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Calculation Logic

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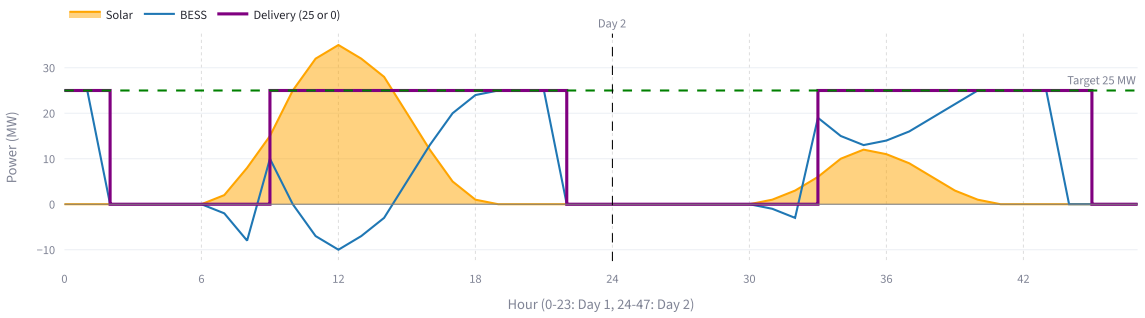
Sample Power Flow Over 2 Days (Realistic Solar Profile)

This chart shows realistic power flow based on actual solar data (mean ~10 MW, peak ~35 MW). Day 1 is a decent solar day, Day 2 is cloudy - demonstrating why BESS capacity is critical.



Orange area: Solar (Day 1: peak ~35 MW | Day 2: peak ~12 MW) | **Blue line**: BESS (negative=charging, positive=discharging) | **Purple line**: Delivery (25 MW or 0)

Key insight: Day 1 achieves ~75% delivery, but Day 2 (cloudy) drops to ~50% - demonstrating why larger BESS or DG backup is needed for 100% delivery.

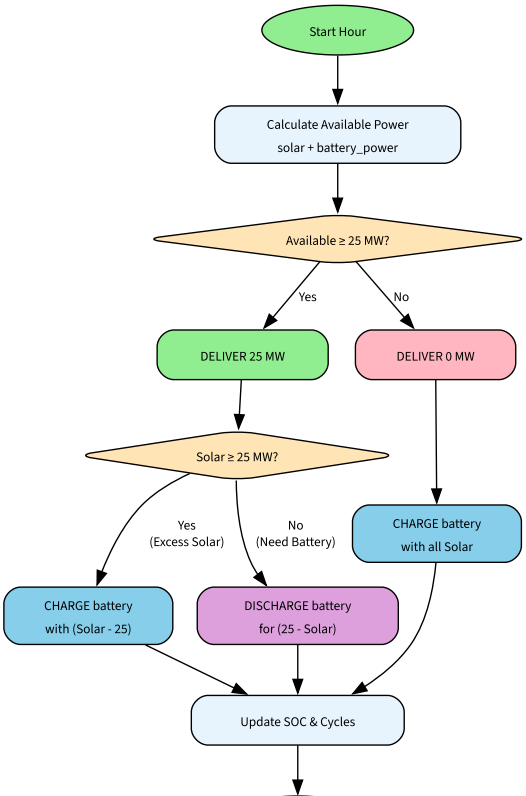
Operational Decision Logic

Binary Delivery System

The system operates on a binary delivery constraint:

- Deliver **exactly 25.0 MW** if possible
- Otherwise deliver **0 MW**
- No partial delivery allowed

Hourly Decision Flow Diagram



End Hour

Hour-by-Hour Decision Tree

⚠️ **Critical**: Battery availability must consider BOTH energy capacity AND C-rate power limits. Energy (MWh) ≠ Power (MW). A 100 MWh battery with 1.0 C-rate can only deliver 100 MW, even if it has 100 MWh of energy available.

Step 1: Check Availability

```
# Battery power limited by BOTH energy and C-rate
battery_power_mw = min(
    battery_energy_mwh,  # Energy for 1 hour
    capacity_mwh * c_rate  # Power limit
)
available_mw = solar_mw + battery_power_mw
can_deliver = available_mw >= 25 MW
```

Step 2: Make Decision

```
if can_deliver:
    deliver = 25 MW
else:
    deliver = 0 MW
```

Operational Scenarios

	Scenario	Solar (MW)	Battery Available (MW)	Delivery (MW)	Battery Action
0	Excess Solar	40	50	25	Charge 15 MW
1	Partial Solar	15	50	25	Discharge 10 MW
2	No Solar (Night)	0	50	25	Discharge 25 MW
3	Insufficient Total	10	10	0	Charge 10 MW

Charging Rules

Battery charges ONLY from solar energy:

1. When delivering and solar > 25 MW: Charge with excess (solar - 25)
2. When NOT delivering: Charge with all available solar
3. No grid charging allowed

See detailed hourly examples: Navigate to the **Hourly Examples** page in the sidebar for complete hour-by-hour simulation tables.

Detailed Hourly Example: June 15-16 (Implemented Solar+BESS Logic)

Configuration: 100 MWh BESS | 25 MW Load | Initial SOC: 50%

SOC Limits: 5% - 95% | **Efficiency:** 93.3% one-way (87% round-trip)

Logic: Solar serves load first, excess charges BESS. BESS discharges when solar insufficient.

Delivery Hours
28/48
↑ 58.3%

Total Deficit
399.2 MWh

Solar Wastage
170.6 MWh

Configuration
100 MWh BESS

	Hour	Day	HoD	Solar_MW	BESS_Power_MW	BESS_Energy_MWh	SoC_%	BESS_State	Load_MW	Deficit_MW	Solar_to_Load	BESS_to_Load	Wastag
0	0	1	0	0.000000	25.000000	23.200000	23.200000	Discharging	25	0.000000	0.000000	25.000000	0.0
1	1	1	1	0.000000	17.000000	5.000000	5.000000	Discharging	25	8.000000	0.000000	17.000000	0.0
2	2	1	2	0.000000	0.000000	5.000000	5.000000	Idle	25	25.000000	0.000000	0.000000	0.0
3	3	1	3	0.000000	0.000000	5.000000	5.000000	Idle	25	25.000000	0.000000	0.000000	0.0
4	4	1	4	2.100000	0.000000	5.000000	5.000000	Idle	25	22.900000	2.100000	0.000000	0.0
5	5	1	5	9.200000	0.000000	5.000000	5.000000	Idle	25	15.800000	9.200000	0.000000	0.0
6	6	1	6	22.700000	0.000000	5.000000	5.000000	Idle	25	2.300000	22.700000	0.000000	0.0
7	7	1	7	37.900000	-12.900000	17.000000	17.000000	Charging	25	0.000000	25.000000	0.000000	0.0
8	8	1	8	51.400000	-26.400000	41.600000	41.600000	Charging	25	0.000000	25.000000	0.000000	0.0
9	9	1	9	61.600000	-36.600000	75.800000	75.800000	Charging	25	0.000000	25.000000	0.000000	0.0
10	10	1	10	62.700000	-20.600000	95.000000	95.000000	Charging	25	0.000000	25.000000	0.000000	17.0
11	11	1	11	64.700000	0.000000	95.000000	95.000000	Idle	25	0.000000	25.000000	0.000000	39.7
12	12	1	12	63.200000	0.000000	95.000000	95.000000	Idle	25	0.000000	25.000000	0.000000	38.2
13	13	1	13	51.000000	0.000000	95.000000	95.000000	Idle	25	0.000000	25.000000	0.000000	26.0
14	14	1	14	26.800000	0.000000	95.000000	95.000000	Idle	25	0.000000	25.000000	0.000000	1.8
15	15	1	15	33.400000	0.000000	95.000000	95.000000	Idle	25	0.000000	25.000000	0.000000	8.4
16	16	1	16	10.100000	14.900000	79.000000	79.000000	Discharging	25	0.000000	10.100000	14.900000	0.0
17	17	1	17	9.000000	16.000000	61.900000	61.900000	Discharging	25	0.000000	9.000000	16.000000	0.0
18	18	1	18	6.400000	18.600000	42.000000	42.000000	Discharging	25	0.000000	6.400000	18.600000	0.0
19	19	1	19	2.200000	22.800000	17.600000	17.600000	Discharging	25	0.000000	2.200000	22.800000	0.0

20	20	1	20	0.000000	11.700000	5.000000	5.000000	Discharging	25	13.300000	0.000000	11.700000	0.0
21	21	1	21	0.000000	0.000000	5.000000	5.000000	Idle	25	25.000000	0.000000	0.000000	0.0
22	22	1	22	0.000000	0.000000	5.000000	5.000000	Idle	25	25.000000	0.000000	0.000000	0.0
23	23	1	23	0.000000	0.000000	5.000000	5.000000	Idle	25	25.000000	0.000000	0.000000	0.0
24	24	2	0	0.000000	0.000000	5.000000	5.000000	Idle	25	25.000000	0.000000	0.000000	0.0
25	25	2	1	0.000000	0.000000	5.000000	5.000000	Idle	25	25.000000	0.000000	0.000000	0.0
26	26	2	2	0.000000	0.000000	5.000000	5.000000	Idle	25	25.000000	0.000000	0.000000	0.0
27	27	2	3	0.000000	0.000000	5.000000	5.000000	Idle	25	25.000000	0.000000	0.000000	0.0
28	28	2	4	0.800000	0.000000	5.000000	5.000000	Idle	25	24.200000	0.800000	0.000000	0.0
29	29	2	5	7.700000	0.000000	5.000000	5.000000	Idle	25	17.300000	7.700000	0.000000	0.0
30	30	2	6	18.200000	0.000000	5.000000	5.000000	Idle	25	6.800000	18.200000	0.000000	0.0
31	31	2	7	33.300000	-8.300000	12.800000	12.800000	Charging	25	0.000000	25.000000	0.000000	0.0
32	32	2	8	34.000000	-9.000000	21.100000	21.100000	Charging	25	0.000000	25.000000	0.000000	0.0
33	33	2	9	27.200000	-2.100000	23.200000	23.200000	Charging	25	0.000000	25.000000	0.000000	0.0
34	34	2	10	36.800000	-11.800000	34.100000	34.100000	Charging	25	0.000000	25.000000	0.000000	0.0
35	35	2	11	45.700000	-20.700000	53.400000	53.400000	Charging	25	0.000000	25.000000	0.000000	0.0
36	36	2	12	49.900000	-24.900000	76.600000	76.600000	Charging	25	0.000000	25.000000	0.000000	0.0
37	37	2	13	51.500000	-19.700000	95.000000	95.000000	Charging	25	0.000000	25.000000	0.000000	6.7
38	38	2	14	37.100000	0.000000	95.000000	95.000000	Idle	25	0.000000	25.000000	0.000000	12.1
39	39	2	15	39.800000	0.000000	95.000000	95.000000	Idle	25	0.000000	25.000000	0.000000	14.8
40	40	2	16	30.900000	0.000000	95.000000	95.000000	Idle	25	0.000000	25.000000	0.000000	5.9
41	41	2	17	15.800000	9.200000	85.100000	85.100000	Discharging	25	0.000000	15.800000	9.200000	0.0
42	42	2	18	9.500000	15.500000	68.500000	68.500000	Discharging	25	0.000000	9.500000	15.500000	0.0
43	43	2	19	2.200000	22.800000	44.000000	44.000000	Discharging	25	0.000000	2.200000	22.800000	0.0
44	44	2	20	0.000000	25.000000	17.200000	17.200000	Discharging	25	0.000000	0.000000	25.000000	0.0
45	45	2	21	0.000000	11.400000	5.000000	5.000000	Discharging	25	13.600000	0.000000	11.400000	0.0
46	46	2	22	0.000000	0.000000	5.000000	5.000000	Discharging	25	25.000000	0.000000	0.000000	0.0
47	47	2	23	0.000000	0.000000	5.000000	5.000000	Idle	25	25.000000	0.000000	0.000000	0.0