Date: September 2025

1 | The Tracking Ramp-Limited Desired (TRLD) Megawatt at the Locational Marginal Pricing (LMP) incorporates consecutive market conditions in creating the real-time energy dispatch profile that a unit should have achieved based on its ramp rates, the energy schedule on which the unit is logged and running, and the dispatch-run LMP at its pricing node, and it is independent of the unit's initial megawatts at each interval.

TRLD is calculated in the post-process LPC pricing-run at every 5-minute interval. TRLD shall not be used to dispatch a unit, but for tracking only, for the purpose of the Regulation opportunity cost calculation in Market Operations and in Settlement:

Tracking will:

i. Start when a unit startup plus notification time is met.

ii. Restart when a unit comes back online after being offline (at least one interval with 0 MW actual generation reported via SE).

iii. Not be tied to unit response (independent of the unit's initial megawatts) but the last dispatch signal.

iv. Have the starting point of the next solution (target interval) as the TRLD of the last 5-minute interval.

v. Not be associated with any log reason.

vi. Be calculated within the eco-limits (Economic Minimum and Economic Maximum) of the unit.

2 | The Tracking Ramp-Limited Desired MW at LMP

$$D_t^{lmp} = D_{t-1} \pm Ramp_t$$

Where D_t^{lmp} is the tracking ramp-limited desired MW for the target interval.

D_{t-1} is the tracking ramp-limited desired MW of the previous interval.

t is the target interval.

$t-1$ is the previous interval.

$Ramp$ is the 5-minute expected increase or decrease in output of the unit.

- With direction based on the dispatch-run LMP
- Latest available unit's ramp rate data
- The latest available unit's incremental offer curve data of the schedule the unit is logged and running in real time.

3 | Energy Schedule (Megawatt/Price) Incremental Curve Application

Step 1: Based on a unit's dispatch-run LMP and energy offer curve, calculate the unit's tracking expected output level if it had been dispatched for energy in economic merit order.

- The starting point is the previous expected output megawatts.

- For a USEBIDSLOPE unit, the linearized energy price curve (with slope) is used to calculate the unit's expected output level.
- For a non-USEBIDSLOPE unit, the unit's expected output level is at one of the megawatt breakpoints in the energy offer curve.

4 | Ramp Rate Application

Step 2: Calculate the unit-specific TRLD MW from the dispatch-run and cap the unit's expected output (from Step 1) with the unit's up/down ramps.

- Previous expected MW + Up Ramp Rate * 5 minutes, or
- Previous expected MW – Down Ramp Rate * 5 minutes.

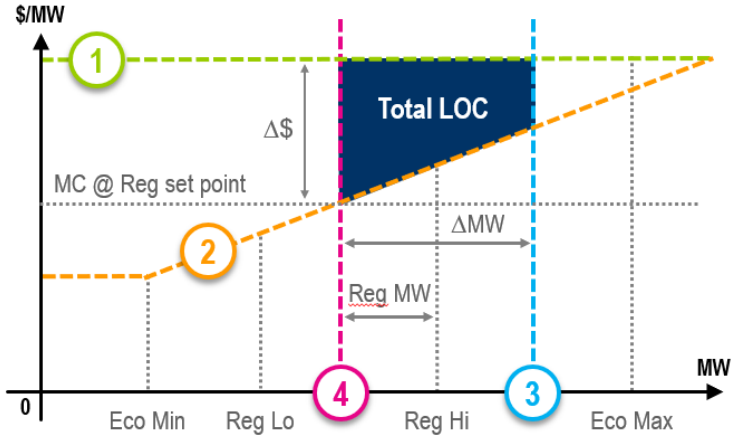
5 | Eco Limits Application

Step 3: Calculate the unit-specific TRLD from the dispatch-run and cap the unit's expected output level (from Step 2) with the unit's eco-limits.

- Minimum dispatch point = EcoMin
- Maximum dispatch point = EcoMax

Regulation Lost Opportunity Cost Calculation in the Pricing Run LPC Every 5-minute Settlement Interval

Figure 1. Lost Opportunity Cost – Sample Unit Held Down Uneconomically



Total LOC Formulation ($) area bounded by:

1. The LMP
2. The resource's energy final offer
3. The generation resource's tracking ramp-rate limited expected output level if it had been dispatched in economic merit order
4. The generation resource's tracking regulation set point

i. The LMP at the pricing node of a regulating unit is obtained from the pricing-run of the LPC interval.

ii. The regulating unit Final Offer at the tracking regulation set point shall be obtained from the energy schedule the unit is running on in real time.

iii. The TRLD MW of a unit is calculated as the TRLD of its last interval plus or minus the applicable five-minute ramp as determined by the dispatch-run LMP and the price/megawatt curve of the energy schedule on which the unit is logged and running.

iv. The unit tracking regulation set point is calculated relative to the last interval regulation set point.

Tracking regulation set point ≤ tracking regulation set point (previous) ± Reduced Energy Ramp x 5-minute. The value is bounded as further described below:

a. Tracking regulation set point = Regulation Minimum (RegMin) MW + Regulation assigned (RegMW), if the TRLD MW ≤ RegMin

b. Tracking regulation set point = Regulation Maximum (RegMax) MW – RegMW, if the TRLD MW ≥ RegMax

If RegMax and RegMin are not the most restrictive limits, calculation will utilize the most restrictive minimum and maximum of all applicable RT limits. If RegMax and RegMin are not provided, economic limits are used.

$$Reduced\ Energy\ Ramp\ Rate = max\left[0, Economic\ Ramp\ Rate - \frac{RegMW}{5}\right]$$

Figure 2. Sample Generator Price/Megawatt Incremental Curve and Parameters

SEGMENTID	MW	PRICE
1	0	9.00
2	100	10.00
3	200	15.00
4	300	20.00
5	400	25.00
6	500	30.00
7	600	35.00
8	700	40.00

Economic Minimum (EcoMin) = 100 MW

Economic Maximum (EcoMax) = 700 MW

Regulation Minimum (RegMin = 300 MW

Regulation Maximum (RegMax) = 500 MW

Ramp Rate = 10 MW/Min

Reg Assigned = 20 MW

Historic Performance Score = 1.0

Figure 3. Price/Megawatt Curve

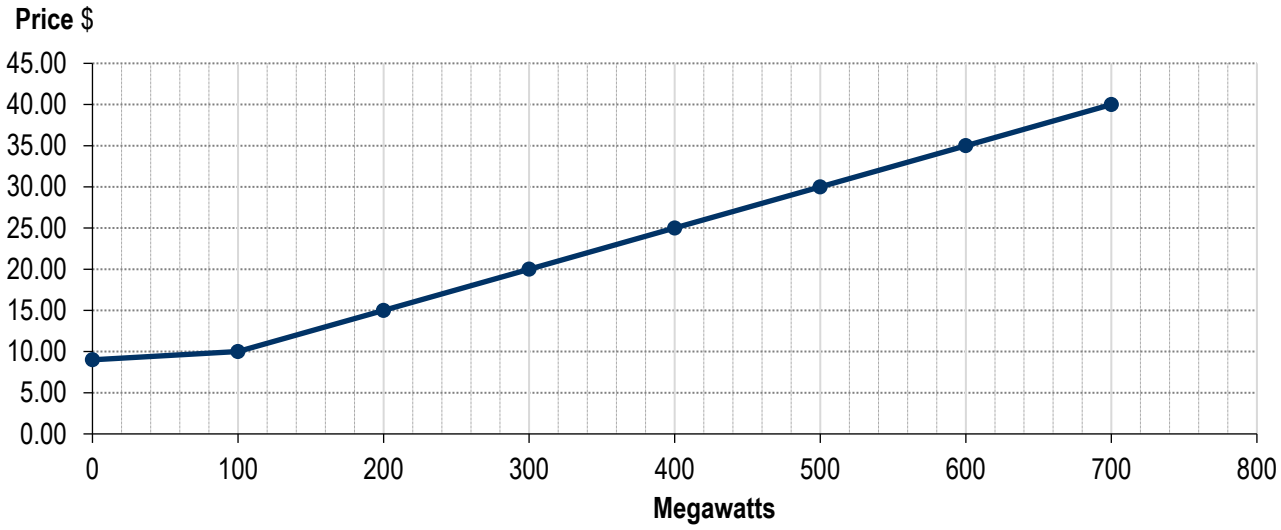


Table 1. Sample TRLD and TRLDAS of a Unit Without and With Regulation Assignment

HR	II	RegMW	LMP_D	LMP_P	Non GPM	MC RegLOC	Desired MW At DLMP	TRLD MW PREVIOUS	TRLD MW	TRLDAS PREVIOUS	TRLDAS	TRLDASMC	LOC Status Quo	LOC TRLD
1	1	0	25.36	27.43			410	100	150	100	150			
	2	0	29.67	32.20			490	150	200	150	200			
	3	0	24.81	25.73			395	200	250	200	250			
	4	0	33.64	37.10			570	250	300	250	300			
	5	0	36.39	37.65			630	300	350	300	350			
	6	0	37.57	43.64			650	350	400	350	400			
	7	0	37.62	50.25			650	400	450	400	450			
	8	0	31.07	33.05			520	450	500	450	500			
	9	0	36.16	37.25			620	500	550	500	550			
	10	0	36.52	37.64			630	550	600	550	600			
	11	0	27.70	32.09			450	600	550	600	550			
	12	0	26.35	30.00			425	550	500	550	500			
2	1	20	28.97	31.98	480	29.00	**480**	500	**480**	500	480	29.00	0.00	0.00
	2	20	25.20	27.54	450	27.50	**405**	480	**430**	480	450	27.50	0.04	0.02
	3	20	26.02	28.24	420	26.00	**420**	430	**420**	450	420	26.00	0.00	0.00
	4	20	46.92	51.08	450	27.50	**700**	420	**470**	420	450	27.50	147.38	11.79
	5	20	37.12	39.44	480	29.00	**640**	470	**520**	450	480	29.00	41.76	10.44
	6	20	37.79	48.95	480	29.00	**650**	520	**570**	480	480	29.00	84.79	44.89
	7	20	37.05	39.94	480	29.00	**640**	570	**620**	480	480	29.00	43.76	38.29
	8	20	37.78	49.22	480	29.00	**650**	620	**650**	480	480	29.00	85.94	85.94
	9	20	36.57	48.06	480	29.00	**630**	650	**630**	480	480	29.00	71.48	71.48
	10	20	36.26	42.02	480	29.00	**625**	630	**625**	480	480	29.00	47.20	47.2
	11	20	36.38	43.26	480	29.00	**625**	625	**625**	480	480	29.00	51.69	51.69
	12	20	42.87	65.72	480	29.00	**700**	625	**675**	480	480	29.00	201.96	179.01
3	1	0	28.57	32.49			470	675	625	480	470		**64.67**	**45.06**
	2	0	31.88	36.49			535	625	575	470	520			
	3	0	29.88	35.26			500	575	525	520	525			
	4	0	36.39	43.83			630	525	575	525	575			
	5	0	31.79	37.52			535	575	535	575	535			
	6	0	31.71	39.8			535	535	535	535	535			
	7	0	32.08	38.64			540	535	540	535	540			
	8	0	33.11	46.43			560	540	560	540	560			
	9	0	45.05	61.26			700	560	610	560	610			
	10	0	48.13	66.95			700	610	660	610	660			
	11	0	87.71	96.14			700	660	700	660	610			
	12	0	71.66	82.53			700	700	700	610	560			
4	1	20	38.23	51.26			**665**	700	**665**	560	**480**	**29.00**	**102.95**	**102.95**

The unit-specific opportunity cost (LOC TRLD) is equal to the area bounded by the:

(i) Pricing-run Locational Marginal Price at the generation bus for the regulating resource, LMP_P

(ii) The resource's Final Offer at the tracking regulation set point, TRLDASMC

(iii) The resource's tracking ramp-rate limited expected output level if it had been dispatched for energy in economic merit order, TRLD

(iv) The resource tracking regulation set point on the energy schedule curve on which the resource is running in the PJM Interchange Energy Market, TRLDAS

The area is divided by the resource performance score and further divided by the resource regulation assigned megawatt to convert to dollars per megawatt.

Legend:

LMP	Locational Marginal Pricing
LPC	Locational Pricing Calculator
RT SCED	Real-Time Security Constrained Economic Dispatch
HR	LPC Hour
II	LPC Interval
Reg MW	Assigned Regulation MW
LMP_D	LMP Dispatch-Run
LMP_P	LMP Pricing-Run
NonGPM	RTSCED base point or Regulation set point for the unit, in MW
MC RegLOC	Unit's marginal cost at the Regulation set point, in $/MW
Desired MW at DLMP	Desired Megawatt at LMP Dispatch-Run – intersection of the unit's incremental offer curve and LMP
TRLD MW Previous	Tracking Ramp-Limited Desired MW at LMP from the previous interval dispatch-run
TRLD MW	Tracking Ramp-Limited Desired MW
TRLDAS Previous	Tracking regulation set point of the last interval
TRLDAS	Tracking Ramp-Limited Desired Ancillary: tracking regulation set point of the current interval
TRLDASMC	Tracking Ramp-Limited Desired Ancillary Marginal Cost: resource Final Offer at the tracking regulation set point
LOC Status Quo	Lost Opportunity Cost Status Quo – LOC value of the pre–Reg Redesign formulation
LOC TRLD	Lost Opportunity Cost Status TRLD – LOC value of the Reg Redesign formulation using the Tracking

Current calculation of RegLOC is the area bounded by the:

(i) Pricing-run Locational Marginal Price at the generation bus for the regulating resource, LMP_P

(ii) The resource's Final Offer at the tracking regulation set point, MC RegLOC

(iii) The resource's expected output level if it had been dispatched for energy in economic merit order, Desired MW at DLMP

(iv) The resource regulation set point on the energy schedule curve on which the resource is running in the PJM Interchange Energy Market, NonGPM

The area is divided by the resource performance score, benefit factor, and further divided by the resource's regulation assigned megawatt to convert to dollars per megawatt.