BESS Profitability Analysis in Greece

Energy & resources

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Introduction

The Greek NECP has set very ambitious targets for Energy storage with 5.6 GW up to 2030, capacity much needed to integrate the very large amounts of variable RES and enhance system flexibility.

The recent tender for storage systems, including the support for grants to the successful tenderers, through the Recovery and Resilience Fund, vastly contributes towards this direction and supports storage technologies. The ex-ante analysis and simulation of BESS indicate that the commercial evaluation of such systems has proven to be a complex exercise to resolve with a number of parameters to be taken into consideration and modelled.

In the weeks before the tender the spotlight was on the relative terms published by RAAEY. The Regulator received and answered hundreds of questions from interested BESS investors, however not shedding light on key issues of the tender, such as the grouping criteria for the BESS or the methodology for the ex-ante calculation of BESS market revenues. The candidate investors were called to submit their offers considering the importance of parameters such as the investment's CAPEX and OPEX components and the possible impacts of the market participation incentive mechanism which compares market revenues between BESS belonging to the same group.

The closure of the first phase of the tender process and the relative experience gathered through performing various exercises regarding the technical and financial modelling of BESS allows us to extract some first conclusions regarding the basic characteristics, mechanics, and drivers of the Greek tender process. The final assessment of this initiative however will need to wait, until the results of all three tenders are published and the first BESS are constructed and become fully operational in the Greek electricity market.

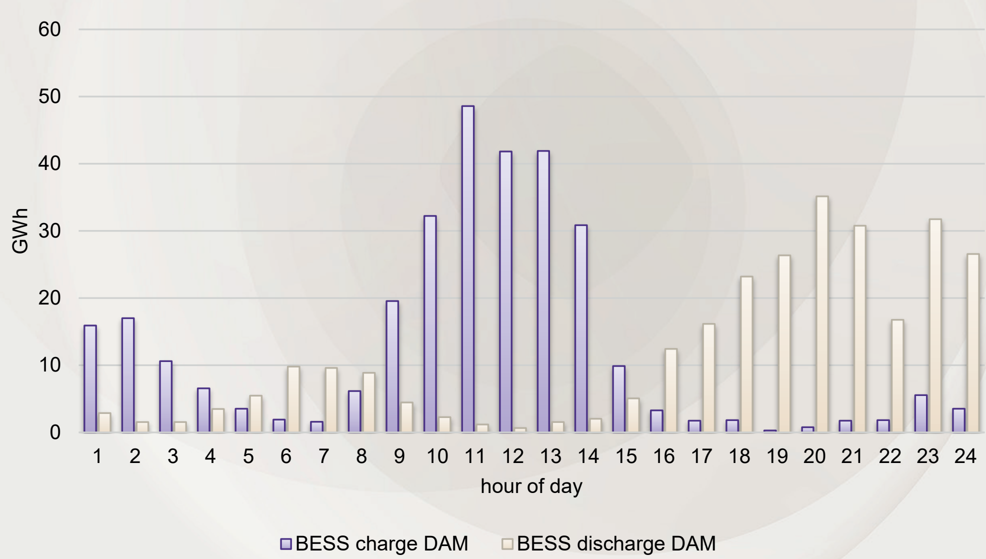
In the following article we present our insight from this analysis.

Insights on the recent BESS tenders in Greece

Greece is amongst the European Champions into the path towards "Net Zero" with very ambitious targets for deployment of Solar PV and Wind Generation.

The Greek NECP has set very ambitious targets for Energy storage with 5.6 GW up to 2030, capacity much needed to integrate the very large amounts of variable RES and enhance System Flexibility. Despite its proven value to social welfare, Energy Markets still cannot monetize the value of Energy storage and therefore support is needed, for market entry. The first such tender for award of CAPEX and OPEX support to BESS organized by RAAEY, is a critical step for the deployment of the first utility scale BESS in Greece. 95 offers in total have been received amounting to approximately 3.3 GW, which contest the 400 MW quota of this first phase. In total 1000 MW of BESS will receive the support mechanism and the plan is to be awarded with two more phases culminating December 2023.

Figure 1: Indicative BESS participation volumes in DAM and IDM for a 2h 50 MW system (2025-2034)



The ex-ante analysis and simulation of BESS indicate that the commercial evaluation of such systems can be complex, and attention needs to be paid on a series of parameters:

CAPEX

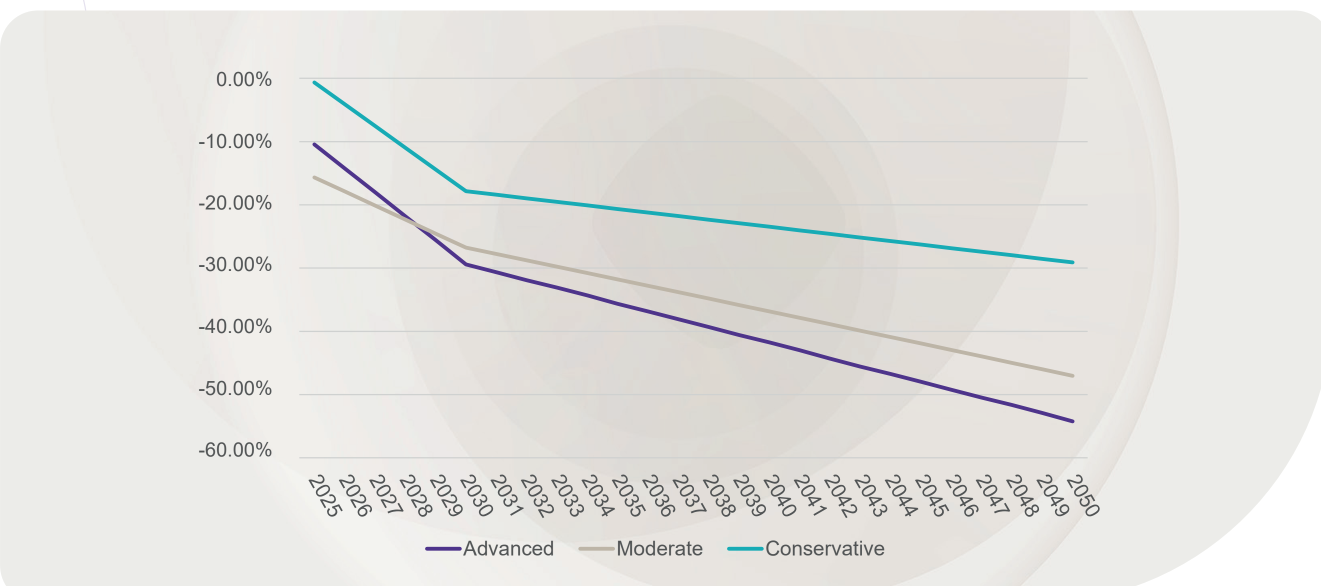
CAPEX of the BESS plant is of the greatest importance regarding the commercial assessment of the investment. With BESS system prices being high today (with costs for Lithium-Ion BESS ranging from 550.000 EUR/MW to 650.000 EUR/MW for 2-hour BESS capacity (turnkey costs), but with costs dropping drastically in the future[1], minimizing CAPEX today can be of great value, in some cases even greater than maximizing revenue ten or more years in the future.

REPEX / augmentation plan strategy

The augmentation or repower plan strategy to be followed by the investor will greatly influence the commercial assessment both in terms of costs and revenues. In order to minimize costs, investors will require the least REPEX possible and make decisions considering the evolution of BESS costs in the future. Effects such as technology developments and economies of scale are anticipated to reduce BESS future prices, but on the other hand, availability and cost of materials and disruptive events such as crises may stall those reductions or even increase temporarily the anticipated costs.

Considering future estimations of considerable cost reduction such as NREL' s (figure above), REPEX plans should delay for as late as possible (in case

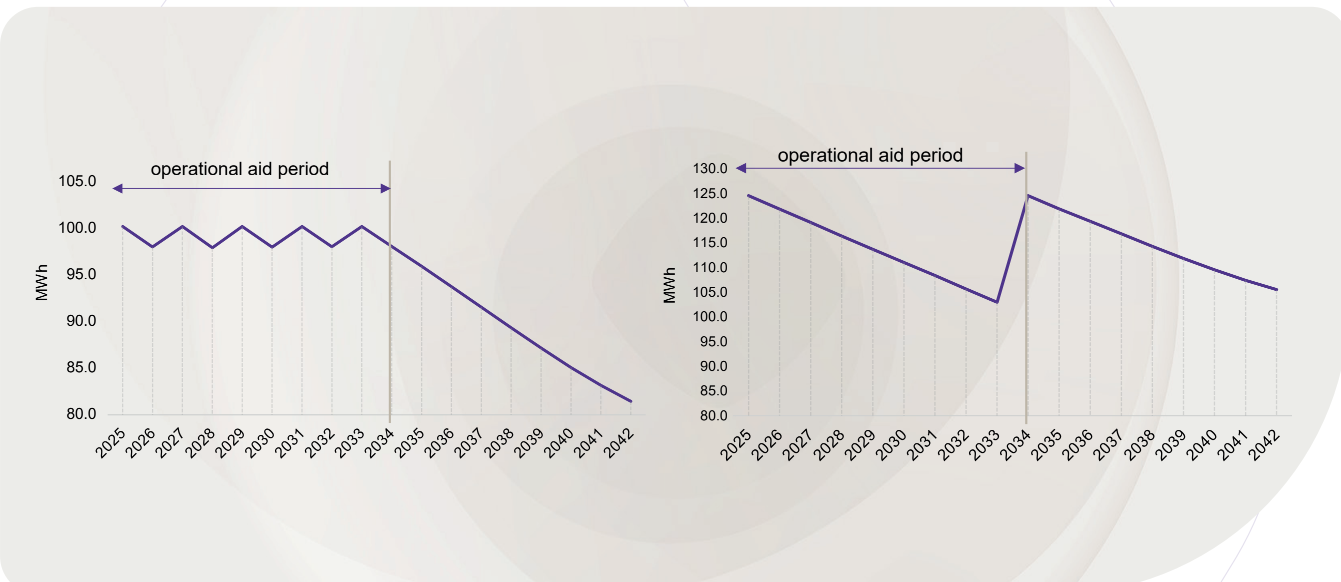
Figure 2: CAPEX reduction criteria according to NREL (2 hr utility scale BESS)



[1]Cost Projections for Utility-Scale Battery Storage: 2023 Update, NREL

of major augmentation) in order to secure the lower prices projected for BESS in the future. However, retaining increased capacity and a healthy system (especially in the first years with high potential for arbitrage) also means increased market revenues. There are cases where the BESS investors choose to overdesign BESS capacity (for example instead of building a 50MW/100MWh system to build a 50MW/125MWh system) in order to get increased market revenues in the early years of operation and not have to perform smaller REPEX at regular time intervals. This strategy entails increased CAPEX however. On the other hand, there are strategies where the battery system is augmented in regular intervals by adding more battery cells and keeping the capacity steady over time. This keeps revenues in a medium level and reduces CAPEX but has increased technical and logistics challenges. Part of the strategy also concerns the available space and the preparation of the ground to receive additional cells containers in the near future. Whichever strategy may be followed investors shall keep in mind tender specifications regarding maintaining BESS systems performance above the predefined criteria. Finally, one can choose to develop a system with small overcapacity combined with a BESS augmentation strategy which is less demanding (keeping revenues and costs balanced). The BESS augmentation strategy can thus play a significant role, especially when the BESS is examined in a competitive environment such as the electricity markets.

Figure 3: BESS capacity over the years and augmentation plan for a 2 hour 50 MW system



BESS Market Route

As soon as a BESS system is completed, it will participate in the DAM and IDM Markets run by HEnEx and BEM Market run by IPTO. This would typically happen through aggregators (especially for independent BESS which are not part of vertically-integrated Market Players. This would possibly mean that the aggregator would have the incentive to over-utilize the BESS ("high cycling") in order to increase profit, but at the same time exhaust the asset which will face the risk of quick aging. In this context, there must be a coherent and clear strategy for the BESS operation by the investor and this strategy must be reflected in the corresponding bilateral agreement in order for the asset to reach the assumed life-time.

Market participation strategy

The market participation strategy assumed for the BESS is one of the most important issues regarding the commercial assessment. The typical assumption for such systems is that they perform arbitrage in the Wholesale markets, i.e. purchase energy (charge) in times when prices are low and sell energy (discharge) in times when prices are high. Our analysis - in line with various studies - shows that the wholesale market arbitrage opportunities are not enough to constitute a BESS investment as profitable and relying just on this revenue stream can be extremely risky. Moreover, wholesale market spreads may still appear quite high in the short to mid-term future but this cannot be guaranteed in advance, as this is related to overall evolution of the system and the deployment of large electricity storage systems, such as those under the latest ambitious NECP targets. This is why parallel revenue streams need to be secured

in what is generally known as revenue stacking. In this concept the BESS can extract revenues from other market segments, such as intra-day market and balancing and "ancillary services" markets, as well as capacity markets (if available in the future). However, there is also a risk for these market revenues too, especially considering increased future competition (BESS or other technologies), as well as other flexible units that will contest shares of these markets (market cannibalization for example regarding future anticipated margins of balancing market). It is important in this case to run sensitivity scenarios regarding the market share that a BESS system can secure.

BESS grouping principle

The grouping of the different BESS (important for the assessment of the operational aid), combined with the competition term of the CfD proposed by RAAEY, may have significant impact on the business plans of the investors. In this case, CAPEX, REPEX (i.e. augmentation strategy) and the market participation strategy (number of cycles per day) interrelate, imposing strong influence on the required operational aid (and thus the bidding strategy during the auction). Let's assume the following indicative scenarios for 50MW BESS:

Scenario 1

A battery with no overcapacity (2hr BESS) and a regular interval augmentation strategy performing 1.5 cycles per day (average). Scenario 1 is expected to have low CAPEX, mid-level REPEX and high revenues (due to 1.5 cycles per day).

Scenario 2

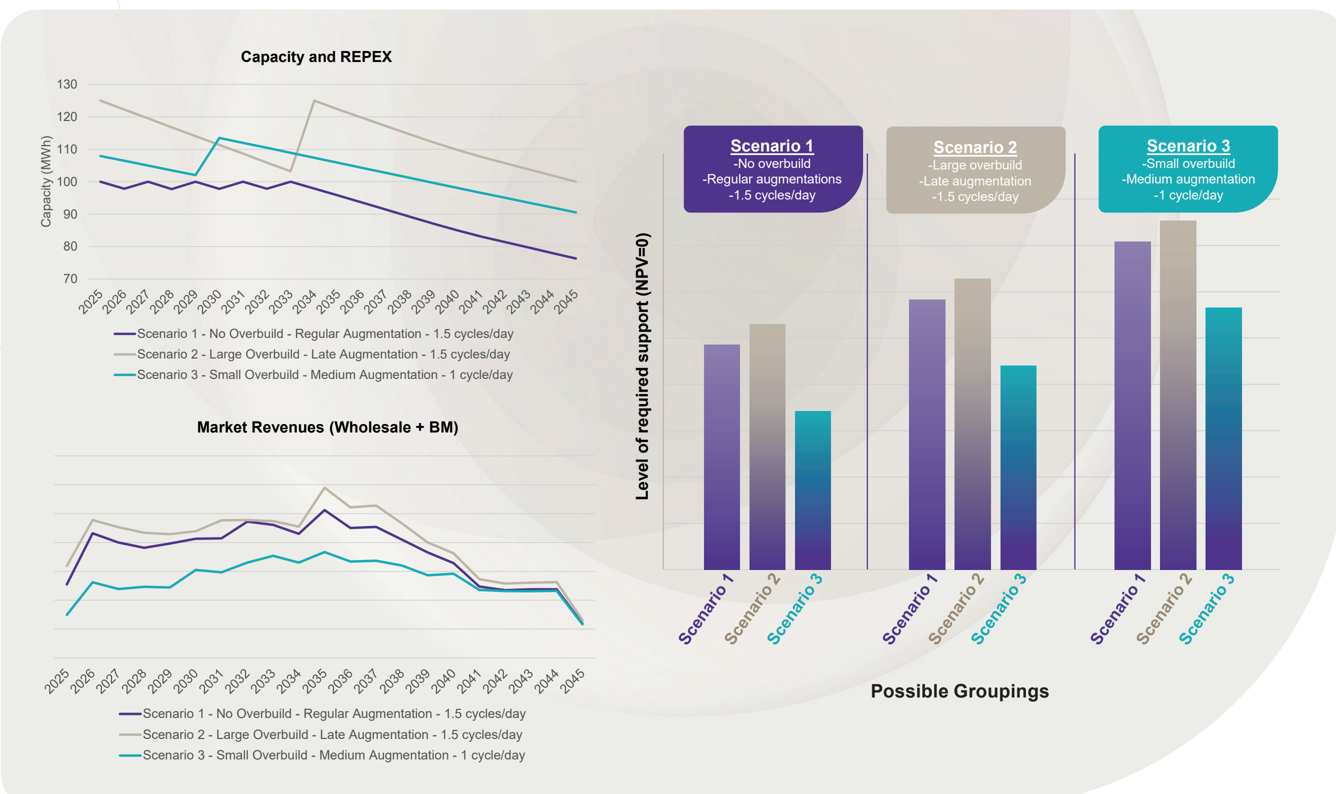
A battery with large overcapacity (2.5hr BESS) with a single late augmentation performing 1.5 cycles per day (average). Scenario 2 is expected to have high CAPEX (due to overbuild), low REPEX (due to decreased prices 10 years later) and higher revenues (due to increased capacity).

Scenario 3

A battery with small overcapacity (2.15hr BESS) with a single mid-term augmentation performing 1 cycle per day (average) Scenario 3 is expected to have mid-level CAPEX and low market revenues (1 cycle per day) but also lower REPEX (due to less aggressive usage of the battery).

The assessment of the required operational aid (i.e. level of bid) can be quite different depending on the composition of the group that each BESS belongs to. The following figure illustrates the level of minimum required operational support (bid for which NPV=0) from the point of view of each system/scenario when grouped with systems of the same or different scenarios. The left part of the bar-chart shows the required aid of a Scenario 1 BESS when grouped with BESS of the same type (first bar) and when grouped with Scenario 2 (2nd bar) and Scenario 3 (3rd bar) BESS. If a Scenario 1 BESS is grouped with Scenario 2 BESSs, the required support increases due to the fact that Scenario 2 BESSs extract more revenue from the markets and thus the Scenario 1 BESS is penalized by the competition term of the CfD. In contrast, if a Scenario 1 BESS is grouped together with Scenario 3 BESSs, then it requires much less support. This is because Scenario 1 BESS makes more market revenues and thus is further supported by the competition term of the CfD. The same analysis has been conducted from the point of view of a Scenario 2 (middle part of the bar-chart) and Scenario 3 (right part of the bar-chart) BESS.

Figure 4: Analysis of different grouping scenaria



OPEX

OPEX also plays a significant role especially when assessing auxiliary power costs for large systems, but most importantly when addressing the issue of fees form market participation which would (for small system at least) typically be realized through aggregators. It is also reasonable to assume that more sophisticated and incentive based or de-risking models of cooperation between the investor and the aggregator will emerge, compared to the simple representation through a EUR/MWh fee.

> “Models for the cooperation of BESS investors and Aggregators are of great importance for assessing the investment.”

Conclusion

In conclusion, the recent Greek storage tender has proven to be a complex exercise to resolve with a number of parameters to be taken into consideration and modelled. In our view, at least the following assumptions with regards to the bidding strategy and behaviour of market actors are to be tested and validated:

- Players that can achieve economies of scale or benefit from a centralized procurement strategy will achieve a significant cost advantage versus medium sized players.
- We expect to see diversified strategies with respect to system size with several players splitting their bids in smaller segments/ projects to ensure a winning position.
- It would not be a surprise to see some players providing aggressively low bids, but we consider that most of them have placed their bids or part of their bids within the reasonable and anticipated figures.
- The methodology for the categorization and grouping of BESS systems to be determined by RAEEY is a crucial element that will hugely affect the augmentation strategies chosen by market actors.
- The largest share of the revenues will come from the Balancing and Ancillary Services Market in the first years of operation.
- Intense competition and technological improvements will drive system costs down in the mid-term future (i.e. potentially in new auctions).
- The terms of financing have not been ex-ante known with high precision (also due to limited available time) and the banking sector will have to deepen understanding on these novel projects.

Regarding the Energy Sector, Grant Thornton is a leading provider of consulting services in the international energy and green transition sectors, focused on sustainable energy for everyone. By combining our unparalleled experience in the design, operation, simulation, and analysis of Energy Systems and competitive Energy Markets (Gas, Electricity and Renewables) as well as our modelling and optimization capabilities regarding electricity storage, we can support different types of institution on analyzing the profitability of BESS and the participation of BESS in tender procedures.

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