A framework for energy storage in the Spanish power market

Public report – KEY MESSAGES

A note from AFRY Management Consulting

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AFRY Management Consulting provides leading-edge consulting and advisory services covering the whole value chain in energy, forest and bio-based industries. Our energy practice is the leading provider of strategic, commercial, regulatory and policy advice to European energy markets. Our energy team of over 250 specialists offers unparalleled expertise in the rapidly changing energy markets across Europe, the Middle East, Asia, Africa and the Americas.

This study has been conducted as a Multiclient project entitled 'Development of a storage framework in the Spanish power market', led by AFRY Management Consulting and with cooperation of the Gold Members of the project. It has been sponsored by 11 founding members, including Gold and Silver Members. Project members are owners of the report, and as such can use it at their discretion, under the conditions agreed in the Multiclient project.

This public report presents the main findings and proposals of the study. All analysis have been conducted by AFRY Management Consulting with proprietary models, and a combination of own assumptions and assumptions discussed specifically for this study. Independent interpretation of results has been led by AFRY, incorporating views of all Gold Members, and does not necessarily represent the views of any of the study members.

This report is published for dissemination and discussion with wider stakeholders of the energy sector. Gold Members (by alphabetical order): Atalaya Generación, Energia de Portugal, Endesa Generación, Galp, Iberdrola, Magtel, Plenium Partners, Repsol, Total Energies. Silver Members (by alphabetical order): Canadian Solar, RWE

Key messages

1

Electricity storage is considered one of the key enablers of Spain's 2030 National Energy and Climate Plan (NECP), which considers a total deployment of 12GW of new storage capacity aggregating different technologies. However, the market seems unlikely to deliver said targets, even when stacking the current revenue streams from available markets and the planned incentives or new markets.

The study has assessed the economics of different storage capacity mix and different macroeconomic scenarios compatible with the political decarbonisation targets. It finds that revenues from price arbitrage in the spot market, and ancillary services revenues, would not enable sufficient returns for investors, particularly considering that storage reduces peak/off-peak price spreads and therefore it cannibalises its main revenue stream.

2

A Capacity Market design was proposed by the Spanish Government in April 2021 for consultation, aiming among other purposes at attracting new storage capacity that will provide backup firm capacity whilst contributing to integrate a high share of RES into the Spanish power system. However, said Capacity Market is likely to detect a limited need of new capacity for security reasons, added to the fact that wider benefits of storage are not considered in the assessment of 'anti-blackouts' firm capacity requirements.

European State Aid Guidelines require that Capacity Markets rely in a security of supply study, which justifies the cost-effective level of back-up against loss of load in the hours with the tightest reserve margin. Given the capacity mix of the Spanish power system, an independent probabilistic assessment of security of supply suggests that limited new capacity would be required if only an 'anti-blackouts' firm capacity is requested. However, storage has wider impacts during all other 'normal hours' in the year, that are not even assessed by the security of supply study.

3

The proposed Capacity Market is a positive mechanism to bring new storage into the power market, by providing an additional revenue stream. However, the expected award process based in the lowest bid and a 'capacity derating factor' may potentially fail to award the best 'value for money' to consumers. Based on the design of this mechanism, higher bids are discarded despite their potentially wider benefits beyond firm availability in the annual tightest hours.

The current methodology to assess security of supply aims at finding the cost-effective new build capacity, based on the cost of back-up and the political value of Expected Energy Not Supplied. Whilst a given 'Project 1' might bid lower in €/MW/year than a 'Project 2' for a same derated capacity service (i.e. contribution as firm capacity available in the tightest hours), 'Project 2' could potentially present more benefits than 'Project 1' regarding RES integration, development time, grid services etc. Therefore, the Capacity Market award process might consider additional features besides a single derating factor to better account for the wider value of competing projects.

4

Whilst the proposed Capacity Market is likely to bring only a fraction of the NECP political storage target of 12GW by 2030, a high capacity of storage (even exceeding the political target) would bring a positive Social Welfare for consumers. This means that the cost of incentivising the deployment of at least 12GW of new storage capacity through an enhanced market-driven mechanism, would be lower than the benefits to consumers.

When modelling expected returns of a new storage project under the current markets available, such as day-ahead price arbitrage and ancillary services, returns are found insufficient to enable investment decisions. However, this does not mean that the project shouldn't get built, if its Social Welfare to consumers is positive, and benefits outweigh the cost of an incentive/service (i.e. a positive cost-benefit analysis). The study shows that up to 17GW of new storage would present in the long run a positive Social Welfare to consumers, with the Net Present Value of benefits exceeding the Net Present Value of costs discounted at a standard social discount rate.

5

New storage provides wider benefits to consumers that can be modelled versus a counterfactual scenario without (or with less) storage. These include a reduction of end-user prices by affecting the peak wholesale prices, but also a reduction of incentives to older and new renewable energies borne by regulated system costs, better RES integration (fewer curtailments) without oversizing RES installed capacity, lower gas consumption and emissions, better balance of trade, and more investments and jobs. Equally importantly, high RES and storage provide resilience of energy prices to volatility of commodity prices.

Adding storage to the power system impacts the wholesale market prices, reducing the frequency of RES curtailments and reducing the cost of peaking thermal generation, with a net reduction of baseload average prices (even without considering potential spikes of gas prices). But additionally, other benefits arise driven by the impacts on the capacity mix which is more efficiently utilised, as well as on jobs or the economy. Finally, scenarios with high RES and storage are an 'insurance' against volatility of commodities, shielding partly electricity consumers and RES developers from suffering transitory gas or carbon price shocks, or the effects of extreme weather patterns.

6

On one hand, innovative regulatory proposals are constrained by a range of principles depicted in the Clean Energy Package, the State Aid Guidelines, and national regulations. On the other hand, effectiveness of innovative regulatory proposals can be ranked based on the volume of storage capacity that the proposal may bring. Both dimensions, 'regulatory complexity' and 'effectiveness' must be considered when proposing new regulatory mechanisms aiming at increasing storage development up to the cost-effective levels for consumers.

Some regulatory constraints are currently red lines, whilst others can be overcome with due arguments. Even those red lines could

be reopened at European level, especially in current times of open discussion on market design. Low regulatory complexity is highly valued by stakeholders to start an early deployment of storage. However, simple new mechanisms may not be the best option if they fail to bring significant new capacity. No easy solution scores the highest in both dimensions, and stakeholders including the Spanish regulator ought to choose the most promising paths, judging whether a greater result is worth a more detailed analysis.

7

Among a wide range of regulatory proposals assessed, a first Proposal A is put up for discussion. Proposal A consists of a Capacity Market adapted for long-duration and short-duration storage. This proposal does not alter the total tendered capacity requirement resulting from the security of supply study mandated by European regulations, yet it provides opportunities to more costly storage bids that bring additional value than their contribution to security of supply.

An example of this is a 'Project 1' which bids a little higher than a 'Project 2', yet 'Project 1' provides a much higher service to the market even accounting for a same derating capacity. This can be addressed with two variants of the Proposal, A1 and A2.

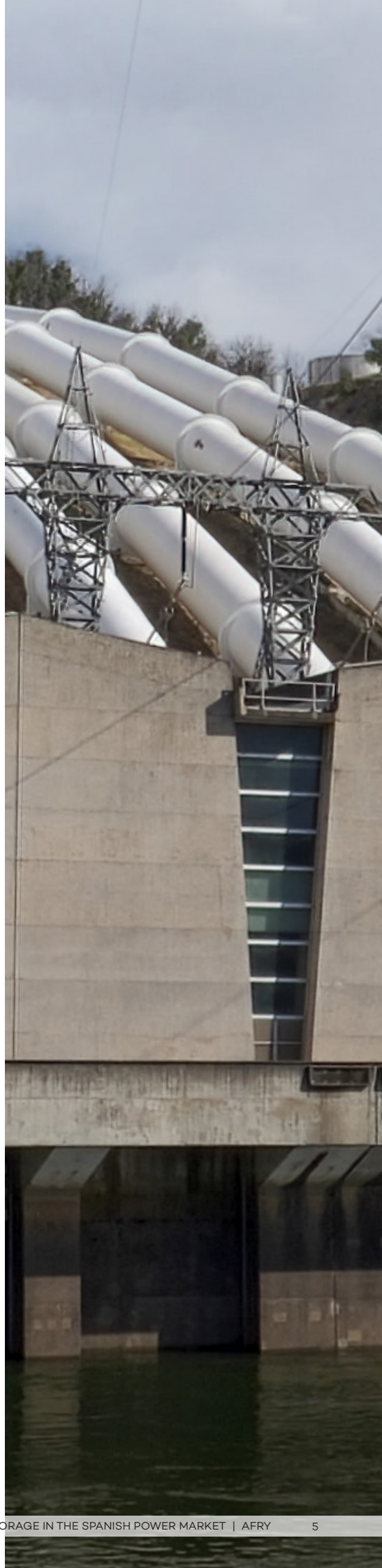
Under Proposal A1, the total tendered capacity is split in two pre-defined buckets of short-term and long-term duration, each bucket with its own development timings, derating factors, duration of the capacity payment, and clearing price.

Under Proposal A2, one single bucket is tendered but 'scaling factors' are used assigning 'extra value' to specific chosen features. For instance storage duration, or 'grid forming' capability, can justify to award at a higher price. One benefit of A2 is that any number of scaling factors can be gradually incorporated, as the market gets familiar and as system requirements evolve over time.

8

A second Proposal B is also put up for discussion, aiming at bringing substantially more storage capacity to the market than Proposal A in exchange for a more sophisticated design. Based on a cost-benefit analysis of the 12GW of storage targeted in the NECP, a two-round capacity market is held, complementing the security of supply needs with additional volumes guided by the NECP.

For this, a first round of the Capacity Market should tender storage volumes under a new procedure justified by efficient RES integration and greenhouse gas emissions reductions, in accordance with State Aid Guidelines. A second round of the Capacity Market would address security of supply requirements and therefore it would ensure that existing plants have an incentive to remain in operation. Hence, with this Proposal B we achieve the coupling of two different categories under State Aid Guidelines: reduction of greenhouse gas emissions through support to renewable energy and security of electricity supply.



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Other regulatory mechanisms that could potentially incentivise the deployment of storage have been assessed. Some of these mechanisms have positive elements worth discussing and should not necessarily be discarded, yet none scores high in the 'regulatory complexity' and 'effectiveness' dimensions. Whilst Proposal A and Proposal B also bring some challenges and require further detail, they seem to bring the best compromises and are generally considered to be fully implementable in reasonable timeframes towards achieving the 2030 targets.

Other mechanisms assessed included direct Capex grants, a 'pool + premium' based in a CBA process, mandatory storage requirements for RES, fiscal incentives, network reinforcement or flexibility services, the creation of new ancillary services, or an innovative settlement based in Contract for Difference on a 'strike spread' etc.

A combination of mechanisms could be foreseeable, with occasional direct Capex grants, or transitory mechanisms under regulatory sandboxes, complementing one main regulatory mechanism that the Spanish market ought to pursue as a main driver.

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The study aims at increasing awareness of the challenges of developing new storage from an economic and regulatory point of view, and at proposing innovative solutions to the Spanish regulatory authorities and to the wider community of the energy sector stakeholders. Therefore, the study is not the end but rather the beginning of a discussion towards designing a new electricity market capable of building a secure, sustainable and affordable electricity system in the Iberian market and in Europe.

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