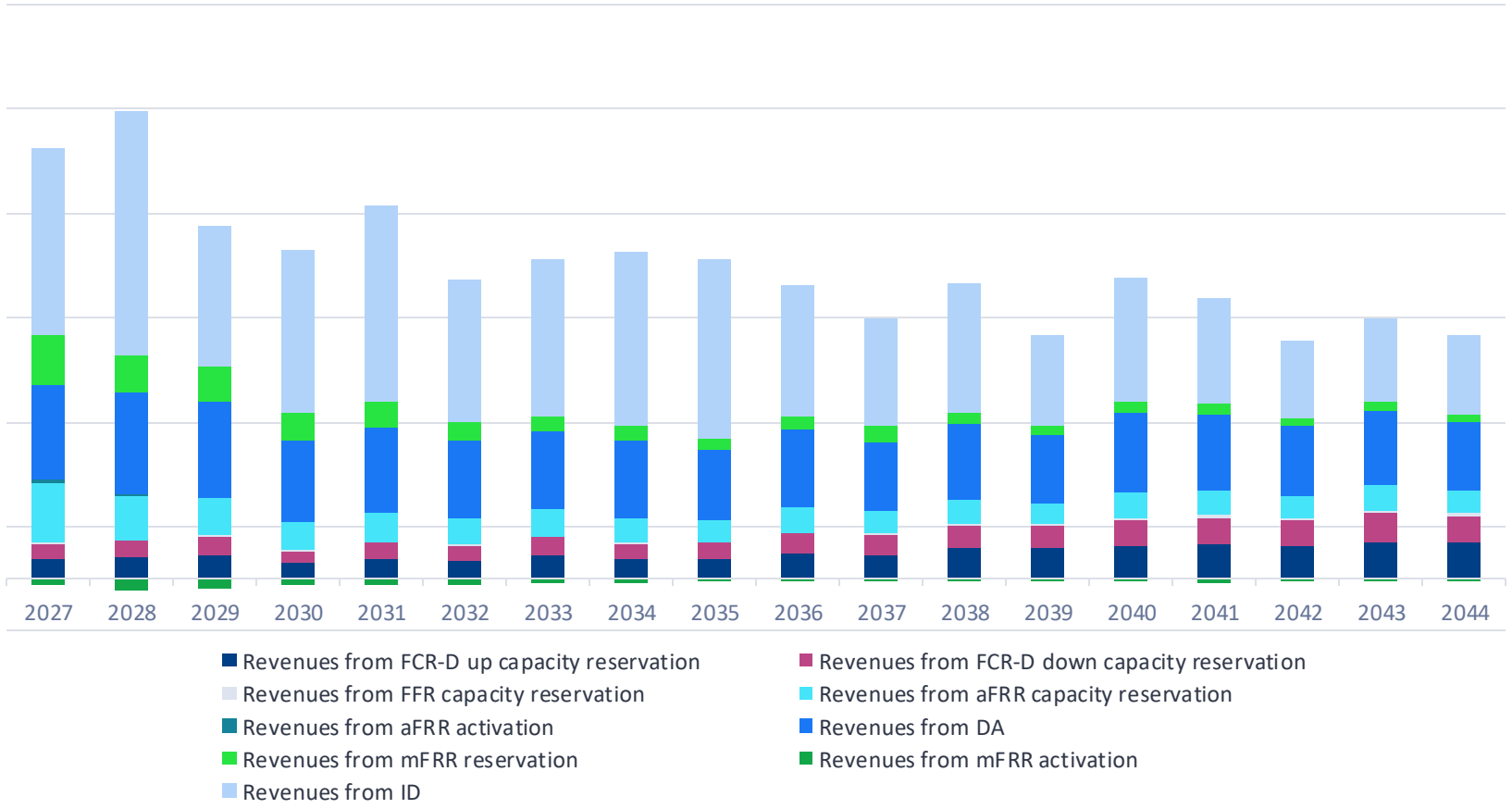
# Revenue stack

Revenue stack for a 50 MW / 100 MWh BESS – Central Scenario S1 2025
*In k€ - real 2025*




**2027-2030:** After 2026, all primary reserve markets are expected to be saturated, shifting BESS operations from FCR-N towards FCR-D, aFRR and mFRR procurement. A 2-hour system generates one third of its revenues on capacity markets in its first years of operation.

**2031-2041**: As aFRR and mFRR capacity markets saturate, trading (on day-ahead, intraday and mFRR energy mainly for charging) represents a larger share of the revenue stack. Intraday's share diminishes but still represent a great source of revenues.

A 2-hour battery relies mostly on energy trading for its revenues.

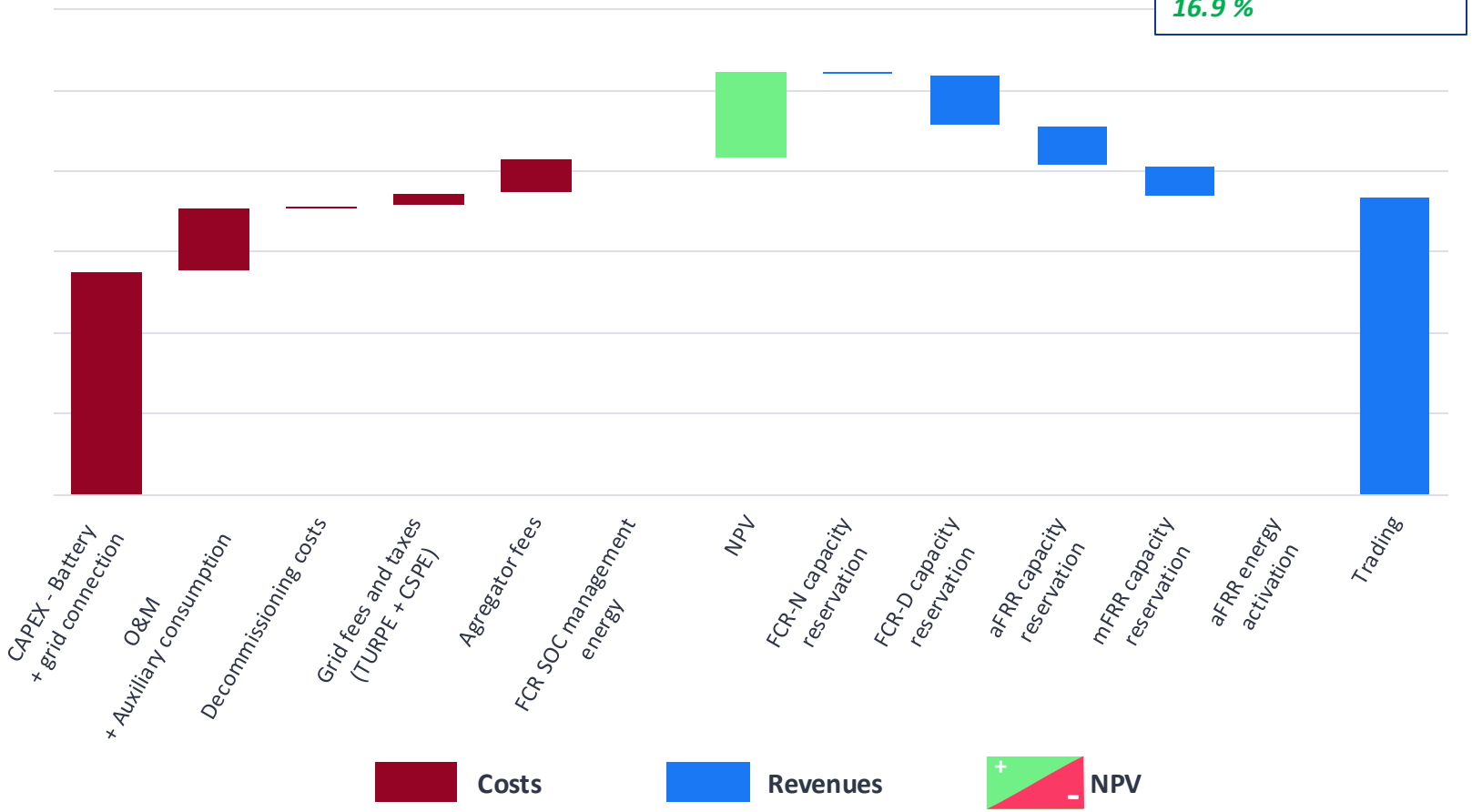
Clean Horizon provides one example of revenue stack, the split of revenues depends on asset size and route to market strategy.

# Discounted cashflow

Discounted costs and revenues of the 50 MW / 100 MWh BESS project – Central scenario S1 2025

*In k€ - real values 2025*

*Project IRR – real 2025:* ***16.9 %***




## Cost Analysis

Battery CAPEX represents a significant amount (66%) of the total cost of the project.

A 2-hour battery generates two thirds of its discounted revenues through energy trading (day-ahead, intraday and mFRR energy), and the rest distributed between the primary, secondary and tertiary reserve capacity markets.

In the Central scenario, the 2-hour battery reaches profitability.

# Changes from S2 2024 to S1 2025 prices and revenue stack

| | |
|---|---|
| **Update of the BESS development scenario** | The numerous announced and commissioned projects in Finland have impacted the BESS development scenario, leading to an addition of 750 MW of battery installation for 2026. |
| **Decrease in aFRR and mFRR capacity prices** | The updated BESS development scenario leads to a high BESS penetration on all capacity reservation markets, including aFRR and mFRR. In consequence, for most markets, reservation prices drop in 2026. This version of the price forecast takes a more conservative approach on long term ancillary services prices, better reflecting the potential risk of low prices in the long term. |
| **Increase of trading in the revenue stack** | With lower capacity markets prices, the battery generates most of its revenues on Day-ahead and Intraday markets. Intraday prices modeling now accounts for both BESS penetration and exchanged volume increase on top of Day-ahead volatility. |
| **BESS COD has been updated to 2027 and project duration to 18 years** | The commissioning date for BESS has been updated to 1 January 2027, and the duration of the project has increased from 15 to 18 years, aligned with recent technology development. |
| **Scenario update** | In this edition, Clean Horizon has updated renewable capacity installation scenarios, accounting for the latest Fingrid's reports. Solar capacity has been revised upwards, as has wind capacity. Demand has been revised downwards to align with the latest trends. |

# Long-term forecast based on market fundamental parameters

**The following assumptions are used as inputs to the model:**

- Country load evolution and flexible assets
- Installed thermal capacity (gas, nuclear, coal, etc.)
- Installed wind & solar capacity
- Future electricity mix of neighbouring countries
- Fuel prices: gas, coal and CO2 price

**Other fundamental parameters used in the modeling:**

- Electricity and storage market knowledge
- Storage deployment
- Market depth evolution
- Weather scenarios
- Regulatory changes
- Opportunity cost of energy storage on other markets (Day Ahead, intraday, and aFRR)

**Clean Horizon's dedicated in-house expertise**

- Expertise in energy storage
- Critical view of storage experts on inputs and obtained scenarios
- AI algorithm tailored for storage
- Mathematically reliable algorithm simulating scenarios
- Multiple iterations and data post-treatment to verify accuracy of results

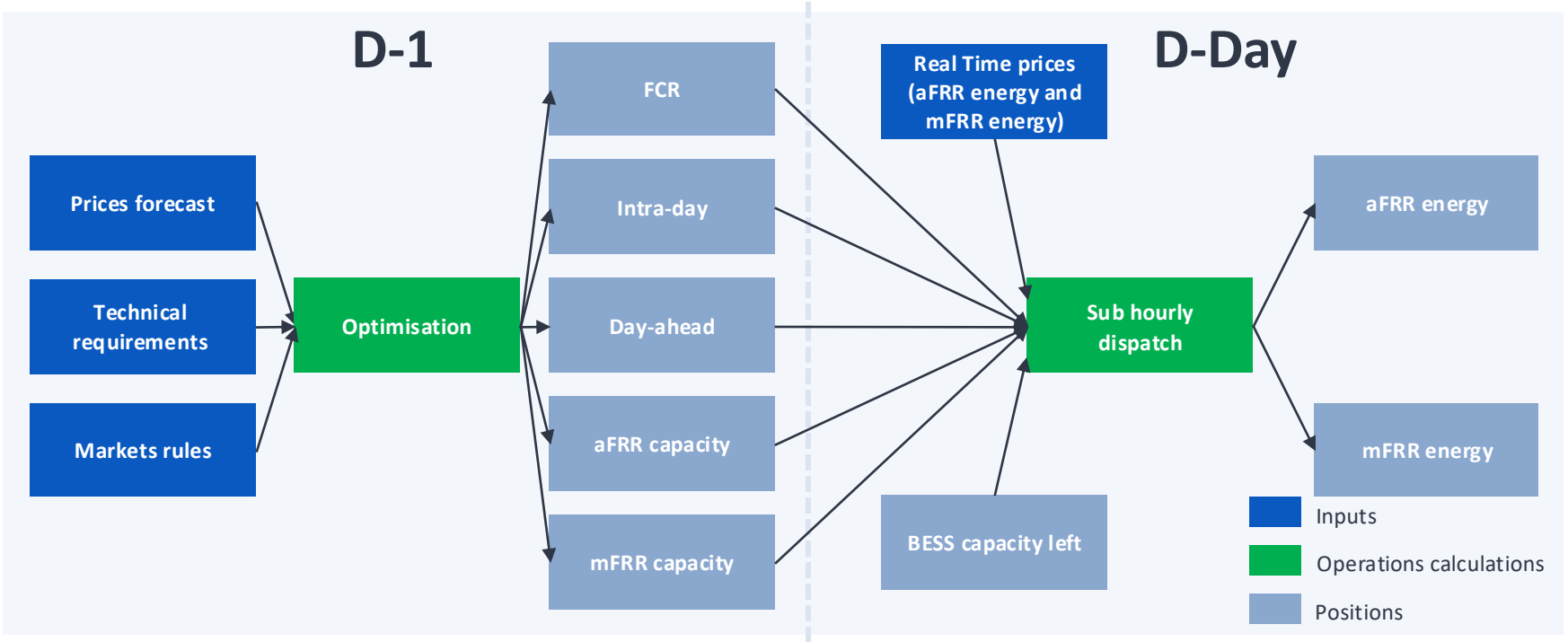
| Forecast provided | Granularity |
|---|---|
| Day ahead market | 1h |
| mFRR reservation | 1h |
| mFRR activation | 15min |
| FCR - N | 1h |
| FFR | 1h |
| FCR – D | 1h |
| aFRR reservation | 1h |
| aFRR activation | 15min |

# Trading Model: COSMOS optimizes battery revenue by simulating market participation decisions across D-1 and D-day markets throughout the project's lifetime

We are using COSMOS to simulate the dispatch and maximize the revenue.

COSMOS runs a simulation over the lifetime of the project and decides for each timeslot in which market the battery should participate. The considered markets are divided into two types:

- D-1 markets which are markets where the decision is taken one day before delivery: **day-ahead, FCR, aFRR and mFRR capacity, ID (capacity reserved for the participation in this market)**
- D markets which are markets where the decision is taken on delivery day: **aFRR energy, mFRR energy**




To take positions for D-1 markets, a **D-1 optimization model** under constraints is solved. The model chooses for each time period what the battery usage should be to maximise its revenues, based on the market prices forecasts, technical requirements and market rules.

Once the D-1 markets positions are taken, the trading model takes decisions for the D-day markets in order to maximise the revenue. Having a forecast of D-day market prices is an unrealistic assumptions, therefore, the **D-day simulation** is based on **logical decisions** that use thresholds that determine when to buy or sell energy (logic control when a certain price is reached).

These thresholds are calculated based on historical prices and they modulated as a function of the state of charge and the consumed cycles during the year

In the trading simulation, it is decided to sell (respectively buy) energy if the real-time price is higher (respectively lower) than the upper (respectively lower) threshold of the given month if the state of charge of the battery permits the operation.