

# Scenario - MDVO/B & SoC without DFR [1]

## **Non-Time Varying**



| Time  | SoC<br>(%) | (MW) | MEL<br>(MW) | MDVB<br>(MWh) | MDVO<br>(MWh) |
|-------|------------|------|-------------|---------------|---------------|
| 15:00 | 93%        | -2   | 50          |               |               |
| 15:30 | 93%        | -2   | 50          |               |               |
| 16:00 | 93%        | 2 -2 | 50          | -1.08         | 41.80         |
| 16:30 | 93%        | -2   | 50          |               |               |
| 17:00 | 93%        | -2   | 50          |               |               |
| 17:30 | 93%        | 0 -2 | 50          |               |               |
| 18:00 | 93%        | -2   | 50          |               |               |
| 18:30 | 40%        | -50  | 33          |               |               |
| 19:00 | 40%        | -50  | 33          |               |               |
| 19:30 | 40%        | -50  | 33          |               |               |
| 20:00 | 40%        | -50  | 33          |               |               |
| 20:30 | 40%        | -50  | 33          |               |               |
| 21:00 | 40%        | -50  | 33          |               |               |

| • | [1] Example 50MW, 50MWh          |
|---|----------------------------------|
|   | storage facility, with warranted |
|   | limits on operation at the SoC   |
|   | extremes, & 88% round trip       |
|   | efficiency. Assumed power        |
|   | curve to be linear across full   |
|   | SoC range.                       |
|   |                                  |

 Determination of useable/tradeable energy from SoC alone, therefore requires assumptions to be made on all of the above.



| Time  | SoC<br>(%) | MIL<br>(MW) | MEL<br>(MW) | MDVB<br>(MWh) | MDVO<br>(MWh) |
|-------|------------|-------------|-------------|---------------|---------------|
| 15:00 | 93%        | -2          | 50          |               |               |
| 15:30 | 93%        | -2          | 50          |               |               |
| 16:00 | 93%        | 0 -2        | 50          | -1.08         | 41.80         |
| 16:30 | 40%        | -50         | 33          |               |               |
| 17:00 | 40%        | -50         | 33          |               |               |
| 17:30 | 40%        | -50         | 33          |               |               |
| 18:00 | 40%        | -50         | 33          | 4             |               |
| 18:30 | -13%       | -50         | -17         |               |               |
| 19:00 | -13%       | -50         | -17         |               |               |
| 19:30 | -13%       | -50         | -17         |               |               |
| 20:00 | -13%       | -50         | -17         |               |               |
| 20:30 | -13%       | -50         | -17         |               |               |
| 21:00 | -13%       | -50         | -17         |               |               |

#### Scenario

- Time now: 16:00
- [2] SCADA reporting 93% fullMDVO: 41.8MWhMDVB: -1.08MWh
- Planned 50MW export at 18:00
- [3] Receive 50MW 30min offerside acceptance (16:00-16:30)
- Modelled SoC at 16:30: 40%
- MDVO unchanged until it is redeclared post instruction
- [4] MEL here based on 30min rule. Only indication that there is a future SoC violation



# Scenario - MDVO/B & SoC without DFR [2]

## Time Varying



| Time  | SoC<br>(%) |     | MIL<br>(MW) | (MW) | MDVB<br>(MWh) | MDVO<br>(MWh) |
|-------|------------|-----|-------------|------|---------------|---------------|
| 15:30 | 93%        |     | -2          | 50   |               |               |
| 16:00 | 93%        |     | -2          | 50   | -1.08         | 41.80         |
| 16:30 | 93%        |     | -2          | 50   | -1.08         | 41.80         |
| 17:00 | 93%        |     | -2          | 50   | -1.08         | 41.80         |
| 17:30 | 93%        | - 0 | -2          | 50   | -1.08         | 41.80         |
| 18:00 | 93%        |     | -2          | 50   | -1.08         | 41.80         |
| 18:30 | 40%        |     | -50         | 33   | -29.73        | 16.63         |
| 19:00 | 40%        |     | -50         | 33   | -29.73        | 16.63         |
| 19:30 | 40%        |     | -50         | 33   | -29.73        | 16.63         |
| 20:00 | 40%        |     | -50         | 33   | -29.73        | 16.63         |
| 20:30 | 40%        |     | -50         | 33   | -29.73        | 16.63         |
| 21:00 | 40%        |     | -50         | 33   | -29.73        | 16.63         |

| e:      | AG-GC0166     | BESS  |
|---------|---------------|-------|
| W       | MWh           | 60.0  |
|         | 50            | 50    |
| Min SoC | Max SoC       | 40.0  |
|         | 5%            | 95%   |
| lmp_eff | Exp_eff       | 20.0  |
| 93      | 3%            | 95%   |
|         | BM (MW)       | € 0.0 |
|         | Dispatch      |       |
| €       | MW<br>MEL MW  | -20.0 |
|         |               |       |
| Z       | MIL MW        | -40.0 |
|         | <b>D</b> FR   |       |
| 8       | MinSOC<br>DFR | -60.0 |
| X       | MaxSoC        |       |

| Time  | SoC<br>(%) |   | (MW) | MEL<br>(MW) | MDVB<br>(MWh) | MDVO<br>(MWh) |
|-------|------------|---|------|-------------|---------------|---------------|
| 15:00 | 93%        |   | -2   | 50          |               |               |
| 15:30 | 93%        |   | -2   | 50          |               |               |
| 16:00 | 93%        |   | -2   | 50          | -1.08         | 41.80         |
| 16:30 | 40%        |   | -50  | 33          | -29.73        | 16.63         |
| 17:00 | 40%        |   | -50  | 33          | -29.73        | 16.63         |
| 17:30 | 40%        |   | -50  | 33          | -29.73        | 16.63         |
| 18:00 | 40%        | 2 | -50  | 33          | -29.73        | 16.63         |
| 18:30 | -13%       | ۲ | -50  | -17         | -58.38        | -8.55         |
| 19:00 | -13%       |   | -50  | -17         | -58.38        | -8.55         |
| 19:30 | -13%       |   | -50  | -17         | -58.38        | -8.55         |
| 20:00 | -13%       |   | -50  | -17         | -58.38        | -8.55         |
| 20:30 | -13%       |   | -50  | -17         | -58.38        | -8.55         |
| 21:00 | -13%       |   | -50  | -17         | -58.38        | -8.55         |

### Scenario - as per [1]

- o [1] Receipt of 50MW 30min offerside acceptance (15:30-16:00) updates future MDVO/B values
- In the absence of any further instructions MDVO/B stays static until next scheduled action (50MW export at 18:00) & shows to NGESO there is a future SoC violation
- Implies export PN will need to be adjusted down [or benefit from bidside acceptance in the BM)
- Needs acceptance that only the most recent MDVO/B value is seen to be firm (and representative of the storage facility's actual usable export/import capacity) and any subsequent value indicative
  - As otherwise at Gate
     Closure, site could be
     interpreted as showing
     75MWh of export availability
     [when in reality it has
     41.8MWh]



# Scenario - MDVO/B & SoC with Partial Outage Time Varying



| Time  | SoC<br>(%) | MIL<br>(MW) | (MW) | MDVB<br>(MWh) | MDVO<br>(MWh) |
|-------|------------|-------------|------|---------------|---------------|
| 15:30 | 93%        | -2          | 50   |               |               |
| 16:00 | 93%        | 0 -2        | 50   | -1.08         | 41.80         |
| 16:30 | 93%        | -2          | 50   | -1.08         | 41.80         |
| 17:00 | 93%        | -2          | 50   | -1.08         | 41.80         |
| 17:30 | 93%        | 0 -2        | 50   | -1.08         | 41.80         |
| 18:00 | 93%        | -2          | 50   | -1.08         | 41.80         |
| 18:30 | 40%        | -50         | 33   | -29.73        | 16.63         |
| 19:00 | 40%        | -50         | 33   | -29.73        | 16.63         |
| 19:30 | 40%        | -50         | 33   | -29.73        | 16.63         |
| 20:00 | 40%        | -50         | 33   | -29.73        | 16.63         |
| 20:30 | 40%        | -50         | 33   | -29.73        | 16.63         |
| 21:00 | 40%        | -50         | 33   | -29.73        | 16.63         |

| _                     | 60.0  | 100%  |
|-----------------------|---|-------|
|                       | 40.0  | 80%   |
| HABITAT<br>ENERGY     | 20.0  | 60%   |
| BM (MW)               | ₹ 0.0   | 40% 0 |
| Dispatch MW MEL MW    | -20.0   | 20%   |
| MIL MW                | -40.0   | 0%    |
| DFR MinSOC DFR MaxSoC | -60.0<br>47 2 5 8 11 14 17 20 23 26 29 32 35 38 | -20%  |

| Time  | SoC<br>(%) | (MW)  | MEL<br>(MW) | MDVB<br>(MWh) | MDVO<br>(MWh) |
|-------|------------|-------|-------------|---------------|---------------|
| 15:30 | 93%        | -2    | 50          | -1.08         | 41.80         |
| 16:00 | 93%        | 2 -1  | 25          | -0.54         | 20.90         |
| 16:30 | 93%        | -1    | 25          | -0.54         | 20.90         |
| 17:00 | 93%        | -1    | 25          | -0.54         | 20.90         |
| 17:30 | 93%        | -1    | 25          | -0.54         | 20.90         |
| 18:00 | 93%        | -1    | 25          | -0.54         | 20.90         |
| 18:30 | -12%       | 3 -25 | -8          | -28.92        | -4.0          |
| 19:00 | -12%       | -25   | -8          | -28.92        | -4.04         |
| 19:30 | -12%       | -25   | -8          | -28.92        | -4.04         |
| 20:00 | -12%       | -25   | -8          | -28.92        | -4.0          |
| 20:30 | -12%       | -25   | -8          | -28.92        | -4.04         |
| 21:00 | -12%       | -25   | -8          | -28.92        | -4.04         |

#### Scenario

- Time now: 16:00
- Planned 50MW export at 18:00 as before
- [1] Half the available power & capacity is made unavailable [Forced outage]
- SCADA stays reporting 93% full [assumes for BESS that all subunits are well balanced]
- [2] MEL/MIL & MDVO/B all change though in response to the drop in availability
   MDVO: 41.8 → 20.9MWh
   MDVB: -1.08 → -0.54MWh
- [3] Future position can no longer be physically met.
   Depending on nature of issue & time to delivery. Position would be retraded / PN adjusted down.
- NGESO only gains an awareness of impact of planned outages though a time vaying signal.