



Unlocking opportunity

Analysing Spain's battery storage landscape



LCP Delta and Santander Corporate & Investment Banking

Providing insight, analysis and finance to support the global energy transition

LCP Delta and Santander have combined their expertise to provide this report into the opportunity for investment in battery energy storage systems (BESS) in Spain.

LCP Delta provide in depth forecasting and analysis across power markets

- Provide detailed revenue forecasts for the lifetime of assets; covering the full suite of technologies and with a specific focus on BESS.
- Relied on and trusted by key decision makers, such as DESNZ and National Grid ESO.
- The only long-term forecasters who also support traders in real time.
- Provide research subscription services across energy storage and flexibility to help clients capture opportunities in these growing markets
- Economic, policy and regulatory analysis on the changing landscape of energy.
- Bringing detailed insights into the evolution of demand and its interaction with the power market.

Santander are a leading global renewable energy financial advisor and lender, with unparalleled experience in BESS financings

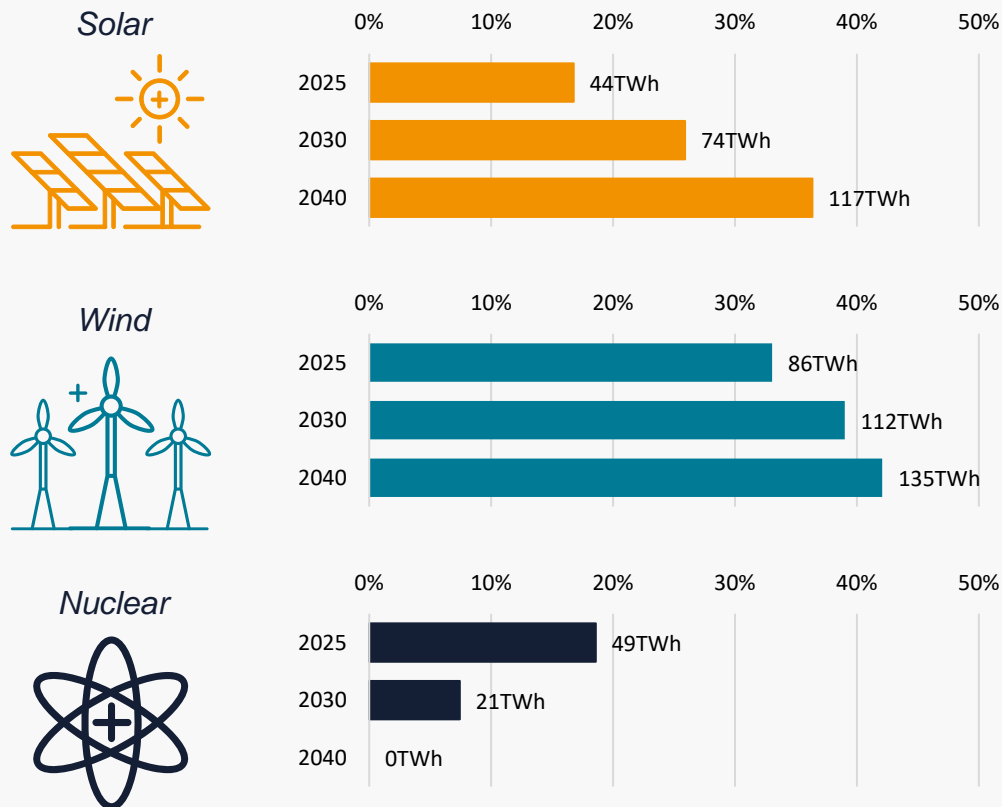
- #1 ranked financial advisor for project finance globally
- Winner of the PFI Award for Best Global Advisory House in 2019 and 2022
- Successfully closed 17 BESS financings since 2019 deploying > €0.5Bn of capital
- Actively supporting clients across all aspects of the renewable energy sector from established technologies such as wind, solar and EfW; through to nascent sectors such as BESS, biogas, hydrogen, SAF and CCU

Spain will be heavily reliant on solar for low carbon power

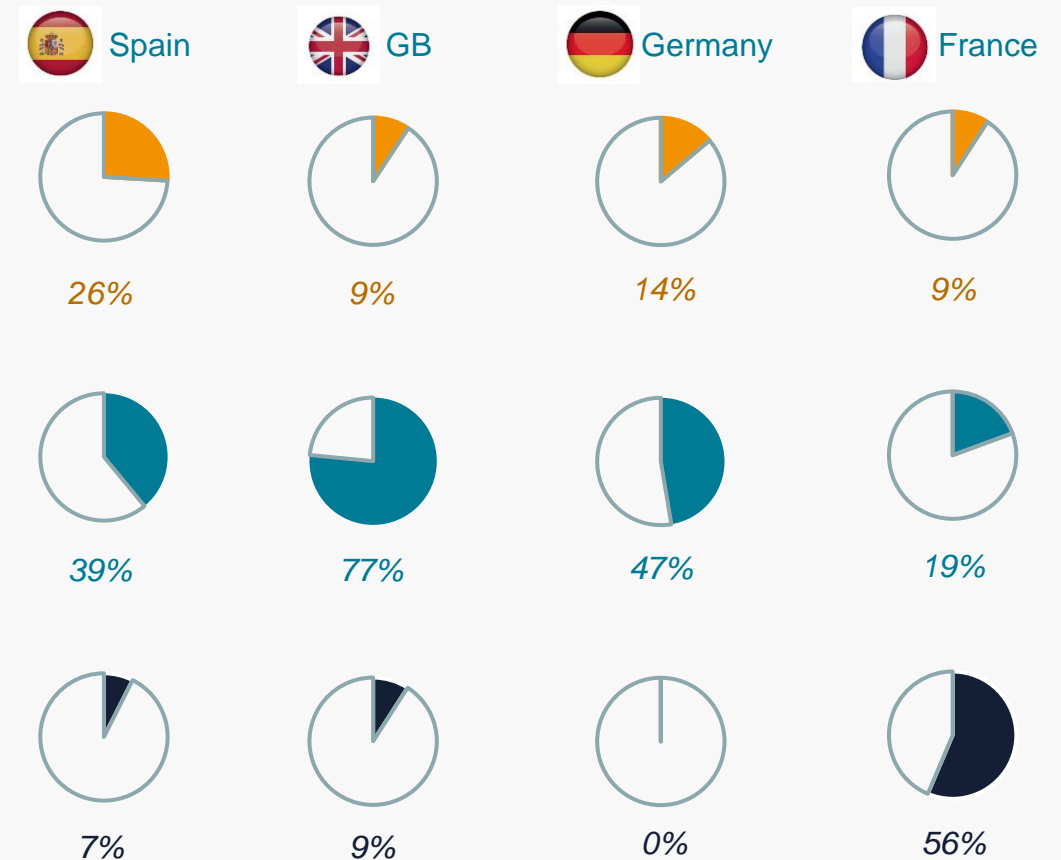
A 2030 comparison of low carbon power generation across European countries

The prevalence of solar generation - with a strong daily pattern – will affect the capacity and type of power storage needed in Spain. This will be different to other European markets whose low carbon transition are wind & nuclear dominated.

Proportion of demand met in Spain by generator type



European comparison of generation breakdown in 2030

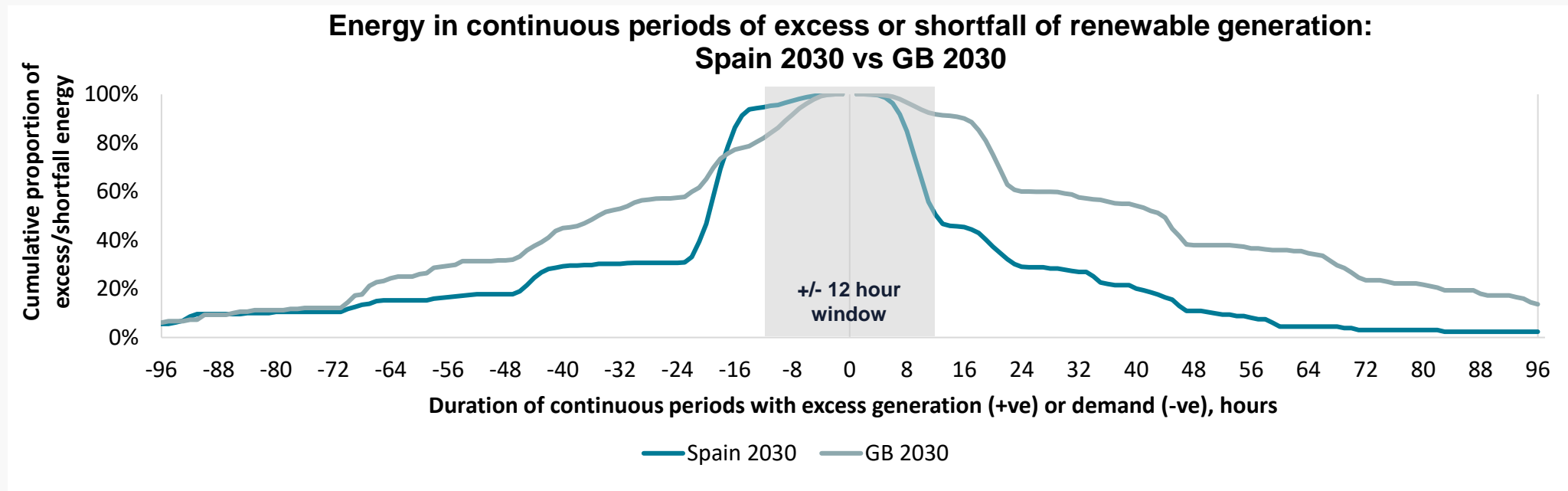


Sources: ENTSO-E TYNDP 2022 National Trends Scenario, and NGESO FES 2023 Consumer Transformation Scenario

Impact of high solar generation in Spain in 2030

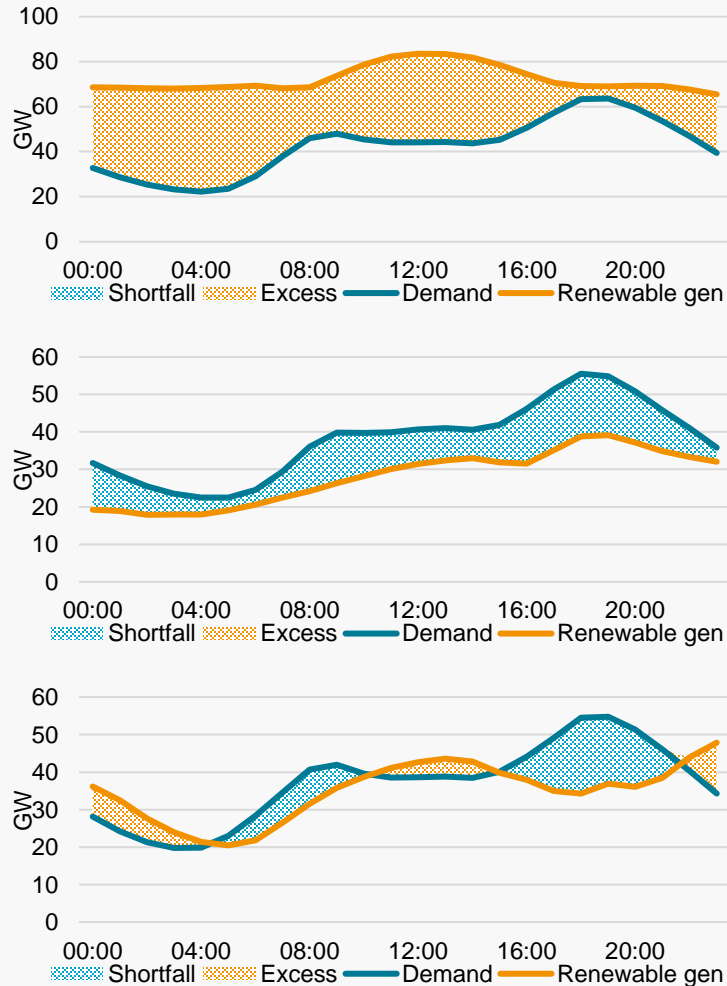
Shorter duration storage is well suited to solar dominated markets like Spain

- Due to the different generation mix, the duration of excess or shortfall of electricity will be shorter in Spain than Great Britain (GB). This is primarily due to the daily generation profile of solar energy and the longer-term patterns in wind generation, which can last for weeks. **As a result, shorter duration storage options like batteries are more suitable in Spain.**
- In Spain, over 50% of excess renewable energy occurs in periods where there is continuous excess for less than 12 hours i.e. a battery that chooses to charge on this energy would be able to discharge within 12 hours. This allows batteries to charge and generate within a day.
- Meanwhile, periods of excess generation in GB will typically be longer than can be met by short duration storage. This gives batteries fewer opportunities to cycle within a day and suggests more opportunities for longer term storage in markets such as GB.



Batteries in Spain have more opportunities to cycle within a day

Batteries are more effective when there are periods of excess energy and shortfalls within the day



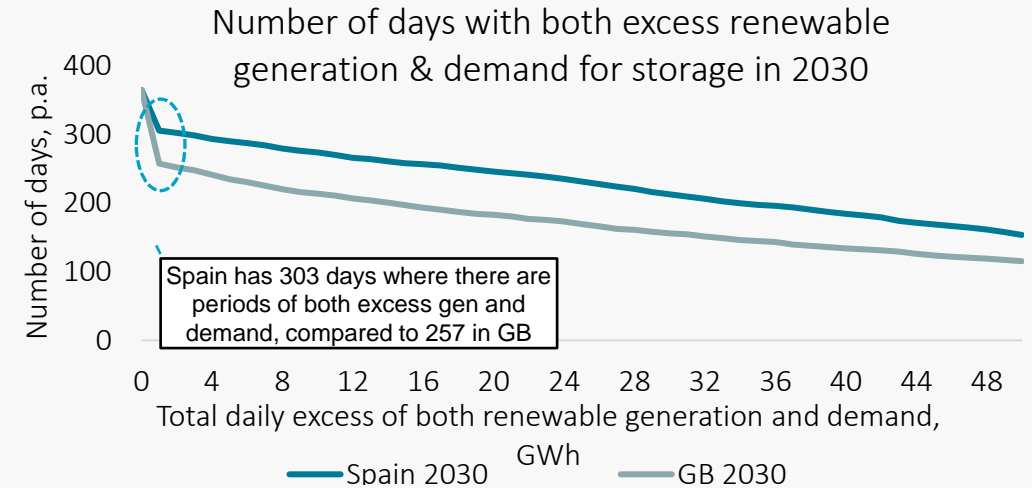
Three day types - with type (3) being the most attractive to BESS:

(1) Where there is an **excess of renewable generation over a full day**, storage will not be able to discharge any stored power within the day.

(2) Equally, storage may not be able to charge at very low prices due to excess renewables **if demand exceeds renewable generation all day**.

(3) **Ideally, there would be periods of excess and shortfall within the same day**, driving price differentials which make battery storage profitable.

We estimate that in 2030, batteries in Spain will have over 300 days when they can charge and discharge within a day



Analysis – Opportunity for Spain compared to GB

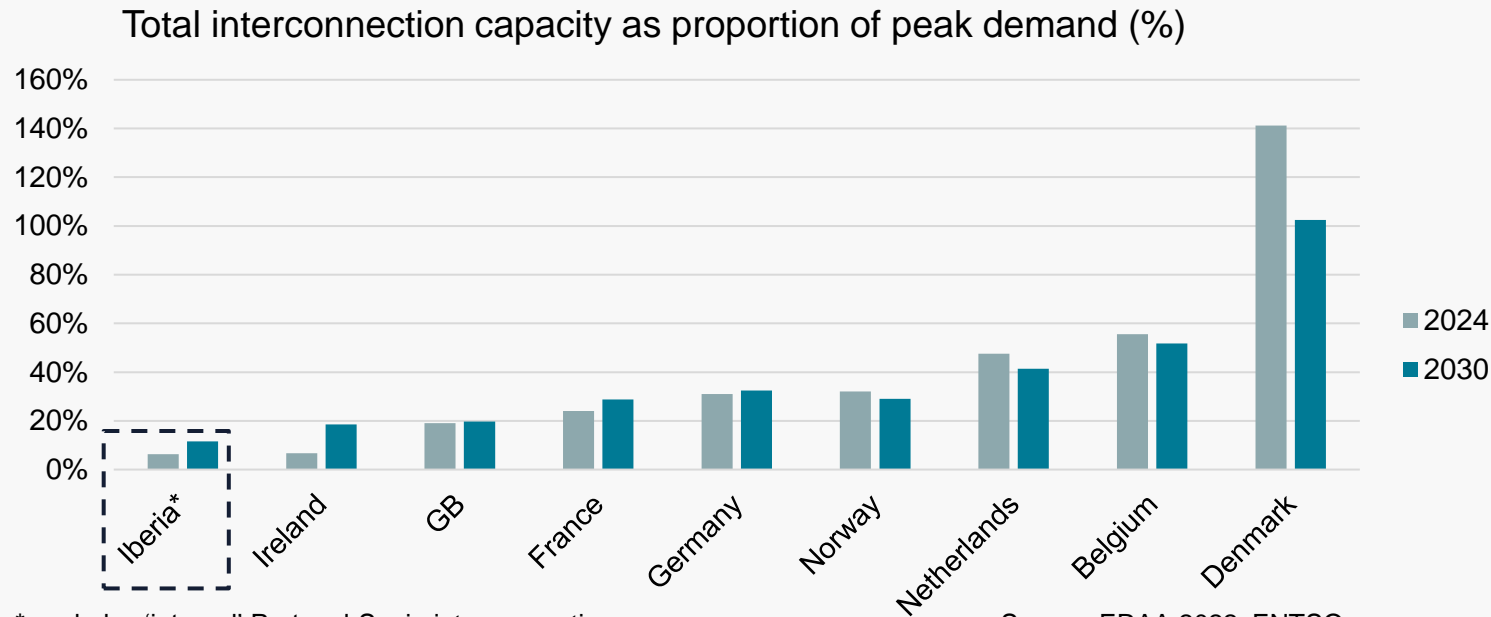
Days with only periods of excess renewable generation (1) or where demand exceeds renewable generation (2) are more common in GB than in Spain in 2030 due to a higher proportion of renewable generation coming from wind, which has longer term fluctuations than solar.

Meanwhile, the daily profile of excess and shortfall within day (3) is much more common in Spain than GB. We estimate the number of these days per year in 2030 to be around 250 days in GB but over 300 days in Spain.

Limited interconnection isolates Spain's system from the rest of Europe

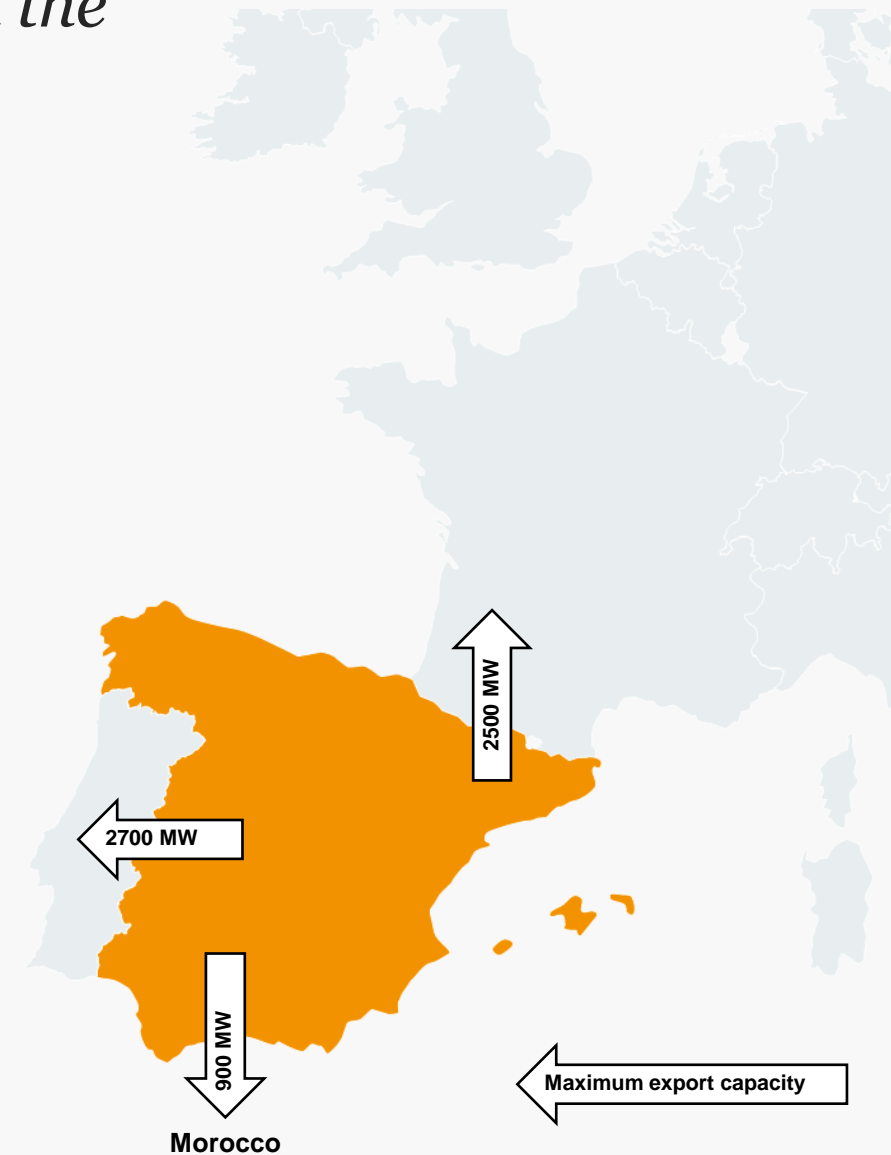
Low levels of interconnection limits competition for Spanish storage

- In addition to high renewable targets, Spain is relatively isolated from other markets and only has limited import and export capacity to France, Portugal and Morocco. An additional 2.2GW is planned that will increase the connection with France by 2028.
- This lack of interconnection isolates the Iberian markets from the rest of Western Europe, meaning Spanish storage faces limited competition from cross-border flexibility.



* excludes 'internal' Portugal-Spain interconnection

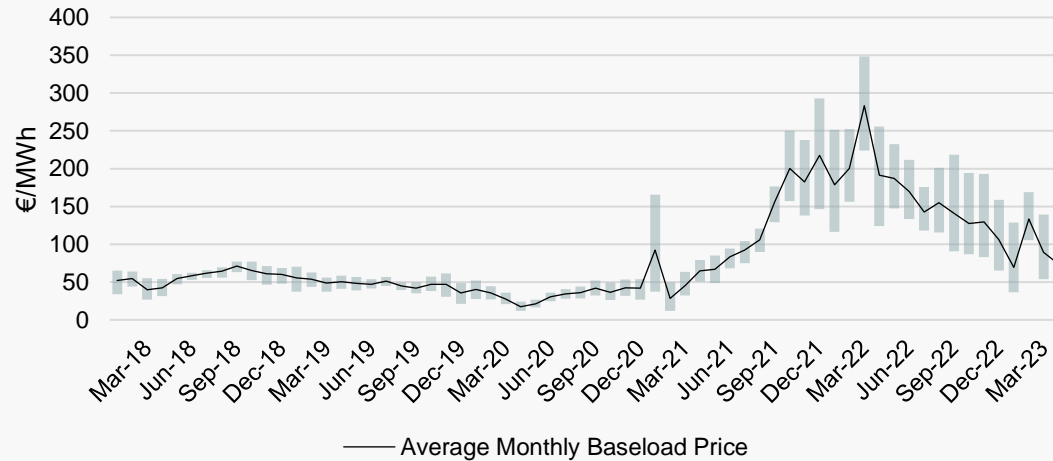
Source: ERAA 2022, ENTSO-e



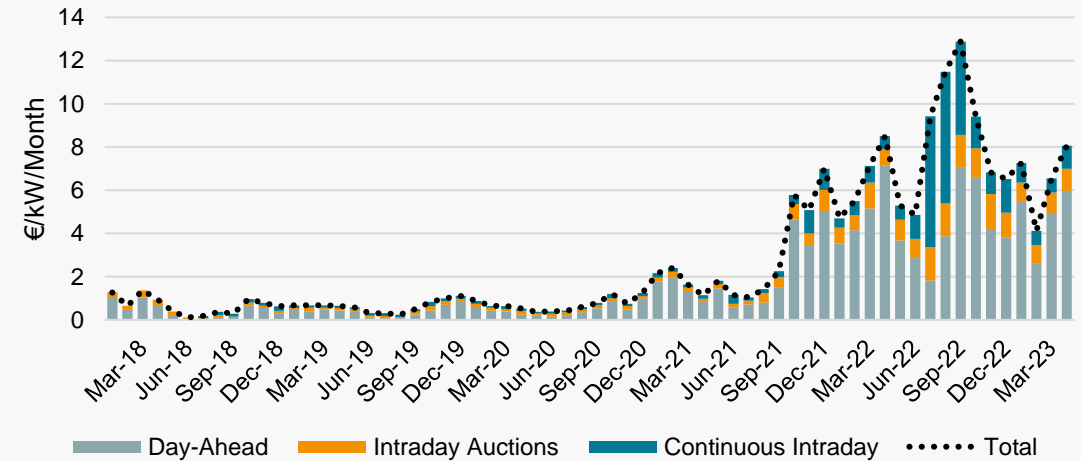
Energy market revenues have increased for batteries

Battery margins for wholesale trading have increased, but need to be stackable

Iberian Day-Ahead Market Price Volatility



Modelled Battery Wholesale Margins



- Wholesale price spreads in the energy market have increased over the past 2 years. Since 2021, despite the gas price cap introduced by the Spanish government on generators, high gas prices have led to much greater price volatility for batteries to capitalise on.
- A modelled 50MW, 2-hour battery, with a roundtrip efficiency of 87% and trading in the Iberian market could have captured an average margin of €7.04/kW/month between September 2021 to December 2022 with a maximum of €12.87/kW/month achieved in September 2022. Prior to 2021 the lower price volatility meant that there were fewer periods of high price spreads, which has limited the opportunity for batteries to gain high energy margins.
- Potential margins for batteries have been driven by the wholesale price volatility from the recent current gas supply crisis. Even as gas price volatility eases, we can expect continued electricity price volatility in the future as a result of intermittency from the increasing share of solar in the generation mix.
- **Battery assets would be increasingly investible with additional revenue stacked from other sources such as Ancillary Services (i.e. FCR, aFRR, mFRR) and the capacity market, in addition to value from wholesale trading.**

Summary - there are strong opportunities for BESS investment

With high spend on flexibility services, continued growth in solar capacity and limited interconnection, Spain will require significant levels of BESS

While there are positive steps - with the government consulting on providing grants to storage - the current regulatory barriers and delayed support are limiting the current pipeline.

- A power system heavily solar dependent in 2030 will require high levels of short duration battery storage installed in Spain in the near future.
- Spain is relatively isolated from other markets and only has limited import and export capacity to France, Portugal and Morocco. This means that Spanish storage faces limited competition from cross-border flexibility.
- The Spanish Government have recognised the need for storage and set a target of 22GW by 2030. We expect this to be predominantly battery storage. Whilst the overly restrictive requirements for co-located storage have limited take-up in the latest renewables auction, the recent consultation on grants for 600MW of energy storage is a positive step towards meeting the Government's target.
- Spanish wholesale markets have offered increasing revenues due to recent price volatility which rewards BESS through power trading. However, sustained investment in batteries will be supported by fully opening up markets. We believe that the investment case would be further strengthened where BESS is able to access the TSO spend on flexibility services and the introduction of the capacity market.



€4.8bn will be required to meet the Spanish Government's target

Addressing Spain's ambitions will require considerable investment in BESS projects with senior debt requirements of up to €3.4 billion

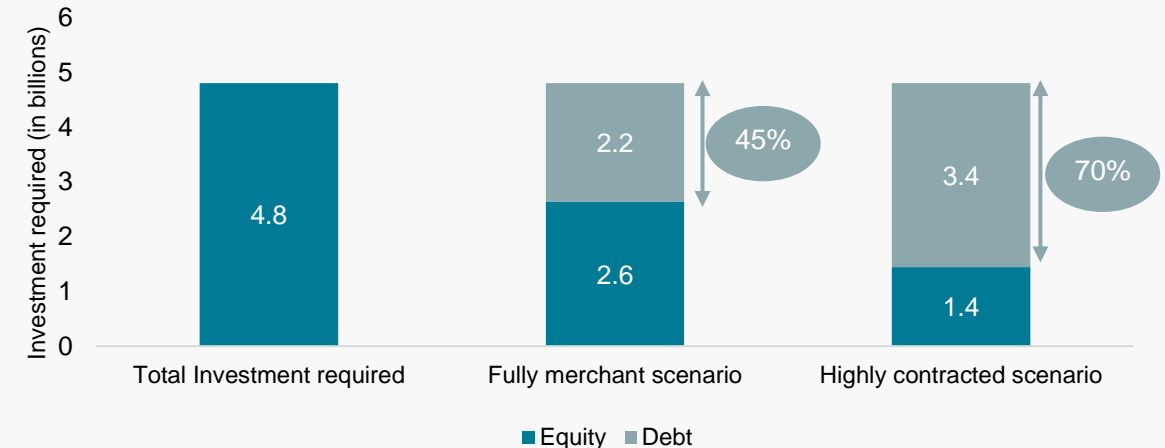
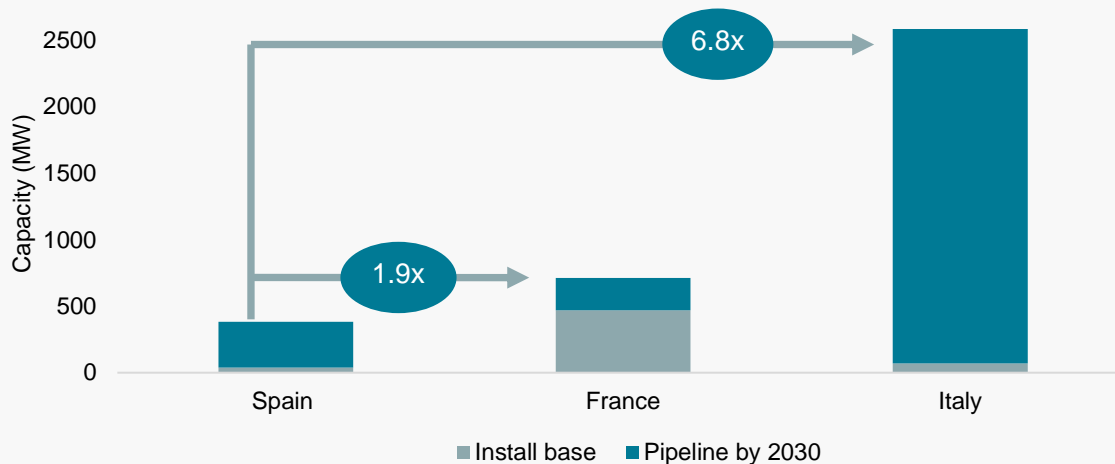
Spain's BESS pipeline lags equivalent markets...

- Despite having a small install base, Italy's current install base and 2030 pipeline is 6.8x that of Spain's due to the presence of a Capacity Market and Firm Reserve (similar to FCR) tenders.
- To start addressing this, the Spanish Government announced that it will provide grants to support the deployment of 600MW of BESS¹. This initial support needs to be coupled with access to reliable, long term revenue streams that are not currently accessible.

...with significant capital required to close this gap

- Financial support for BESS capex is closely aligned with underlying revenue streams. Whilst a fully merchant project could raise up to 45% of the total funding requirement, if contracted revenues are secured, such as the ones provided with a Capacity Market, gearing could increase to up to 70%.
- As regulation evolves, we expect the Spanish government to open up with highly attractive new markets for batteries, such as Capacity Market, Contracts for Difference or Fast reserve, which could provide a higher degree of contracted revenues. Each contracted revenue stream will have a different off-taker as well as a different remuneration mechanism, both of which will have to be carefully analysed and will define the gearing ratio.

BESS Capacity by Country



(1) SOURCE: [Ministerio para la Transición Ecológica y el Reto Demográfico - Detalle Participación Pública \(energia.gob.es\)](https://www.energies.gob.es/participacion/ingles/ingles_detalle_participacion_publica.htm)

Selected Experience



Portfolio analysis & Market forecasts



Provided this leading UK developer of flexible generation with revenue forecasts, both for a wide range of existing and potential new assets (batteries, thermal, renewable & hydrogen). Provided portfolio analysis to support raising of further investment, covering robustness to range of scenarios and diversification benefits

Market modelling across several assets



Analysis and modelling to support RWE market forecasts, including participation in the capacity market auctions and asset valuations

Department of Energy & Net Zero (DESNZ)



















Provided UK Government with their primary long term power market model, the Dynamic Dispatch Model. Providing analysis on the need for long duration energy storage in GB markets and, separately, assessing the value of locational pricing to inform policy decision.

Battery and long duration storage support (2019 – Present)

Provided analysis and modelling to support storage developers, investors and operators on 30+ projects, including BESS, co-located assets and long-duration storage across markets.

Publications

- [Renewable curtailment and the role of long duration storage](#)
- [Has 2021 changed the outlook for battery storage investment?](#)

<p>UK 2023</p>  <p>RCF for utility-scale energy storage global portfolio</p> <p>GBP 50,000,000 MLA and Agent Bank</p> 	<p>UK 2023</p>  <p>Financing the construction of a battery storage portfolio</p> <p>GBP 175,000,000 Lender</p> 	<p>UK 2022</p>  <p>Battery and Gas Peaking Assets Financing</p> <p>GBP 43,100,000 Sole Lender</p> 	<p>UK 2022</p>  <p>Financing the acquisition of a 50MW battery storage project</p> <p>GBP 19,200,000 Sole Lender</p> 
<p>UK 2022</p>  <p>Incremental Facility to finance a utility-scale Energy storage System</p> <p>GBP 155,000,000 Mandated Lead Arranger</p> 	<p>UK 2022</p>  <p>Financing the construction of a 107MW/MWh battery storage portfolio</p> <p>GBP 27,400,000 Sole Lender</p> 	<p>UK 2021</p>  <p>Funding for construction of 100MW/107MWh battery flagship</p> <p>c. GBP 60,000,000 Mandated Lead Arranger</p> 	<p>UK 2021</p>  <p>Phase 2 financial close of a flagship 30MW UK battery storage project</p> <p>GBP 28,000,000 Sole Lender</p> 

Contact Details

We would be very happy to arrange an exploratory session to discuss our findings in more detail, please get in touch with one of the team



Chris Matson

Partner, Energy Modelling

+44 20 7432 0674
chris.matson@lcp.uk.com

Sam Hollister

Head of Markets

+44 20 7432 3780
sam.hollister@lcp.uk.com

Bart White

Head of Structured Finance Energy Europe

2 Triton Square, Regents Place, London. NW1 3AN
Mob. +44 (0) 7566 290 644
Bart.White@santandercib.co.uk

William Evans

Executive Director

2 Triton Square, Regents Place, London. NW1 3AN
Mob. +44 (0) 7548 107 872
William.Evans@santandercib.co.uk

Jon Ferris

Head of Flexibility & Energy Storage

+44 7939 546647
jon.ferris@lcp.com

Faisal Wahid

Senior Consultant, Energy Modelling

+44 78 6308 5893
faisal.wahid@lcp.uk.com

Hector Muñoz Salgado

Executive Director

Avenida de Cantabria, Boadilla del Monte, Madrid 28660
Mob. +34 615 901 817
hemuoz@gruposantander.com

Javier Trueba De Sinety

Managing Director

Avenida de Cantabria, Boadilla del Monte, Madrid 28660
Mob. +34 692 654 072
fjtrueba@gruposantander.com

Edward Smith

Consultant, Energy Modelling

+44 20 3824 7297
edward.smith@lcp.uk.com

Sam Secher

Consultant, Energy Modelling

+44 20 3314 4938
sam.secher@lcp.uk.com

James-Augustine Foley

Executive Director

2 Triton Square, Regents Place, London. NW1 3AN
Mob. +44 (0) 7783 165 065
James.foley@santandercib.co.uk

LCP Delta Disclaimer

About LCP Delta

LCP Delta is a trading name of Delta Energy & Environment Limited and Lane Clark & Peacock LLP. References in this document to LCP Delta may mean Delta Energy & Environment Limited, or Lane Clark & Peacock LLP, or both, as the context shall require.

Delta Energy & Environment Limited is a company registered in Scotland with registered number SC259964 and with its registered office at Argyle House, Lady Lawson Street, Edinburgh, EH3 9DR, UK.

Lane Clark & Peacock LLP is a limited liability partnership registered in England and Wales with registered number OC301436. All partners are members of Lane Clark & Peacock LLP. A list of members' names is available for inspection at 95 Wigmore Street, London, W1U 1DQ, the firm's principal place of business and registered office. Lane Clark & Peacock LLP is authorised and regulated by the Financial Conduct Authority and is licensed by the Institute and Faculty of Actuaries for a range of investment business activities.

LCP and LCP Delta are registered trademarks in the UK and in the EU. Locations in Cambridge, Edinburgh, London, Paris, Winchester and Ireland.

Copyright © 2023 LCP Delta.

<https://www.lcp.uk.com/emails-important-information> contains important information about this communication from LCP Delta, including limitations as to its use.

LCP Delta Disclaimer and use of our work

Where this report contains projections, these are based on assumptions that are subject to uncertainties and contingencies. Because of the subjective judgements and inherent uncertainties of projections, and because events frequently do not occur as expected, there can be no assurance that the projections contained in this report will be realised and actual events may be difference from projected results.

The projections supplied are not to be regarded as firm predictions of the future, but rather as illustrations of what might happen. Parties are advised to base their actions on an awareness of the range of such projections, and to note that the range necessarily broadens in the latter years of the projections.

Santander Disclaimer

This presentation has been prepared by Santander Corporate & Investment Banking. Santander Corporate & Investment Banking is a brand name used by Banco Santander, S.A., and its affiliates. Banco Santander, S.A. Registered Address: Paseo de Pereda 9-12, 39004 Santander, Spain. Registered with the Bank of Spain (Banco de España) under registration number 0049 with CIF A-39000013. Banco Santander S.A., London Branch is authorised and regulated by Bank of Spain. Authorised by the Prudential Regulation Authority. Subject to regulation by the Financial Conduct Authority and limited regulation by the Prudential Regulation Authority (Financial Services Register number: 136261). Details about the extent of our regulation by the Prudential Regulation Authority are available from us on request. The Banco Santander, S.A. entry in the Financial Services Register can be viewed by visiting the Financial Conduct Authority's website www.fca.org.uk/register. Santander and the flame logo are registered trademarks.

This presentation and its contents are proprietary to Santander and are strictly private and confidential, and for the exclusive use of the person to whom it is provided by Santander. The recipient agrees to keep confidential at all times the information contained in it or made available by Santander in connection with it. It should be read in its entirety and shall not be photocopied, reproduced, distributed or disclosed in whole or in part to any other person without the prior written consent of Santander, nor should any other person act on it. This document is intended to be read by market professionals (eligible counterparties and professional clients). Santander shall not be responsible or liable to you or to any other person or entity for any damages or loss that may be alleged as a result of this document. No transaction or services related hereto are contemplated without a subsequent formal agreement with Santander. Save for your obligation of confidentiality described above, this document is not intended to create legal relations between us and is not an offer of financing or a commitment with respect to any financing and creates no obligation or liability on Santander to provide, arrange, underwrite or participate in any financing. Neither the information nor any opinion expressed constitutes a prospectus, offering document, an underwriting commitment or an offer, or an invitation to make an offer, to buy or sell any securities, other investment or any options, futures or derivatives related to securities or investments.

Certain information contained herein may use indicative valuations based on certain market conditions and information that can be subject to further verifications, amendments or additions by Santander. Clients and /or investors are advised to make an independent review of the information and financial facts included in this document. Certain transactions may give rise to substantial risks and are not

suitable for all clients or investors. Each party is advised to reach their own conclusions regarding the legal, tax and accounting aspects of a proposed transaction as it relates to their asset, liability, or other risk management objectives and risk tolerance. This document is not intended to provide personal investment advice and it does not take into account the specific investment objectives, financial situation and the particular needs of any specific person who may receive this document. Each party should seek independent financial advice regarding the suitability and/or appropriateness of making an investment or implementing the investment strategies discussed in this document and should understand that statements regarding future prospects may not be realised. Each party should note that income from investments, if any, may fluctuate and that the value of such investments may rise or fall, accordingly, they may receive back less than they originally invested. Although the information set forth herein is reflective of the manner in which Santander believes a transaction might be structured, no assurance can be given that such a transaction could, in fact, be executed as described herein.

Santander and associated personnel may (a) act in several capacities (including hedging activity and trading positions) in financial instruments which may adversely affect any investment performance referred to herein; (b) provide oral or written market commentary or trading strategies to its clients that reflect opinions that may be contrary to those in the materials discussed herein; (c) act upon the contents of this publication prior to your having received it; (d) and/or effect transactions which are not consistent with the materials discussed herein. The information contained in this document (other than disclosure information relating to the Santander group) has been obtained from, or are based on, sources believed to be reliable, but no representation or warranty, express or implied, is made that such information, assumptions, performance data, modelling or scenario analysis is accurate, complete or up to date and it should not be relied upon as such. To the fullest extent permitted by law, no Santander group company accepts any liability whatsoever (including in negligence) for any direct or consequential loss arising from any use of or reliance on material contained in this document. In addition, Santander does not state or guarantee in any manner whatsoever the accuracy, adequacy or comprehensiveness of the information contained in this document and expressly waives any responsibility arising from any lack of accuracy, comprehensiveness and adequacy of the information contained in this document.

Please note the publication date of this document. It may contain specific information that is no longer current and should not be used to make an investment decision. Unless otherwise indicated, there is no intention to update this document.