PDR-LSR Example

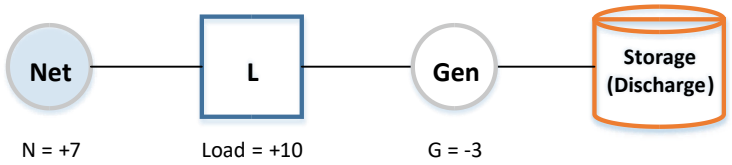
Net Export Rule[1]: Deriving the generation value of storage device $G(t)$

$$G(t)^{nx} = \sum_{i=1}^{n} G(i,t) - \min\{0, N(i,t)\}$$

Where,

- $i = 1,2, \ldots n$ – location
- $G(i,t)$ – storage device generation metered output at location i during the dispatch interval t
- $N(i,t)$ – net meter quantity at location i during dispatch interval t

Assume[2]:



- $N(i,t)$ = +7
- Load at facility = +10
- BTM storage device Gen = -3

Then apply the net export rule:

$$G(t)^{nx} = (-3) - \min(0,7)$$

$$G(t)^{nx} = -3$$

Discharge value after applying the net export rule is 3 MW

[1] Applicable when determining performance for PDR-LSR curtailment only.

[2] A specific sign convention was used in developing the application of the net export rule. Load served by the storage device is expressed as a positive quantity and its output in a discharging mode is a negative quantity. This is used in the application of the net export rule only.

Typical Use Calculation: Curtailment

Pmax = 3 MW
$\boldsymbol{G(t)^{nx}}$ **=** -3 MW
Dispatched for 3 MW (Tuesday, May 30)

Table 1: Examination of 10 similar days, non-event intervals[3]

	5/1	5/2	5/3	5/4	5/5	5/8	5/9	5/10	5/11	5/12	5/15	5/16	5/17	5/18	5/19	5/22	5/23	5/24	5/25	5/26	5/29
Curtailment[4]	E	E	0	0	0	E	2	0	0	2	4	E	0	E	0	E	0	2	1	1	E
Consumption[5]	0	0	-4	E	E	0	0	-2	-2	0	0	0	-2	0	E	0	-2	0	0	0	0

*E represents an event**

Typical use formula:

$G_{LM} = Max\{(G_{LMcurt} + G_{LMcons}), 0\}$

- G_{LM} – Typical use value
- G_{LMcurt} – Typical curtailment value (simple average of 10 non-event 15-minute intervals)
- G_{LMcons} – Typical consumption value (simple average of 10 non-event 15-minute intervals)

[3] Event interval is one in which the PDR-LSR was subject to an Outage or previously provided Demand Response Services (other than capacity awarded for AS or RUC).
[4]Curtailment sign convention is expressed as positive quantity representing energy storage output in a discharging mode. This convention used for both the typical use and performance evaluation calculations.
[5] Consumption sign convention is expressed as negative quantity representing energy storage input in a charging mode. This convention used for both the typical use and performance evaluation calculations.

PDR-LSR Example

Determine and add the simple interval average for both the curtailment and consumption values:

$$G_{LM} = Max\ \{[(\frac{1+1+2+0+0+4+2+0+0+2}{10}) + (\frac{0+0+0+(-2)+(-2)+0+0+(-2)+(-2)+0}{10})], 0\}$$

Then identify the value at or above 0:

$$G_{LM} = Max\ \{[1.2 + (-.8)], 0\}$$

Load curtailment typical value is evaluated as .4 MW:

$$G_{LM} = .4$$

Performance Evaluation Methodology: LSR-Curtailment

Pmax = 3 MW

$\boldsymbol{G(t)^{nx}}$ **=** -3 MW

$\boldsymbol{G_{LM}}$ **=** .4 MW

Performance Evaluation (LSR-Curtailment) formula:

$LSR_{curt} = [|G(t)^{nx}| - G_{LM}]$

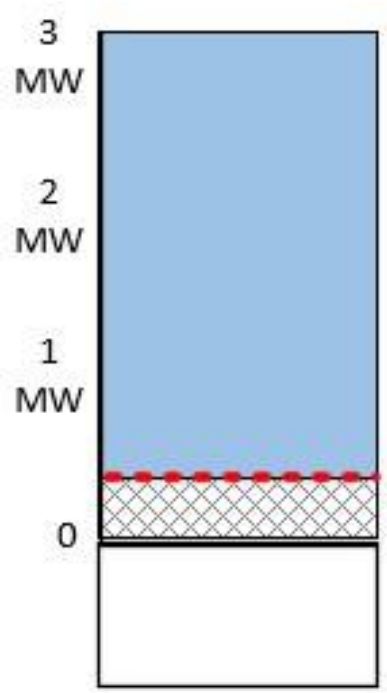
- $|G(t)^{nx}|$ – Generation value of the energy storage device (net export rule applied)
- LSR_{curt} – Curtailment performance of PDR-LSR
- G_{LM} – Typical use value

Calculate the difference between the generation and typical use value:

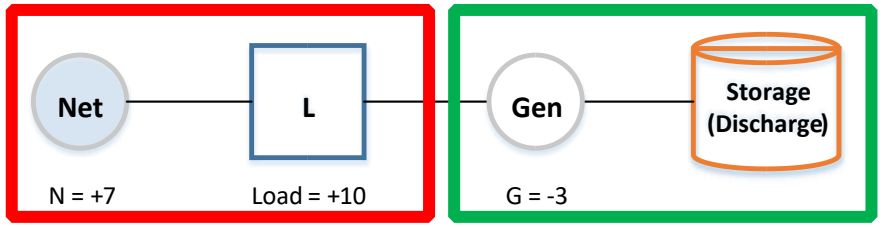
$LSR_{curt} = [3 - .4]$

Resource provided 2.6 MW of load curtailment:

$LSR_{curt} = 2.6\ MW$



Performance Evaluation Methodology: Facility Load Curtailment + LSR Curtailment



$$DR_{Load}(t) = \max\{B_{N-G}(t) - [N(t) - \min(G(t), 0)], 0\}$$

Table 2: Examination of 10 similar non-event days and the total MWhs delivered during a 15-minute interval event period

	5/1	5/2	5/3	5/4	5/5	5/8	5/9	5/10	5/11	5/12	5/15	5/16	5/17	5/18	5/19	5/22	5/23	5/24	5/25	5/26	5/29
Facility load[3]	E	E	11	E	E	E	12	E	13	10	10	E	10	E	E	E	11	10	E	12	11

$$B_{N-G}(t) = \frac{11 + 12 + 13 + 10 + 10 + 10 + 11 + 10 + 12 + 11}{10}$$

$$B_{N-G}(t) = 11$$

$$DR_{Load}(t) = \max\{11 - [7 - (-3)], 0\}$$

$$DR_{Load}(t) = \max\{1, 0\}$$

$$DR_{Load}(t) = 1 \text{ MW}$$

Facility provided 1 MW of load curtailment

$$LSR_{totalcurt}(t) = DR_{load}(t) + LSR_{curt}(t)$$

$$LSR_{totalcurt}(t) = 1 + 2.6\ MW$$

$$LSR_{totalcurt}(t) = 3.6\ MW$$

Facility and energy storage provided 3.6 MWs of load curtailment

[3] Facility load is expressed as positive quantity.

Typical Use Calculation: Consumption

Maximum Consumption = -4 MW

$\boldsymbol{G(t)}$ **=** -4 MW

Dispatched for -4 MW (Tuesday, May 30)

Table 3: Examination of 10 similar days, non-event intervals[7]

	5/1	5/2	5/3	5/4	5/5	5/8	5/9	5/10	5/11	5/12	5/15	5/16	5/17	5/18	5/19	5/22	5/23	5/24	5/25	5/26	5/29
Curtailment[8]	E	E	0	0	0	E	2	0	0	2	4	0	0	E	0	E	0	2	0	1	0
Consumption[9]	0	0	-4	E	E	0	0	E	-2	0	0	E	-2	0	E	0	-2	0	E	0	-3

*E represents an event**

Typical use formula:

$$G_{LM} = Min\{(G_{LMcurt} + G_{LMcons}), 0\}$$

- G_{LM} – Typical use value
- G_{LMcurt} – Typical curtailment value (simple average of 10 non-event 15-minute intervals)
- G_{LMcons} – Typical consumption value (simple average of 10 non-event 15-minute intervals)

[7] Event interval is one in which the PDR-LSR was subject to an Outage or previously provided Demand Response Services (other than capacity awarded for AS or RUC). [8] Curtailment sign convention is expressed as positive quantity representing energy storage output in a discharging mode. This convention used for both the typical use and performance evaluation calculations.

[9] Consumption sign convention is expressed as negative quantity representing energy storage input in a charging mode. This convention used for both the typical use and performance evaluation calculations.

PDR-LSR Example

Determine the simple average of the typical curtailment/consumption values:

$$G_{LM} = Min\left\{\left[\left(\frac{0+1+2+0+0+4+2+0+2+0}{10}\right) + \left(\frac{(-3)+0+0+(-2)+(-2)+0+0+(-2)+0+(-4)}{10}\right)\right], 0\right\}$$

Then identify the typical value at or below 0:

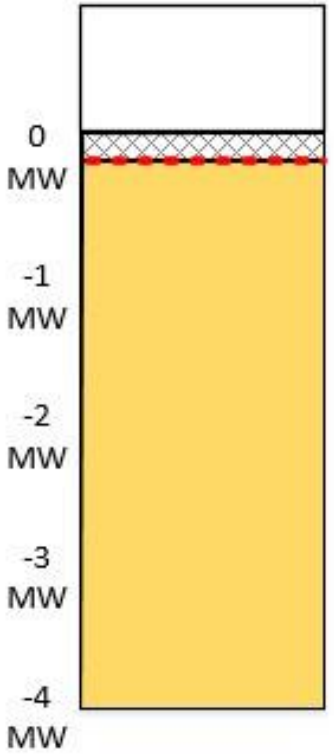
$$G_{LM} = Min\left\{[1.1 + (-1.3)], 0\right\}$$

Resource is typically consuming load at -.2 MW

$$G_{LM} = -.2$$

Performance Evaluation Methodology: LSR-Consumption

$\boldsymbol{G(t)}$ = -4 MW
$\boldsymbol{G_{LM}}$ = -.2 MW



Performance Evaluation (LSR-Consumption) formula:

$LSR_{cons} = [G(t) - G_{LM}]$

- LSR_{cons} – Consumption value of PDR-LSR
- $G(t)$ – Load value of the energy storage device
- G_{LM} – Typical use value

Calculate the difference between the generation and typical use value:

$LSR_{cons} = [-4 - (-.2)]$

$LSR_{cons} = -3.8\ MW$

Resource provided -3.8 MW of load consumption: