AURORA
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AURORA KEYNOTE
BESS IN SOUTHERN EUROPE: HOW TO NAVIGATE RISKS & FIND VALUE

Southern Europe stands as a promising region for BESS investments, with Italy emerging as a top market

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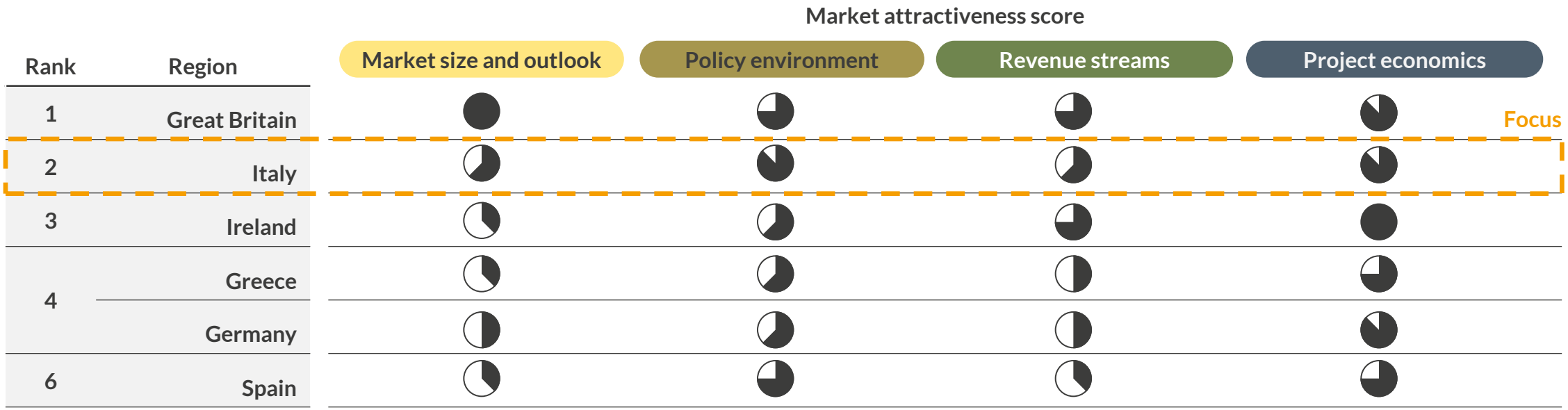

- **Great Britain**'s robust installed capacity today and outlook make it the leading BESS market in Europe by size. Potential opportunities from BM and high daily spreads in the wholesale market present attractive revenue opportunities.
- **Ireland** has attractive economics for 2h batteries, driven initially by regulated arrangements and later by energy arbitrage.
- **Greece**'s scheme to support at least 1GW of storage projects and a 3GW deployment target by 2030 from its updated NECP makes it an attractive market to watch, though is hampered by lower frequency response prices.
- The upcoming Capacity Market in **Spain** improves the availability of contractable revenue streams and boosts Spain's policy environment for BESS.

An ambitious target of 58GWh of battery by 2030, coupled with favourable merchant project IRRs, makes Italy the most attractive market in Southern Europe, and second most attractive in Europe as a whole.

Sources: Aurora Energy Research

In Italy, full achievement of national target would see utility-scale battery capacity grow sevenfold to 58GWh by 2030, a ~50GWh increase

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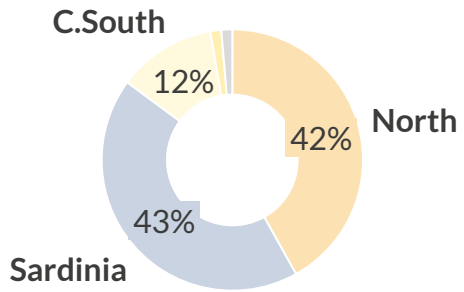
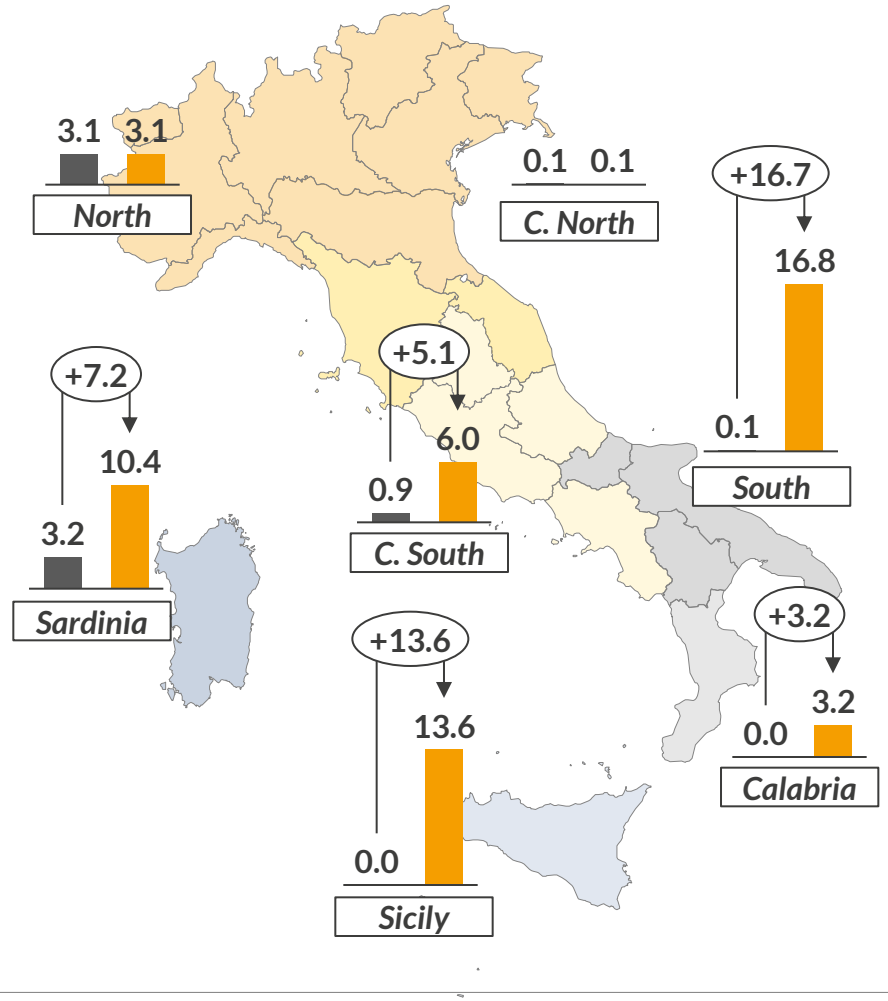
Installed utility-scale battery capacity in Italy, 2025 vs target 2030
GWh

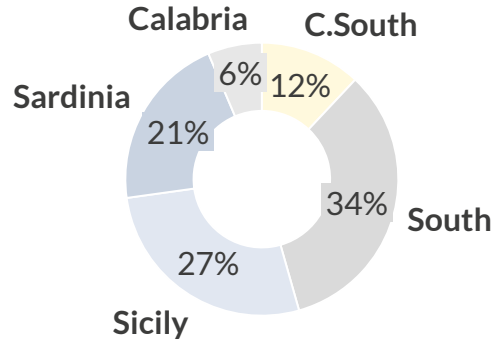
2025



The past Capacity Market rounds awarded
7.4GWh (~2GW) BESS by 2025



2030



The TSO identifies the need of
~58GWh BESS in 2030
+50GWh (+6-8GW[1]) vs 2025

Installed capacity (2024) National target (2030)

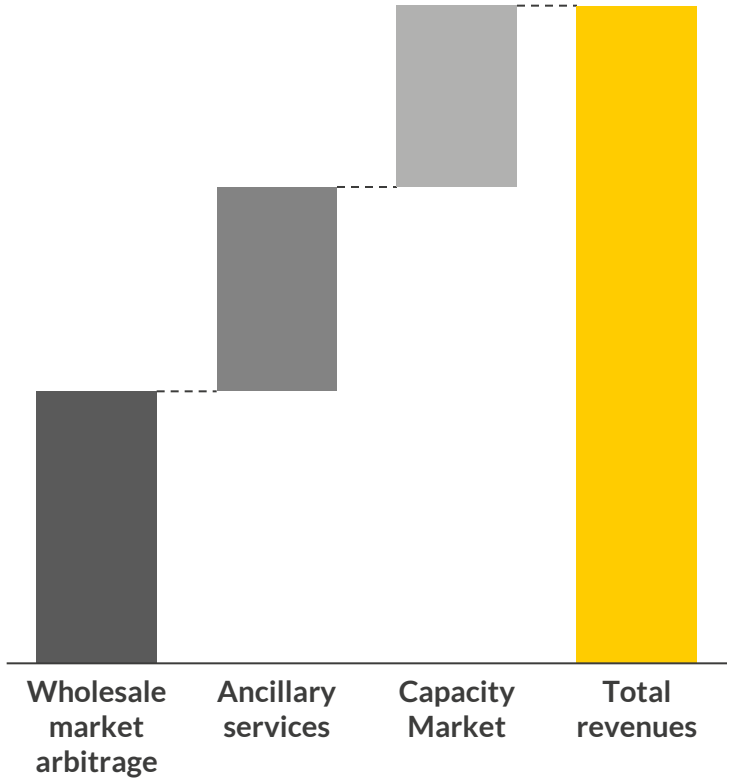
1) Assuming 8h-6h durations.

Source: Aurora Energy Research, Terna

Two main routes-to-market will be driving battery buildout, allowing different revenue stacking opportunities

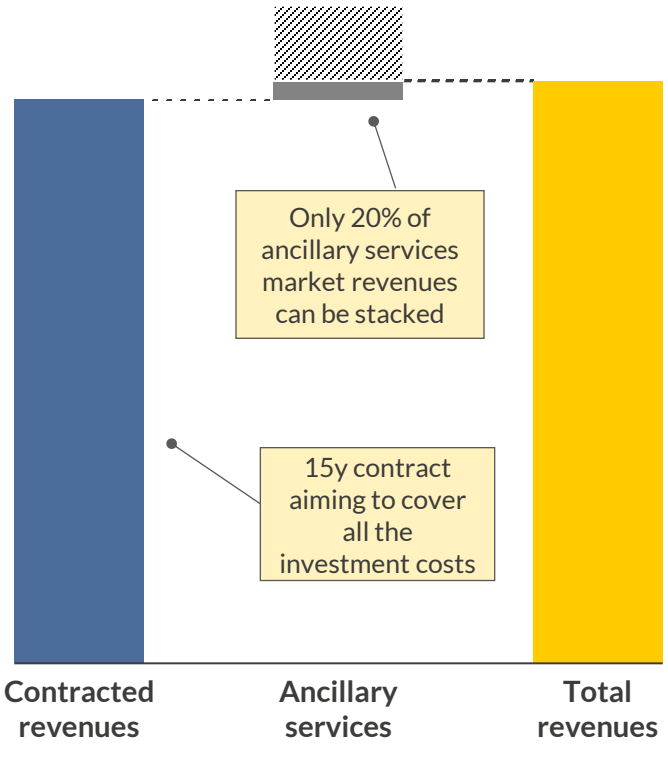
1 Merchant business model

Capacity Market + merchant trading
€/kW



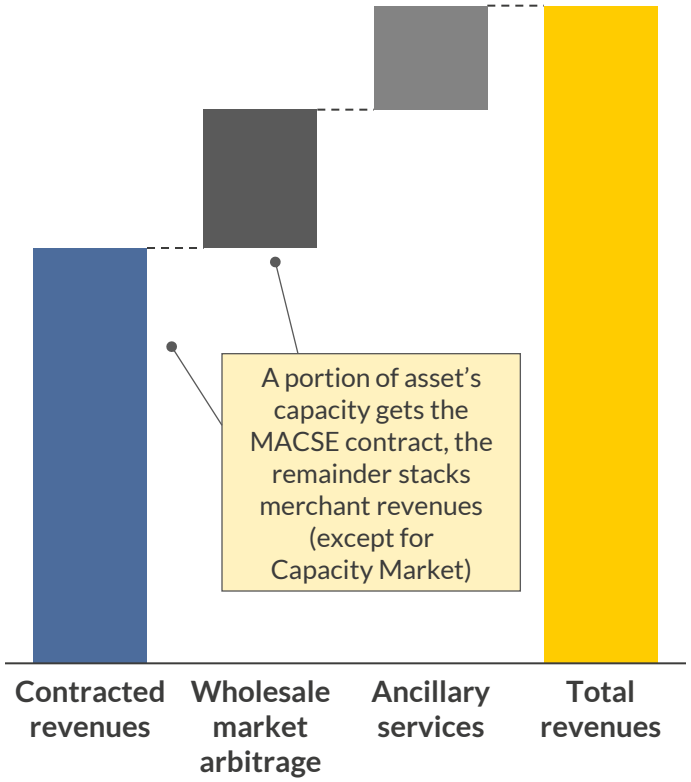
2 Contracted revenues business model

Full participation to MACSE
€/kW



3 Hybrid business model

Participation to MACSE + merchant trading
€/kW



Sources: Aurora Energy Research

Growing daily spreads increase opportunities for day-ahead market arbitrage, though they are not sufficient alone to achieve the required rate of return

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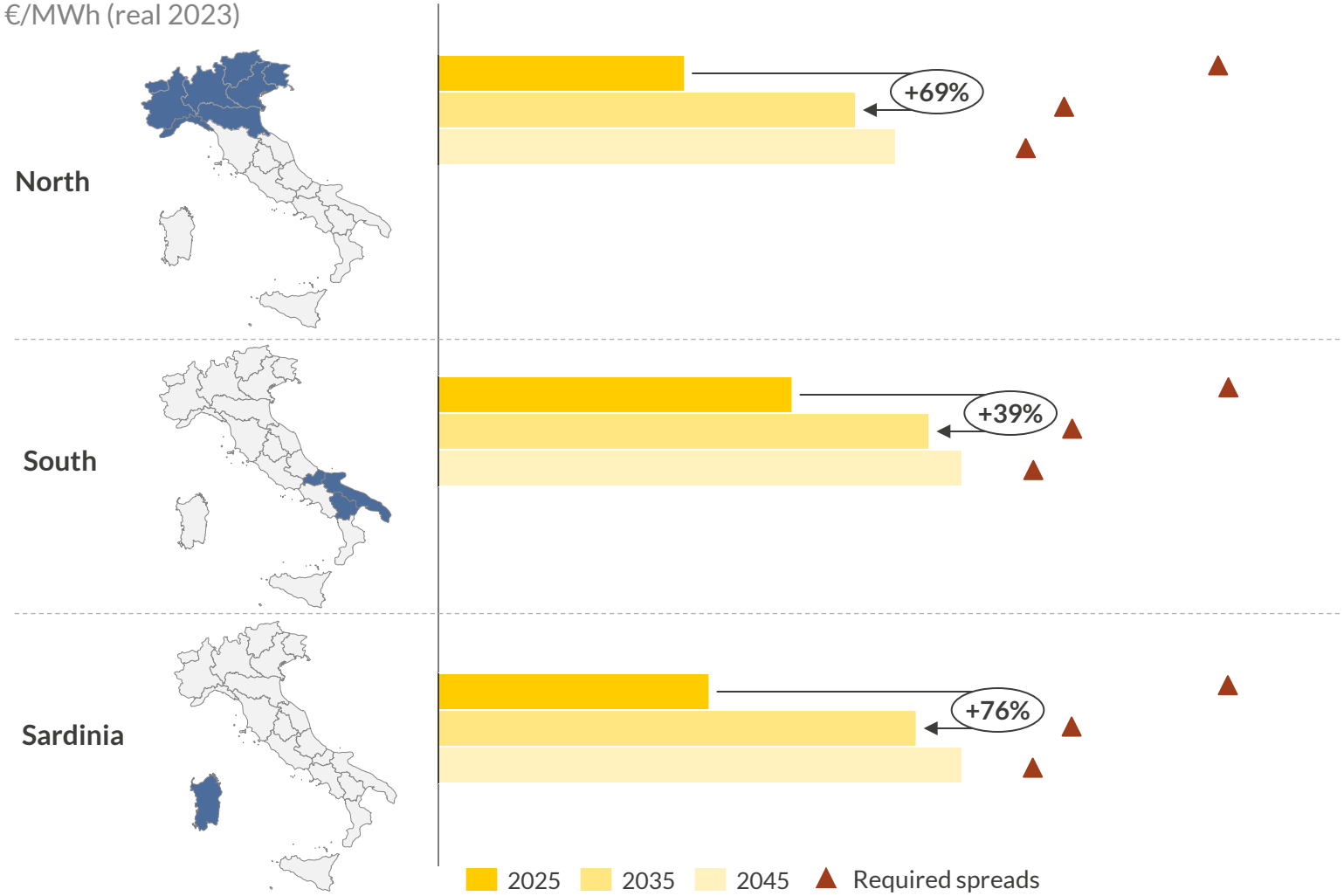
Average daily 4-hour spreads
€/MWh (real 2023)



North will see a significant increase in RES capacity
+28GW (+135%) by 2035

South hosts the highest share of demand from RES
~70% vs 12% in the North in 2025

Increased interconnector capacity leads to long-term convergence of daily spreads across zones

In the long term, spreads increase at a slower pace and flatten out thanks to increased flexibility
~19GW nationwide by 2045 (3GW in 2025)

1) Fixed spread necessary to reach an IRR of 11% over the lifetime of the battery; values for required and realized spreads are theoretical and based on no battery degradation and 100% system efficiency. Including these would further increase the disparity between the two.
Sources: Aurora Energy Research

Increased battery participation will lead to convergence of prices also in the national ancillary services market (MSD)

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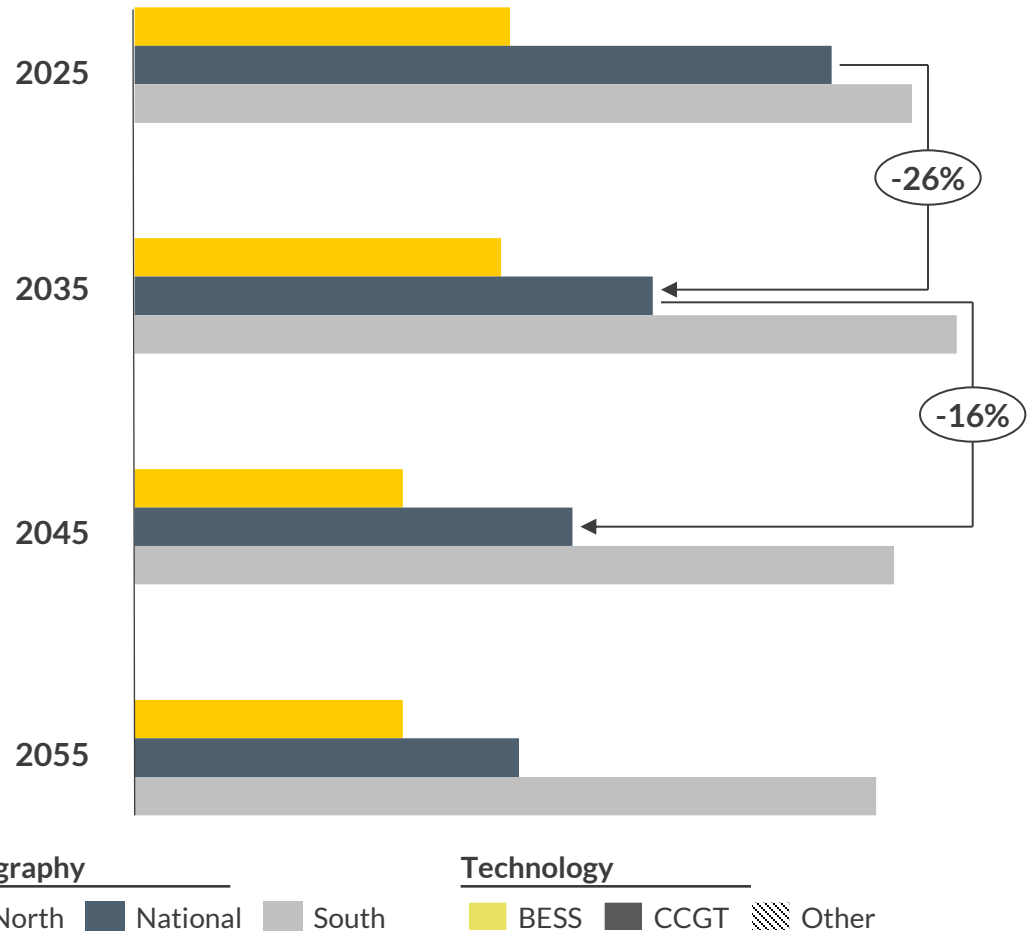
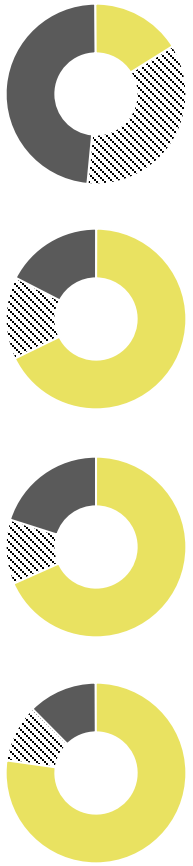
MSD premiums versus the day-ahead price
€/MWh (real 2023)



BESS MSD market share nationwide[1]
%



Take-away

1. In the medium-term, zonal deviations in the MSD prices curb thanks to:
   - Grid expansion improving local constraints
   - New capacity at critical nodes
   - Battery build-out

2. However, as day-ahead prices tend to reduce to a different extent depending on the zone, MSD premiums versus the day-ahead prices remain different across zones

3. Whilst MSD volumes are expected to increase due to higher RES imbalance, the increasing participation of batteries leads to decreasing MSD spreads, to a different extent depending on the zone

1) Considering the upward volumes in the MSD market.

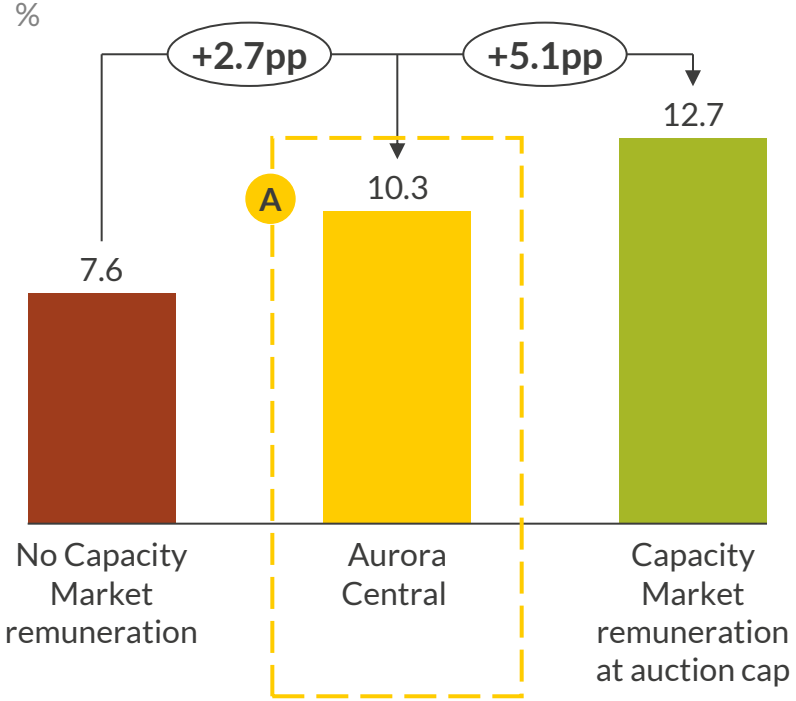
Sources: Aurora Energy Research

Energy arbitrage between wholesale and MSD markets is not sufficient to sustain the business case – projects are reliant on capacity remuneration

COD: 2028 | 4h | Derating factor 67%

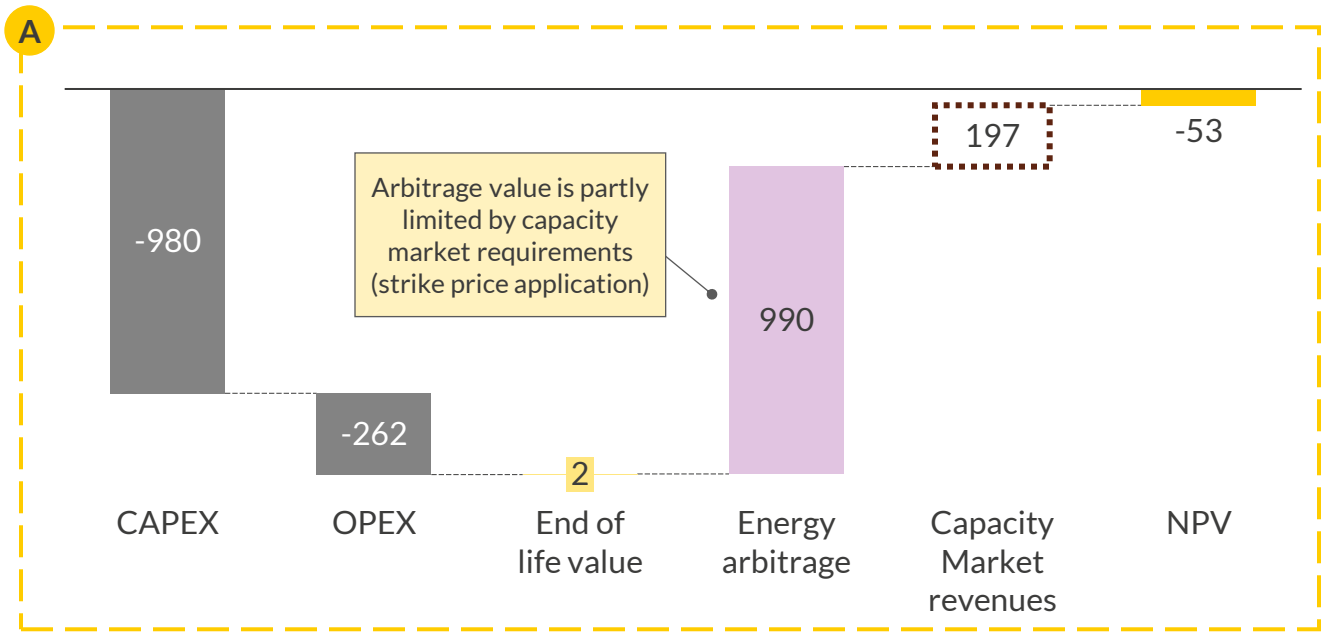
IRR - 4h battery in South

%



NPV stack - 4h battery in South

€/kW



Sources: Aurora Energy Research

Under a merchant business case, stacking revenues is essential for BESS investments, but their expected level sees variations across zones

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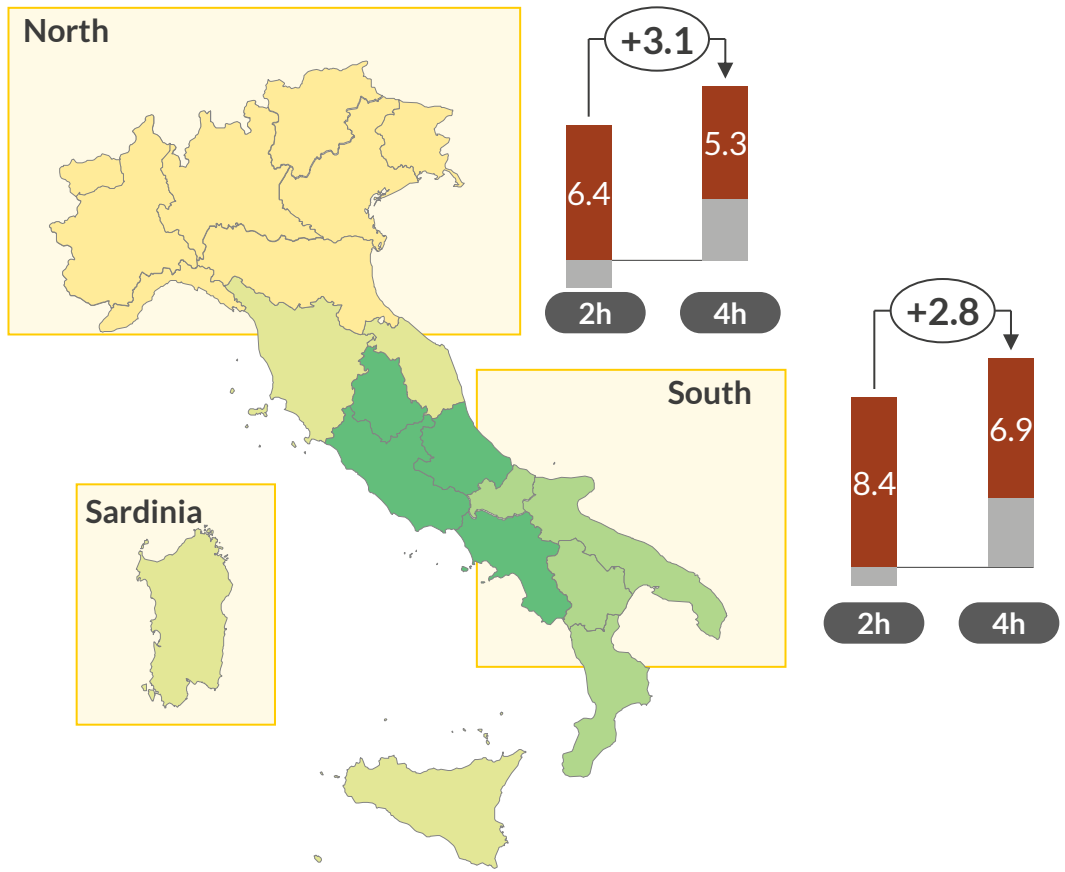
IRR by zone and duration

%

COD: 2028



IRR for 4h battery

IRR < 9% | 9% <= IRR < 10% | 10% <= IRR < 12% | IRR >= 12% | MSD benefit | Wholesale Market Arbitrage + Capacity Remuneration

Take-away

1. 4h batteries profitability outperforms the 2h batteries thanks to Capacity Market de-rating factors favouring longer-duration batteries, as well as greater energy arbitrage opportunities

2. Batteries in South benefit from higher day-ahead spreads as well as higher margins on the MSD market due to stronger balancing needs

3. Unlocking MSD potential, BESS profitability increases with a relative importance varying by zone: Sardinia offers lower returns due to lower balancing needs and remaining coal generation in the island

Sources: Aurora Energy Research

Despite the expected high profitability in a Central scenario, merchant battery investments have a different degree of exposure to risk scenarios

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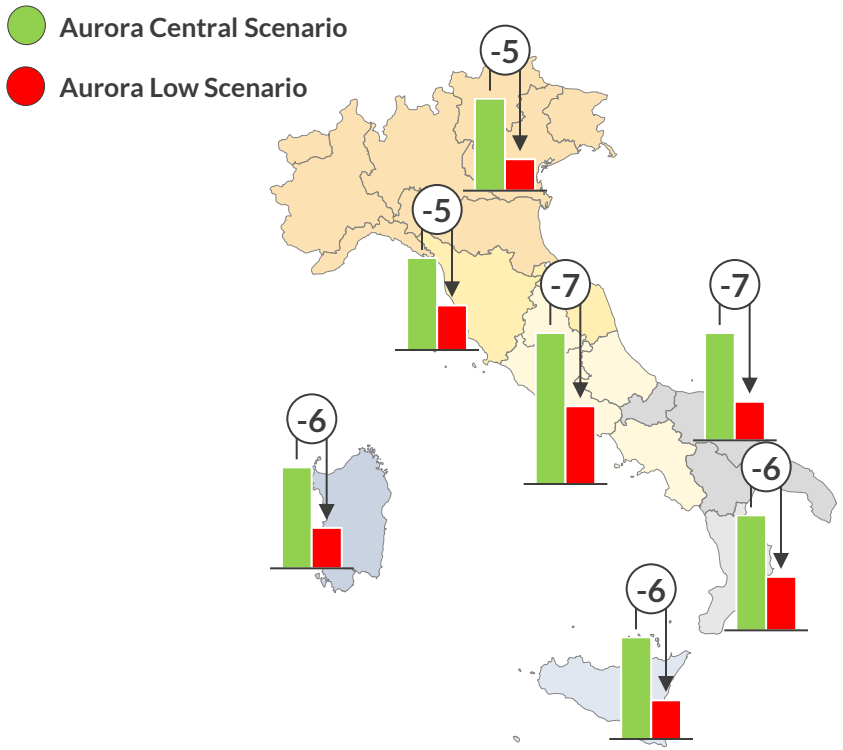
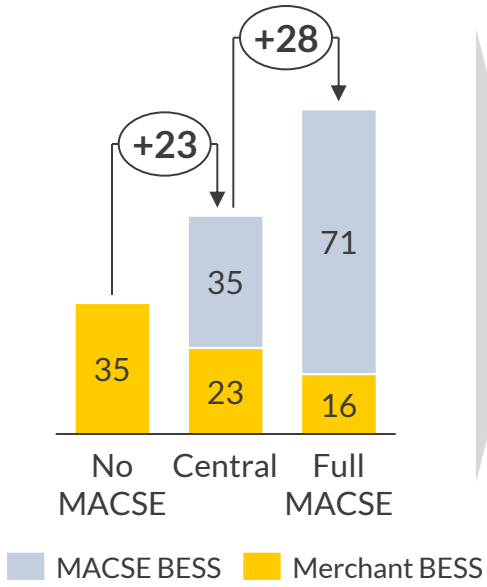
Low market scenarios would put the expected return of a battery coming online in 2028 at risk

Expected profitability for batteries with COD 2028
IRR % (pre-tax, real)

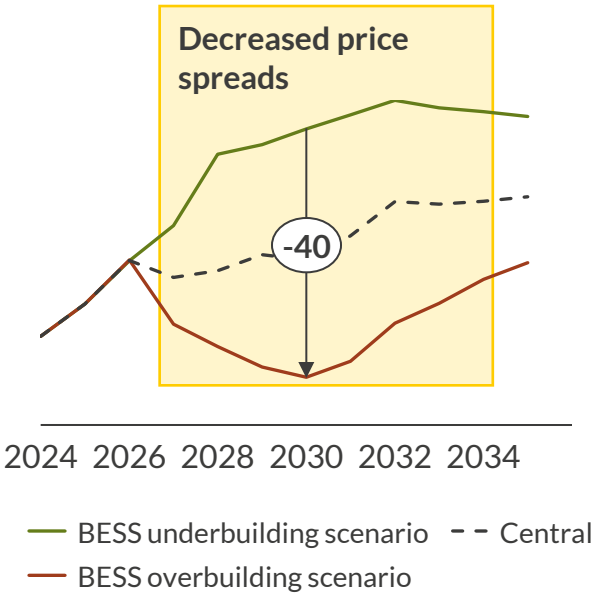


Assuming a battery overbuild scenario, opportunities for merchant batteries would reduce

BESS energy capacity, 2030
GWh



Average 4-hour daily spreads[1], South
€/MWh (real 2023)



Over-procurement of the national BESS target results in a strong drop in daily spreads, reaching in 2030 a decrease of 40 €/MWh in 4-hour daily spreads in South compared to a scenario where there is no procurement of MACSE capacity

1) Defined as the average difference between the most expensive 4 hours and the cheapest 4 hours in a day.

Sources: Aurora Energy Research

Conversely, the MACSE business case is not exposed to merchant risks as it offers predictable revenue for 15 years, but has drawbacks

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MACSE is a new support mechanism for battery investments in Italy. Competitive auctions provide long-term payments in exchange for the obligation to make the asset capacity available to third-parties in wholesale markets and to the TSO for use in the MSD market.

Benefits

1

Investment cost recovery

Fixed payments (€/MWh) for 15 years determined through pay-as-bid auction, aiming at recovering all the investment costs (no missing money)

Revenue security

Very limited exposure to market risk (merchant tail)

Inflation adjustment

The payment is partially adjusted for 20% of yearly inflation

Drawbacks

2

Limited merchant upside

Not stackable with wholesale and capacity market revenues. 80% of MSD margins paid back to the TSO

Auction competition

High competition and low risk profile limit the expected profitability

Technical requirements

The regulated contract comes with several performance requirements in some cases challenging for the standard technologies (e.g. maximum allowed degradation of 1%/year)

Sources: Aurora Energy Research, Terna

An asset can participate in the MACSE with only a share of its capacity, avoiding additional costs of oversizing & gaining merchant upside

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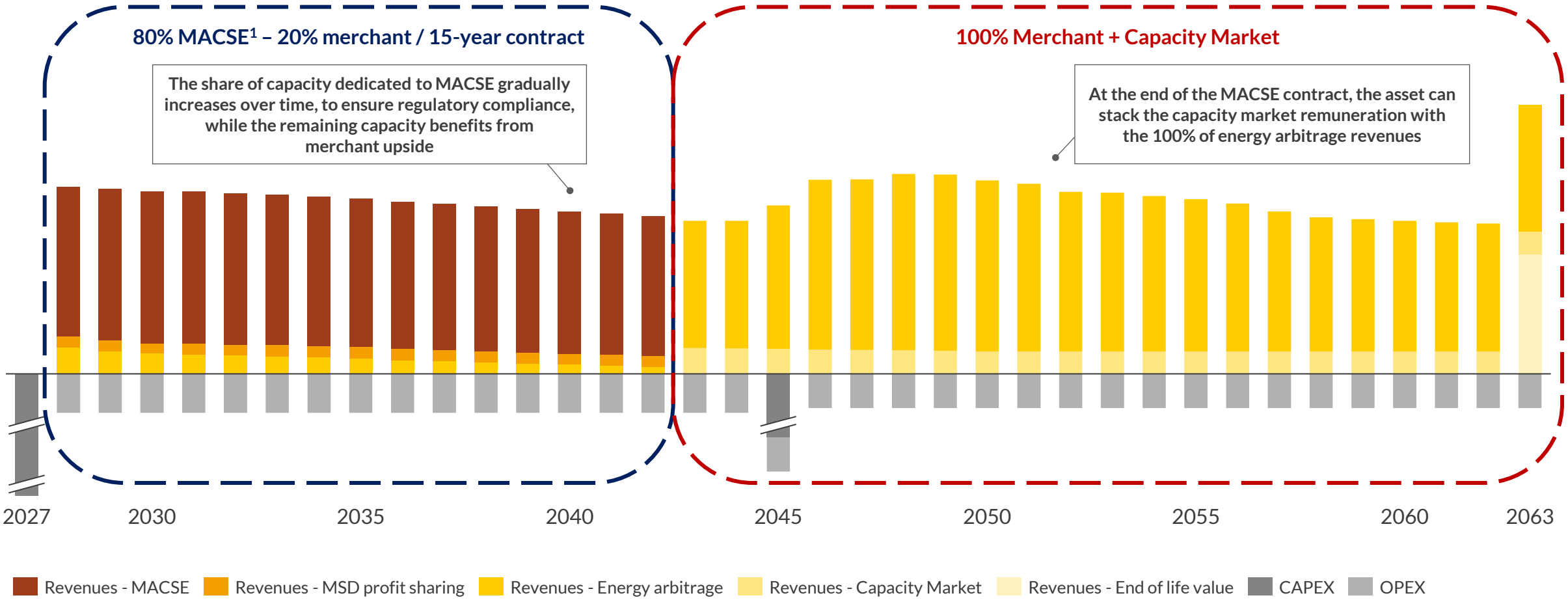
MACSE & merchant split investment case – 4h asset, South, COD 2028
€/kW (real 2023)



1) Initial %. % of asset dedicated to MACSE will increase over time to account for permitted degradation profile of 1%/year in the MACSE not being sufficient.

Sources: Aurora Energy Research

Conclusions

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1. An ambitious target of 58GWh of battery by 2030 and favourable merchant economics make Italy the most attractive market in Southern Europe. BESS investors can access two main business models, with different revenue stacking opportunities and risk profiles.
2. While a merchant business case results in higher project profitability, the MACSE 15-year contracts provide protection against downside scenarios and ensures highly bankable projects, although competitive auction dynamics could drive down returns.
3. It is crucial for investors to understand energy arbitrage and stacking opportunities as well as risk scenarios. The optimal business model depends on the asset's location, duration and technical configuration, as well as the investor risk/return profile.
4. Asset location is a crucial factor for the business model assessment: merchant revenues are strongly dependent on the price zone, with Southern regions and the islands offering higher energy arbitrage opportunities due to favourable RES build-out and local grid constraints.
5. Capacity payments in Italy are more supportive for longer duration batteries. Without them, batteries investments are unlikely to be viable. At the same time, ≥4h batteries could benefit from the MACSE regulated scheme, targeting higher duration investments.
6. Based on their characteristics, battery investments have a different degree of exposure to negative market scenarios. Over-procurement of the national BESS target results in a strong drop in daily spreads, with some zones more exposed to the risk of market saturation.
7. Portfolio diversification (mixed business model and/or varying zones) could represent the best risk-return trade-off, with project IRRs benefitting from the merchant share while also ensuring effective financing thanks to secure revenues.


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