

GREECE

Analysis of the Battery Storage Market



Acknowledgements

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This report is part of a series that analyses the battery storage market in select European countries.

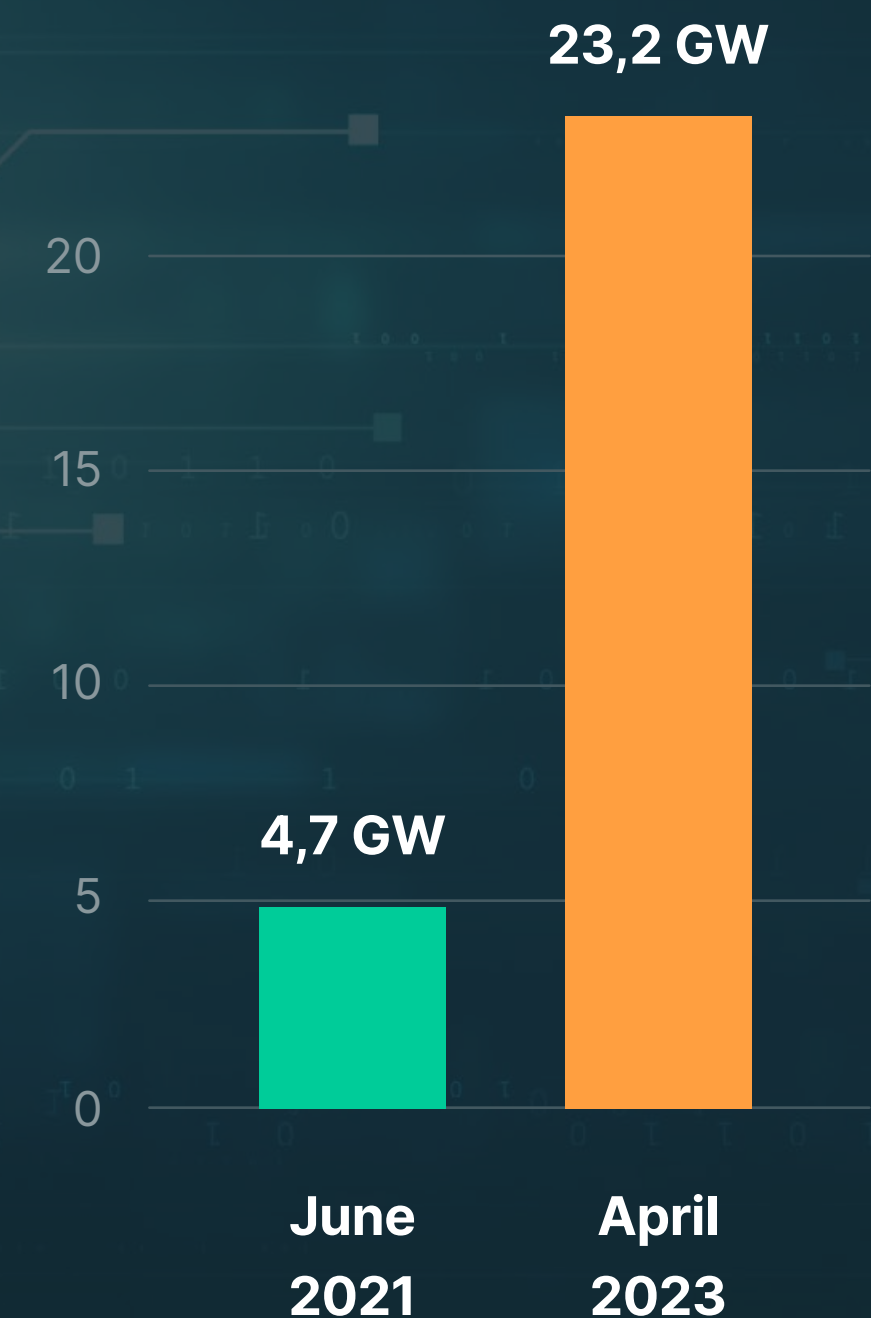
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As of April 2023, the total battery capacity in the **licensing pipeline** in Greece already exceeds 23 GW

- While Greece currently has virtually no utility-scale battery storage capacity installed, the country's project pipeline points to explosive growth in the coming years.
- The rapid growth of Greece's storage market is driven by a combination of factors, including Greece's heavy reliance on fossil gas which has led to high price volatility, ambitious energy and climate targets, and the recent introduction of a legal and regulatory framework supportive of battery storage development.

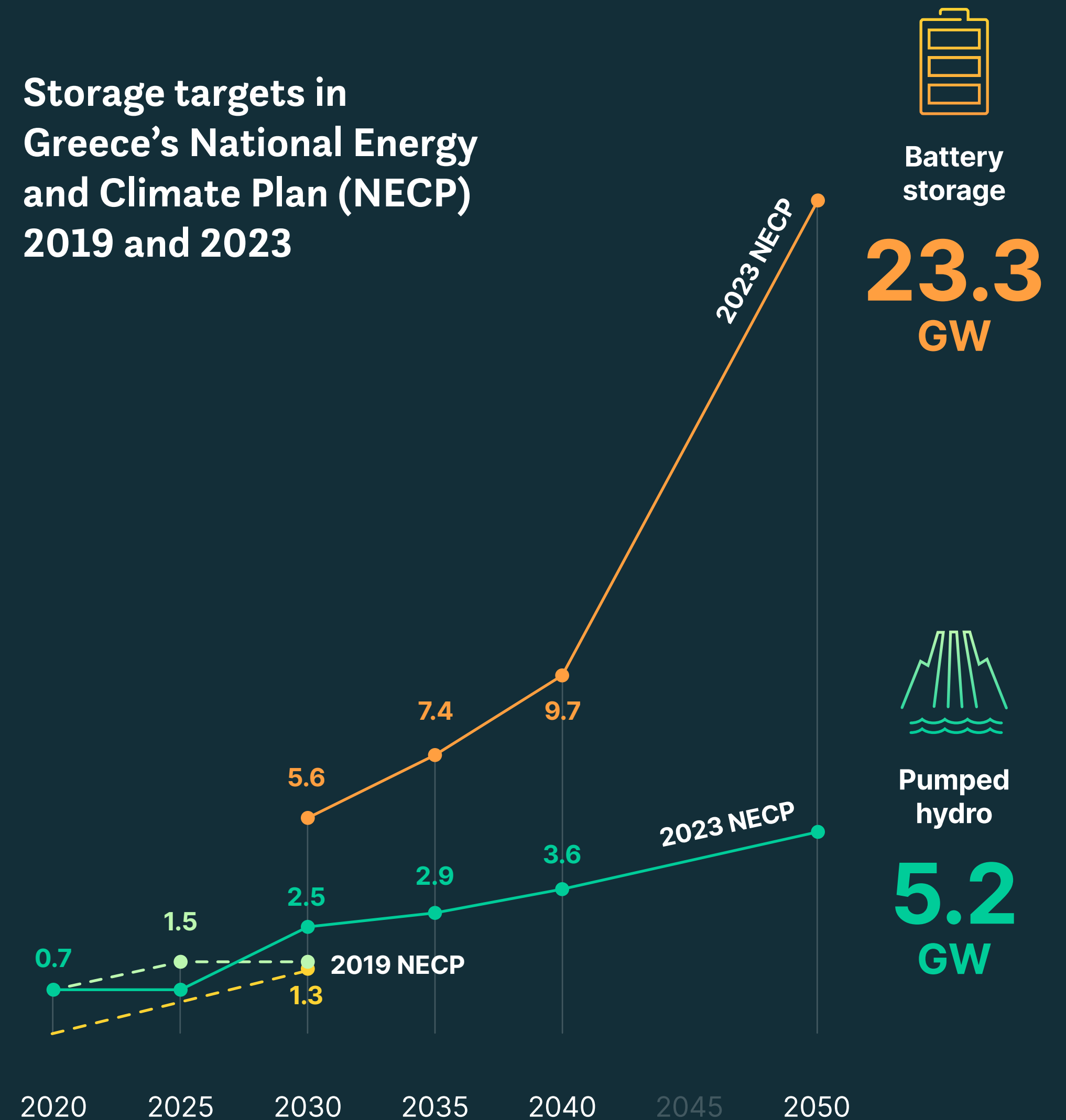
Battery Storage Licenses
(GW)¹



Greece's battery storage sector is currently a market in the making

- Until recently, Greece had only two pumped hydro storage systems in place (commissioned in 1986 and 1999 respectively) with a total installed capacity of 696 MW.²
- Both projects effectively halted their pumping operations around 2006. In recent years, a major shift toward battery storage has taken place.
- Greece's updated National Energy and Climate Plan has increased the planned capacity of battery storage by nearly 20-fold (in orange), with a significantly smaller role envisaged for pumped hydro (in green).^{3,4}

Storage targets in Greece's National Energy and Climate Plan (NECP) 2019 and 2023



The share of variable renewables like wind and solar has grown rapidly in Greece in recent years

Total installed capacity in 2022 (all sources)^{5,6}

22.5 GW



Share of wind and solar in the electricity mix in 2022^{5,6}

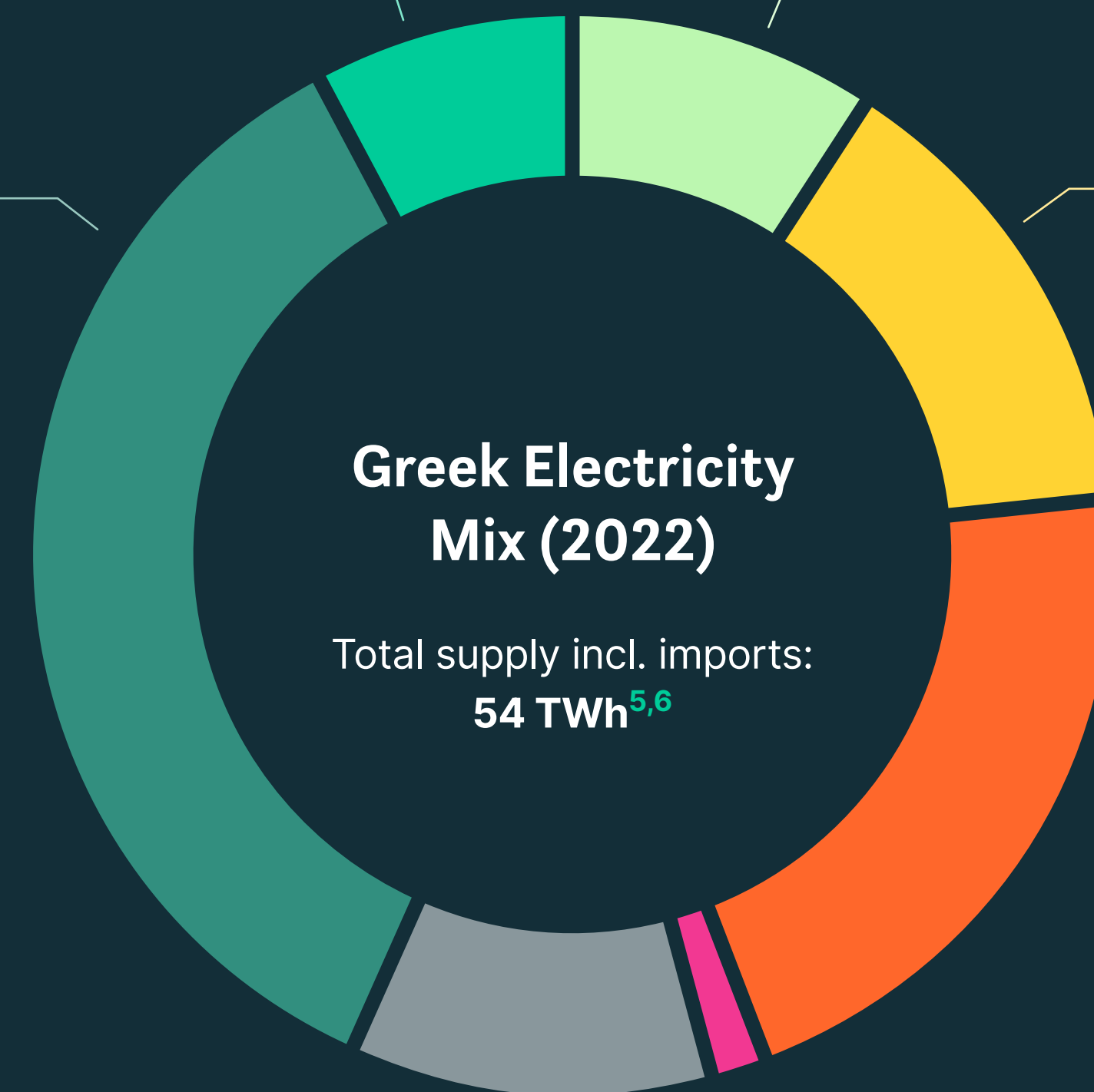
over 35%



7,8% Oil

35,5% Gas

11,1% Lignite



Greek Electricity Mix (2022)

Total supply incl. imports:
54 TWh^{5,6}

Hydro 9,2%

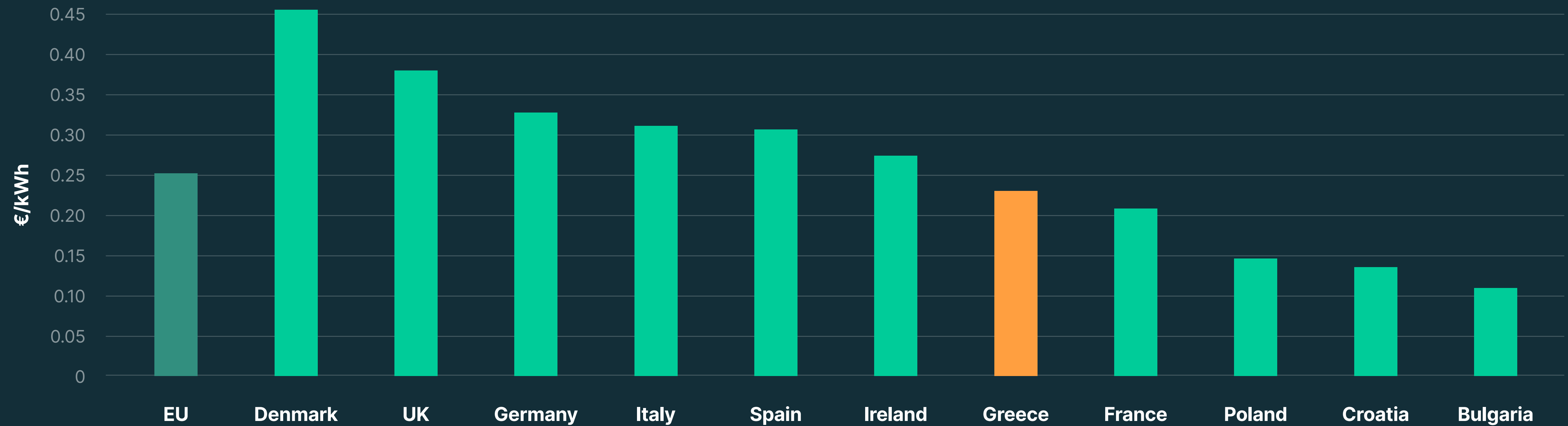
Solar PV 13,9%

Wind 21,1%

Biogas 1,4%

High electricity prices provide attractive conditions for the growth of battery storage

Greece's household electricity prices rank among the highest in South East Europe.^{7,8,9}



Greece has recently introduced a new **support scheme** for customer-sited solar+storage systems

- Starting in May 2023, Greek households and farmers are able to apply for public funds to cover the purchase and installation of small solar+storage systems up to 10.8kW (featuring up to 10.8kWh of storage). The grants can cover up to 75% of total cost of a system.¹⁰
- The total budget available is EUR 238 million, which is expected to fund approximately 30,000 battery systems by mid-2024.
- For households looking to install solar PV under the program, it will be mandatory to add battery storage; for farmers, storage will be optional.



The Greek Parliament has recently adopted a **new regulatory framework** for storage systems

Law 4951/2022 has set the basis for storage development in Greece, making Greece one of the first countries in Europe to adopt a legal and licensing framework specifically for energy storage.

Greece's regulatory framework distinguishes between two main categories of storage assets:

- **Stand-alone** storage systems
- Storage systems **co-located with renewable energy projects.**¹¹



Greece's regulatory framework creates **clear distinctions** between different types of storage project

- Greece's framework introduces a further distinction between storage systems that can charge from the network and those that are charged exclusively from a renewable power plant.¹²
- Plants that can charge from the network can participate in energy markets (i.e. in the wholesale market), while projects charging exclusively from renewable projects can also benefit from Contracts for Differences (CfDs) under the country's renewable energy auctions.



Greece currently in the process of preparing **special auctions** for storage systems¹³

- In addition, Greece is launching a competitive bidding process for storage projects.
- The first auction (400 MW) is expected to take place by the end of June 2023, with the second and third auctions planned by the end of 2023.
- Developers are required to reach commercial operation by the end of 2025.
- Given supply chain constraints for batteries and other key project components, this timeline is likely to prove challenging to meet.



The current status of storage licenses points to **massive growth** in the years ahead

Storage licenses as of April 2023¹⁴



Utility-scale storage projects in Greece can benefit from a variety of different **revenue streams**

Storage project in Greece will be able to revenue stack, earning revenues from several different sources:

- Selling energy in the day-ahead market (DAM) while discharging
- The balancing market (including from FCR)
- Revenues from the provision of mFRR services
- Revenues from the activation of aFRR services

These revenues streams are in addition to any public funds awarded.

In addition, a further revenue stream may originate through the ability of battery storage assets to participate in Greece's capacity market, which has yet to be implemented.¹⁵

DAM = Day-Ahead Market, **FCR** = Frequency Containment Reserve,
aFRR = automatic Frequency Restoration Reserve, **mFRR** = manual Frequency Restoration Reserve



Additional **State Aid funding for energy storage** has been approved by the **European Commission**

The European Commission has approved the Greek state's funding initiative for **1,000 MW of energy storage**.¹⁶

As part of the initiative, **€341 million** will be allocated to grid-connected energy storage systems.

The funding will be provided in two forms:

- investment grant
- annual support during the first ten years of operation.

The average total funding is estimated at 380,000 €/MW.



A clawback mechanism has been proposed for projects benefiting from public funds to avoid overcompensation

- Under Greece's recently approved rules, a clawback mechanism has been introduced to limit windfall profits.
- The mechanism will only apply to projects that have benefited from public funds.
- The annual support for each project will be assessed and an adjustment will be made through a clawback mechanism if the energy storage units generate market revenues deemed by the regulator to be excessive.¹⁷



Despite certain risks on the horizon, the outlook for Greece's storage market remains promising

- The actual revenues earned by storage projects in Greece will depend on how electricity markets and electricity prices evolve in the years ahead.¹⁸
- Several risks remain including lower market prices, cannibalization from other storage projects, or rapid increases in demand response that could erode storage's position.¹⁹
- A further risk is the expansion of interconnectors with neighboring countries, which could boost supply and reduce the need for storage in the years ahead.²⁰
- Given the high degree of uncertainty, a stable regulatory framework remains critical to mobilizing investment.



Endnotes

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