

SPAIN

Analysis of the Battery Storage Market



Acknowledgements

Authors:

Toby D. Couture

Javier Pamos Serrano

Joseph Thomas

The research and analysis conducted for this report were supported by the European Climate Foundation.

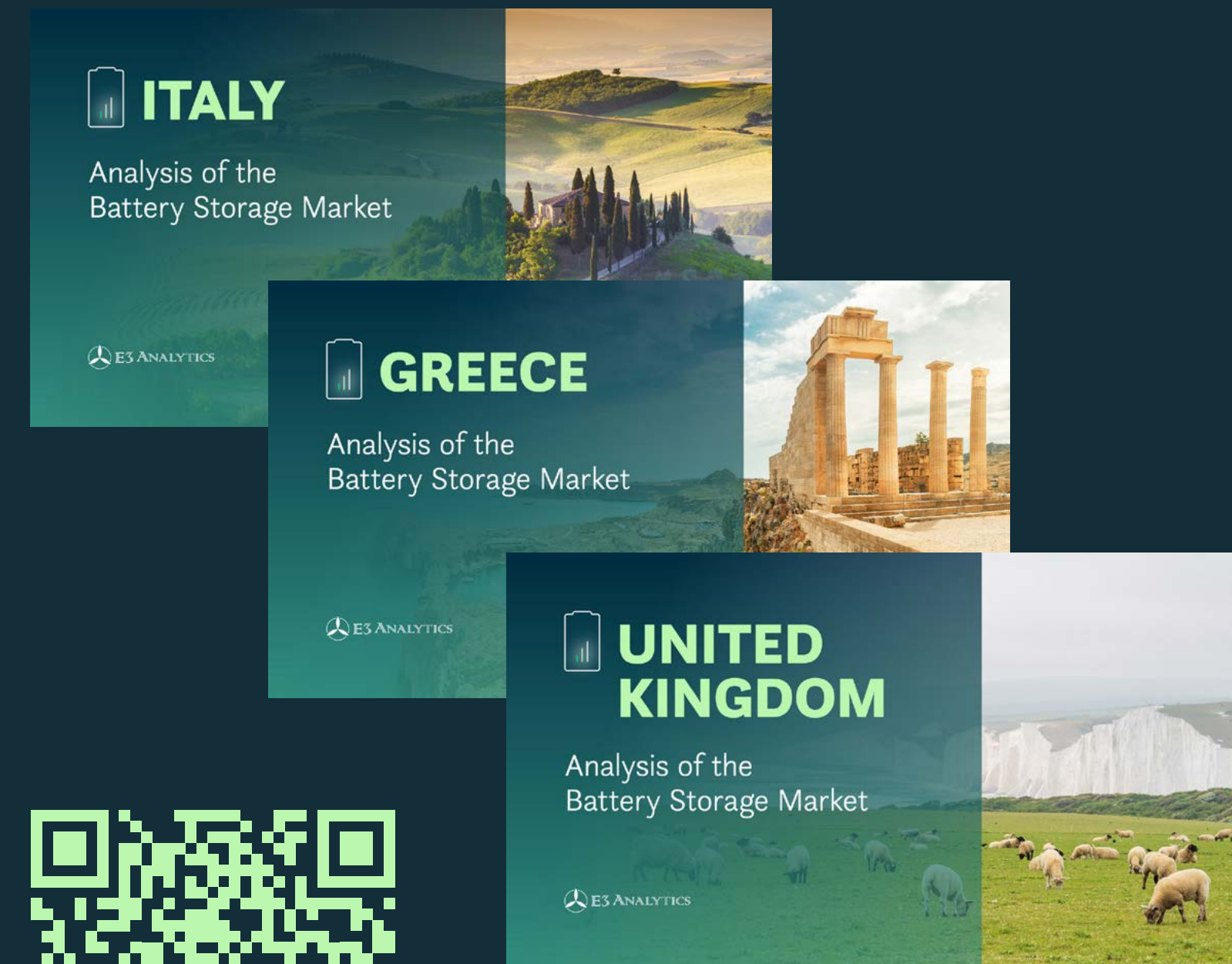


Copyright: E3 Analytics, May 2023

Design and Layout: Hot Ice Creative Studio

Photo Credits

Cover: Alejandro / Adobe Stock; 4: NOWRA photography / Adobe Stock; 5: Anton Blanke / Adobe Stock; 7: iamchamp / Adobe Stock; 9: Negro Elkha / Adobe Stock; 11: Blue Planet Studio / Adobe Stock; 15: Alvaro / Adobe Stock; 16: Vilaysack / Adobe Stock; 17: Hot Ice Creative Studio



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

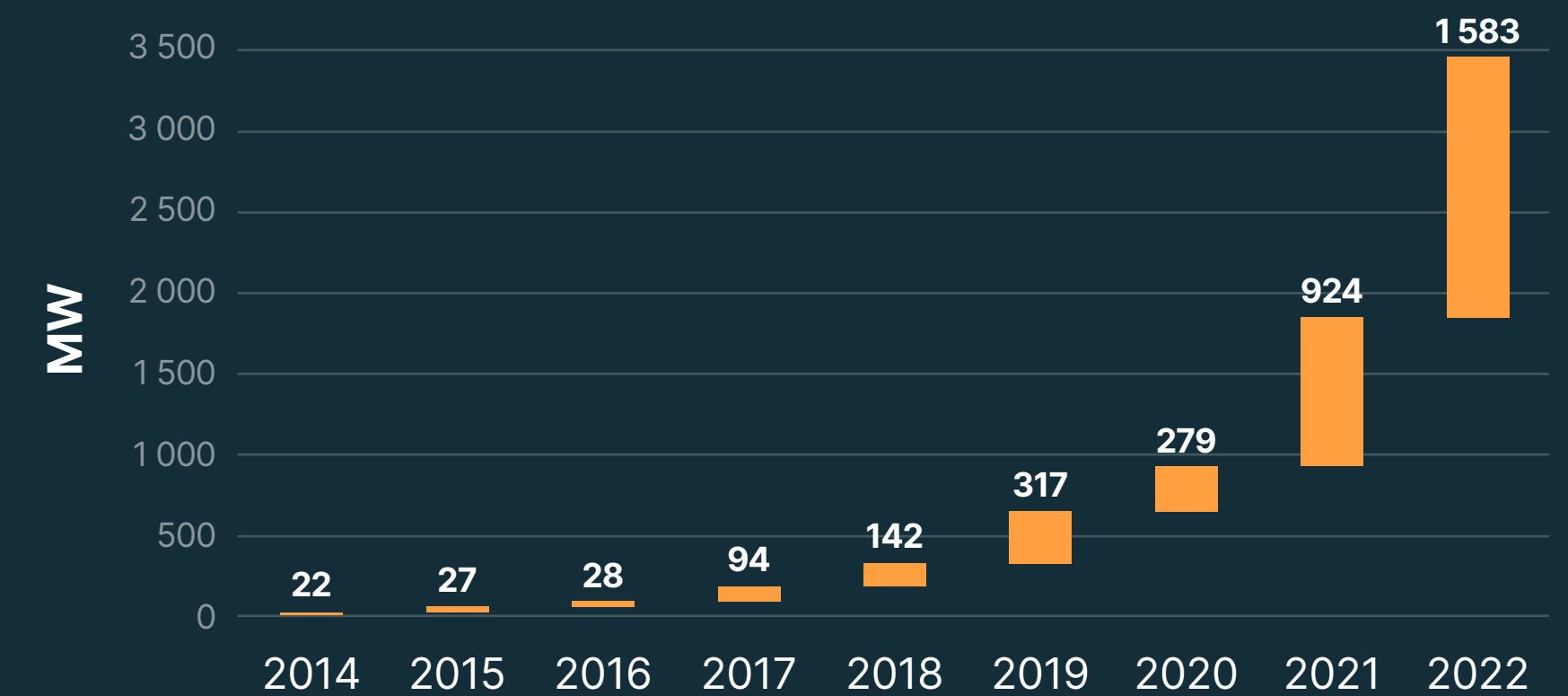
To access the other reports, visit our website at:

www.e3analytics.eu/project/eu-storage-market-analyses

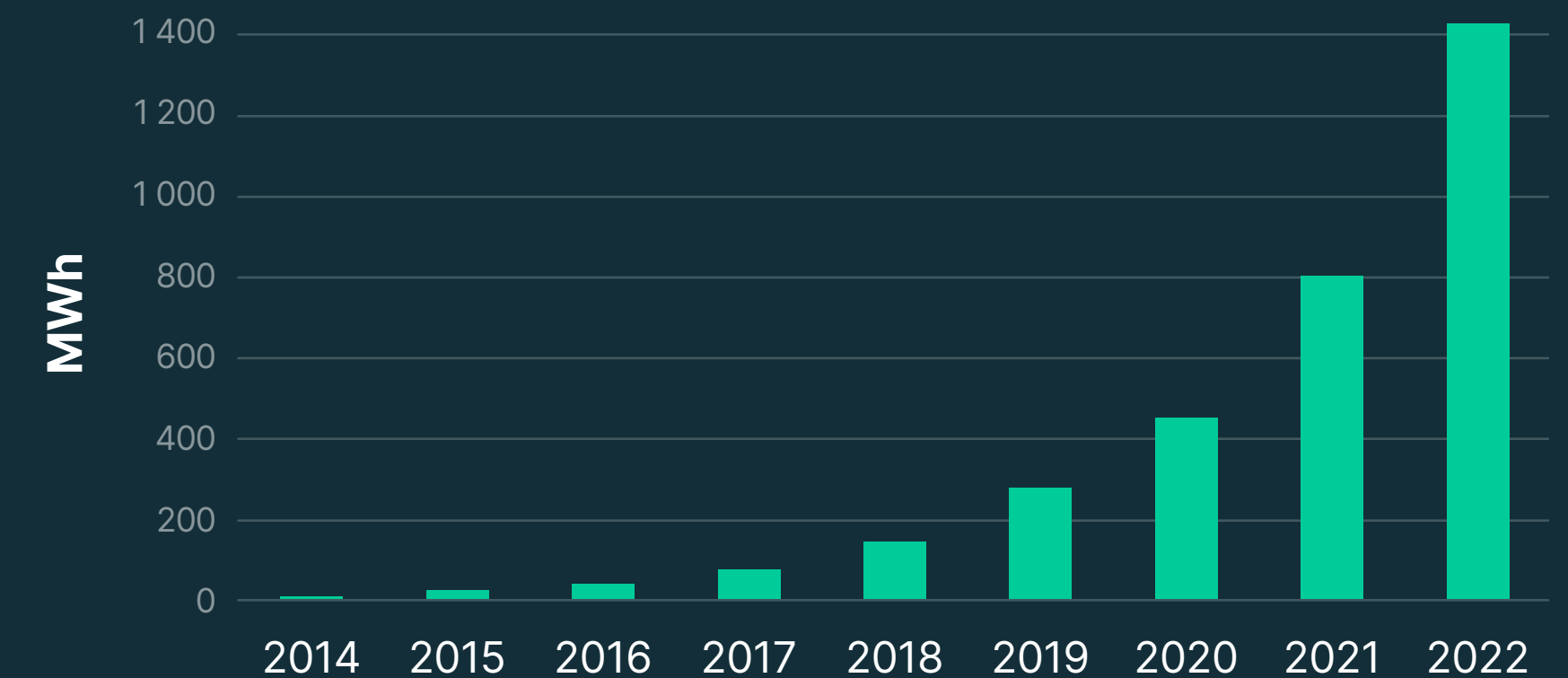
Spain's battery storage market is dominated by customer-sited systems. Utility-scale storage remains nascent.

- Currently, Spain's storage market is mainly composed of small-scale batteries co-located with solar PV.
- As of early 2023, the total customer-sited storage capacity is estimated at approximately 1.4 GWh.¹
- The market for utility-scale storage projects remains comparatively small at around 100MW, though a pipeline of projects is beginning to emerge.^{2,3,4,5}
- Much of Spain's existing utility-scale storage capacity is in concentrating solar power plants (thermal storage) and pumped hydro.^{6,7}

Cumulative customer-sited solar PV capacity (MW)¹



Cumulative customer-sited storage capacity (MWh)^{8,9}

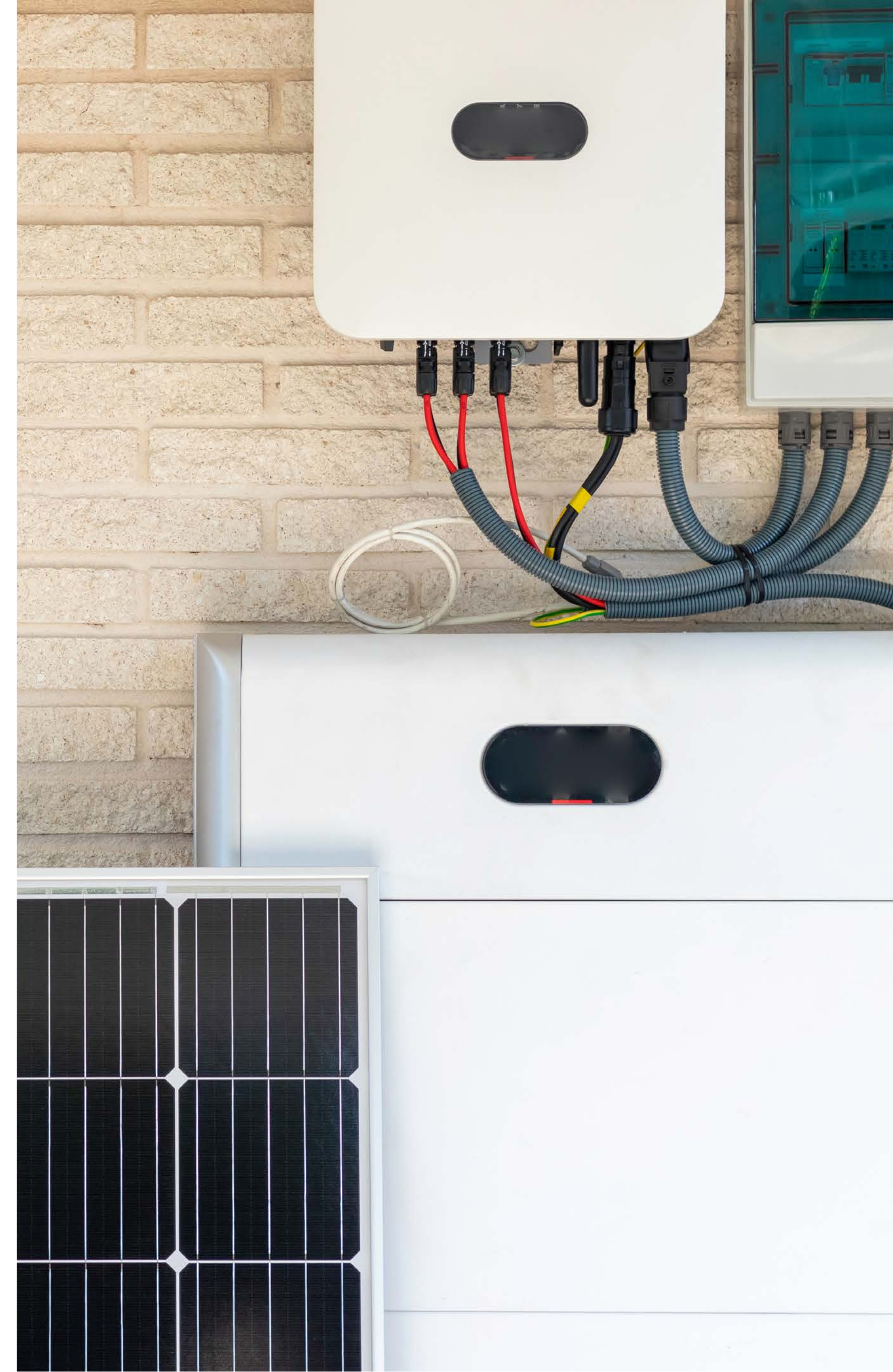


Customer-sited storage installations are **growing rapidly**, supported by high and increasingly volatile electricity prices

As in other European markets, the rate of installation of storage combined with solar PV is growing rapidly due to a combination of factors:¹⁰

- Battery cost declines
- Rising electricity prices
- A broadly supportive regulatory regime

Since 2019, small power generators have been able to receive compensation for their surplus solar generation.¹¹ This has led to a rapid growth of customer-sited solar PV projects, which in turn has triggered concurrent growth in battery storage adoption.¹²



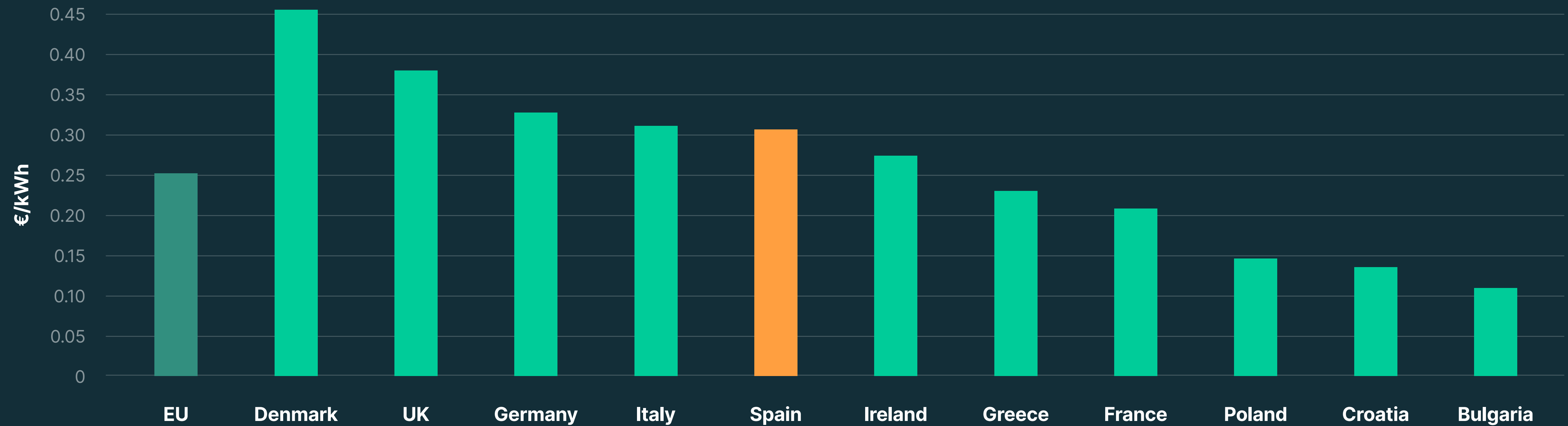
Municipalities are starting to introduce their own measures to accelerate the energy transition

- Many Spanish municipalities provide tax reliefs for individuals and companies that install distributed PV for self-consumption.^{13,14}
- Although much of the adoption of solar+storage installations to date has been concentrated in the residential sector, adoption is starting to occur in the commercial sector as well as in number of energy communities.¹⁵



Spain's household **electricity prices** have nearly tripled since 2009

Spain's household electricity prices now stand at over EUR 0.30/kWh on average. In addition, Spain's reliance on fossil gas has increased price volatility in recent years.^{16,17,18,19}



Many electricity customers have **variable price contracts**, making customer-sited **solar+storage** more attractive

- In addition to higher prices, many customers in Spain have contracts with market-linked prices, which means that electricity prices can fluctuate considerably from one hour (or day, or month) to the next.²⁰
- This variability, combined with Spain's excellent solar resources, make the economics of combining solar with storage increasingly favorable.



Spain's **renewable energy share** is growing steadily, with both wind and solar breaking output records in 2022

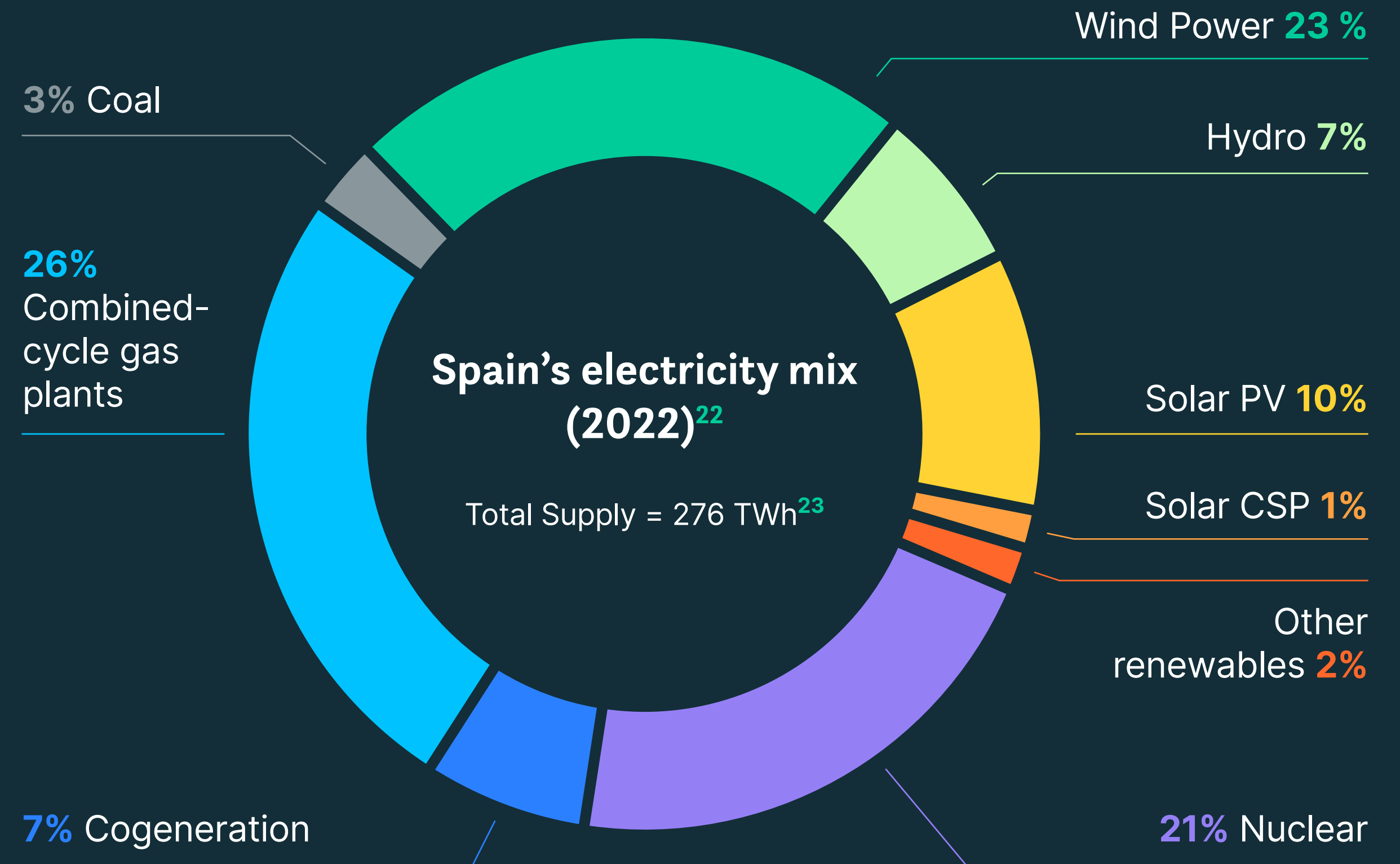
Total installed capacity in 2022 (all sources)²¹

118GW



Share of wind and solar in the electricity mix in 2022²²

over 32%



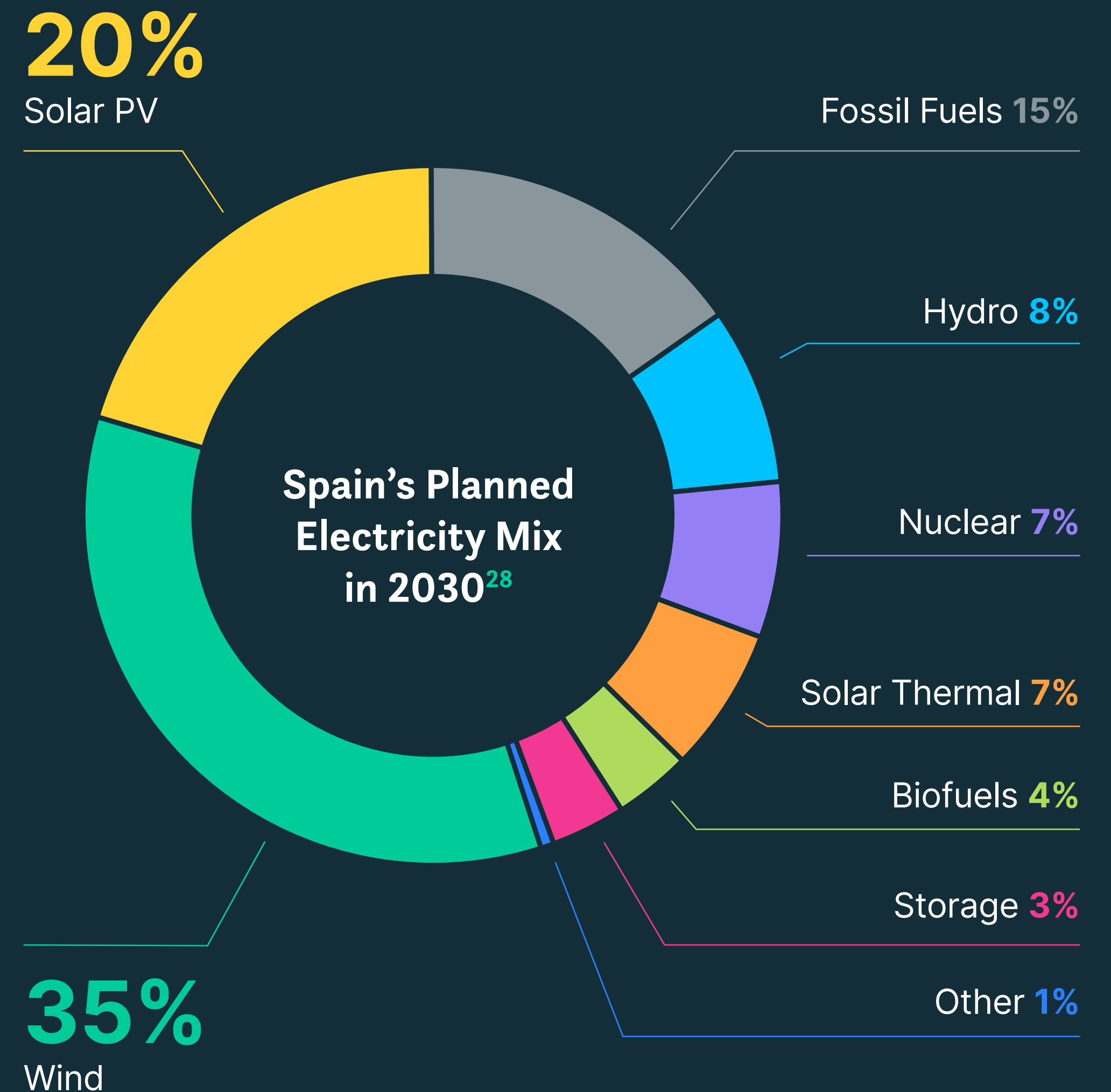
The market for **utility-scale storage** remains in its infancy

- The market for utility-scale batteries has been almost non-existent until recently as the market has lacked a clear policy and regulatory framework.
- However, ambitious renewable energy targets combined with recently announced government subsidies are expected to spur the adoption of larger-scale battery storage projects in the coming years.^{24,25,26}



The massive deployment of renewables is likely to **require further growth** in utility-scale storage

- The Spanish TSO currently maintains grid stability and security of supply mainly by relying on approximately 40 GW of thermal and nuclear plants.²⁷
- According to Spain's NECP, the share of variable renewable energy sources in the power mix is expected to grow to 62% by 2030 (from roughly 32% today).²⁸
- The planned growth of renewables creates a clear rationale to further scale-up utility-scale battery storage.²⁹



A lack of **supportive regulations**, including an inability of operators to engage in “revenue stacking” is holding the market back

There are several factors that explain the relatively nascent stage of Spain’s utility-scale battery storage market:

- Price arbitrage is not yet sufficiently attractive in Spain as a stand-alone business model.^{30,31,32}
- Revenue stacking is currently not allowed.³³
- The risks with regard to double charging remain unclear.³⁴
- Capacity markets are not yet attractive for developers of storage assets in Spain.

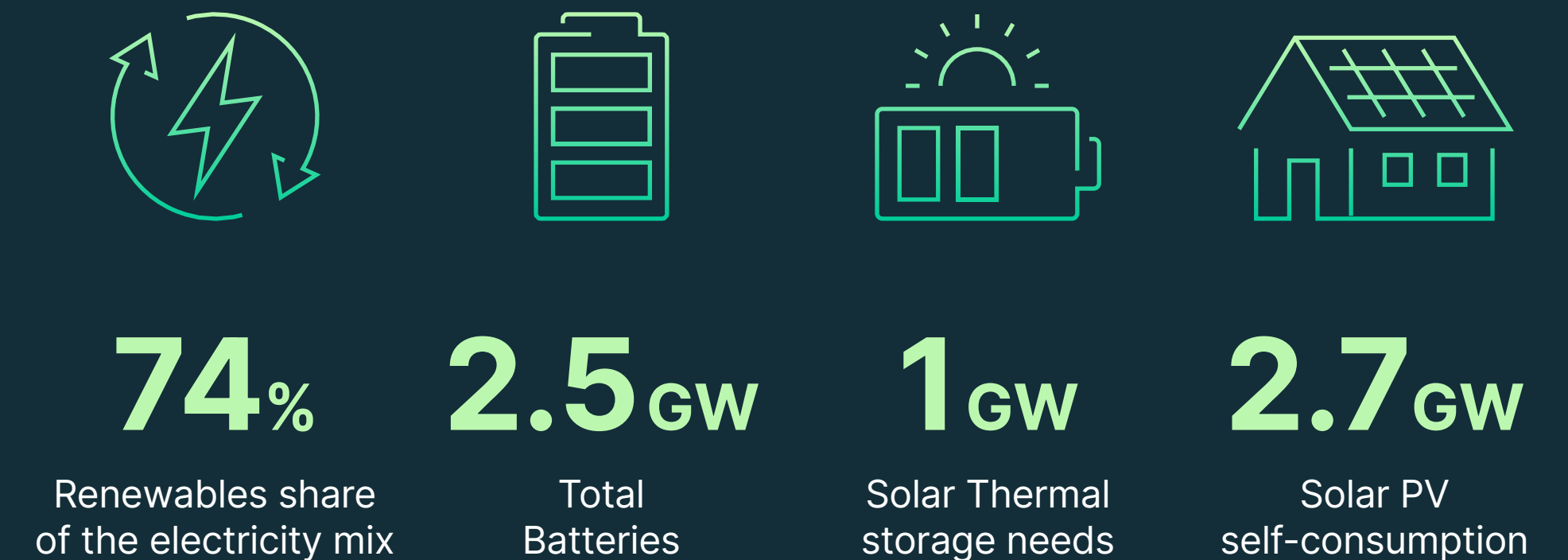
However, the government is developing new schemes to incentivise storage deployment, including adapting capacity markets under a new scheme named ‘Renewable Energy Economic Regime’. In addition, Spain has recently introduced subsidies specifically for storage systems co-located with solar PV.³⁵



Spain's national targets will see the country meet 74% of its electricity needs from renewables by 2030

- Spain's energy transition targets are among the most ambitious in Europe.
- Unlike a number of other EU countries, Spain's National Energy and Climate Plan (NECP) specifically includes targets and policies aimed at encouraging storage projects.
- In addition, Spain has developed a national storage roadmap that includes a target to achieve 20GW of storage by 2030. However, current levels of customer-sited storage adoption already exceed its 2030 targets.³⁷

Spain's 2030 NECP targets³⁶

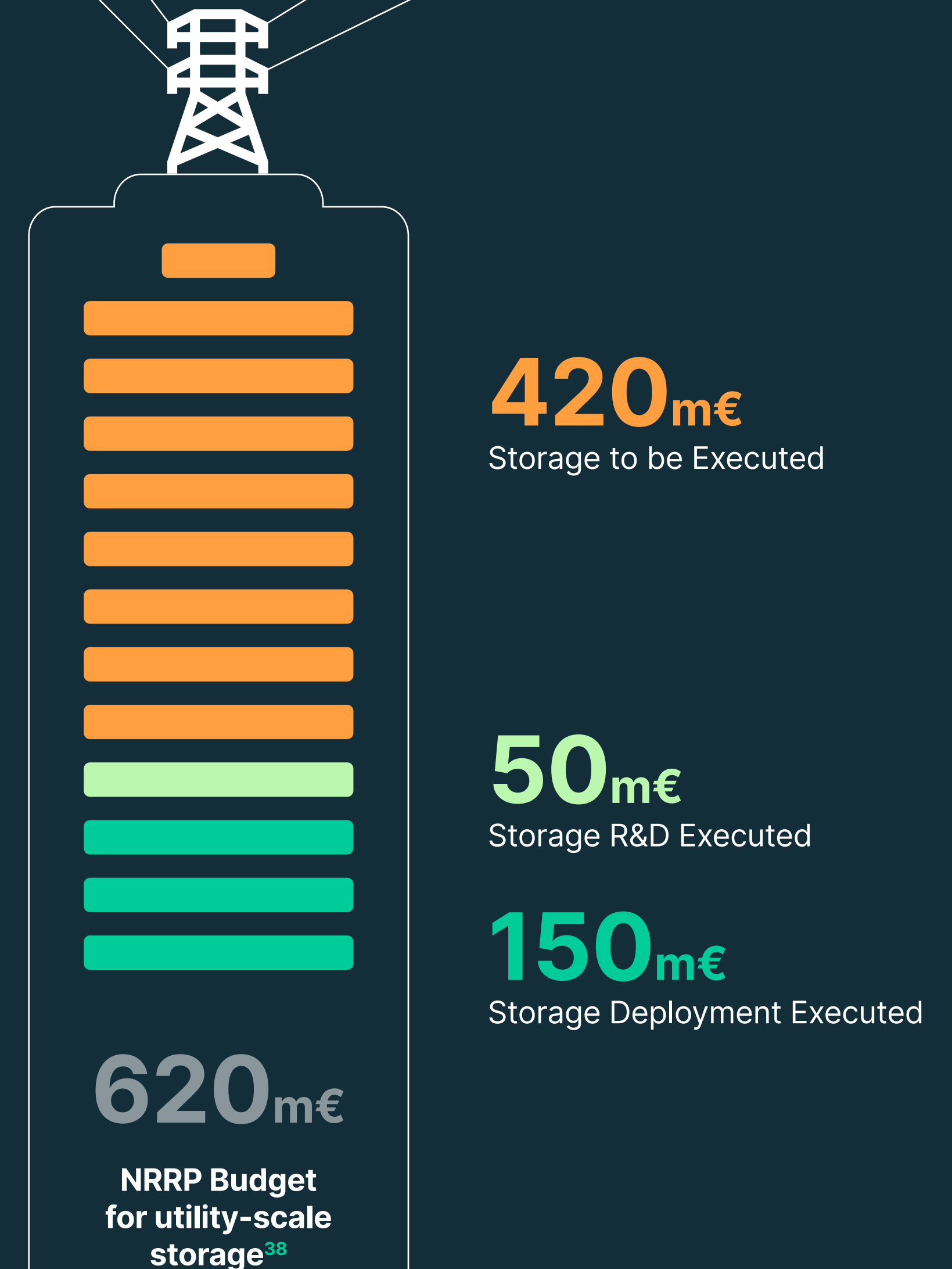


Spain's 2030 storage roadmap targets³⁷



Spain's National Recovery and Resilience Plan (NRRP) is providing targeted support to storage projects

- The NRRP, a funding package from the EU, has promised a funding pot of 620m€, extendable to 1.320m€, specifically for energy storage and flexibility at both utility- and distributed-scales.³⁸

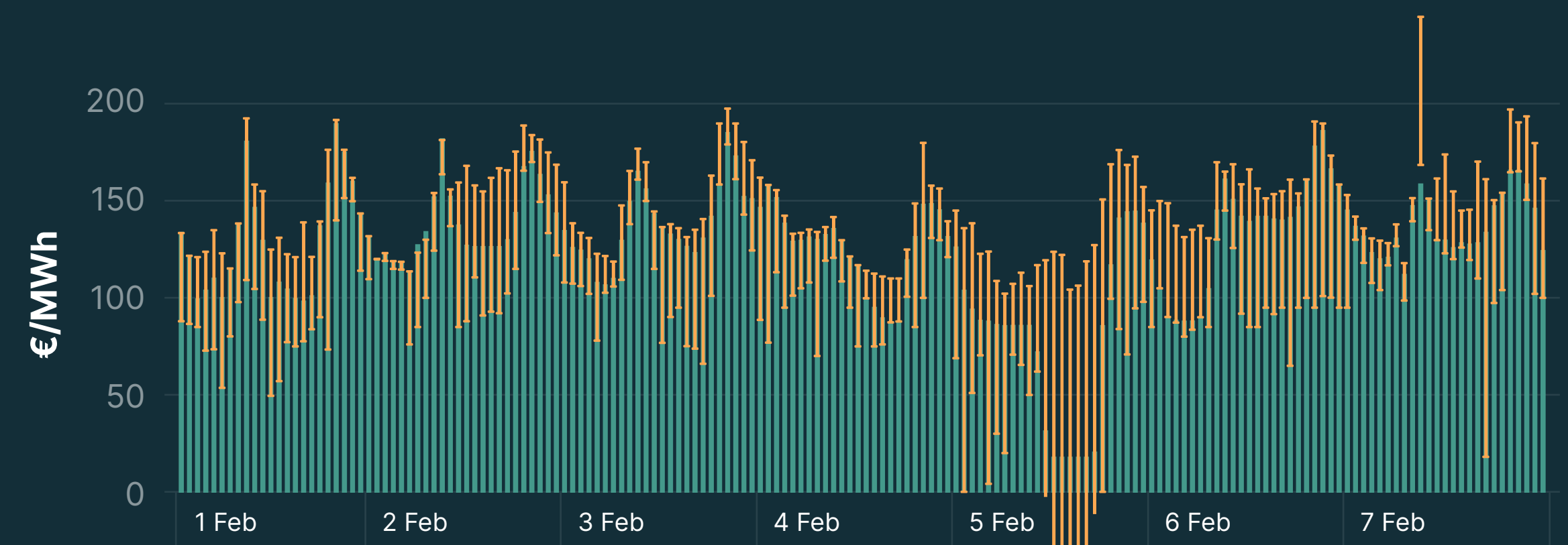


Price arbitrage is possible, but has thus far been economically unattractive

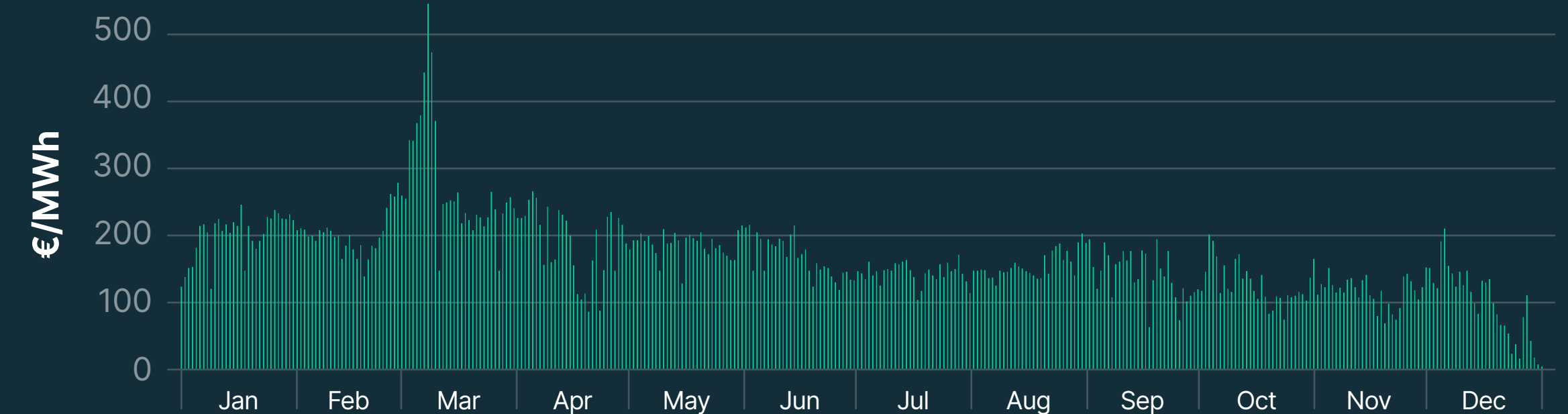
- As it stands, price arbitrage has not yet been profitable as a stand-alone business model for battery storage projects in Spain.^{39,40,41}
- Since revenue stacking is not allowed, utility-scale battery storage plants must choose between price arbitrage in wholesale markets or operating in Spain's capacity markets.⁴²
- To date, neither has been sufficiently attractive to mobilize investments at scale.

Hourly Day-Ahead Market prices (teal) and min/max continuous market (orange)

First week of February 2023⁴³



Daily average prices in 2022⁴³



Recent changes to Spain's renewable energy auctions provide additional support to storage systems

- In the past, Spain's renewable energy auctions were based on a 'first come first serve' principle in terms of securing grid access.
- Recently, Spain has shifted its auction design and identified 34 grid access points.⁴⁴
- Projects bidding to secure access to these sites are scored according to certain criteria (technical requirements, socioeconomic impact, environmental impact, etc.)
- In addition, one of the criteria is the hybridization with storage technologies.



Continued growth of customer-sited battery storage is expected

- With NRRP funds and recently announced tax incentives, the market for customer-sited storage is expected to maintain its recent growth rates in the coming years.
- If energy communities grow, the market for medium-size batteries (in the tens of kWh) is likely to expand further. Currently, there are 289 energy communities in total, of which 9 have storage systems.⁴⁵
- Over a longer timescale, the uncertainty is higher, as a higher share of renewable generation is likely to lower wholesale electricity prices. If household electricity prices follow, this could weaken the economics of customer-sited storage.



The economics of utility-scale projects likely to improve due to recent **policy and regulatory changes**

- At the beginning of 2023, the Spanish government submitted a power market reform proposal to tackle the growing volatility of electricity prices. Among other changes, the proposals could provide further support to flexible assets such as storage.⁴⁶
- In another potentially transformative development for Spain's fledgling utility-scale storage market, the government is developing legislation to allow revenue stacking.⁴⁷
- As these and other policy changes start to take effect, the utility-scale market is expected to play an increasingly important role in helping Spain achieve its broader energy and climate goals.



Endnotes

- 1 **UNEF (2022)**. Annual UNEF Report '(2022) Informe Anual UNEF - Energía Solar'. <https://www.unef.es/es/recursos-informes>
- 2 **Energy Storage (2022)**. Ingeteam provides four-hour BESS for world's biggest operational green hydrogen facility. <https://www.energy-storage.news/ingeteam-provides-four-hour-bess-for-worlds-biggest-operational-green-hydrogen-facility/>
- 3 **Energy Storage (2022)**. Ingeteam supplied full BESS solution to Spain's first solar-plus-storage project. <https://www.energy-storage.news/ingeteam-supplied-full-bess-solution-to-spains-first-solar-plus-storage-project/>
- 4 **Energy Storage Substation for Grid Resiliency and MV Renewable Integration (2018)**. <https://ease-storage.eu/news/energy-storage-substation-for-grid-resiliency-application-at-caravaca/>
- 5 **Cameron Murray (January 5 2023)**. Solar-plus-storage project with 200MWh battery system proposed in Spain, Energy Storage News, <https://www.energy-storage.news/solar-plus-storage-project-with-200mwh-battery-system-proposed-in-spain/>
- 6 **European Association for Storage of Energy (September 6 2018)**. Cortes-Muela: the largest pumped hydro storage station in continental Europe, <https://ease-storage.eu/news/la-muela-ii-is-the-largest-pumped-hydroelectric-storage-plant-in-europe/>
- 7 **SolarPaces (2017)**. CSP Project Development, <https://www.solarpaces.org/csp-technologies/csp-potential-solar-thermal-energy-by-member-nation/spain/>
- 8 **SolarPower Europe (2022)**. Electricity Storage for EU Renewable Deployment and Energy Resilience. https://api.solarpowereurope.org/uploads/SPE_whitepaper_on_electricity_storage_final_e8ac25707d.pdf?updated_at=2022-12-06T09:06:32.026Z
- 9 **UNEF (2022)**. Annual UNEF Report. <https://www.unef.es/es/recursos-informes>
- 10 See endnote 8 – SolarPower Europe (2022).
- 11 **Spanish Government (2019)**. Royal Decree 244/2019. <https://www.boe.es/buscar/doc.php?id=BOE-A-2019-5089>
- 12 **Forbes (2019)**. Renewable Energy in Spain: From The 'Sun Tax' To The Promotion Of Collective Self-Consumption. <https://www.forbes.com/sites/anagarciavaldivia/2019/04/15/renewable-energy-in-spain-from-the-sun-tax-to-the-promotion-of-collective-self-consumption/>
- 13 **Spanish Ministry of Energy Transition and Demographic Challenge (2021)**. Self-consumption Roadmap. https://www.miteco.gob.es/es/prensa/estrategiaalmacenamiento_tcm30-522655.pdf
- 14 **Otovo (2022)**. Subsidies for self-consumption PV installations. <https://www.otovo.es/blog/autoconsumo/subvenciones-placas-solares-autoconsumo/>
- 15 **IDAE (2023)**. Energy Communities Visualizer. <https://informesweb.idae.es/visorccee/>
- 16 **CountryEconomy (December 2009)**. Spain household electricity prices, <https://countryeconomy.com/energy-and-environment/electricity-price-household/spain?dr=2009-12>
- 17 **European Commission (2023)**. Quarterly Report on European Electricity Markets. Vol. 15. <https://energy.ec.europa.eu/system/files/2023-01/Quarterly%20Report%20on%20European%20Electricity%20markets%20Q3%202022.pdf>
- 18 **Eurostat 2023**. https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Electricity_price_statistics#Electricity_prices_for_household_consumers
- 19 **Energy Guide (February 15 2023)**. Average Cost of Electricity per kWh, <https://energyguide.org.uk/average-cost-electricity-kwh-uk/>
- 20 **Right Casa (2023)**. What Time is Electricity Cheapest in Spain? Hour by Hour, <https://rightcasa.com/what-time-is-electricity-cheapest-in-spain-hour-by-hour/>
- 21 **Statista (2023)**. Cumulative installed power capacity in Spain in 2022, by technology, <https://www.statista.com/statistics/1002759/installed-power-capacity-in-spain/>
- 22 **Sladjana Djunicic (January 6 2023)**. Spain's renewables share at 42.2% in 2022, Renewables Now, <https://renewablesnow.com/news/spains-renewables-share-at-422-in-2022-810506/>
- 23 **Red Eléctrica (December 22 2022)**. Wind and solar photovoltaic electricity generation break records in Spain in 2022, <https://www.ree.es/en/press-office/press-release/news/press-release/2022/12/wind-and-solar-photovoltaic-electricity-generation-break-records-spain-2022>
- 24 **Cameron Murray (January 9 2023)**. Spanish state providing EUR 150 million in grants for co-located energy storage projects, Energy Storage News, <https://www.energy-storage.news/spanish-state-providing-e150-million-in-grants-for-co-located-energy-storage-projects/>
- 25 See endnote 8 – SolarPower Europe (2022).
- 26 **Timera Energy (2021)**. Battery Investment Focus Shift to Spain. <https://timera-energy.com/battery-investment-focus-shifts-to-spain/>
- 27 **Red Eléctrica de España (2023)**. Installed Capacity Dataset. <https://www.ree.es/es/datos/generacion/potencia-instalada>
- 28 **European Commission (2019)**. Spain's Integrated National Energy and Climate Plan. https://energy.ec.europa.eu/system/files/2019-06/ec_courtesy_translation_es_necp_0.pdf
- 29 **Red Eléctrica de España (2023)**. Generation Dataset. <https://www.ree.es/es/datos/generacion>
- 30 **University of Seville (2019)**. Energy Storage Economic Analysis via Li-Ion Batteries in the Electric Grid. <https://idus.us.es/bitstream/handle/11441/92223/TFM-1398-PEREZ.pdf>
- 31 **Ramos Galán et al., Papeles de la Economía española (2023)**. Analysis of Electric Storage Needs in Spain 2030. <https://www.funcas.es/wp-content/uploads/2023/01/PEE-174-WEB.pdf>
- 32 **ATA Insights (2022)**. Webinar: Is Spain the Next Growth Market for Energy Storage?. <https://www.youtube.com/watch?v=0McpgXPh3uw>
- 33 See endnote 8 – SolarPower Europe (2022).
- 34 **Spanish Ministry of Energy Transition and Demographic Challenge (2020)**. Renewable Energy Economic Regime. <https://energia.gob.es/electricidad/energias-renovables/Preguntas-Frecuentes/Paginas/FAQs-regimen-economico-energias-renovables.aspx?Faq=Almacenamiento...>
- 35 See endnote 5 – Cameron Murray (January 5 2023).
- 36 See endnote 28 – European Commission (2019).
- 37 **Spanish Ministry of Energy Transition and Demographic Challenge (2021)**. Energy Storage Roadmap. https://www.miteco.gob.es/es/prensa/estrategiaalmacenamiento_tcm30-522655.pdf
- 38 **Spanish Presidency (2021)**. Recovery, Transformation and Resilience Plan: Renewable Energies, Green Hydrogen and Storage. https://planderrecuperacion.gob.es/sites/default/files/2021-12/PERTE_Energias%20renovables_14122021.pdf
- 39 See endnote 30 – University of Seville (2019).
- 40 See endnote 31 – Ramos Galán et al., Papeles de la Economía española (2023).
- 41 See endnote 32 – ATA Insights (2022).
- 42 See endnote 34 – Spanish Ministry of Energy Transition and Demographic Challenge (2020).
- 43 **OMIE (2023)**. Datasets. <https://www.omie.es/es/file-access-list>
- 44 **BOE (2021)**. Mudejar "Just Transition" node access tender. <https://www.boe.es/boe/dias/2021/11/03/pdfs/BOE-A-2021-17966.pdf>
- 45 See endnote 15 – IDAE (2023).
- 46 **Spanish Government (2023)**. Proposal to Reform the EU's Wholesale Power Market. https://table.media/europe/wp-content/uploads/sites/9/2023/01/230110_Strommarktreform_Non-Paper_ES.pdf
- 47 **CMS (2022)**. Energy Storage Trends – Spotlight on Spain. <https://cms-lawnow.com/en/ealerts/2022/10/energy-storage-trends-spotlight-on-spain>

