

*BESS*: Peak shaving,  
energy shifting & arbitrage

Your speaker today

# Faten Driss

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01. Dispatch strategy definitions
02. Deep dive of each operating logic
03. Comparison table: objective, inputs and constraints
04. RatedPower : Arbitrage
05. Case studies and scenario walkthroughs
06. Key takeaways , Q&A

# 01. Definitions of dispatch strategies

**Peak shaving**

**Reduce the site's maximum imported or exported power during constrained hours. The battery discharges during peaks to flatten the profile.**

**Primary driver:** demand charges, export cap compliance, interconnection constraints.

**Energy shifting**

**Move energy from one time block to another without necessarily optimizing against price. Typical goal: shift midday PV surplus into evening delivery.**

**Primary driver:** align production with load or contracted delivery windows.

**Arbitrage**

**Charge when energy has low opportunity cost and discharge when its value is higher. In PV+BESS, the battery compares price spread, curtailment recovery and operational limits.**

**Primary driver:** maximize revenue from temporal price differences.

*Key point: the same battery hardware can behave very differently depending on the objective you assign at design stage*

# 02. Deep dive of each operating logic

Deep dive of each operating logic

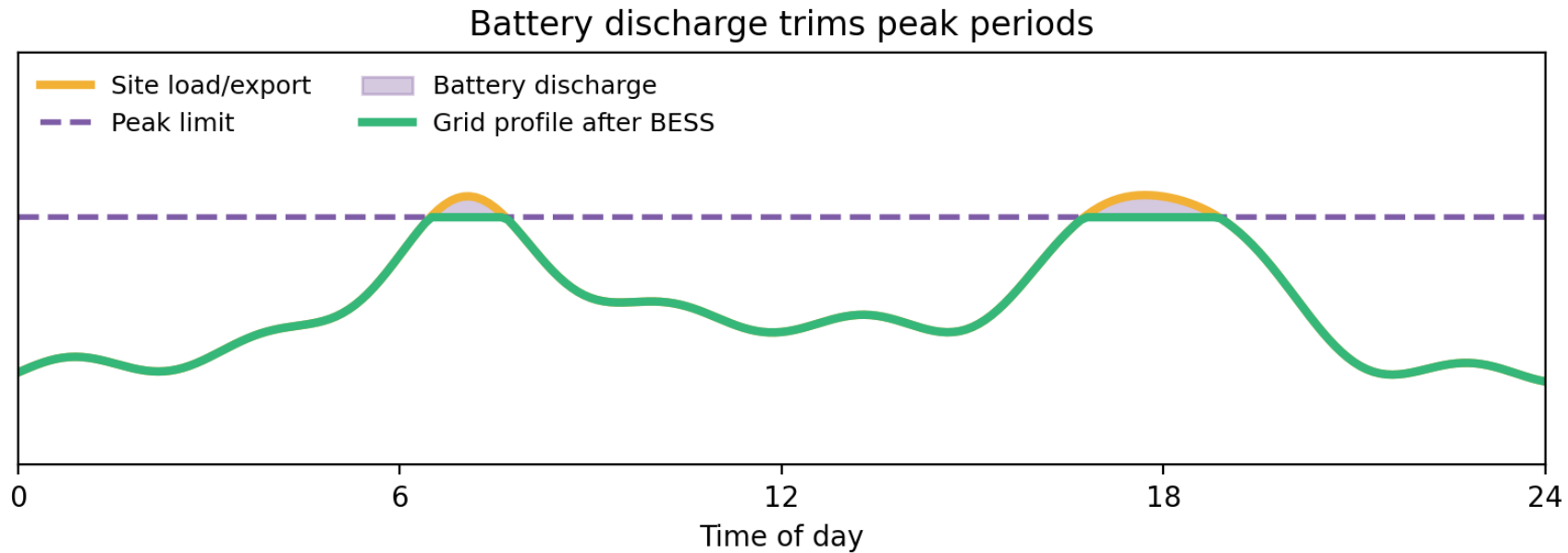
## Peak shaving



- Power-led strategy: inverter power rating is critical
- Usually dispatches during a narrow set of peak windows.
- Value depends on avoided peaks more than daily cycling.

*Design implication*

*Higher value on kW / MW capability, peak window definition and site limits*



Deep dive of each operating logic

## Energy shifting

Midday PV surplus



Battery charge



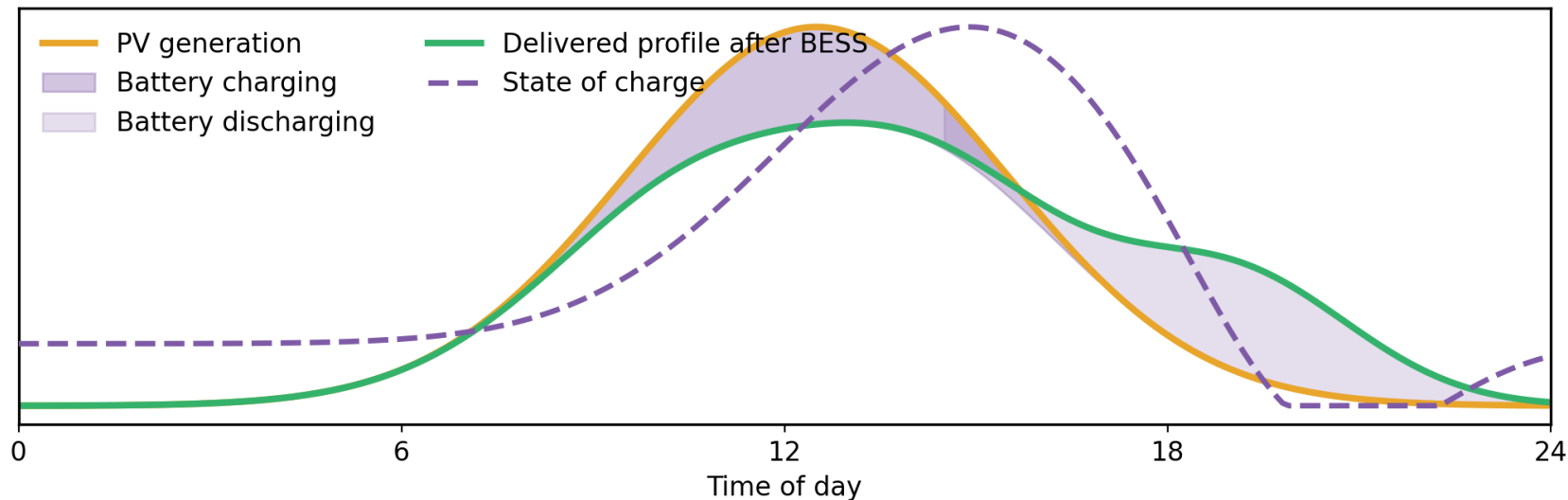
Evening delivery

- Energy-led strategy: battery duration matters
- Often linked to PV surplus, evening firming or delivery shaping
- Can be rule-based even when no market price signal is used

*Design implication*

*Higher value on usable MWh, duration and target delivery window.*

Battery stores midday surplus and extends delivery into evening



Deep dive of each operating logic

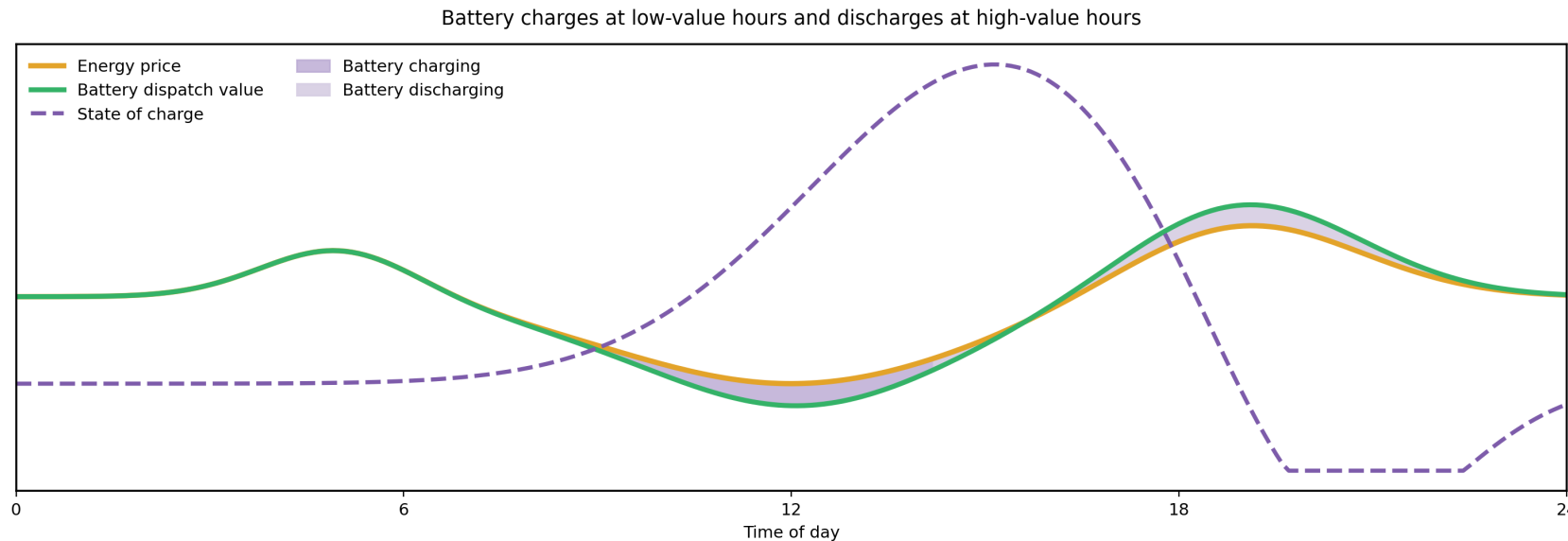
# Arbitrage



- Optimization-led strategy: charge and discharge depend on value spread.
- Curtailment recovery acts like zero-opportunity-cost charging

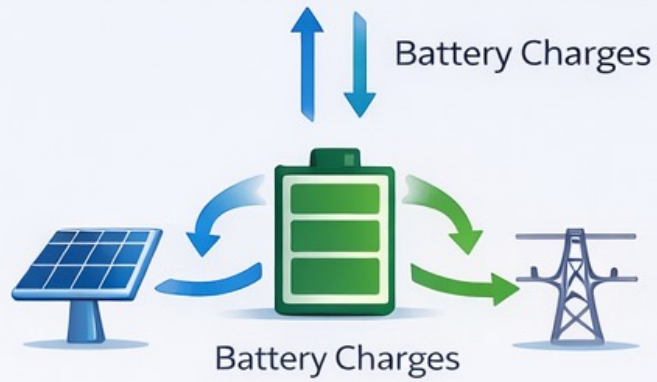
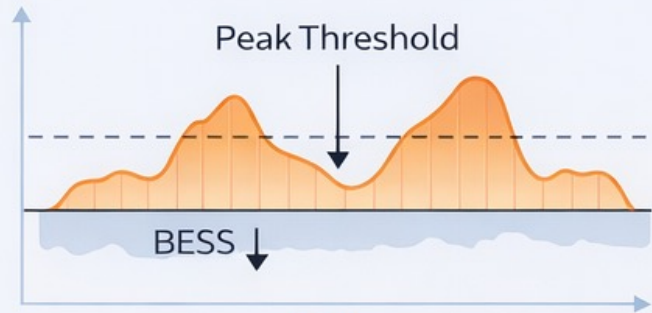
*Design implication*

*Needs explicit dispatch inputs: prices, curtailment, grid charging permissions, SoC and cycling limits.*



# 03. Comparison

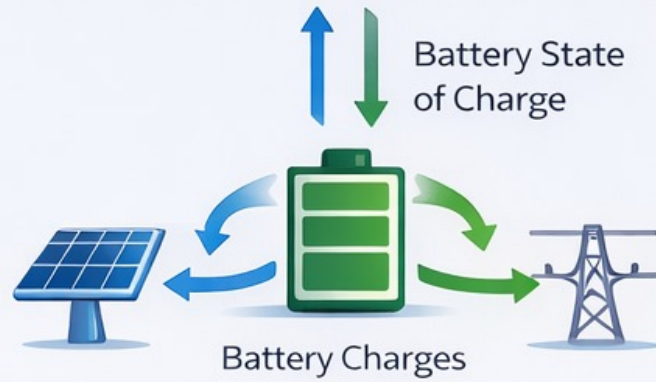
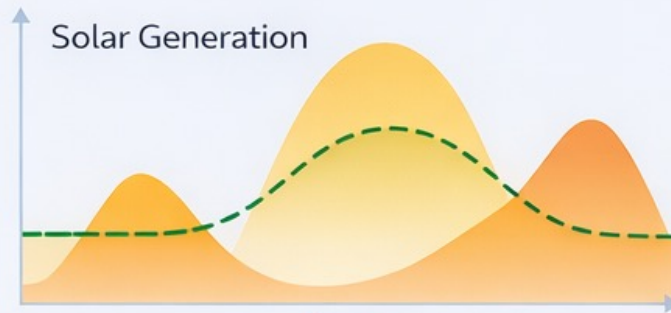
## Peak Shaving



Battery charges during off-peak hours



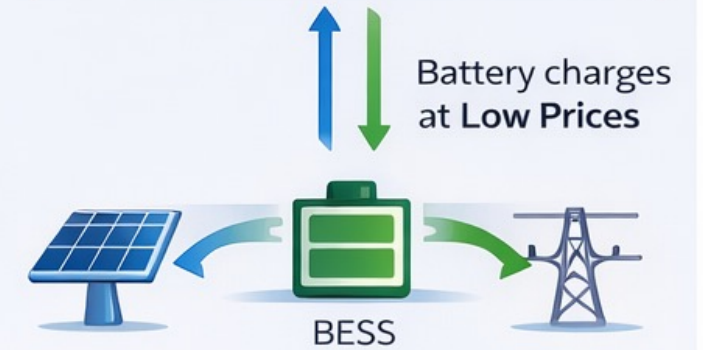
## Energy Shifting



Battery charges in midday and discharges in evening



## Arbitrage



Battery charges when energy prices are low



## Comparison table

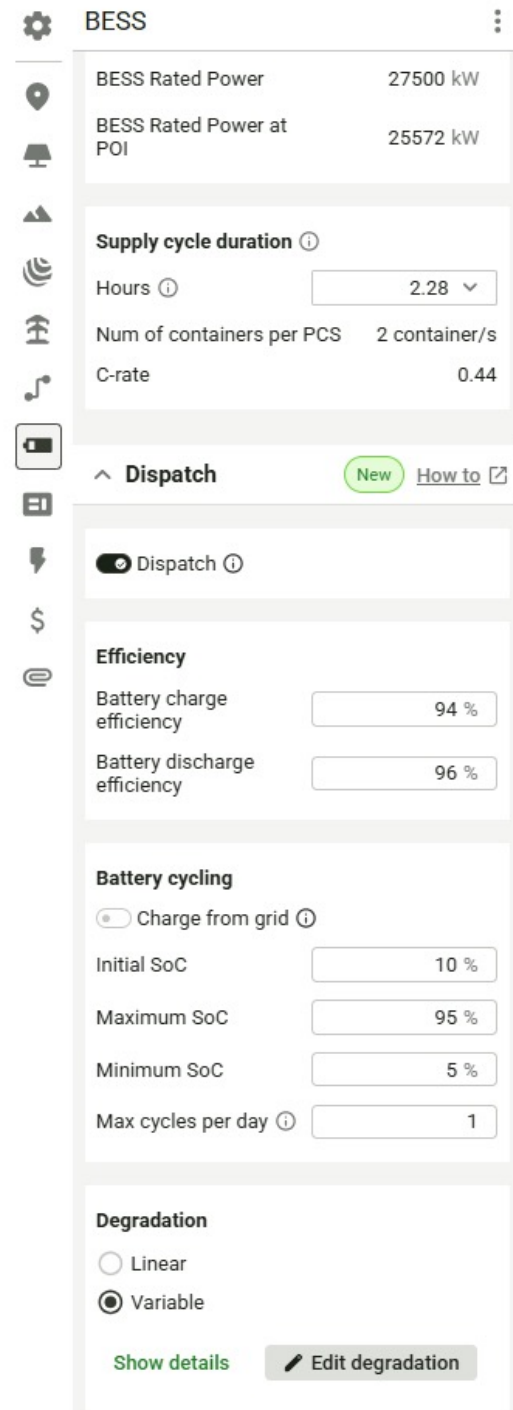
Criteria	Peak shaving	Energy shifting	Arbitrage
<b>Primary objective</b>	Limit peaks	Move energy to target hours	Capture value spread across hours
<b>Main sizing driver</b>	Power rating	Energy capacity / duration	Both power and energy, driven by spread
<b>Typical charge source</b>	Grid or PV depending on site	Mostly PV surplus	Curtailment, PV at low opportunity cost, or grid if allowed
<b>Typical discharge timing</b>	Peak windows	Target delivery window	Highest-value hours
<b>Data needed early stage</b>	Demand/export profile	PV surplus and target window	Prices, curtailment, SoC

# 04. RatedPower: Arbitrage

Why focus on arbitrage in RatedPower?

RatedPower models the strategy where dispatch is decided by economic value under constraints: arbitrage.

- The model compares low-value charging opportunities with higher-value discharge hours.
- Curtailment recovery is naturally prioritized because curtailed PV has no opportunity cost
- PV price, BESS price, grid charging permissions and cycling constraints change the optimal behavior.
- So the same physical plant can dispatch differently across commercial setups



**BESS**

BESS Rated Power 27500 kW

BESS Rated Power at POI 25572 kW

**Supply cycle duration**

Hours 2.28

Num of containers per PCS 2 container/s

C-rate 0.44

**Dispatch** New [How to](#)

Dispatch

**Efficiency**

Battery charge efficiency 94 %

Battery discharge efficiency 96 %

**Battery cycling**

Charge from grid

Initial SoC 10 %

Maximum SoC 95 %

Minimum SoC 5 %

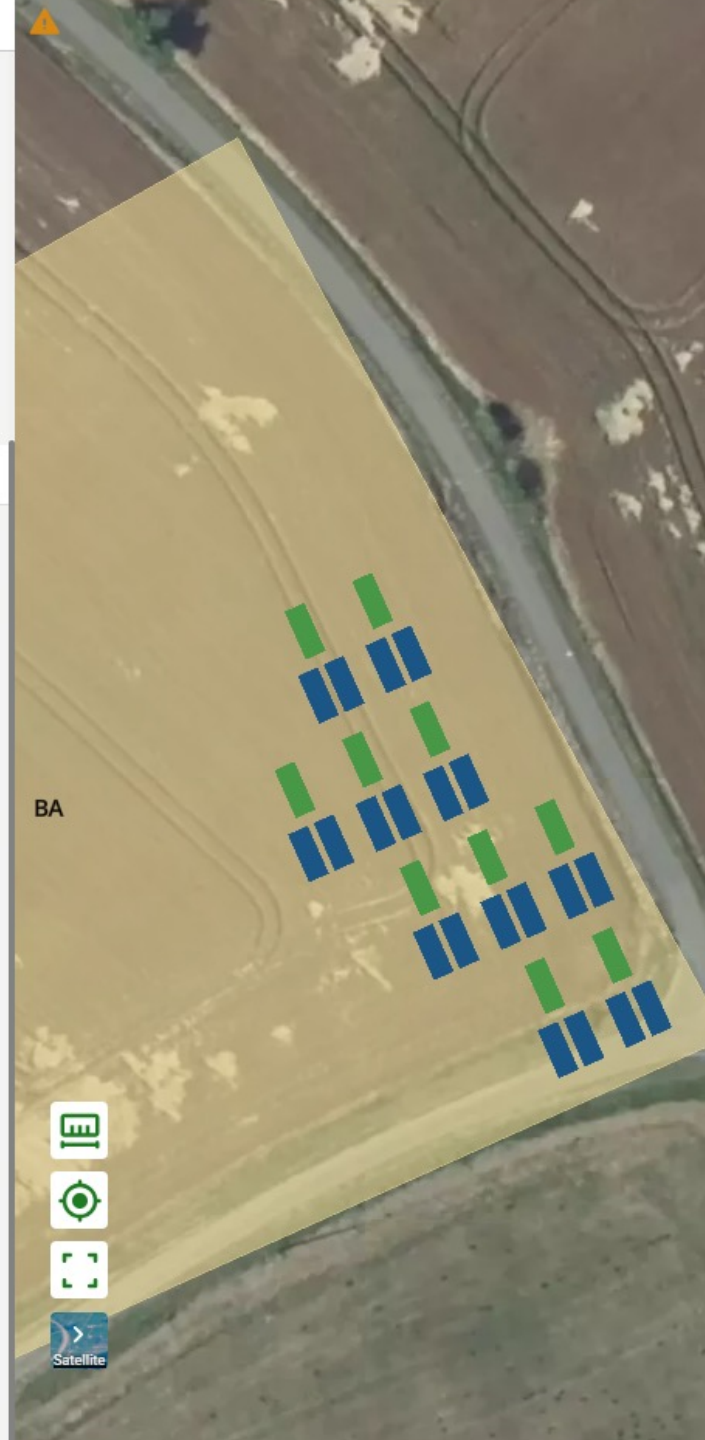
Max cycles per day 1

**Degradation**

Linear

Variable

[Show details](#) [Edit degradation](#)



# 05. Case studies and scenario walkthroughs

## Project criteria

### PV part:

- Project type: PV + AC BESS
- PV Rated Power : 36.96 Mwac
- Peak Power : 43.066 MWdc

### BESS Sizing:

- PCS inverter power: 2.75 MW per PCS
- Container energy: 3.1 MWh per container
- **BESS Rated Power = 11MW**
- C-rate = 0.11
- Num of containers per PCS = 8



**BESS**

**Battery container**

Manufacturer CANADIAN SOLAR

Model SolBank 2.0 4h

Energy Capacity 3130 kWh

Length 6058 mm

Width 2438 mm

Height 2896 mm

[Change battery container](#)

**Requirements**

Maximum capacity  Specific capacity

Number of PCS

BESS Rated Power 11000 kW

BESS Rated Power at POI 10703 kW

**Supply cycle duration**

Hours

Num of containers per PCS 8 container/s

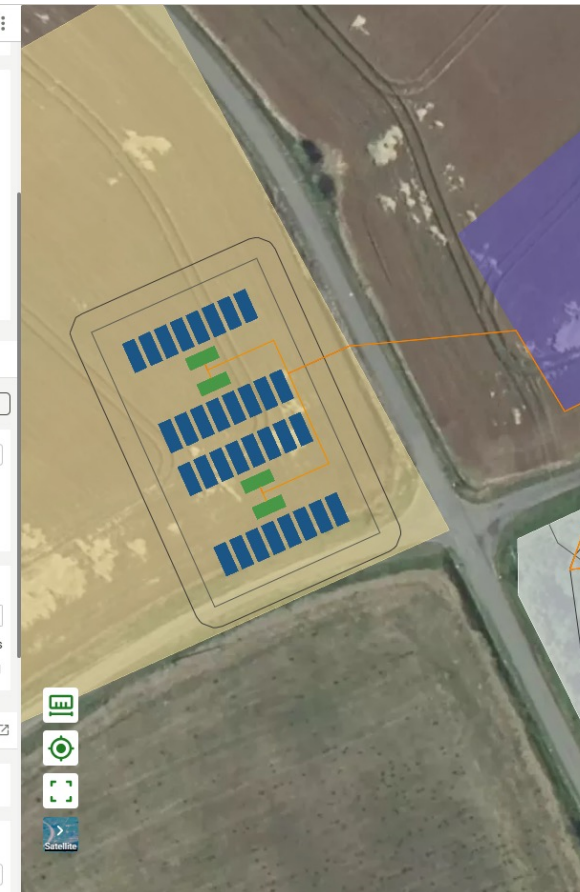
C-rate 0.11

**Dispatch**  [New](#) [How to](#)

Dispatch

**Efficiency**

Battery charge efficiency



**Layout**

**Power requirements**

Maximum Capacity  Specific Capacity

DC/AC ratio at the inverters

DC/AC ratio at POI

Install the maximum peak power

Lower limit at the inverter  Min: 0.9

Upper limit at the inverter  Max: 1.5  
Max strings per inverter 205±2

**Energy clipping**

Curtailment at Delivery Point

Active Power limit

# Configuration

→ Revenue: **fixed price, same for PV and BESS**

→ No charging from grid, only PV

Financial

CAPEX [How to](#)

OPEX

Revenue [How to](#)

Revenue ⓘ

Fixed price ⓘ

Variable price ⓘ

**Fixed price**

Energy Price

Escalation Factor

**BESS Revenue**

Use different energy prices for batteries

Financial parameters

AC Battery Energy Storage System (BESS)

BESS Rated Power	BESS Capacity	Supply duration
11 MW	100.16 MWh	9.1 Hours

Battery Energy

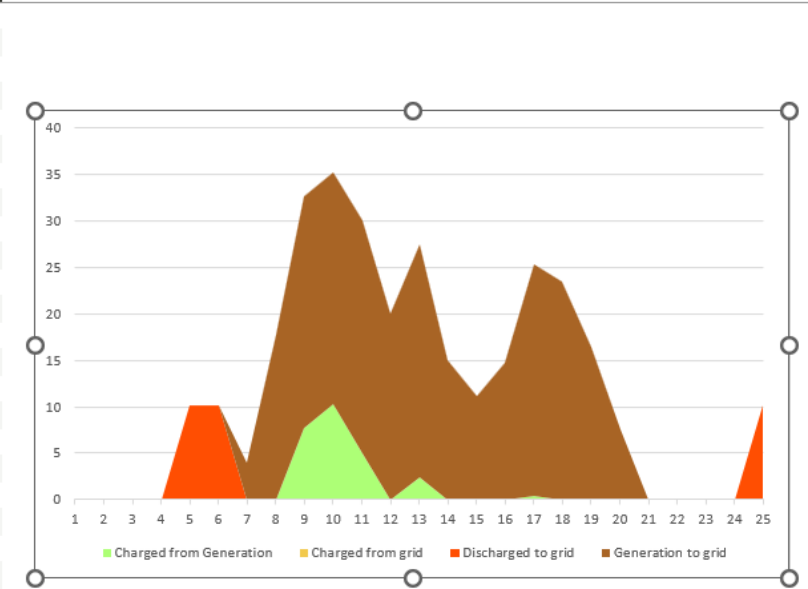
Energy charged from PV	Energy consumed from grid	Energy discharged to grid
6.57 GWh	0 Wh	5.56 GWh

Total energy discharged over lifespan	Avg. daily cycles	Battery lifespan
98.57 GWh	0.18	21 years

Recovered curtailment **99.27 %**

# Case 1 | Fixed price, High Curtailment

hour of the year Date	BESS price	Generation price	Stored in BESS	Charged from Generation	Charged from grid	Discharged to grid	Generation to grid	Curtailment
3023 1990-05-06T22:00	60	60	89.58	0	0	0	0	0
3024 1990-05-06T23:00	60	60	89.58	0	0	0	0	0
3025 1990-05-07T00:00	60	60	89.58	0	0	0	0	0
3026 1990-05-07T01:00	60	60	89.58	0	0	0	0	0
3027 1990-05-07T02:00	60	60	89.58	0	0	0	0	0
3028 1990-05-07T03:00	60	60	89.58	0	0	0	0	0
3029 1990-05-07T04:00	60	60	78.58	0	0	10.18	0	0
3030 1990-05-07T05:00	60	60	67.58	0	0	10.18	0	0
3031 1990-05-07T06:00	60	60	67.58	0	0	0	3.97	0
3032 1990-05-07T07:00	60	60	67.58	0	0	0	17.74	0
3033 1990-05-07T08:00	60	60	74.58	7.65	0	0	25	0
3034 1990-05-07T09:00	60	60	83.98	10.28	0	0	25	0
3035 1990-05-07T10:00	60	60	88.61	5.06	0	0	25	0
3036 1990-05-07T11:00	60	60	88.61	0	0	0	20.07	0
3037 1990-05-07T12:00	60	60	90.84	2.45	0	0	25	0
3038 1990-05-07T13:00	60	60	90.84	0	0	0	14.99	0
3039 1990-05-07T14:00	60	60	90.84	0	0	0	11.14	0
3040 1990-05-07T15:00	60	60	90.84	0	0	0	14.8	0
3041 1990-05-07T16:00	60	60	91.22	0.41	0	0	25	0
3042 1990-05-07T17:00	60	60	91.22	0	0	0	23.48	0
3043 1990-05-07T18:00	60	60	91.22	0	0	0	16.47	0
3044 1990-05-07T19:00	60	60	91.22	0	0	0	7.61	0
3045 1990-05-07T20:00	60	60	91.22	0	0	0	0	0
3046 1990-05-07T21:00	60	60	91.22	0	0	0	0	0
3047 1990-05-07T22:00	60	60	91.22	0	0	0	0	0
3048 1990-05-07T23:00	60	60	91.22	0	0	0	0	0
3049 1990-05-08T00:00	60	60	80.22	0	0	10.18	0	0
3050 1990-05-08T01:00	60	60	80.22	0	0	0	0	0
3051 1990-05-08T02:00	60	60	80.22	0	0	0	0	0
3052 1990-05-08T03:00	60	60	69.22	0	0	10.18	0	0
3053 1990-05-08T04:00	60	60	69.22	0	0	0	0	0
3054 1990-05-08T05:00	60	60	69.22	0	0	0	0	0



# Configuration

→ Revenue: **Variable price, same price for PV and BESS**

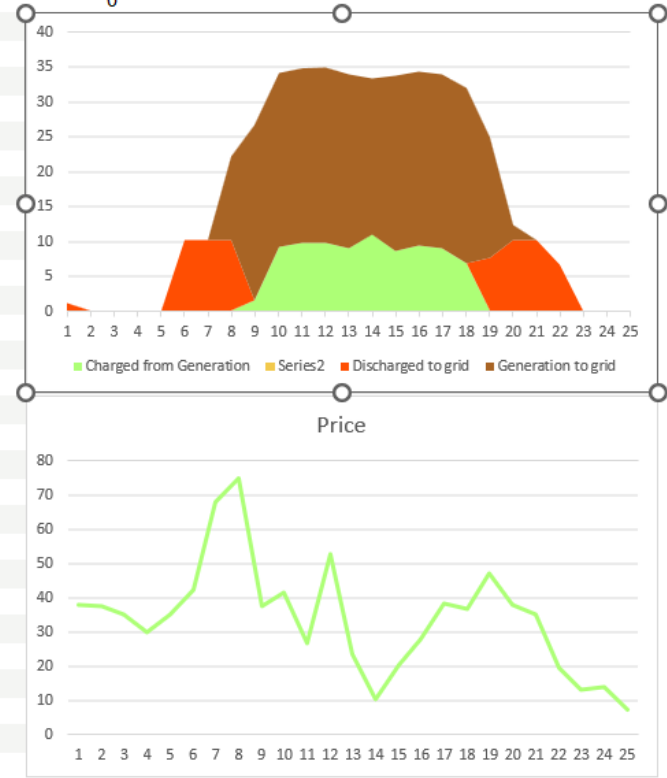
→ No charging from grid, only PV

The screenshot shows a configuration panel for 'Financial' settings. The 'Revenue' section is expanded, showing 'Variable price' selected. Below this, there is a list of energy price sources, with '8760 hours' currently selected. The 'Fixed price' section shows an 'Escalation Factor' of 2%. The 'BESS Revenue' section has a toggle for 'Use different energy prices for batteries' which is turned off. The 'Financial parameters' section shows a 'Discount rate' of 6%.

^ AC Battery Energy Storage System (BESS)		
BESS Rated Power	BESS Capacity	Supply duration
<b>11 MW</b>	<b>100.16 MWh</b>	<b>9.1 Hours</b>
^ Battery Energy		
Energy charged from PV	Energy consumed from grid	Energy discharged to grid
<b>21.24 GWh</b>	<b>0 Wh</b>	<b>17.98 GWh</b>
Total energy discharged over lifespan	Avg. daily cycles	Battery lifespan
<b>341.06 GWh</b>	<b>0.60</b>	<b>21 years</b>
Recovered curtailment		
<b>97.62 %</b>		

## Case 2 | Variable price, same price for PV and BESS

Hour of the year Date	BESS price	Generation price	Stored in BESS	Charged from Generation	Charged from grid	Discharged to grid	Generation to grid	Curtailment
2473 1990-04-14T00:00	38.16	38.16	37.96	0	0	1.15	0	0
2474 1990-04-14T01:00	37.74	37.74	37.96	0	0	0	0	0
2475 1990-04-14T02:00	35	35	37.96	0	0	0	0	0
2476 1990-04-14T03:00	30.01	30.01	37.96	0	0	0	0	0
2477 1990-04-14T04:00	35.01	35.01	37.96	0	0	0	0	0
2478 1990-04-14T05:00	42.5	42.5	26.96	0	0	10.18	0	0
2479 1990-04-14T06:00	68.19	68.19	15.96	0	0	10.18	0	0
2480 1990-04-14T07:00	74.94	74.94	4.96	0	0	10.18	12.02	0
2481 1990-04-14T08:00	37.74	37.74	6.41	1.59	0	0	25	0
2482 1990-04-14T09:00	41.7	41.7	14.8	9.17	0	0	25	0
2483 1990-04-14T10:00	26.77	26.77	23.84	9.88	0	0	25	0
2484 1990-04-14T11:00	52.65	52.65	32.84	9.84	0	0	25	0
2485 1990-04-14T12:00	23.51	23.51	41.05	8.97	0	0	25	0
2486 1990-04-14T13:00	10.16	10.16	51.12	11	0	0	22.4	0
2487 1990-04-14T14:00	20.24	20.24	59.02	8.64	0	0	25	0
2488 1990-04-14T15:00	28.12	28.12	67.61	9.4	0	0	25	0
2489 1990-04-14T16:00	38.46	38.46	75.84	8.99	0	0	25	0
2490 1990-04-14T17:00	36.63	36.63	82.13	6.87	0	0	25	0
2491 1990-04-14T18:00	47.02	47.02	73.95	0	0	7.57	17.32	0
2492 1990-04-14T19:00	37.81	37.81	62.95	0	0	10.18	2.24	0
2493 1990-04-14T20:00	35	35	51.95	0	0	10.18	0	0
2494 1990-04-14T21:00	19.75	19.75	44.73	0	0	6.67	0	0
2495 1990-04-14T22:00	13	13	44.73	0	0	0	0	0
2496 1990-04-14T23:00	14	14	44.73	0	0	0	0	0
2497 1990-04-15T00:00	7.5	7.5	44.73	0	0	0	0	0
2498 1990-04-15T01:00	5.64	5.64	44.73	0	0	0	0	0
2499 1990-04-15T02:00	4.5	4.5	44.73	0	0	0	0	0
2500 1990-04-15T03:00	3.6	3.6	44.73	0	0	0	0	0
2501 1990-04-15T04:00	7.08	7.08	44.73	0	0	0	0	0
2502 1990-04-15T05:00	36.42	36.42	33.73	0	0	10.18	0	0
2503 1990-04-15T06:00	34.45	34.45	22.73	0	0	10.18	0	0
2504 1990-04-15T07:00	35	35	11.73	0	0	10.18	9.14	0



# Configuration

→ Revenue: **variable price for BESS, fixed price for PV**

→ No charging from grid, only PV

The screenshot shows a configuration interface for financial parameters. It is divided into three main sections:

- BESS OPEX:** Includes input fields for BESS Capacity (100 US\$/MWh), BESS Power (0 US\$/MW), Battery Area (0 US\$/ha), and Escalation Factor (2%).
- Revenue:** Features radio buttons for 'Fixed price' (selected) and 'Variable price'. Under 'Fixed price', there are fields for Energy Price (40 US\$/MWh) and Escalation Factor (2%). A 'How to' link is also present.
- BESS Revenue:** Includes a toggle for 'Use different energy prices for batteries' (checked), a 'Variable price' dropdown menu (currently showing '8760 hours' and '2024 France Day-Ahead Energy Pric...'), an 'Upload Energy Prices' button, and another 'Escalation Factor' field (2%).

AC Battery Energy Storage System (BESS)		
BESS Rated Power	BESS Capacity	Supply duration
<b>11 MW</b>	<b>100.16 MWh</b>	<b>9.1 Hours</b>

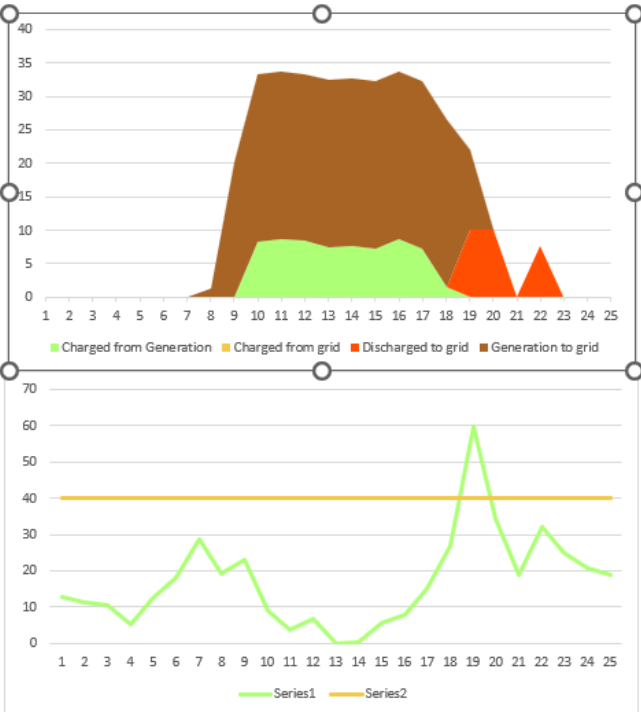
Battery Energy		
Energy charged from PV	Energy consumed from grid	Energy discharged to grid
<b>23.81 GWh</b>	<b>0 Wh</b>	<b>20.16 GWh</b>

Total energy discharged over lifespan	Avg. daily cycles	Battery lifespan
<b>380.62 GWh</b>	<b>0.67</b>	<b>21 years</b>

Recovered curtailment  
**99.02 %**

### Case 3 | Variable price for BESS, fixed price for PV

Hour of the year	Date	BESS price	Generation price	Stored in BESS	Charged from Generation	Charged from grid	Discharged to grid	Generation to grid	Curtailment
2059	1990-03-27T18:00	95.41	40	26.96	0	0	10.18	12.19	0
2060	1990-03-27T19:00	60.95	40	15.96	0	0	10.18	0	0
2061	1990-03-27T20:00	49.5	40	4.96	0	0	10.18	0	0
2062	1990-03-27T21:00	46.21	40	4.96	0	0	0	0	0
2063	1990-03-27T22:00	32.66	40	4.96	0	0	0	0	0
2064	1990-03-27T23:00	21.24	40	4.96	0	0	0	0	0
2065	1990-03-28T00:00	12.82	40	4.96	0	0	0	0	0
2066	1990-03-28T01:00	11.19	40	4.96	0	0	0	0	0
2067	1990-03-28T02:00	10.37	40	4.96	0	0	0	0	0
2068	1990-03-28T03:00	5.16	40	4.96	0	0	0	0	0
2069	1990-03-28T04:00	12.43	40	4.96	0	0	0	0	0
2070	1990-03-28T05:00	17.92	40	4.96	0	0	0	0	0
2071	1990-03-28T06:00	28.62	40	4.96	0	0	0	0	0
2072	1990-03-28T07:00	19.39	40	4.96	0	0	0	1.27	0
2073	1990-03-28T08:00	22.91	40	4.96	0	0	0	20.12	0
2074	1990-03-28T09:00	8.98	40	12.55	8.3	0	0	25	0
2075	1990-03-28T10:00	3.68	40	20.42	8.61	0	0	25	0
2076	1990-03-28T11:00	6.71	40	28.11	8.4	0	0	25	0
2077	1990-03-28T12:00	0.05	40	34.96	7.5	0	0	25	0
2078	1990-03-28T13:00	0.15	40	41.96	7.64	0	0	25	0
2079	1990-03-28T14:00	5.57	40	48.66	7.33	0	0	25	0
2080	1990-03-28T15:00	7.89	40	56.58	8.65	0	0	25	0
2081	1990-03-28T16:00	15.03	40	63.23	7.27	0	0	25	0
2082	1990-03-28T17:00	26.64	40	64.54	1.43	0	0	25	0
2083	1990-03-28T18:00	59.87	40	53.54	0	0	10.18	11.87	0
2084	1990-03-28T19:00	34.46	40	42.54	0	0	10.18	0	0
2085	1990-03-28T20:00	18.71	40	42.54	0	0	0	0	0
2086	1990-03-28T21:00	32.06	40	34.25	0	0	7.67	0	0
2087	1990-03-28T22:00	25	40	34.25	0	0	0	0	0
2088	1990-03-28T23:00	20.6	40	34.25	0	0	0	0	0
2089	1990-03-29T00:00	18.83	40	34.25	0	0	0	0	0
2090	1990-03-29T01:00	12.43	40	34.25	0	0	0	0	0
2091	1990-03-29T02:00	10.24	40	34.25	0	0	0	0	0
2092	1990-03-29T03:00	12.59	40	34.25	0	0	0	0	0
2093	1990-03-29T04:00	14.32	40	34.25	0	0	0	0	0
2094	1990-03-29T05:00	22.91	40	34.25	0	0	0	0	0



# Configuration

→ Revenue: **variable price for BESS, fixed price for PV**

→ **Charging from grid enabled**

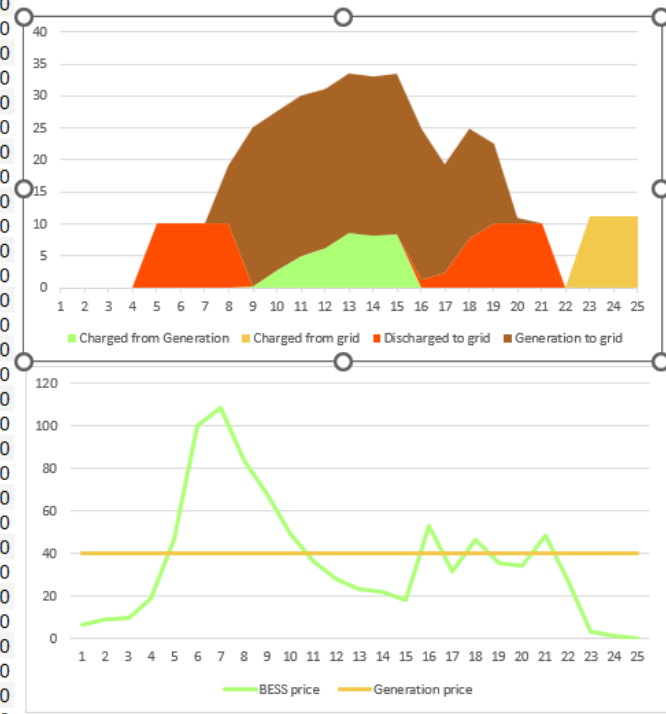
The screenshot shows the 'Financial' configuration panel. It is divided into several sections: 'BESS OPEX' with fields for BESS Capacity (100 US\$/MWh), BESS Power (0 US\$/MW), Battery Area (0 US\$/ha), and Escalation Factor (2%); 'Revenue' with radio buttons for 'Fixed price' (selected) and 'Variable price', and fields for Energy Price (40 US\$/MWh) and Escalation Factor (2%); 'BESS Revenue' with a toggle for 'Use different energy prices for batteries' (checked), a 'Variable price' field, an 'Upload Energy Prices' button, a dropdown menu for 'Currently selected' (showing '8760 hours' and '2024 France Day-Ahead Energy Pric...'), and a '+ Show more' button; and another 'Escalation Factor' field (2%) at the bottom.

The summary dashboard for the AC Battery Energy Storage System (BESS) displays the following metrics:

AC Battery Energy Storage System (BESS)		
BESS Rated Power	BESS Capacity	Supply duration
<b>11 MW</b>	<b>100.16 MWh</b>	<b>9.1 Hours</b>
Battery Energy		
Energy charged from PV	Energy consumed from grid	Energy discharged to grid
<b>23.81 GWh</b>	<b>0 Wh</b>	<b>20.16 GWh</b>
Total energy discharged over lifespan	Avg. daily cycles	Battery lifespan
<b>380.62 GWh</b>	<b>0.67</b>	<b>21 years</b>
Recovered curtailment		
<b>99.02 %</b>		

# Case 4 | Grid charging activated

Hour of the year Date	BESS price	Generation price	Stored in BESS	Charged from Generation	Charged from grid	Discharged to grid	Generation to grid	Curtailment
2373 1990-04-09T20:00	6.35	40	93.41	0	11.27	0	0	0
2374 1990-04-09T21:00	7.15	40	93.41	0	0	0	0	0
2375 1990-04-09T22:00	20.98	40	82.41	0	0	10.18	0	0
2376 1990-04-09T23:00	6.69	40	86.26	0	4.25	0	0	0
2377 1990-04-10T00:00	6.7	40	86.26	0	0	0	0	0
2378 1990-04-10T01:00	9.06	40	86.26	0	0	0	0	0
2379 1990-04-10T02:00	9.76	40	86.26	0	0	0	0	0
2380 1990-04-10T03:00	18.71	40	86.26	0	0	0	0	0
2381 1990-04-10T04:00	46.16	40	75.26	0	0	10.18	0	0
2382 1990-04-10T05:00	99.63	40	64.26	0	0	10.18	0	0
2383 1990-04-10T06:00	108.69	40	53.26	0	0	10.18	0	0
2384 1990-04-10T07:00	83.56	40	42.26	0	0	10.18	9.01	0
2385 1990-04-10T08:00	67.5	40	42.43	0.19	0	0	25	0
2386 1990-04-10T09:00	49.03	40	44.88	2.68	0	0	25	0
2387 1990-04-10T10:00	35.86	40	49.46	5	0	0	25	0
2388 1990-04-10T11:00	27.96	40	55.17	6.24	0	0	25	0
2389 1990-04-10T12:00	23.37	40	63.02	8.58	0	0	25	0
2390 1990-04-10T13:00	21.84	40	70.48	8.16	0	0	25	0
2391 1990-04-10T14:00	17.93	40	78.19	8.43	0	0	25	0
2392 1990-04-10T15:00	52.7	40	76.73	0	0	1.36	23.62	0
2393 1990-04-10T16:00	31.85	40	74.19	0	0	2.35	17.03	0
2394 1990-04-10T17:00	46.49	40	65.95	0	0	7.62	17.27	0
2395 1990-04-10T18:00	35.71	40	54.95	0	0	10.18	12.38	0
2396 1990-04-10T19:00	34.45	40	43.95	0	0	10.18	0.72	0
2397 1990-04-10T20:00	48.22	40	32.95	0	0	10.18	0	0
2398 1990-04-10T21:00	27.59	40	32.95	0	0	0	0	0
2399 1990-04-10T22:00	3.25	40	43.16	0	11.27	0	0	0
2400 1990-04-10T23:00	1	40	53.37	0	11.27	0	0	0
2401 1990-04-11T00:00	0.04	40	63.58	0	11.27	0	0	0
2402 1990-04-11T01:00	0	40	73.78	0	11.27	0	0	0
2403 1990-04-11T02:00	0	40	83.99	0	11.27	0	0	0
2404 1990-04-11T03:00	1.47	40	94.2	0	11.27	0	0	0
2405 1990-04-11T04:00	13.21	40	94.2	0	0	0	0	0
2406 1990-04-11T05:00	22.42	40	83.2	0	0	10.18	0	0
2407 1990-04-11T06:00	52.2	40	72.2	0	0	10.18	0	0



# 06. Key takeaways, Q&A

## Start with the objective, not the battery

Peak shaving is about peaks, energy shifting is about timing, arbitrage is about value spread.

In RatedPower, arbitrage behavior is driven by prices, curtailment recovery and operating constraints

Early design choices on power, energy, grid charging and SoC limits directly change dispatch outcomes.

# Questions?

We're all ears! Drop yours in the question box!



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