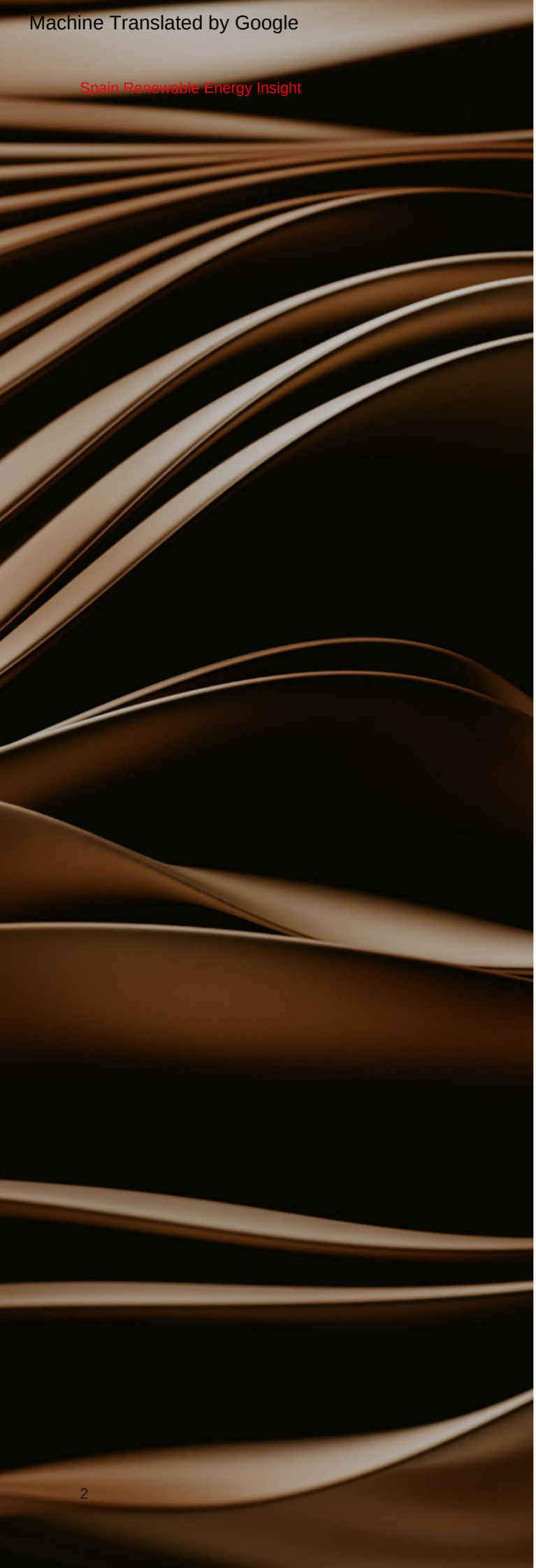
Research

Spain | October 2023

Spain Standalone BESS Market

Renewable Energy



Contents

Source: Recurrent Energy

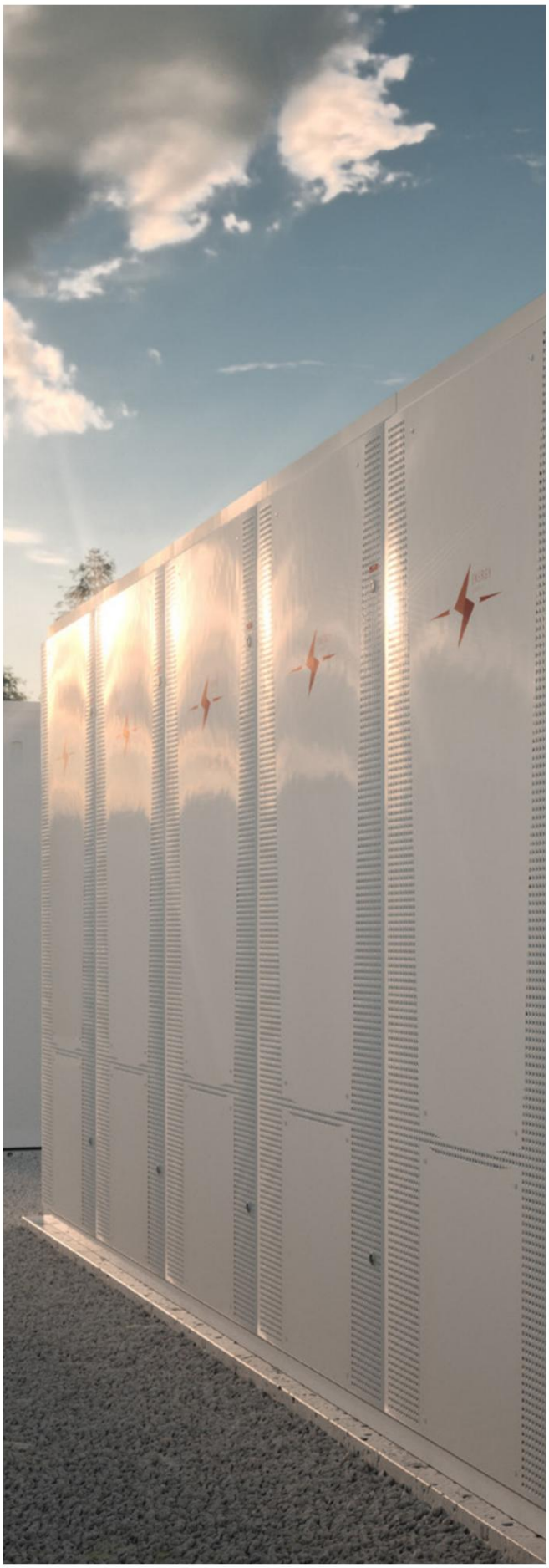
Cover photograph source: Recurrent Energy

1

Background

Power generation from renewable sources had **two fundamental challenges** to overcome until just a few years ago: **cost and intermittency.** Technological improvements and significant implementation (initially spurred by public support schemes such as FiTs, tax incentives and other subsidies) have massively reduced the cost of renewable generation. In fact, nowadays it is widely accepted that solar and wind are the cheapest sources of electricity generation – According to IRENA1, by 2022 solar PV and onshore wind had reduced their LCOE by 89% and 69% to 0.049 USD/MWh and 0.033 USD/MWh in 2022 respectively versus 2010 levels. This cost reduction has put renewables right at the center of the 'Energy Trilemma' triangle (ie, sourcing power that is sustainable, affordable, and secure/ indigenous) and has significantly increased their presence in the global generation mix.

1IRENA, “Renewable Power Generation Costs in 2022”



However, renewable power generation continues to be intermittent as it is driven by the availability of natural resources (eg, sun shining or wind blowing). This intermittency poises obvious challenges – most importantly, power supply-demand mismatches – and needs to be properly managed. **Undoubtedly storage will play a key role in managing this intermittency and facilitating the integration of renewables in the energy mix.** Aware of this, governments and TSOs are taking political, regulatory, and technical steps to facilitate the deployment of storage facilities and thus accelerate the energy transition.

Among the different energy storage technologies – depending on the physical principle: mechanical, electrochemical (batteries and hydrogen), thermal or electro-magnetic –, battery energy storage systems (BESS) are undergoing the fastest technology development and LCOS reduction and are thus expected to dominate the storage market.

Storage systems, and in particular BESS, are often naturally combined with renewable generation projects in “hybrid” or “co-located” installations. In these cases, BESS can be charged with power coming from the renewable project, typically solar PV or onshore wind. However, BESS projects can also be “standalone”, that is, connected directly to the power grid without any associated generation source. **This document focuses on grid-scale standalone BESS projects in Spain.**

As we will discuss below, **the standalone BESS market in Spain is becoming very attractive and is set to grow rapidly.** However, it is also important to highlight that this market is still nascent and there are some uncertainties and unknowns. In fact, we are not aware of any commercially viable standalone BESS projects already in operation in Spain (except perhaps for some R&D projects).

2

BESS Market Outlook

Following the ambitious energy transition targets throughout the world, renewable energy penetration is rapidly increasing. This brings some challenges to global power systems associated with grid-stability and mismatches in constant supply-demand balance (due to renewable generation intermittency). **Energy storage can convert renewable energy into a dispatchable source** of electricity; hence the implementation of storage projects is key for a successful integration of the increasing renewable energy generation. This is reflected in the following BESS market outlooks.

Global

- The global battery storage market is expected to reach ca. 2,600 GWh of installed capacity by 2030 according to recent analysis by McKinsey2. Assuming an average 3-h battery duration, this figure would translate into some **867 GW of installed BESS power worldwide.** In terms of sectors, most of this capacity will be grid-connected utility-scale installations (82%), followed by commercial and industrial (13%) and residential (5%).

- Geographically, this BESS market will be heavily dominated by the US and China, concentrating some 45% and 31% of the global BESS installations, according to Wood Mackenzie3.

Europe

- **Europe could reach 42 GW by 2030 and 95 GW by 2050 of commercial-scale, grid-connected battery energy storage capacity** (>10 MW), according to projections by Aurora Energy Research4. Current European installed capacity is just above 5 GW, with the UK leading the way with 2.8 GW of stand-alone BESS in operation5.

- The investment opportunity in Europe exceeds €70 Bn between 2023 and 2050 and batteries with more than 4 hours of storage capacity will account for 61% of total installed capacity in 2050, according to Aurora. Of these, some €27 Bn (40% of total investment) will be deployed by the end of 2030.

- Beyond the UK, two European countries of particular interest for storage are Italy and Poland. In Italy, Terna6 has published a 2030 target for standalone BESS of 78.7 GWh (which would translate into 19.7 GW, 13.1 GW and 9.8 GW for 4-h, 6-h and 8-h duration installations respectively). In Poland, the Government has published a roadmap7 considering some 2.15 GW of storage systems by 2030.

[2] McKinsey & Company, Energy Storage Insights BESS

3 Wood Mackenzie, “Global energy storage market outlook update: Q2 2022”

[4] Aurora Energy Research, Eurostat

5 Solar Media, “UK Battery Storage Project Database Report (Aug 2023)”

6 Italian TSO Terna

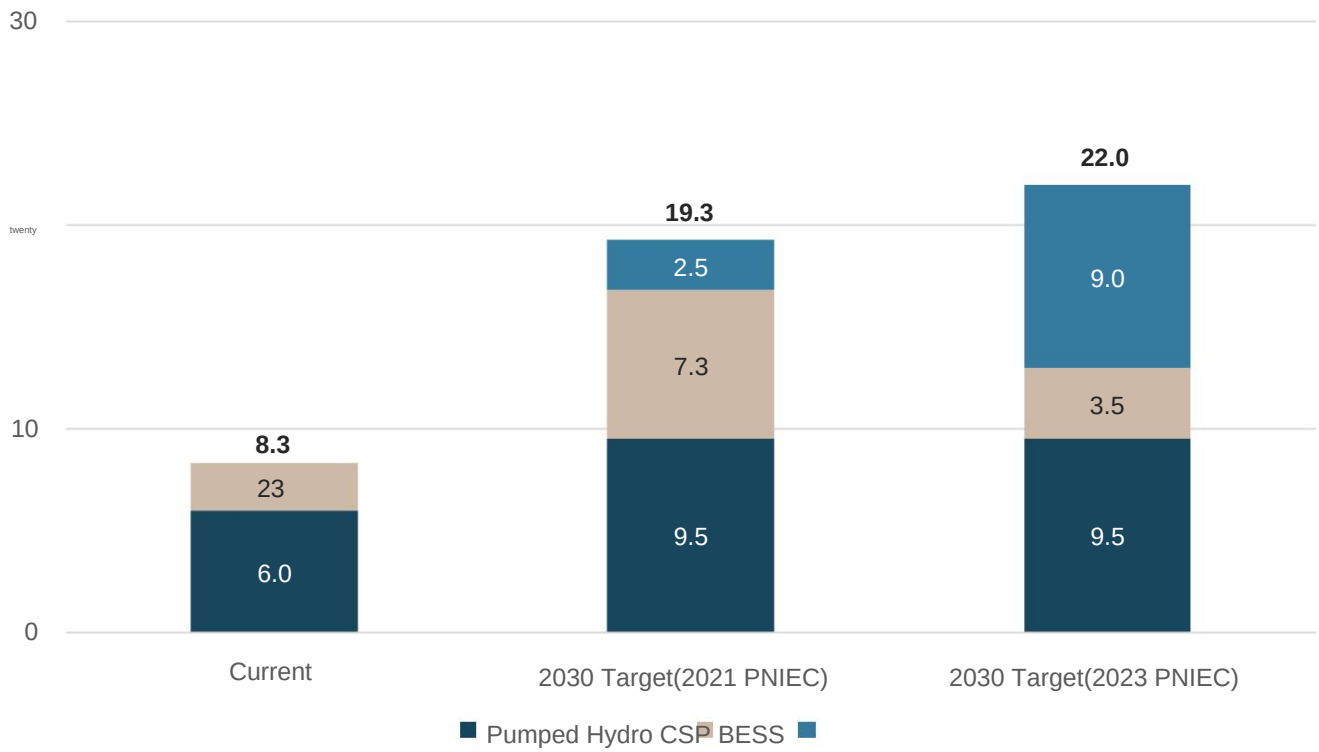
7 Polish “Energy Policy of Poland until 2040”

Spain

- The initial PNIEC (2021-2030) targeted just 2.5 GW of additional storage through BESS for the period. With its recent update in June 2023 (currently under review after a consultation period), the total target for additional storage in 2030 has been increased to 12 GW. Breakdown of storage technology is not specified but it **is expected that at least 9 GW will come from BESS projects8.**

- According to Red Eléctrica, 15 GW of energy storage projects have requested grid access at the time of writing; of which 2.2 GW had already been granted grid access as of April 2023.

2030 BESS Targets in Spain (GW)



Source: Spanish PNIEC, JLL

Note: The 2023 PNIEC does not provide a breakdown between pumped-hydro and BESS to reach the total 22 GW. We assume that the figure provided in the 2021 PNIEC for pumped hydro remains unchanged and the rest is covered with BESS. CSP capacity is an approximation extracted from a footnote of the draft 2023 PNIEC.

8 Spanish National Energy and Climate Plan, PNIEC 2023-2030 (draft opened to public consultation in June 2023)

Battery Storage Market Size by 2030 (GW)

Global1

867 GW

Europe2

42 GW

Spain3

9 GW

Sources:

[1] McKinsey & Company

2 Aurora Energy Research

3 Spanish PNIEC

3

Spanish Regulatory Framework

Existing Regulation

Driven by public support tailwinds and following European directives9, the regulatory framework for standalone BESS projects in Spain has developed quite significantly in the last three years. Even though BESS-specific regulation still needs to be extended or adapted (see section below), **the regulation exists to enable a BESS market in Spain.** In fact, according to our market intelligence, permitting challenges arise not because the lack of regulation but rather because the lack of experience by the Spanish Administration (in particular, local or regional bodies) when it comes to process permits for standalone BESS projects in Spain . Here is a summary of the key regulations relevant to grid-scale standalone BESS projects in Spain:

[9] European “Green Deal” initiatives and “Fit for 55” regulatory package

- Storage systems are recognized as 'subject' in Spanish electricity system (Royal Decree-Law 23/2020)
- Hybridisation of different technologies (including storage) is allowed for new and existing generation plants (Royal Decree 960/2020)
- Access to the grid for new storage systems and hybridization of generation systems with grid access is regulated (Royal Decree 1183/2020)
- Grid toll payments are waived for BESS (CNMC's Circular 3/2020)
- Storage systems are allowed to participate in the balancing markets (CNMC's Resolution, 10th December 2020)

- Spanish Energy Storage Strategy is launched, targeting 20 GW of installed capacity by 2030 and 30 GW by 2050 (MITECO, 9th February 2021)
- Draft capacity market regulation is released for public consultation (MITECO, 20th April 2021)
- Storage systems are exempt from electricity system charges (Royal Decree 148/2021)

- Storage installations are regulated under the same conditions as any other electric power production unit (Royal Decree-Law 6/2022)
- €150 M support under PERTE ERHA program (financed by NextGenerationEU) for existing and new hybrid storage systems is launched (MITECO & IDAE, 28th December 2022)

- Operational Procedures PO 3.8, PO 7.2 and PO 9.2 are adapted to account for storage systems (CNMC's Resolution, 16th March 2023)
- Standalone BESS projects are required to complete a simplified environmental evaluation (Royal Decree 445/2023)
- €150 M support under PERTE ERHA program (financed by NextGenerationEU) for new standalone BESS projects is launched (MITECO & IDAE, 21st July 2023)

Missing Regulation

Despite the significant progress outlined above, **there are still some uncertain regulatory issues and clarifications affecting BESS installations that need to be addressed.** In particular, some pieces of the current power market rules need to be adapted to account for the operation of BESS installations.

Most importantly, beyond permitting and operational aspects, the most important market evolution (due to its impact on the financial viability of BESS projects) is the expected approval of a Capacity Market in Spain. Despite the draft that MITECO published in April 2021, we have seen limited progress in its regulatory development. Furthermore, several market players have expressed their limitations to drive the storage market to meet the PNIEC objectives and have suggested ideas for improvement. However, in September 2023 MITECO announced that a new draft Capacity Market proposal will be released in “some weeks.”

From a technical perspective, even though there are some Operational Procedures *(“Procedimientos de Operación”* or “PO”) that still need to be adapted to fully enable the participation of standalone BESS projects in all available power markets, these are less concerning and are expected to be approved by the CNMC soon.

- REE's Operational Procedures PO 3.1, 3.2, 3.8, 3.11, 9.3, 12.2, 14.1, 14.4 and 14.8 are expected to be adapted by CNMC shortly to account for storage systems.
- Capacity Market (see description below): the following are the pending steps before a Capacity Market in Spain is enacted:
  - REE completes a study on national coverage and drafts operational procedures
  - MITECO defines CM auctions mechanism (including de-rating factors) and sends proposal to the European Commission (EC)
  - EC runs a public consultation, consults with TSO/regulator and issues opinion on CM (nb EC may decide to initiate a state-aid investigation that can delay the process)
  - EC issues final positive opinion and MITECO approves Capacity Market

4

Technical Considerations

Without aiming at providing a detailed technical description of BESS projects, we believe it is important to outline the following key technical aspects (by the way, nonexistent in renewable energy generation projects):

Storage is not generation

It is crucial to highlight that BESS projects are fundamentally different in nature to renewable generation projects. Unlike solar or wind energy assets, **BESS projects do not generate any new power,** they 'only' absorb and re-inject power from and to the electricity grid. A key obvious consequence is that BESS don't need any renewable resources such as solar irradiation or wind resource to operate.

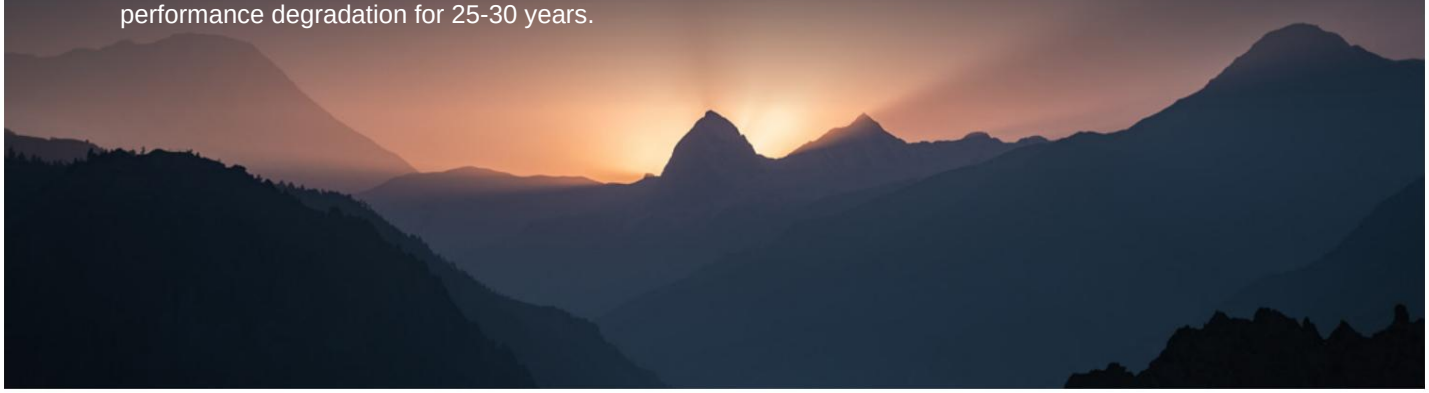
Most market players active in storage *(ie,* developers, utilities, engineering firms, technical advisors, etc.) come from the renewable energy industry. However, despite some similarities between both asset classes (especially around permitting), there are significant differences *(eg,* technical, revenues, operations) that require these players to undergo a **necessary mindset shift to transition from renewable asset players to become BESS players.**

BESS Technologies

Industry regularly reports state that **Lithium Ion (Li-Ion)** based battery technologies are dominating the stationary energy storage market, representing a range between **90%-95%** of the systems deployed according to different sources10,11. Within the Li-Ion universe, initially the market was dominated by **Nickel-Manganese-Cobalt (NMC)** batteries, driven by the dominance in the electric vehicle industry. However, over the last 2 years most BESS assets have been constructed with **Lithium-Iron-Phosphate (LFP).**

Other technologies are being developed that may challenge the Li-Ion dominance in the future BESS market:

- **Sodium-sulfur batteries (NaS)** are emerging as a viable alternative, due to (i) superior environmental credentials, (ii) enhanced safety and (iii) better raw material costs.
- **Flow batteries** could emerge as a breakthrough technology for stationary storage as they do not show performance degradation for 25-30 years.



Capacity (Battery Duration)

The capacity of a battery measures the amount of electrical energy that can be stored in this battery. This capacity can also be measured as the amount of time a fully charged battery can be fully discharged at its maximum power before depleting all its electrical energy. As an example, a battery with a power capacity of 10 MW and an energy capacity of 40 MWh can be fully discharged in 4 hours and therefore has a “duration” of 4 hours.

A key question in the BESS industry is to determine the **“sweet spot” (in terms of battery duration) that finds the optimal balance between CAPEX vs. revenues** (considering longer duration BESS will be more expensive but may capture additional revenue streams depending on the market). In markets dominated by ancillary services/frequency regulation, these calls for BESS assets of ca. 1-h as these markets only require very short periods of near instantaneous power delivery. Markets dominated by energy arbitrage will call for 2-h duration BESS assets as this matches the duration of peak demand period (7-10 pm). Finally, some markets with lucrative capacity markets that require 4-h BESS to qualify, BESS assets are more likely to be 4-h duration.

However, it is worth noting that (1) **in Spain the PERTE ERHA grant requirement is driving developers to design 4-h systems (to be eligible for the grant)** and (2) the duration of the battery should ultimately depend on your revenue stack strategy.

10 CNESA Global Energy Storage Market Analysis 2020, Q3

11 ReTHINK Technology Research (https://rethinkresearch.biz/articles/bess-see-mass-adoption-alternative-batteries-alongside-li-ion/)

Degradation

Batteries suffer from degradation, an effect that reduces their ability to store energy over time as measured by their 'state of heath' (SoH). Therefore, BESS undergo MWh capacity reductions throughout their expected 30-year asset lifetime.

Battery degradation can be separated into two types:

- **Calendar degradation:** the effect on the battery's capacity due to the passage of time. This degradation will depend on the BESS technology and location (in particular, due to temperature and humidity) but can be generally estimated around 0.75-1.25% per annum on average.
- **Cycling degradation:** the effect of the active charge and discharge of the battery. This effect varies greatly depending on the number cycles the battery hardens and can be modeled as 0.003-0.004% per cycle.

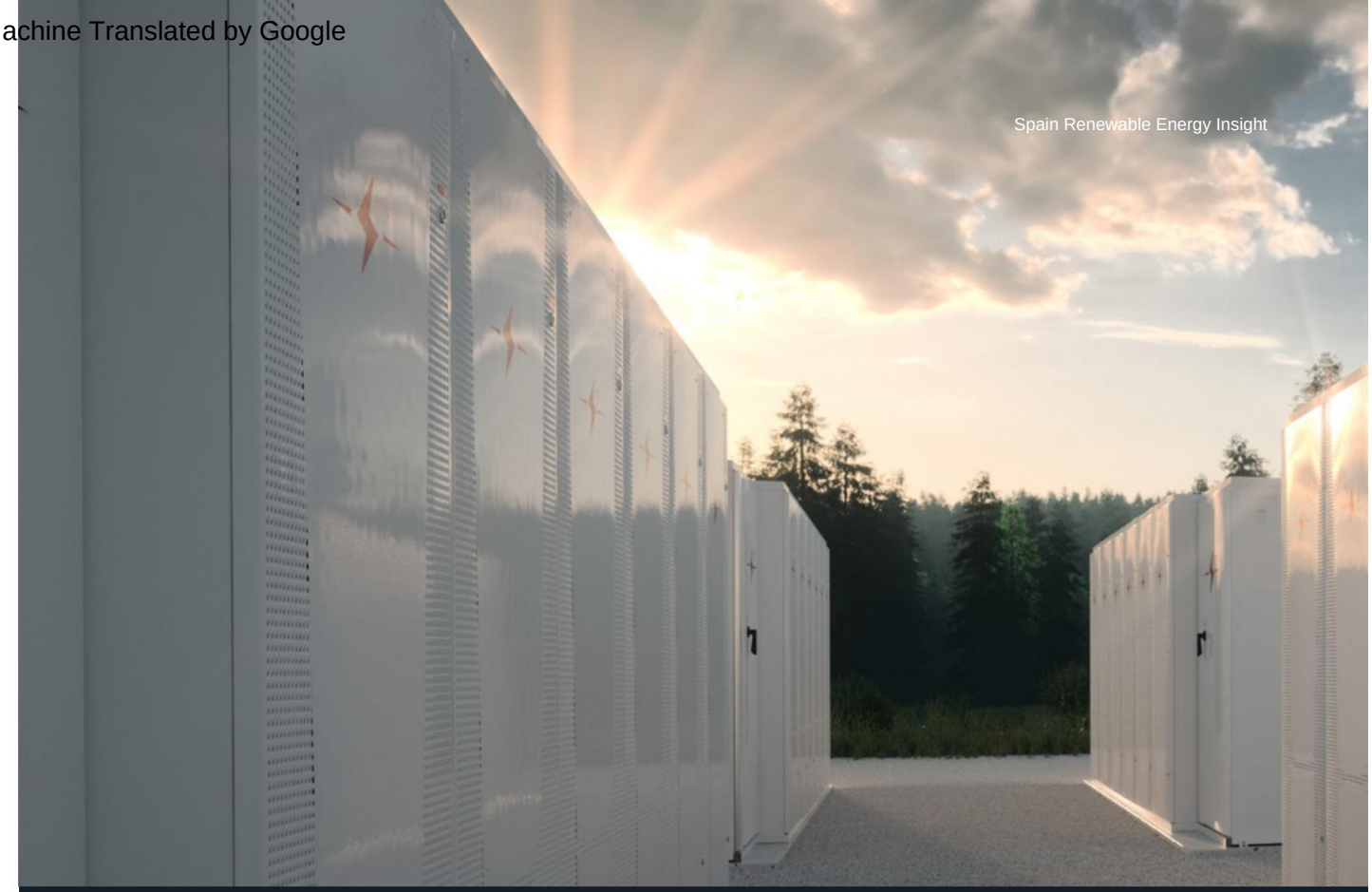
Maintaining degradation under control is therefore critical for the operation (and financial profitability) of a BESS project. Battery manufacturers recommend keeping the SoH above a certain threshold which industry practices sets at ca. 60-70%. This can be done with a combination of:

- **Repowering** – SoH managed by replacing all the battery units in a given year (typically either 1 repowering in year 15 for a 1.5 cycles/day or 2 repowerings in years 10 and 20 for a 2.0 cycles/day BESS project).
- **Augmentation** – SoH managed by adding new additional battery cells over time, typically on on an annual basis.

The timing and magnitude of the repowering or augmentation will depend greatly on the intensity of cycling over the BESS assets lifetime.

There is still great uncertainty around this topic since due to the nascent stage of this technology, there are no known examples of commercial BESS projects that have gone through their whole asset life.

Photo source: Recurrent Energy



Cycles

The number of 'cycles' is the count of full charges and discharges of a battery. This figure is meant to be net and additive, ie, it doesn't need to be a full and consecutive 100% charge and discharge. Instead, this could be through lots of smaller charges and discharges that all add up to a 100% charge or discharge.

Typical values for battery cycles range from 0.5 to 3.0 cycles/day (or ca. 180 to 1,800 cycles/year). However, the **most common values we are observing to be modeled in the Spanish BESS market are 1.5 and 2.0 cycles/day** (or ca. 550 to 730 cycles/year) but depends on warranty limitations.

Long Duration Energy Storage (LDES)

LDES can be defined as technologies with capacity duration higher than 4-h. This type of storage aims to reduce unbalances between supply and demand on a daily, weekly and even seasonal basis. Their implementation may also be key to effectively manage the intermittency of renewable energy generation in the future.

5

Revenue Stack:

The Name of the Game

Clearly, the single-most important (and debated) issue to assess the financial viability of a BESS project is the revenue stack. Like renewable energy assets, BESS projects require an important upfront investment (DEVEX and CAPEX) and moderate costs during operation (OPEX) that will be recovered by generating future revenues during its lifetime. Therefore, having visibility and, to some extent certainty, on those revenue sources is thus key to making an investment decision.

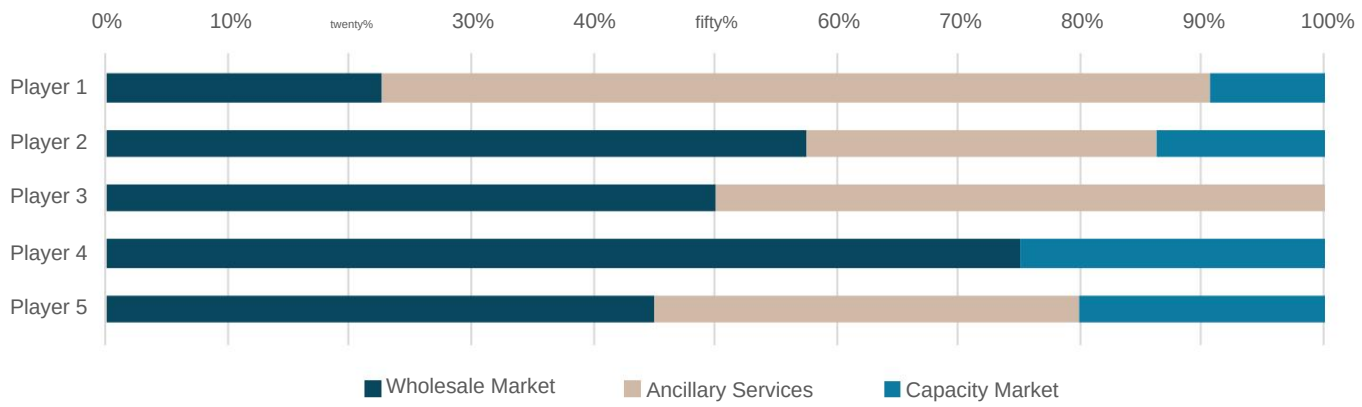
The following revenue streams are available (or planned to be) to BESS projects in Spain:

market	Description	Comments
1.Wholesale Market		
Wholesale market	• Market to buy/sell power on an hourly basis (to be changed to 15 min in 2024) • Contracted from years to up to 1h ahead • Market participants can trade energy in day-ahead and intraday markets	• Markets managed by OMIE, Iberian electricity market operator • Must be certified as a market agent to participate

market	Description	Comments
2. Ancillary Services		
Secondary Reserve (aFRR, automatic Frequency Restoration Reserve)	• Aims to maintain the generation-demand balance and system's nominal frequency by automatically correcting deviations production and consumption • Its action time horizon ranges from 20 seconds to 15 minutes • Remuneration based on 2 components: available capacity *('regulation band')* and dispatched energy in real time	• Minimum bid capacity: 1MW • Must be part of a regulating zone *('regulation zone')* with minimum capacity of 200 MW • Must pass qualification test within the zone • Pending approval PO 12.2
Tertiary Reserve (mFRR, manual Frequency Restoration Reserve)	• Allows the restitution of the use of automatic secondary regulation reserves • Manually activated in a time equal to or less than 15 minutes • Remuneration based on dispatched energy	• Minimum bid capacity: 1MW • Pending approval PO 12.2
Replacement Reserve (RR)	• Aims to solve generation-demand unbalances identified after intraday market closing. Re-establishes secondary and tertiary reserves • Remuneration based on dispatched energy	• Minimum bid capacity: 1MW • Pending approval PO 12.2
Technical Restrictions (TR)	• Service to solve any circumstance deriving from programmed generation, that could affect security, quality or reliability of supply • Remuneration conditioned by the physical location of the installation. Higher margins than other balancing services	• Grid node dependent • Pending approval PO 3.2
3. Capacity Market		
Capacity Market (CM)	• Draft regulation issued in April 202112: • Pay-as-bid auction for firm capacity (in MW) • Remunerated in €/MWÿyear (paid monthly without inflation adjustment) according to a pre-defined 'capacity derating factor' • Contract period of 5 years for the annual main auction (starting up to 5 years after awarding) or 12 months for annual adjustment auction. • Eligible installations (including generation, storage and demand-side response): existing assets with < 550 gCO2/kWh and new non-CO2-emitting assets • Higher BESS capacity, higher derating factor (expected between 20%-60% for 1-4h capacity)	• Additional power market mechanism to ensure reliable capacity in the long term • Provides additional secured revenues to market participants • There are still many uncertainties and undefined terms in the draft • Approval process stalled since 2021

However, there is significant uncertainty in the market with regards to the future revenue stack for BESS projects. This uncertainty is driven by (a) the difficulty to forecast these future revenues and (b) the lack of experience for BESS projects participating in these markets. This uncertainty is showcased in the major discrepancies that we are observing in the breakdown of revenue sources by different market players in a real BESS transaction:

BESS Revenue Stack Distribution (%) - Illustrative Only



[12] MITECO

Source: JLL

6

Other BESS Value Drivers

In addition to the future revenue stack, the value – and, depending on the required equity return, the financial viability – of a BESS project will also be largely determined by other 'value drivers'. Here is a (non-comprehensive) list of some key value drivers affecting BESS projects:

CAPEX

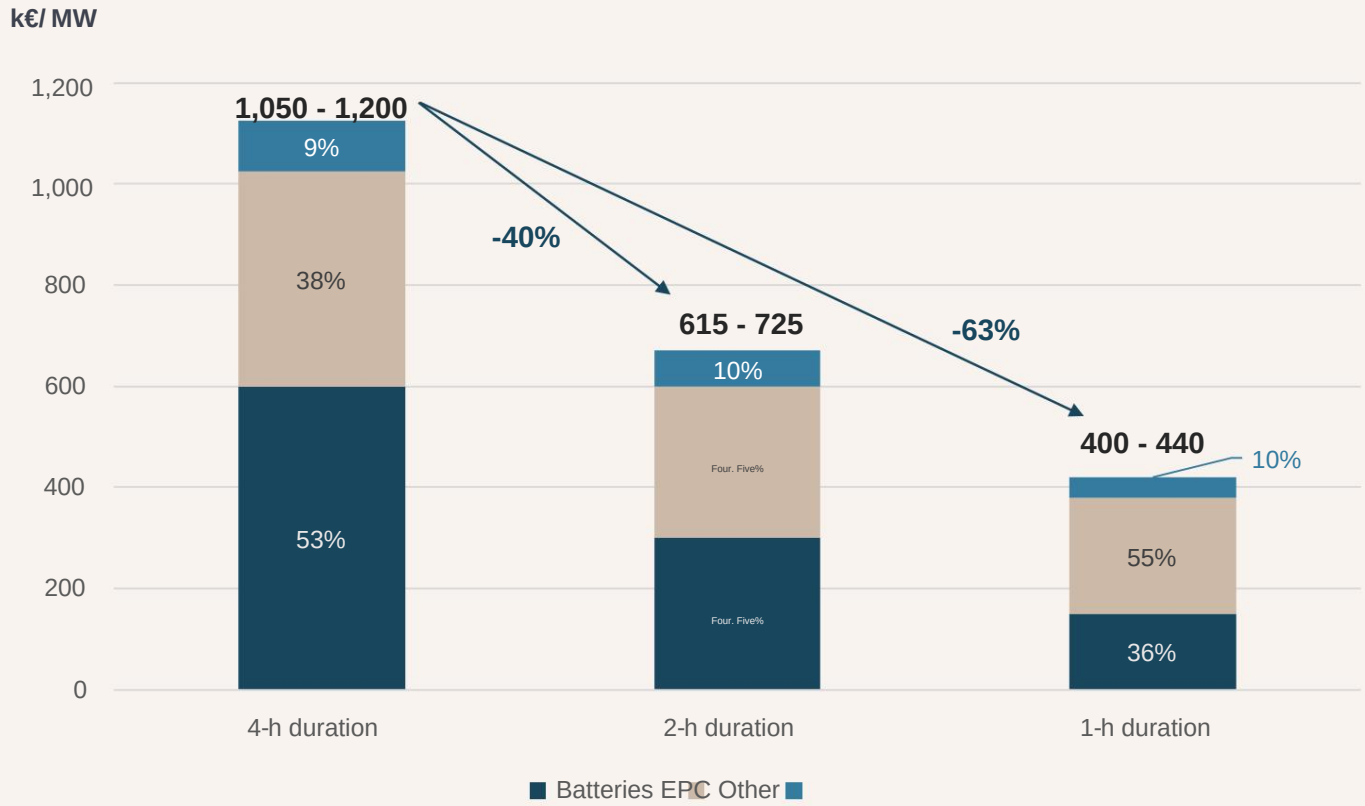
The level of initial CAPEX investment has clearly a major impact on the financial attractiveness of a BESS project. For a 4-h project, approximately half of this CAPEX is attributable to the batteries. In turn, the price of batteries is largely dependent on battery-grade lithium carbonate prices. In the last year, lithium carbonate prices have fallen significantly since its maximum price at 66,000 USD/mt in September 2022 to some 30,000 USD/mt in September 202313.

For BESS projects, we are currently observing **full CAPEX levels for H1-2024 construction around 1,050-1,200 k€/ MW for a 4-h BESS,** split as follows:

- ÿ53% batteries14
- ÿ38% EPC (including inverters, interconnection, civil works, etc.)
- ÿ9% Other: insurance, taxes & fees, development (excluding the 40 k€/ MW grid bonds in Spain)

As we have seen in other technologies (eg, solar PV modules), we expect a very significant CAPEX decrease for storage projects in the near term. This will be especially driven the decreasing cost of batteries as mass deployment takes place and recovery of construction cost to pre-2020 levels.

BESS CAPEX Breakdown (2024 Estimates)



Source: JLL

Re-powering Strategy

As discussed above, battery cells in BESS projects suffer from degradation that gradually decreases their SoH, initially at 100%. Experts recommend replacing the existing or add new battery cells when the SoH reaches 60-70%., *ie* to “re-power” the system. Different re-powering strategies can be followed depending on: (i) the SoH threshold (typically at 70%), (ii) year of operation (typically at year 15), (iii) replacing or adding new cells and (iv) the electrical components replaced.

There is significant uncertainty as to how much additional CAPEX this re-power will cost *(nb* even BESS manufacturers are not certain simply because there is no track-record of long-standing BESS installations). We are observing projected values in the range of 120-300 k€/ MW for 4-h BESS occurring around year 2040, driven by a significant cost reduction in batteries in the coming years.

13 Standard & Poor's Capital IQ
14 BloombergNEF, 2022 annual battery price survey

Battery Capacity

The choice of battery capacity is a very strategic decision and is largely determined by (a) the available revenue streams, (b) the desired revenue stack strategy and (c) other factors (eg, PERTE grant, permitting considerations) . Short duration BESS projects (0.5 – 1.0 h) usually aim to obtain most of their revenues from ancillary markets, offering frequency regulation services. Longer duration projects (2 – 4 h) offer more flexibility and allow to capture more arbitrage opportunities in the wholesale markets.

Obviously, longer duration BESS requires higher CAPEX investments (albeit a lower unitary cost per MWh). However, the **CAPEX increase is not proportional to the battery duration** *(ie,* a 4-h BESS will not cost twice as much as a 2-h BESS) because there are economies of scale in the inverters, electronics, land, interconnection, civil works, etc. Considering the CAPEX of a 4-h BESS as a reference, this figure would be 55-65% for a 2-h project and 35-40% for a 1-h project.

In Spain, the recent launch of the PERTE ERHA grant for standalone BESS projects will probably favor 4-h systems.

Revenue Stack Strategy – the role of the 'Optimizer'

In traditional renewable generation projects, active energy management is becoming increasingly important. In fact, we are starting to observe how solar and wind plants are participating in ancillary markets (and thus securing additional revenues). However, solar and wind plants cannot control when they generate and how much energy they produce; Therefore, their ability to participate in these markets is limited.

For BESS projects, it's a totally different game. Their mere existence is about playing in those markets *(ie,* revenue streams described above) and aiming at maximizing their revenues. To this end, the **strategic and operational decisions related to revenue streams will be critical.** These decisions will be largely determined by trading experience and market intelligence.

Here is where the role of the market agent (sometimes called 'Optimizer') comes into play. The Optimizer will define and execute a revenue stack strategy to maximize BESS revenues over its lifetime. Needless to mention the Optimizer will charge a fee for this service (typically a percentage of the revenues generated or a variable fee in EUR/MWh of the energy traded, with or without a 'floor'). In Spain there are not yet any benchmarks due to the nascent stage of the BESS market, but in the UK – the most mature BESS market in Europe – this Optimizer fee typically ranges between 4-6% of BESS revenues for RtM schemes without a ' contracted floor', and 10-14% in the cases with one.

PERTE ERHA Grant 15

Within the NextGenerationEU context, the Spanish Government (through MITECO and IDAE) recently launched a program to incentivize the implementation of standalone BESS projects in Spain.
This program provides a grant to cover a major portion of the CAPEX of the BESS project.
Obviously, securing such grant will significantly improve the financial performance of awarded projects.

The key aspects of this grant program are as follows:

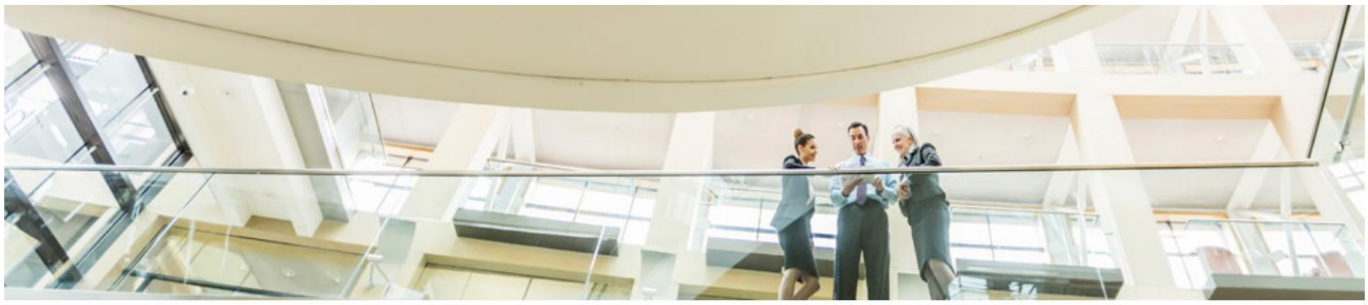
- €150 M earmarked for standalone BESS projects
- Projects should have an installed storage capacity equal or greater than 4 hours •
- The financing intensity would range between 40%-60% of the CAPEX depending on the company's size (with a 5% extra financing for projects located in insular territories)
- Project ownership cannot be modified during first 5 years
- The maximum grant to be allocated to a single standalone project is €50 M •
- The period to submit requests from 20th September to 31st October 2023
- Project must be operational no later than **30th April 2026**
- Grant amount may be obtained in two ways:
- Downpayment up to 80% of the total grant amount backed by an appropriate guarantee during 18 months after project execution (including accrued interests)
- After the project has been executed

[illegible] MITECO, *Call for aid for standalone storage projects (July 20, 2023) and Order TED/807/2023*

7

Observations on BESS Development, Transactions and Capital

JLL's Energy & Infrastructure Advisory team benefits from a privileged position to observe (and participate in) the evolution of the standalone BESS market in Spain. Other relevant observations related to development, transactions, as well as equity and debt financing of BESS projects/portfolios in Spain include the following:



Development

We are observing a growing development activity for standalone BESS projects in Spain. According to REE some 15 GW of storage projects have requested grid access to date, of which 2 GW had already secured PAC as of April 202316. Furthermore, of these 2 GW of projects, 1,056 MW are in the process of securing EIA17 (840 MW standalone + 216 MW hybrids).

In our frequent conversations with market players, we notice how pure developers are feverishly securing land plots nearby promising substations and applying for PAC for BESS projects (including injection and consumption) as soon as new grid access capacity becomes available (more often at DSO level than in the transport grid).

Also interestingly, even though this development activity has been spearheaded by Spanish players (both small developers and large utilities who started some 12-18 months ago), international players have already started to take positions – especially those players coming from the UK and benefiting from their BESS experience there.

Transactions

We are now running one of the very first BESS transactions in Spain. In helping our client to raise capital for a standalone BESS project in advanced stage of development, we are engaging with numerous investors and market players. Throughout this process, we have observed a lot of interest from specialized BESS players, funds, utilities and power traders. Most importantly, the number and quality of NBOs received indicates that, for some players, the financial viability of standalone BESS projects in Spain is achievable, even without any Capacity Market, PERTE ERHA grant or economic regime under the REER umbrella.

We expect more BESS transactions in the near future, especially for standalone BESS projects or portfolios under development (with land and PAC already secured), as smaller developers will want (or need) to secure an equity partner that will be able to build the projects once they reach RTB status.

Capital

International capital markets continue to enjoy high liquidity levels and a strong appetite for renewables, including storage technologies. Furthermore, Spain has recently been ranked as the top 8 most attractive renewable market globally18 due to its strong fundamentals.

Throughout our regular contact with renewable investors and capital providers, we are observing strong interest to build BESS pipeline in Spain. These players are looking to either develop greenfield projects themselves or preferably to partner with local developers that already have BESS projects under development.

In the latter case, these players (including utilities, IPPs, funds or larger BESS developers) are willing to fund the DEVEX and the 40 k€/MW grid-bonds throughout the development process or alternatively acquire BESS projects at RTB.

With regards to debt providers, while both commercial banks and alternative debt funds show strong interest to analyze BESS opportunities, the significant uncertainty around future revenues coupled with lack of experience with this technology, makes it very challenging for them to lend debt capital yet.

We expect that, as the BESS market develops and future revenues become more predictable – potentially thanks to a new Capacity Market –, financiers will start to provide debt financing. Worth noting, non-recourse debt financing for BESS projects is now readily available in the UK but only after some 3 years of market evolution to get banks comfortable with the sector risk.

16 El Periódico de la Energía *(https://elperiodicodelaenergia.com/large-scale-battery-projects-arrive-in-spain-to-give-stability-to-the-grid/)*

17 MITECO *(https://sede.miteco.gob.es/portal/site/seMITECO/navServiceContent)*

18 EY RECAI 61

8

Conclusions

Storage is set to become a cornerstone technology
to manage renewables intermittency and grid integration.

Global battery storage market is expected to grow very significantly
dominated by utility-scale BESS. Spanish PNIEC targets some 9 GW of BESS projects by 2030.

Despite some uncertainties and needed adjustments,
the regulation exists to enable a standalone BESS market in Spain.

Major technical differences between BESS and renewable generation assets
call for a mindset shift and a revisit to business models.

Five different revenue streams already exist for BESS projects in Spain, and we expect an additional Capacity Market to be approved.

Despite significant uncertainty around future revenue streams and limited experience with other value drivers, **standalone BESS projects in Spain are already financially viable for some players.**

The nascent Spanish standalone BESS market is driving an intense greenfield development activity, **strong investors' appetite and already some transactions.**

JLL's Energy & Infrastructure Advisory

JLL's Energy & Infrastructure Advisory is the **No. 1 financial advisor for BESS projects in Europ** Having **completed 35 transactions totaling 5.6 GW,** our deep expertise in the BESS space spans across the UK, Spain, Ireland, Australia, Poland and Italy. Our track-record in BESS transactions, profound market knowledge and extensive network of BESS market players (including investors, developers, utilities/ IPPs and advisors) enables us to help our clients with:

- Sell-side support
- Buy-side support
- Capital raise or JV formation
- Financial modeling & valuations
- Strategy & market-entry consulting

JLL's Energy & Infrastructure Advisory credentials include:

- 6 offices in Europe
- 40 professionals
- 110+ transactions completed
- 17+ GW of energy assets transacted
- €16+ Bn of capital raised

19 According to Inframation

Annex: List of Acronyms

- aFRR - Automatic Frequency Restoration Reserve
- BESS - Battery Energy Storage Systems
- CAPEX - Capital expenditure
- CM - Capacity Market
- CNMC - *National Markets and Competition Commission*
- CSP - Concentrated Solar Power
- DEVEX - Development Expenditure
- DSO - Distribution System Operator
- EC - European Commission
- EIA - *Environmental Impact Assessment*
- EPC - Engineering, Procurement and Construction
- ERHA - *Renewable Energy, Hydrogen Renewable and Storage*
- FiTs - Feed-in Tariffs
- GW – Gigawatt
- GWh - Gigawatt hour
- IDAE - *Institute for Diversification and Energy saving*
- IPP - Independent Power Producer
- IRENA - International Renewable Energy Agency
- JV - Joint Venture
- LCOE - Levelized Cost of Electricity
- LCOS - Levelized Cost of Storage
- LDES - Long Duration Energy Storage
- LFP - Lithium-Iron-Phosphate
- Li-Ion - Lithium Ion
- mFRR - Manual Frequency Restoration Reserve
- MITECO - *Ministry for the Ecological Transition and the Demographic Challenge*
- MW - Megawatt
- MWh - Megawatt hour
- NaS - Sodium-sulfur batteries
- NBO – Non-Binding Offer
- NMC - Nickel-Manganese-Cobalt
- OMIE - *Operator of the Iberian Energy Market*
- OPEX - Operating Expenditure
- PO - Operational *Procedure*
- PAC - *Access and Connection Permission*
- PERTE - *Strategic Project for the Recovery and Economic Transformation*
- PNIEC - *National Integrated Plan Energy and Climate*
- PV - Photovoltaic
- R&D - Research and Development
- REE - *Red Eléctrica de España*
- REER - *Economic Regime Renewable energy*
- RR - Replacement Reserve
- RTB - Ready to Build
- RtM - Road To Market
- SoH - State of Health
- TR - Technical Restrictions
- TSO - Transmission System Operator


Source: Recurrent Energy

Disclaimer

Any figures appearing in this document, especially those relevant for financial modeling purposes, are to be considered as indicative only and subject to change. You should not rely on these figures to make any investment decision. Please note the BESS technology and market are evolving rapidly. Therefore, we strongly recommend you seek advice from experienced power market and technical advisors.

JLL Spain

Madrid

Pº de la Castellana 79 - 4th

28046

T: +34 91 789 11 00

Barcelona

Glòries Tower

Av. Diagonal 211 Pl. 26

08018

T: +34 93 318 53 53

Contacts

Tomas Garcia

Senior Director, Energy & Infrastructure Advisory, Capital Markets, EMEA

tomas.garcia@jll.com

Ines Araguas

Head of Research & Strategy, Spain

ines.araguas@jll.com

About JLL

For over 200 years, JLL (NYSE: JLL), a leading global commercial real estate and investment management company, has helped clients buy, build, occupy, manage and invest in a variety of commercial, industrial, hotel, residential and retail properties. A Fortune 500® company with annual revenue of $20.9 billion and operations in over 80 countries around the world, our more than 103,000 employees bring the power of a global platform combined with local expertise. Driven by our purpose to shape the future of real estate for a better world, we help our clients, people and communities SEE A BRIGHTER WAYSM. JLL is the brand name, and a registered trademark, of Jones Lang LaSalle Incorporated. For further information, visit jll.com.
