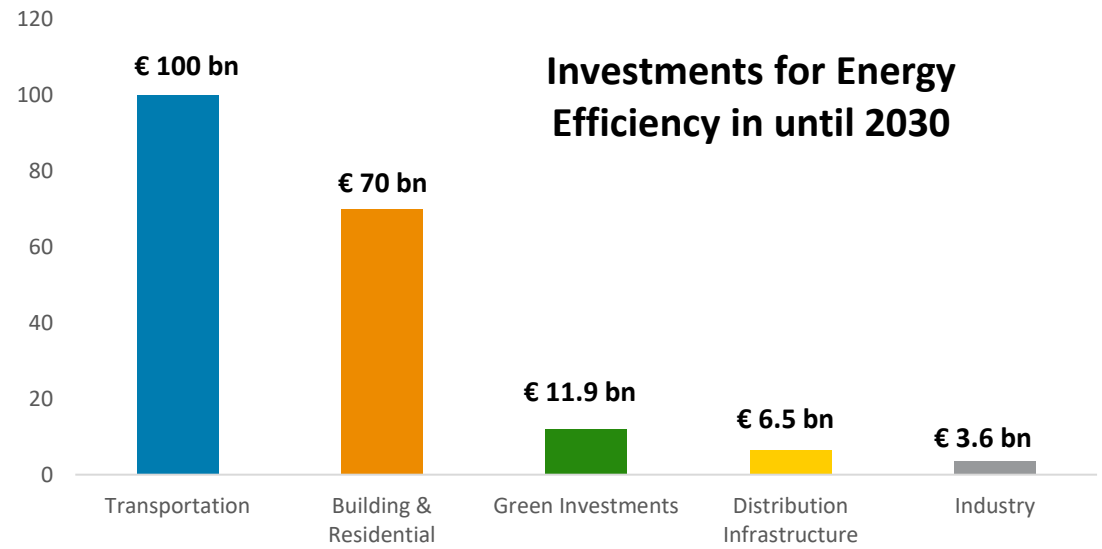
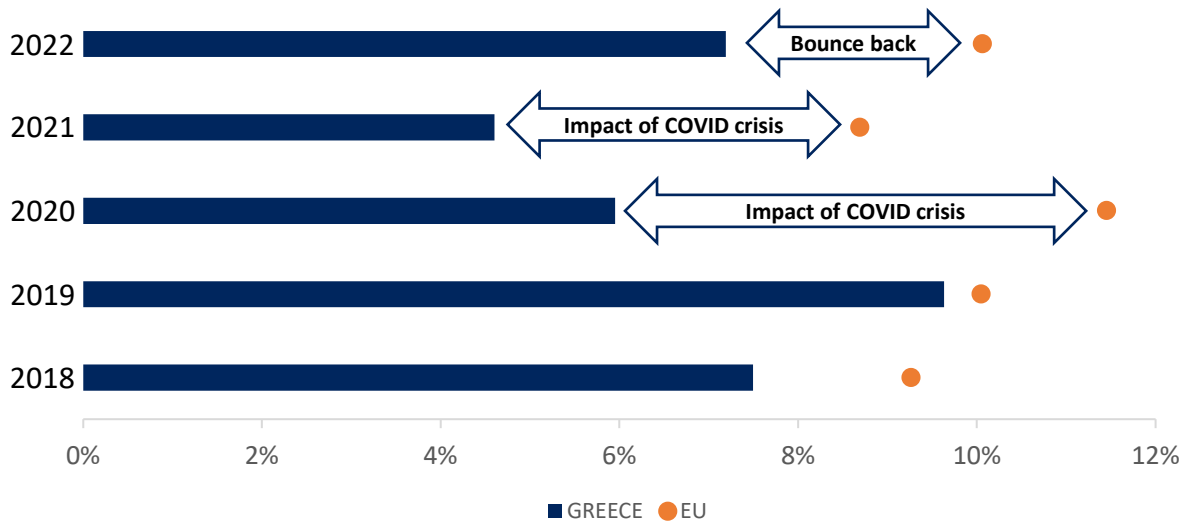
Source: Greek NECP, IEA, HAEE Analysis

Capital Expenditure under the new NECP

(average annual spending on the 5-year average – amounts in million €)



Proportion of total investments, allocated energy efficiency improvements



The Covid-19 pandemic had a profound impact on the investment landscape of the energy sector with a sharp **decrease of 52.2%** between **2019-2021**.

However, Greece quickly bounced back and **increased** its investments directed to the energy sector by **56.3%**, quickly catching up to the EU market average, between **2021-2022**.

Macros

Investment Grade : Greece has been upgraded in the investment grade as sign of economic growth and stability.

Growth : Forecasts indicate higher growth rates than EU in the next year.

Funds : Significant amounts of funds will be directed to Greece through the RRF and the REPowerEU.

Energy

RES attractive conditions: Highly favorable conditions for traditional RES development.

Emergence of new technologies: First steps for the new technologies that will support energy transition (hydrogen, CCUS, Offshore-Wind)

Positioning: Pivotal role in the energy independence of Europe. Major interconnector, LNG, pipelines are under development.

Investments

Vote of confidence: International funds and companies have invested in the Greek Energy Sector.

Room for more: New targets from NECP will require significant capital mobilization with potentially attractive returns.

Adopting the **ESRS** (EU Sustainability Reporting Standards)



Environment

Social

Governance

Who?

- All large companies and all companies listed on regulated markets (except micro-enterprises).
- All large companies with >500 FTE and/or €500 million annual turnover. → *Expected to soon include companies with >250 FTE.*
- Any European-based or non-European company with a local branch within an EU-27 Member State.

When?

- Companies within scope must report in compliance with the ESRS, as early as the 2024 reporting period.
- The 1st set of ESRS has already been adopted by the European Commission, with additional sets, expected to be released.

Why?

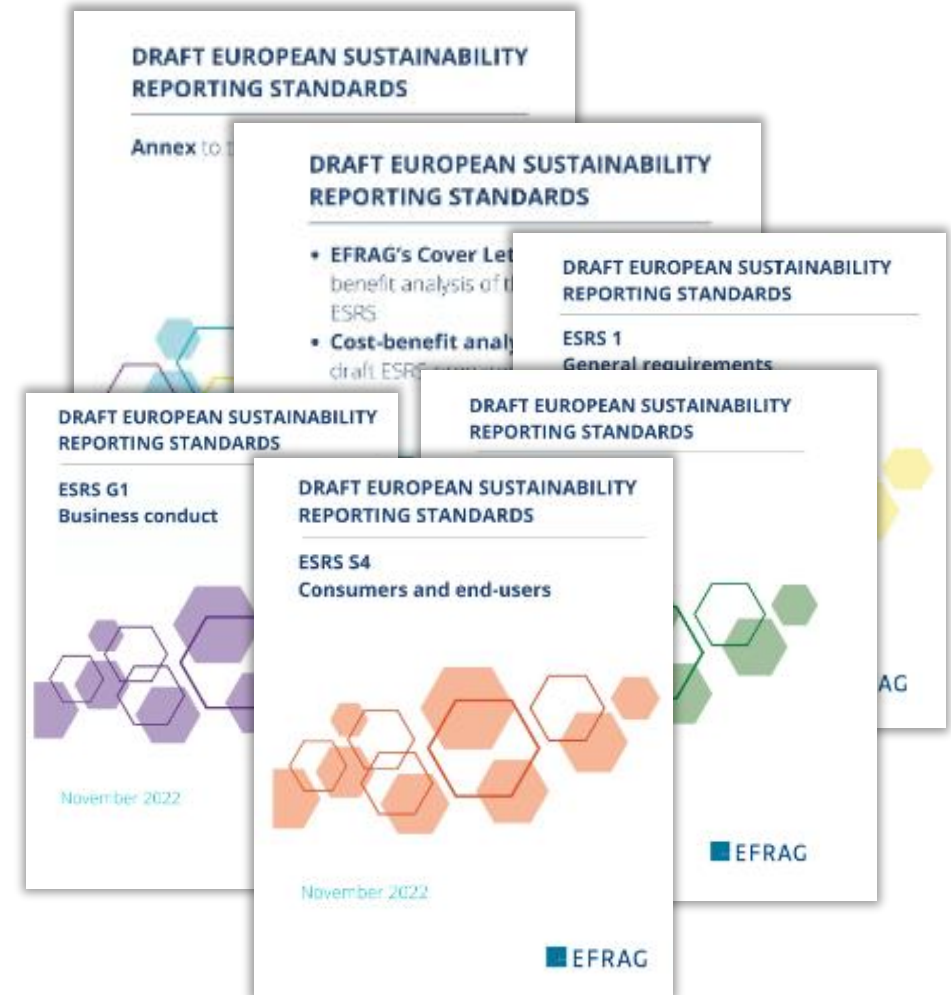
- A means to accelerate the motion towards a net-zero European economy
- Accelerating acquisition due diligence, through a universal screening framework.
- The Standards are notable for their breadth and granularity, going well beyond reporting requirements in other mandatory voluntary ESG reporting frameworks.

Adopting the **ESRS** (EU Sustainability Reporting Standards)









Environment

Social









Governance



Based on the **targets** set out in the **new NECP**, the **key takeaways** for the **future** of the **Greek Energy Market** are:

<p>WIND</p>  <p>The first pilot offshore-wind parks have been licensed.</p>	<p>CCUS</p>  <p>Prinos field in the PCI list. Industrial companies and refineries are investing in pilot CCUS projects.</p>	<p>HYDROGEN</p>  <p>Industrial companies and refineries are investing in pilot Hydrogen projects.</p>	<p>GRID</p>  <p>Saturated grid – upgrade and expansion plan offer opportunities</p>
<p>SOLAR</p>  <p>Exceptional solar irradiation rates, very attractive for Solar PV investors / developers.</p>	<p>ENERGY STORAGE</p>  <p>First 3 rounds of auctions for subsidies have been announced within 2023.</p>	<p>NATURAL GAS</p>  <p>Natural gas power producing plants and FSRU's are under development/construction.</p>	<p>INVESTMENTS</p>  <p>Vote of confidence from international investors with multi-billion investments in Greece.</p>

Based on the **targets** set out in the **new NECP**, the **key takeaways** for the **future of the Greek Energy Market** are:

<p>WIND</p>  <ul style="list-style-type: none"> • Increase of wind power by 2050, reaching 29.2 GW. • Focus on offshore wind parks, with future developments already underway. 	<p>CCUS</p>  <ul style="list-style-type: none"> • Prinos hub is a highlight for Greek CCUS. • 2 Mt CO₂ annual capacity for CCUS by 2030 	<p>HYDROGEN</p>  <ul style="list-style-type: none"> • Increase in demand for H₂ reaching 63.6 TWh in 2050. • Strong need for network infrastructure development. 	<p>GRID</p>  <ul style="list-style-type: none"> • Imports and exports increase by over 60% by 2030. • Advancement of NII interconnections by 2030, lowering Fossil Fuel dependency.
<p>SOLAR</p>  <ul style="list-style-type: none"> • 10x increase in installed capacity by 2050 • Solar power has reached a tipping point. 	<p>ENERGY STORAGE</p>  <ul style="list-style-type: none"> • Need for energy storage, with advancement of BESS. • BESS domination (over 90%) by 2050 	<p>NATURAL GAS</p>  <ul style="list-style-type: none"> • 38% reduction in NG consumption between 2021-2023 • 70% of NG consumption relates to electricity generation. 	<p>INVESTMENTS</p>  <ul style="list-style-type: none"> • Vote of confidence from international investors with multi-billion investments in Greece.



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