

UNITED KINGDOM

KINGDOM

Analysis of the
Battery Storage Market



Acknowledgements

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The market for battery storage in the UK is **growing rapidly**, spurred on by a combination of policies and supportive market rules

- The UK's battery storage markets is among the largest in Europe, with both utility-scale and distributed battery storage systems experiencing significant growth.^{1,2,3,4}
- Like in Italy, utility-scale battery storage systems in the UK benefit from the ability to earn multiple revenue streams.⁵
- At the distributed scale, battery adoption has been closely coupled with the development of household solar PV systems.
- Based on new data and recent policy developments, both market segments are poised to grow significantly in the coming years.



A major driver of battery adoption in the UK is the **growing share of variable renewables**, in particular wind power

Total installed capacity in 2021 (all sources)^{6,7}

103 GW



Share of wind and solar in electricity mix (Q4:2022)⁸

32.7%



Fossil Gas
38%

Nuclear
15%

Coal **2%**

Other **4%**

Electricity Supply in the UK (2022)

Total Supply = 326 TWh⁸

Renewables **41%**

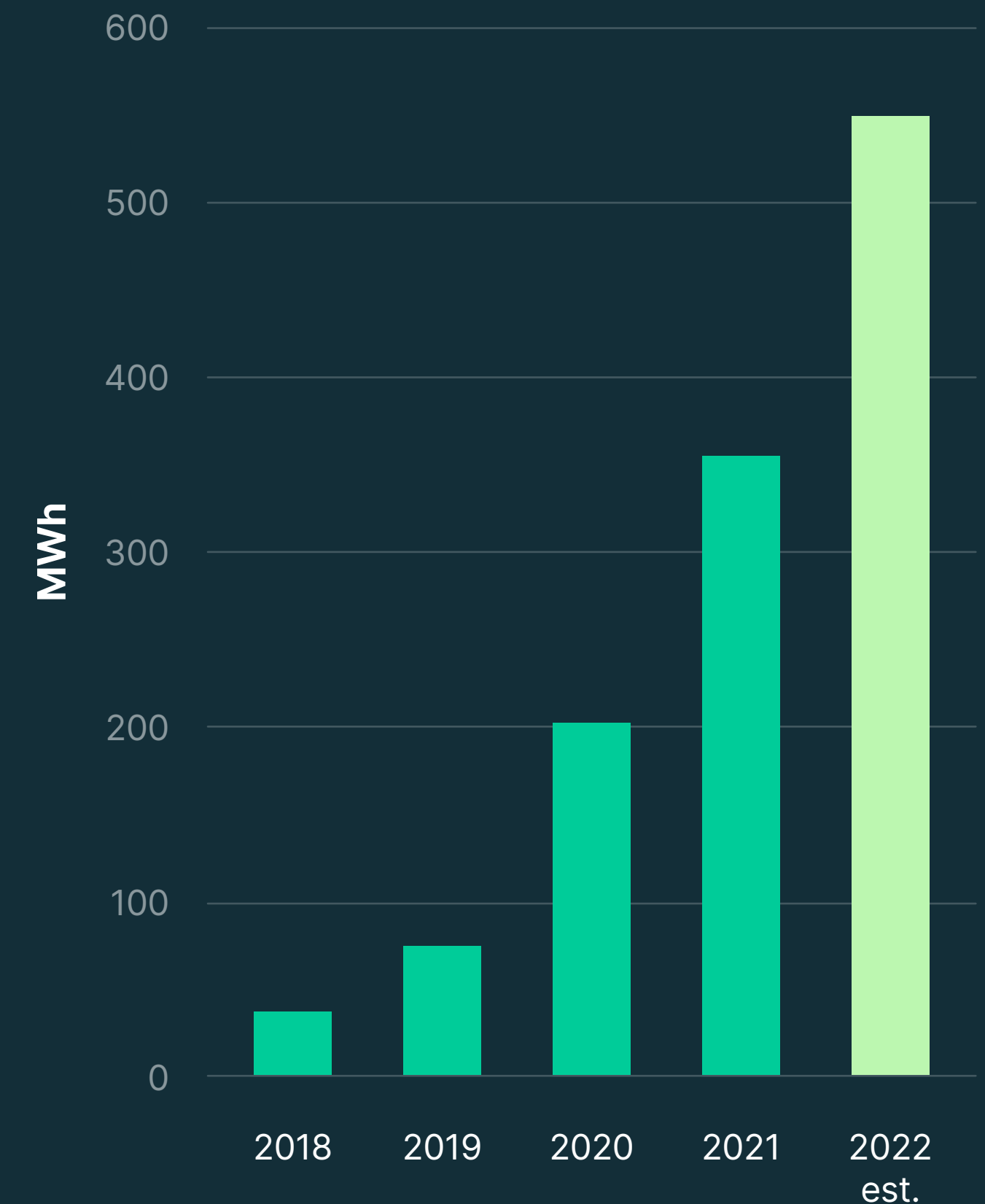
Renewables are now the single largest source of supply in the UK, providing 41% of the UK's total power supply

Recent **policy developments** are supportive of further **customer-sited storage adoption**

- As of April 2022, the value added tax (VAT) for households installing new battery storage systems coupled with solar PV has been set to 0% until April 2027.⁹
- This policy change is likely to significantly accelerate the adoption of customer-sited solar+storage systems.

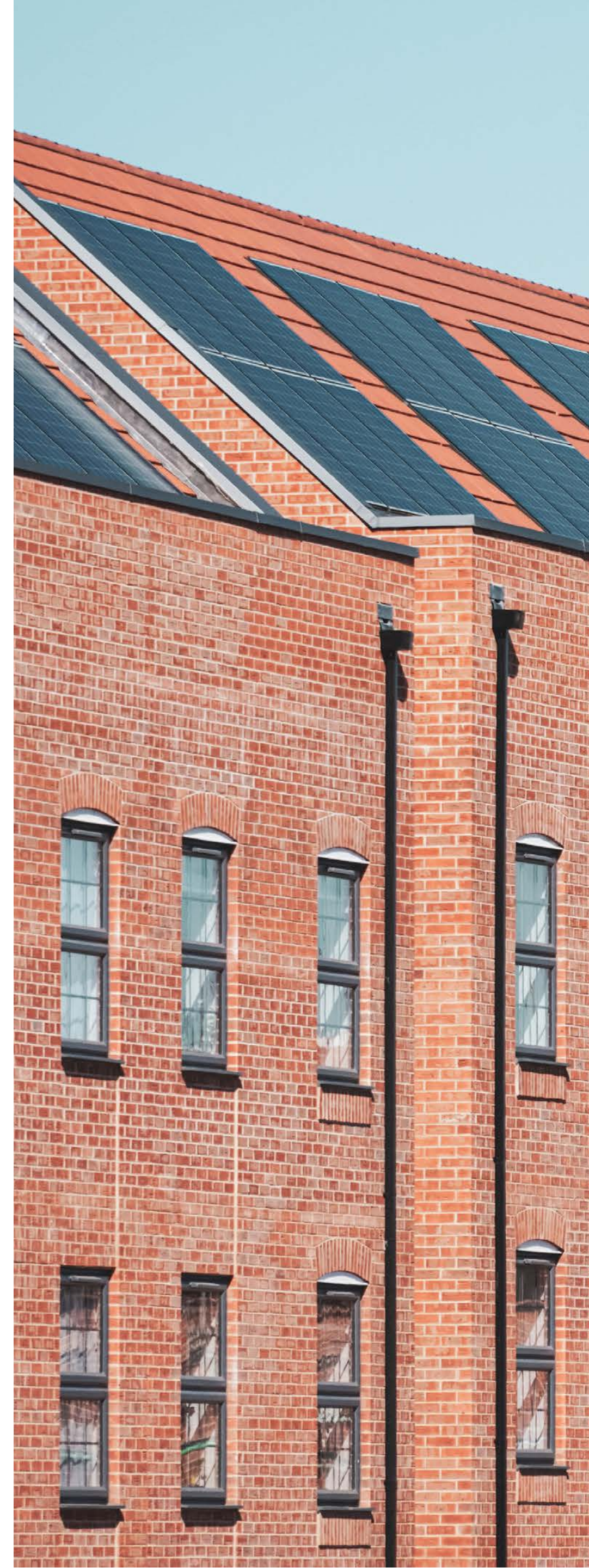


UK Cumulative Residential Battery Capacity Deployment¹⁰



Most customer-sited battery systems to date are **coupled with solar PV**

- Adding battery storage to a solar PV system can improve the economics of going solar by increasing self-consumption and reducing reliance on the grid.
- The share of residential solar PV systems equipped with batteries has grown from 6% in 2019 to 45% in 2021.^{11,12,13}



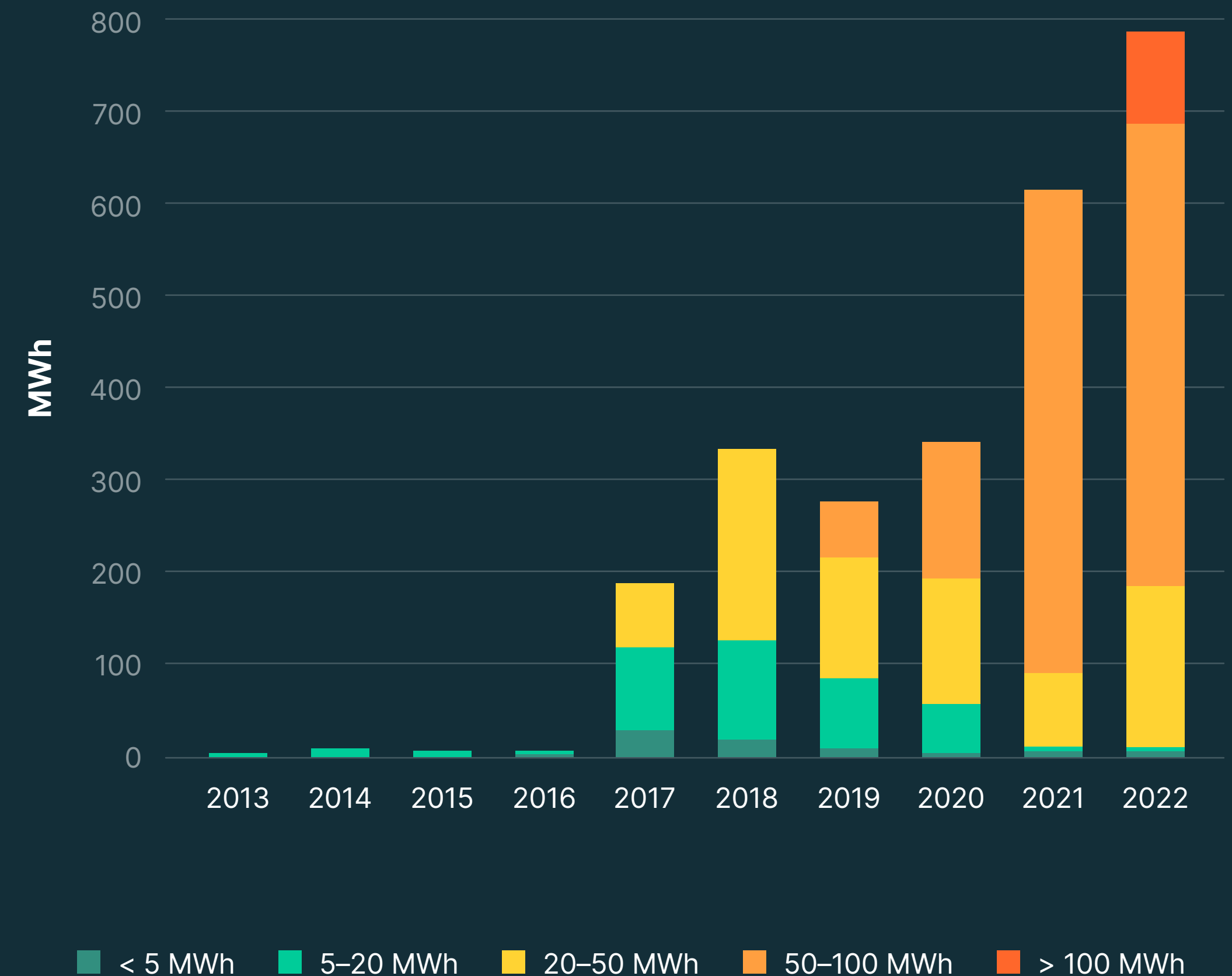
Share of residential solar PV systems combined with battery storage by year^{11,12,13}



The total **utility-scale** battery capacity is approximately 5x larger than customer-sited capacity

- By end of 2022, utility-scale batteries reached a total of 2.4GW/2.6GWh.¹⁴
- The utility-scale market segment has grown at an annual average of 50% over the past four years.
- Between 2021 and 2022, a total of 18 projects over 50MWh were connected to the grid.¹⁴
- The bulk of new utility-scale battery storage capacity being added is now in the 50-100MWh market segment.

Utility-scale battery adoption by project size category¹⁴



The UK's storage project pipeline dwarfs its current capacity by a factor of almost 30

- Around 20GW of future storage capacity has been approved and is expected to become operational in the next four years.¹⁵
- This represents an almost 10-fold increase over current installed capacity.
- A further 39GW of projects are currently at various stages of planning permission.

Build status of energy storage projects in the UK

(Jan 2023)¹⁵



Several steps have been taken to facilitate **market access** for storage systems in the UK

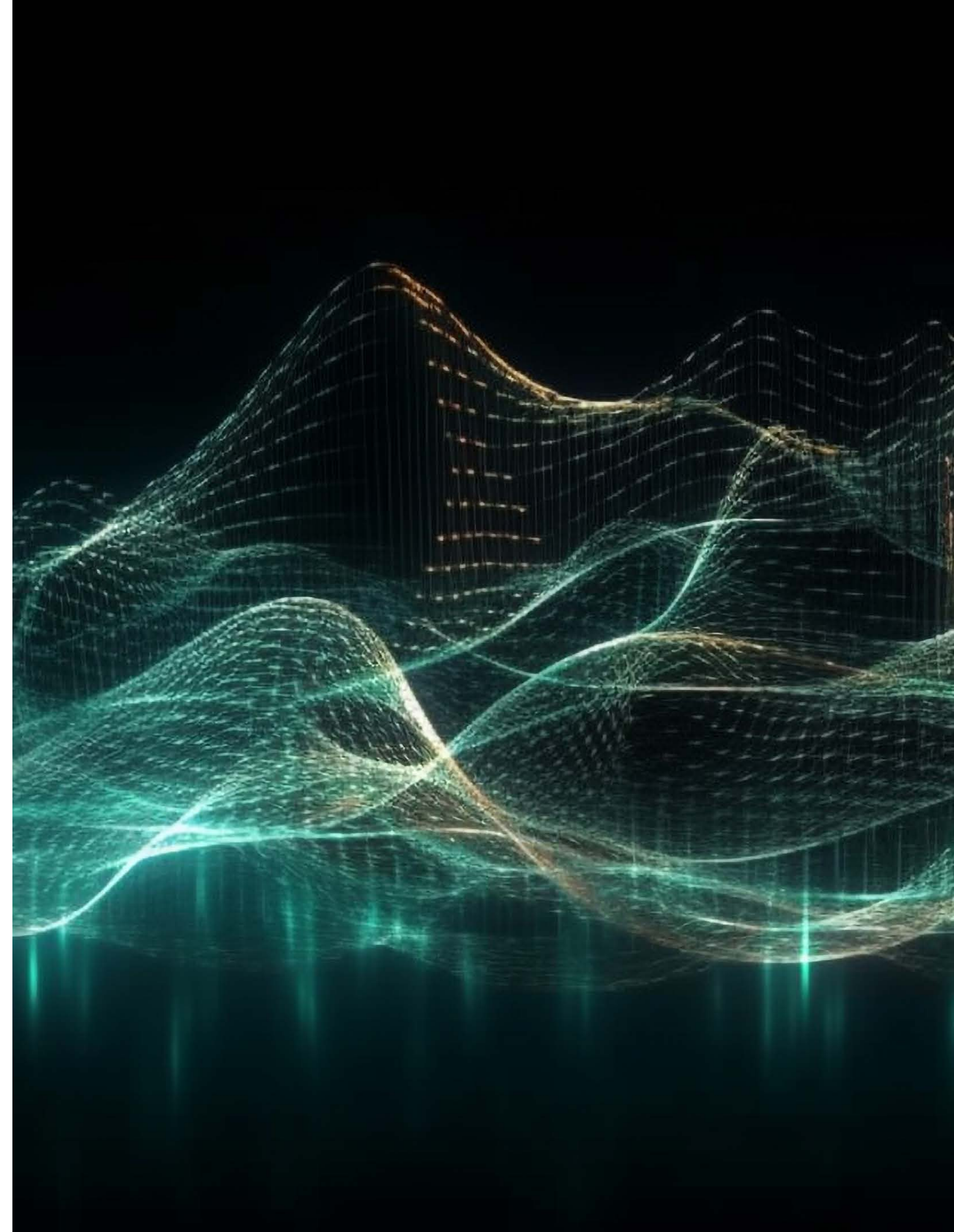
- Access to the balancing market has been eased¹⁶
- The implementation of a new fast frequency response service
- Lowering of the capacity threshold to 1 MW to participate in capacity markets, enabling smaller storage projects to compete
- The elimination of double charging¹⁷

Collectively, these and other measures have helped make UK one of the most dynamic markets for battery storage in Europe.¹⁸



Ancillary services vital to power system reliability

- Storage project operators can earn revenues from the provision of a range of ancillary services to the UK power grid.¹⁹
- The most common services delivered by batteries are voltage management, reserve services, and frequency response.
- As the share of variable renewables like wind and solar in the UK's power system has grown, the UK has started to experience greater variations in grid frequency and a greater need for grid support services.
- Utility-scale batteries are proving to be reliable and cost-competitive providers of a wide range of grid services.²⁰



Limiting batteries' involvement to frequency control **understates their potential**

- As the number of utility-scale batteries grows, battery operators are starting to look beyond frequency response to other services.
- The UK government is exploring widening the range of new services that battery storage operators could provide, including virtual inertia, system resilience, active filtering and voltage unbalance mitigation.²¹
- In addition, local markets are being tested where storage will provide flexibility to zonal distribution networks.²²

Range of services that battery storage can provide²³



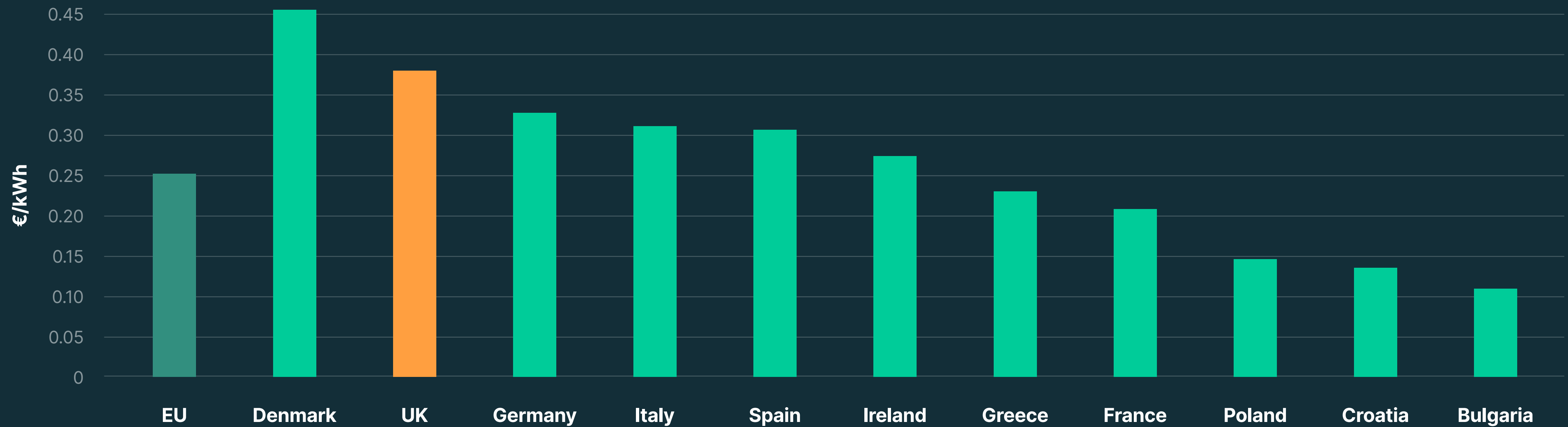
Storage is starting to be deployed to mitigate curtailment

- The UK currently suffers from high levels of curtailment during certain hours of the year.²⁴
- The brunt of this curtailment is currently borne by the country's wind power projects.
- In 2022, 7% of total electricity generated nationwide was curtailed.²⁵
- Storage provides one way to mitigate curtailment,²⁶ with major players starting to explore the benefits of co-locating projects with storage.²⁷



The UK's **electricity prices** remain relatively high

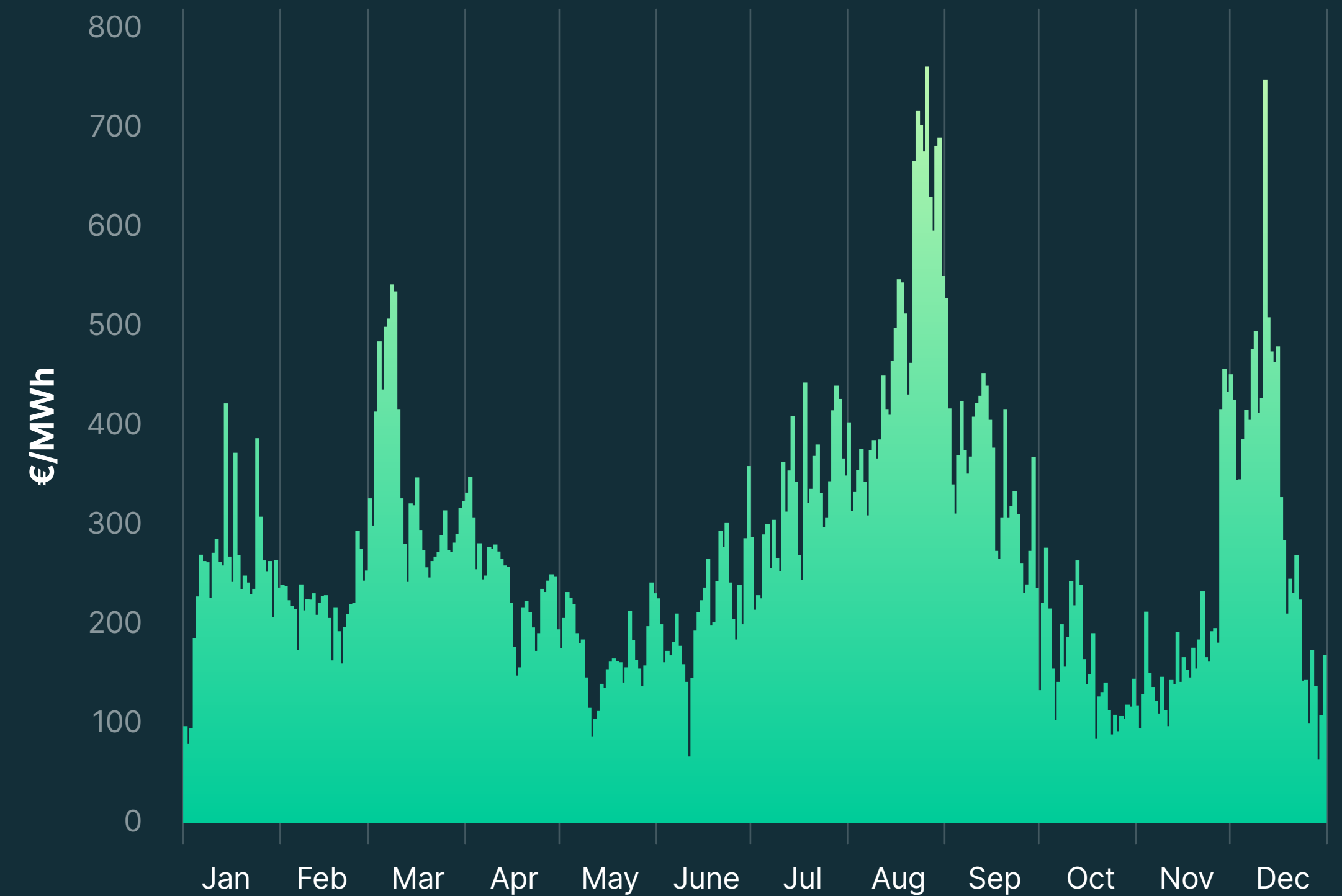
The UK's electricity prices for households currently stand at over EUR 0.38/kWh on average, putting them above many of their European peers.^{28,29,30}



The next frontier for battery operators in the UK is the **wholesale market**

- Another way storage projects can diversify their revenues is through arbitrage: buying low and selling high.
- Due to in part to its relatively high reliance on fossil gas, combined with daily and seasonal changes in power supply and demand, the UK electricity system regularly experiences significant price fluctuations.³¹
- Storage can help mitigate this volatility by increasing supply during times of scarcity, helping keep prices lower for customers in the process.

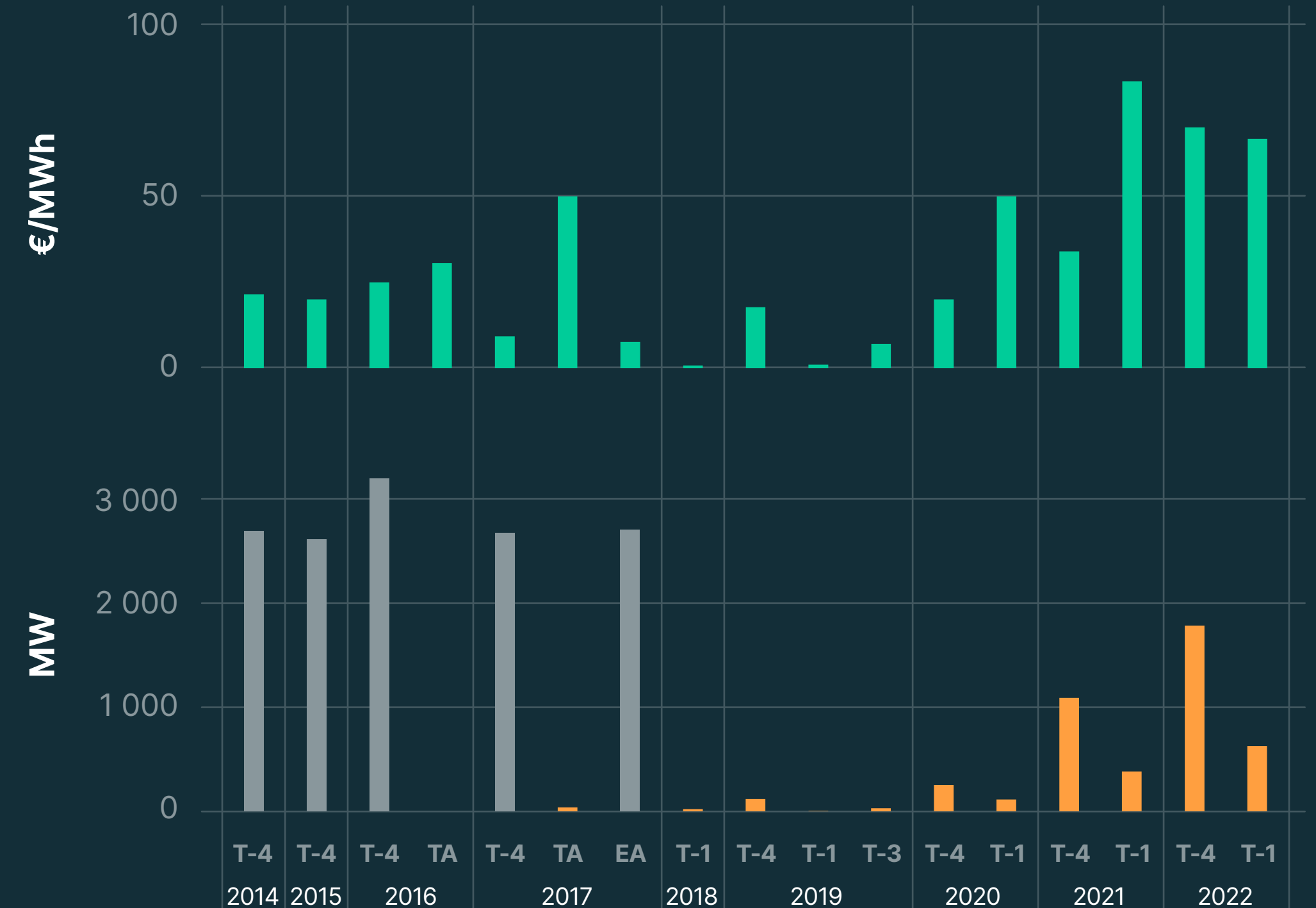
Daily average day-ahead market prices
(2022)³²



Another area where storage has started to play an important role is in the UK's capacity market

- Capacity markets have been operating in the UK since 2014, with storage projects able to participate since the beginning. Prices are currently in the range of 60 €/kW/year, having increased significantly from 20–30 €/kW/year in 2014–2016.³³
- Of the new-build projects to win in the UK's latest capacity market auction, battery storage projects secured 54% of the auctioned capacity, totalling 568MW.³⁴
- Half the systems are equipped to provide 1-hour storage, while 40% are equipped to provide 2-hour storage.³⁴

Capacity Market Results: Pricing³³



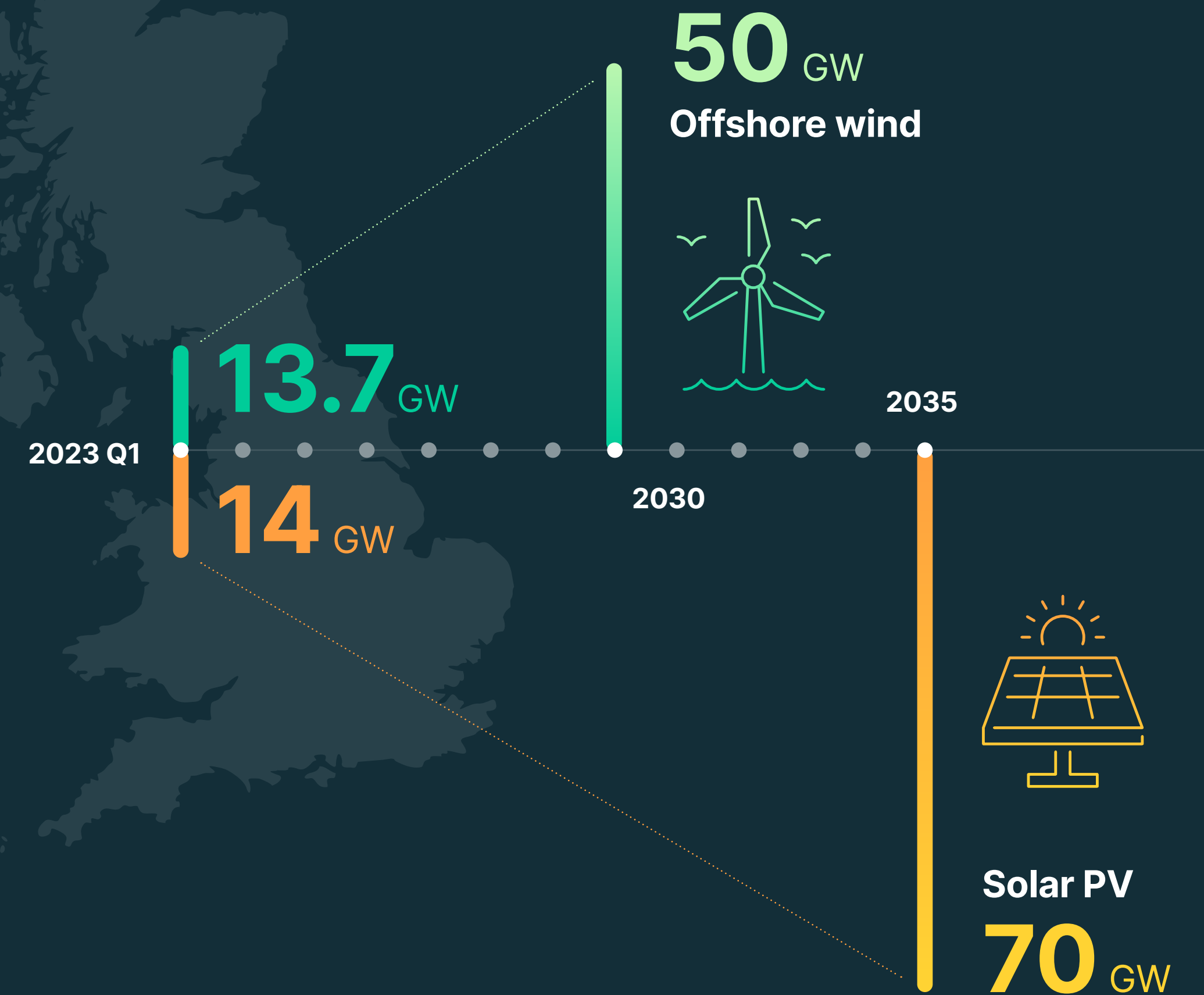
Storage Deployment under the UK's Capacity Markets³³

Grey bars lump all storage systems together (pumping, compressed air and batteries).
Note: £ to € conversion rate is 1.13

The UK government is targeting a **substantial increase** in renewable generation

- Unlike many jurisdictions across the EU, the UK does not yet have formal energy storage targets. It does, however, have ambitious targets for the growth of renewables such as solar and wind.

UK National Renewable Energy Targets^{35,36,37}



Both small-scale and utility-scale projects are **poised for substantial growth** in the coming years

- Since battery assets can be flexibly managed, deriving some of their revenues from contracted services and the rest from other activities like arbitrage, different operating strategies can significantly impact how profitable each individual storage project is.
- The flexibility offered by storage makes it a valuable addition not only to the UK power system, but also to its overall energy transition.



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