Regulation Redesign
Phase 2 Implementation

Special Session of the Market Implementation Committee

November 13, 2026

Disclaimer: While materials are current at the time of publishing, applicable requirements may change. PJM Governing Documents control.

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The information seen here **does not** supersede the PJM Operating Agreement or the PJM Tariff or any pending FERC filings or orders.

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Agenda

Oct. 30

High-Level Summary of Changes

AGC – Signal and Telemetry Changes

Performance Metrics
Testing, performance scoring, mileage, de-assignment

Markets Gateway

Data Miner 2

Nov. 13

Regulation Market Business Rules Changes
RegUp/RegDn *Offer Data and clearing and Opportunity Cost calculation*

Regulation Settlement

FAQ/Q&A

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Background

- The Regulation Market Design Senior Task Force worked to address the existing Regulation Market, operation and settlement design flaws from April 2022 through November 2023.
  - Stakeholders endorsed enhancements, including regulation signal redesign, regulation performance scoring, regulation requirement MW, regulation market clearing and regulation market settlement.
- The overall benefits of the FERC-approved Regulation Market updates will be to create efficiencies in procurement and price formation for regulation service while meeting the challenges presented by the changing resource mix over the next several years.
  - FERC approval on June 14, 2024
  - Phase 1 implemented on Oct. 1, 2025.
  - Phase 2 scheduled for Dec. 1, 2026.

Key Takeaway: PJM's Regulation Market has shifted from a market with one product and two signals ("RegA and RegD") to a market with one signal and two products, Regulation Up and Regulation Down, which will bring significant operational and market enhancements.

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Regulation Redesign – Phase Implementation and Timeline

FERC Approval on June 14, 2024

Clean order accepting our Regulation Market Reform 205 filing

Phase 1 Went Live

Oct. 1, 2025

Phase 2 Go-Live

Dec. 1, 2026, at 00:00 Eastern



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Overview

Effective Dec. 1, 2026, Phase 2 aspects of the PJM Regulation Market, Operation and Settlement will change.

Result of Regulation Market Design Senior Task Force

The intent of this special session is to:

- Refresh understanding of new terminology and concepts.
- Ensure awareness of business rule changes and impacts.
- Create opportunity for clarifying questions.

Updated manual language has been endorsed by the applicable stakeholder committee meetings – not part of this session.

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Phase 2 Summary of Changes

#	Design Components	Summary Description
1	**Signals and Products**	Bifurcate ***one*** signal bidirectional to two products, **RegUp and RegDn**, each with its own requirement, clearing price and settlement. Eligible resources will be able to offer, clear and follow either the RegUp, RegDn or both in a given market interval. Only one product is deployed at a time.
2	**Requirement MW**	Seasonal and hourly requirement MW separate for RegUp and RegDn may be asymmetric to better reflect operational needs, with consideration both to historic and future system conditions and with annual requirements MW updates.
3	**Performance Metrics**	Phase 1 changes plus performance score, mileage and bias-factor calculation separately for RegUp and RegDn.
4	**Offer and Clearing Timing**	Phase 1 changes plus offer MW, offer price and availability status separately for RegUp and RegDn. Offer MW will change from hourly granularity to 30 min. granularity.
5	**Opportunity Cost Calculation**	Separate resource's RegUp and RegDn opportunity cost for pricing. Settlements will calculate one intra-commitment opportunity cost that accounts for both RegUp and RegDn assignments on a resource. The settlements calculated intra-commitment opportunity cost will also account for the amount of energy produced while providing Regulation, referred to as "Regulation signal bias."
6	**Settlement**	Regulation billing for RegUp and RegDn – Separate clearing price credits for RegUp and RegDn – Ability to submit Regulation bilateral transactions separately for RegUp and RegDn – Separate clearing price charges for RegUp and RegDn – A single lost opportunity lost credit accounting for both RegUp and RegDn assignments – A single lost opportunity cost charge

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Regulation Signal and Market Products – Phase 2

Moving From a One-Signal Bidirectional Product to One-Signal RegUp and RegDn Products **will split many of the design elements into two.**

Two requirements:
One for RegUp and one for RegDn

Two offers:
One for RegUp and one for RegDn

Two performance scores and mileages:
One for RegUp and one for RegDn

Two clearing prices:
One for RegUp and one for RegDn

Two settlement billings:
One for RegUp and one for RegDn

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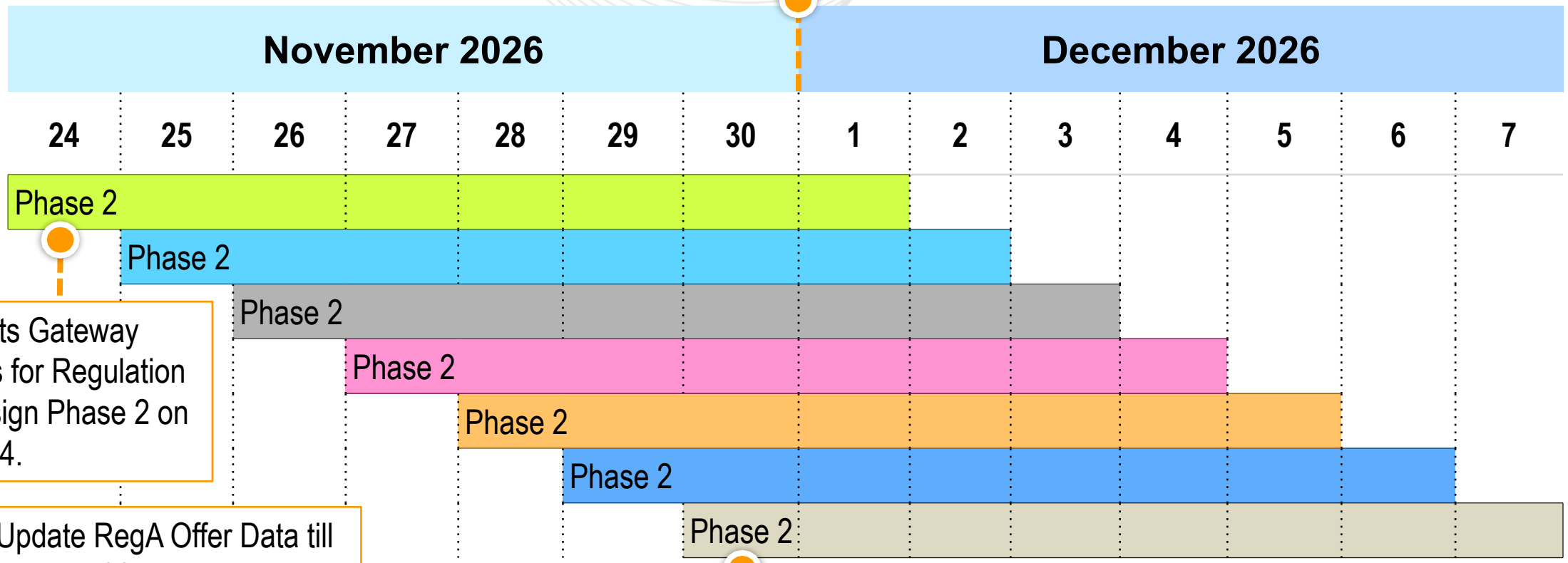
Phase 2 Ongoing and Upcoming Milestones and Timeline

No.	Milestone	Timeline
1	**RegUp/RegDn resources conversion testing**	Since June 8, 2026
2	**Markets Gateway Train (Sandbox) for testing**	Since June 16, 2026
3	**Market PCT Pricing Simulation**	Since Oct. 27, 2026
4	**Special Education Series 1 & 2**	Oct. 30 | Nov. 13, 2026
5	**Telemetry Tabletop Sessions**	Nov. 11 | Nov. 20, 2026
6	**Regulation Redesign Phase 2 market opens**	Nov. 24, 2026
7	**Regulation Redesign Phase 2 go-live (cutover)**	Dec. 1, 2026, at 00:00 EST

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Markets Gateway Opens on Nov. 24 for Phase 2 Go-Live

All Offer Data for RegA will stop being used at 00:00 on Dec. 1.



Markets Gateway Opens for Regulation Redesign Phase 2 on Nov. 24.

Enter/Update RegA Offer Data till 22:55 on Nov. 30.

Key Takeaway To continue to participate (uninterrupted) in the Regulation Market, Offer Data must be submitted between Nov. 24 and Nov. 30.

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Capability Megawatts, Performance Score and Mileage Initialization

Capability MW Initialization

Regardless of megawatts tested for conversion, each resource will carry their Phase 1 RegA capability over to RegUp and/or RegDn.

Performance Score Initialization (Daily Score)

Each resource will be initialized using their Daily Score for Nov. 30, 2026.

This will be captured on Nov. 29, 2026, and written to the test record for RegUp and/or RegDn so that PSCE will use it to calculate the initial Daily Scores for Dec. 1, 2026.

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Capability MW, Performance Score and Mileage Initialization

Mileage Initialization (Daily Mileage)

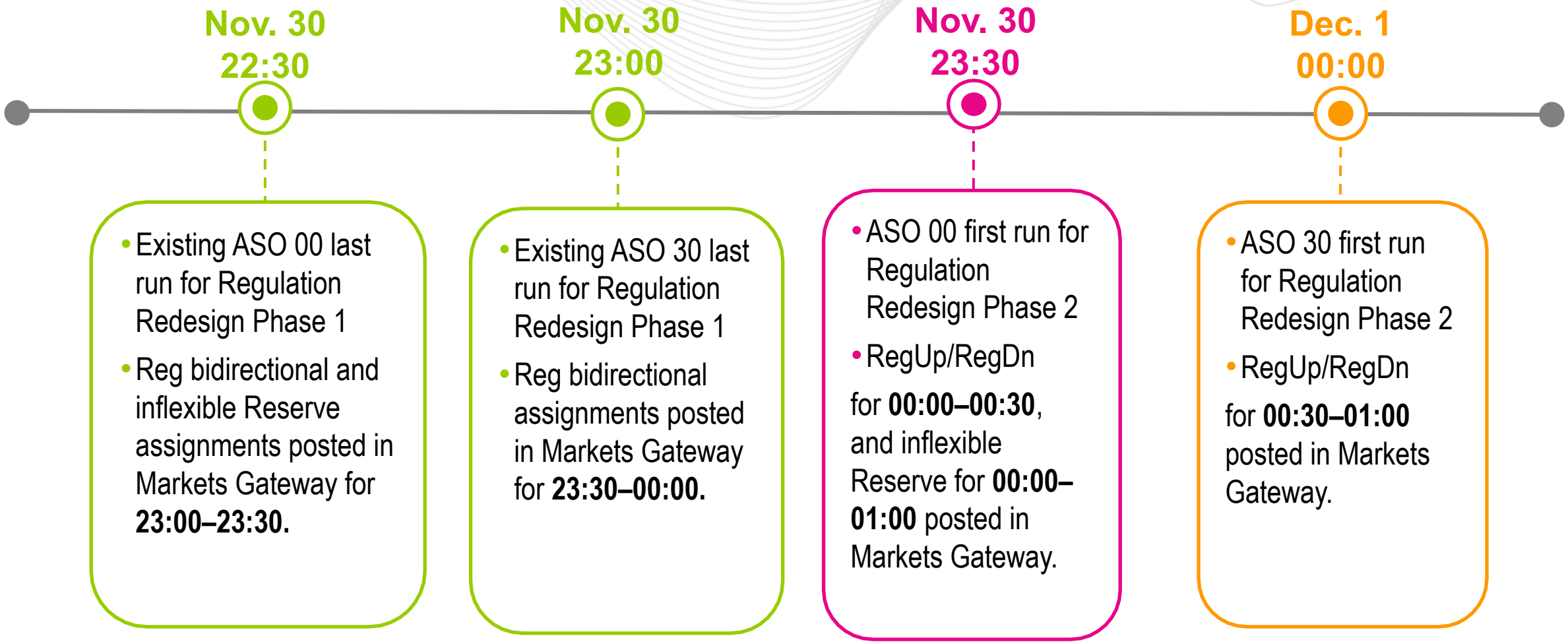
Daily Mileage is calculated seven days ahead using 30 days of historical Hourly Mileages.

1. **PSCE will use Phase 1 RegA Hourly Mileage** to calculate RegUp and RegDn Daily Mileage for all days prior to Dec. 1, 2026.
2. **Beginning with Dec. 1, 2026,** RegUp and RegDn will have their own separate Hourly Mileages, which will be used to calculate Daily Mileage.

Daily Mileage	Calculated On	Data From	Hourly Mileages Used
Dec. 1, 2026	Nov. 24, 2026	Oct. 25–Nov. 23, 2026	RegA
Jan. 6, 2027	Dec. 31, 2026	Dec. 1–30, 2026	RegUp and RegDn

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Cutover Night – Nov. 30/Dec. 1



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Posted Documents for Phase 2 Changes

The following documents have been posted on the Ancillary Services page under a new section called **Regulation Redesign Phase 2.**

PJM.com > Markets & Operations > Ancillary Services >

Regulation Redesign Phase 2	Date
Regulation Up-Down Opportunity Cost Calculation Review in LPC Pricing PDF	11.5.2026
Regulation Redesign Phase 2 FAQs PDF	7.17.2026
Regulation Phase 2 Changes WEB	7.17.2026
XML Schema XSD	5.19.2026
PJM External Interface Specification Guide PDF	5.19.2026
Regulation Cost-Based Offers Validation Template - Phase 2 XLS	8.25.2026
Regulation Phase 2 Open House - March 2026 PDF	4.2.2026
Sample Regulation Up and Regulation Down Test Signal Pattern XLS	3.3.2026
40-Minute Performance Score Template XLS	3.3.2026
Regulation Conversion Testing Checklist for Phase 2 PDF	9.9.2026
Regulation Up & Down Effective Megawatt Requirement Definition PDF	1.27.2026

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Complete Your RegUp/RegDn Signal Conversion Testing



Be Ready.

Timely testing today prevents participation disruption tomorrow.

Test early and avoid risk.

Why Test Now?

- Validate your RegUp/RegDn telemetry and signal path and logic.
- Ensure your systems correctly receive, process and respond to the new signals.
- Identify and resolve issues early – before they impact your ability to participate.

Gain confidence that your resources will perform reliably on go-live day and beyond.

Avoid Last-Minute Testing

- Late testing increases the risk of unresolved issues before go-live.
- A surge of last-minute requests can overwhelm support teams and delay issue resolution.
- Limited time for fixes and retesting may jeopardize your readiness.

Last-minute overwhelming testing requests are highly discouraged.

Start Testing Today	Early testing helps ensure a smooth transition and uninterrupted participation when Regulation Redesign Phase 2 goes live.

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Regulation Phase 2 Testing – Please, We Need Your Participation

Actively Submit Your RegUp/RegDn Offers and Parameters in the Markets Gateway (MG) Sandbox!

Why Your Participation Matters

- Ensure full representation of various resource types for RegUp/RegDn testing.
- Validate your offers, parameters and integrations early.
- Provide real-world data that drives better logic validations and results.

Let's Work Together for Phase 2 Success

Your active participation is key to building a robust, efficient and reliable Regulation Market, operation and pricing. Thank you for partnering with PJM.

How It Works in the Sandbox



Submit RegUp/RegDn Offers & Parameters in MG Sandbox



QLIK Process Moves Data to STG



Regulation Clearing Every 30 minutes



QLIK Process Returns Results to MG Sandbox for Posting

*Regulation Market clearing and results will be posted **every 30 minutes.***

What You Can Do



1. Submit your RegUp/RegDn offers and parameters.
2. Test new and updated MG features.
3. Develop and validate your third-party software integrations.
4. Share feedback and report issues.

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Email Contacts

Inquiry	Email Contact
To request a Regulation test	RegulationTesting@pjm.com
Regulation telemetry – signal setup or conversion	PJMTelemetrySupport@pjm.com
Regulation Redesign questions	RegulationDesign@pjm.com
Communication to PJM Member Relations	custsvc@pjm.com

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Regulation Market Business Rules Changes

RegUp/RegDn *Offer Data and clearing and Opportunity Cost calculation*

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Markets Gateway Summary of Changes – Phase 2

#	Markets Gateway Screen	Summary Description
1	**Demand Response > Regulation Market > Offers** **Generator > Regulation Market > Offers**	▪ Product Type Column added for RegUp and RegDn ▪ Reg Self Scheduled column moved to Unit > Detail / Demand Response > Parameters
2	**Demand Response > Regulation Market > Updates** **Generator > Regulation Market > Updates**	▪ Tab renamed to “Hourly Updates” ▪ Reg MW column removed – Offer MW is moved to Period Updates ▪ New column Symmetry – as a drop down with list as “None,” “Bidirectional,” “Symmetrical” ▪ Existing Offer Price and Cost columns replaced with Offer Price and Offer Cost columns for RegUp and RegDn
3	**Demand Response > Regulation Market > Availability Updates** **Generator > Regulation Market > Availability Updates**	▪ Tab renamed to “Period Updates” and will have all parameters with 30-min granularity ▪ RegUp MW and RegDn MW columns added ▪ Reg Availability replaced with RegUp and RegDn Availability columns ▪ Reg Self-Schedule moved to a separate column from Reg Availability and is a single column that applies to both RegUp and RegDn

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Markets Gateway Summary of Changes – Phase 2

#	Markets Gateway Screen	Summary Description
4	**Demand Response > Demand Response > Parameters** **Generator > Unit > Detail**	▪ Regulation Self-Schedule field added and applies to both RegUp and RegDn ▪ New column Symmetry – as a drop down with list as "None," "Bidirectional," "Symmetrical"
5	**Generator > Unit > Detail**	▪ Regulation Resource checkbox replaced with RegUp Resource and RegDn Resource checkboxes
6	**Generator > Dispatch Lambda**	▪ Reg MW column replaced with RegUp MW and RegDn MW columns
7	**Demand Response > Market Results > Regulation Award** **Generator > Market Results > Regulation Award**	▪ Split into separate RegUp and RegDn Regulation Award tabs. It will continue to be 30-minute granularity.
8	**Public > Market Results Ancillary > Regulation Results**	▪ Split into separate RegUp and RegDn Regulation Award tabs. It will continue to be 30-minute granularity.
9	**Bilaterals**	▪ Reg MW column replaced with RegUp MW and RegDn MW columns

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Offer Parameter Deadlines

Offer Type	Markets Gateway Location	Deadline to Update
Daily Offer	**Demand Response > Regulation Market > Offers** **Generator > Regulation Market > Offers**	End of Rebid Period (14:15) the Day Before the Operating Day
Hourly Updates	**Demand Response > Regulation Markets > Hourly Updates** **Generator > Regulation Market > Hourly Updates**	35 Minutes Prior to the Operating Hour*
	**Note: Hourly Regulation Capability Offer Price/Cost and Hourly Regulation Mileage Offer Price/Cost can only be updated intraday for resources that are opted in to Intraday Offers (IDO). If opted out of IDO, they may still be submitted prior to 14:15 the day before the Operating Day.*	
Period Updates (30-min granularity, only applies to Regulation)	**Demand Response > Regulation Market > Period Updates** **Generator > Regulation Market > Period Updates**	35 Minutes Prior to the Operating Period

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Offer Options

Self-scheduled may be submitted for RegUp only, RegDn only or for both RegUp and RegDn.

A resource offering both RegUp and RegDn in the same interval cannot submit self-schedule in one direction only.

Participants offering both RegUp and RegDn may constrain clearing to bidirectional only, bidirectional and symmetrical or leave offers unconstrained.

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Offer and Capability Validation

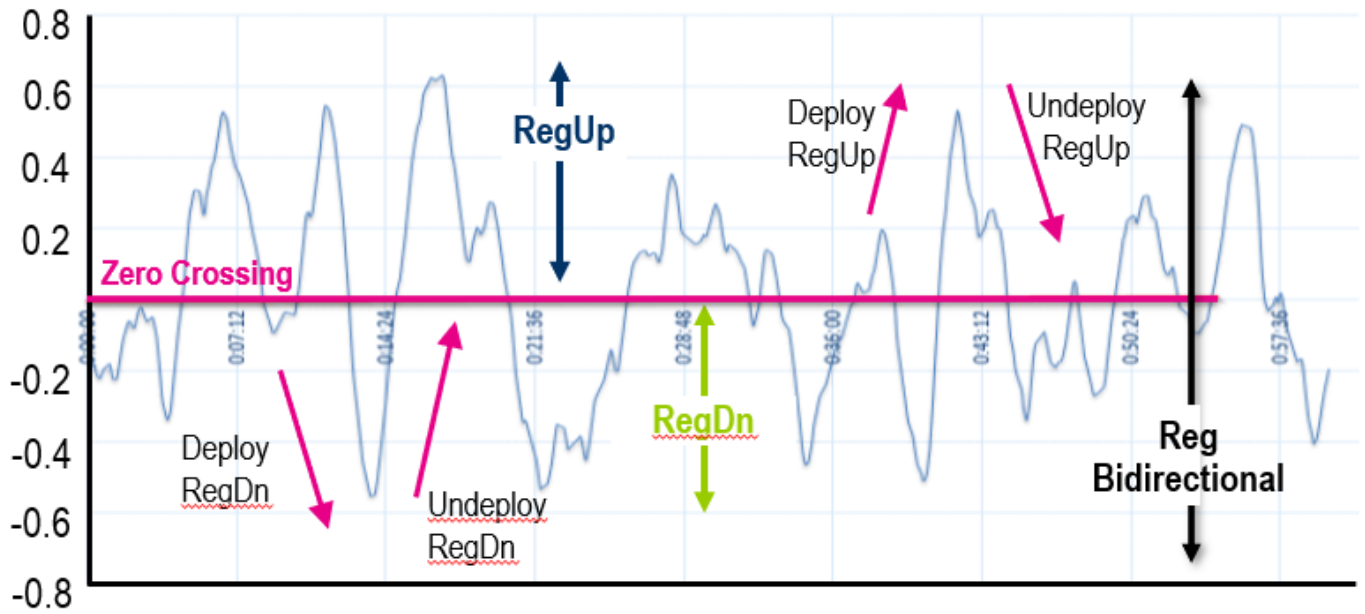
RegUp-only resource can only submit RegUp offer and can only clear RegUp.	**RegDn-**only resource can only submit RegDn offer and can only clear RegDn.	**RegUp/RegDn** resource may submit offers into (and clear in) either or both RegUp and RegDn markets for the same interval. *Option available for Market Participants around the clearing constraint*

- Self de-assign will result in zero performance score in the Regulation Market interval (current or next).
- PJM dispatch de-assign does not impact performance score in the Regulation Market interval (current or next).

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Regulation Signal and Market Products

RegUp-only resource will follow Regulation signal above the zero crossing only.	**RegDn-**only resource will follow Regulation signal below the zero crossing only.	**RegUp/RegDn** resource will follow Regulation signal above and below the zero crossing if both cleared in the same market interval.



- RegUp product operates above the zero crossing.
- RegDn product operates below the zero crossing.
- Resources will be able to follow the full signal (bidirectional) by being assigned RegUp and RegDn.
  - Only one product will be deployed at a time.

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Regulation Minimum (RegMin) megawatts and Regulation Maximum (RegMax) megawatts are:

1. Optional parameters submitted by the Market Participant.
   - Economic Minimum (EcoMin) megawatts and Economic Maximum (EcoMax) megawatts are used for resource-type hydro and if RegMin and RegMax values are not available for all other resource types.
2. Resource related but not product (RegUp/RegDn)
3. Validated against Economic megawatt limits to determine the Regulation range

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Regulation Range Validation

A resource's Regulation range is the operating band, in megawatts, within which it can move in response to the Regulation signal.

The band (reg range) runs from RegLo to RegHi, and its width is RegHi – RegLo.	**Regulation range can limit the amount of regulation assigned to a resource as economic or as self-scheduled.**
• *RegHi = EcoMax or min[RegMax, EcoMax]* • *RegLo = EcoMin or max[RegMin, EcoMin]*	• *RegUp MW <= min[RegUp Offer MW, Reg Range], else, zero* • *RegDn MW <= min[RegDn Offer MW, Reg Range], else, zero*

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Regulation Set Point

Regulation set point (load base point) establishes the megawatt headroom and/or foot room the resource must hold to provide Regulation service at a given time.

It is defined within a resource's reg band (reg range).

It is resource-specific dynamic megawatt value (no separate Regulation set points for RegUp and RegDn).

Resource regulation performance score is measured against its regulation set point (or load base point).

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Regulation Offers

Regulation Offer
Separate for RegUp and RegDn

Cost
Up to limits described in M11, Section 3.2.1, and Manual 15, Section 2.8

Capability ($/MW)
Reservation cost for megawatts that includes the fuel cost increase and unit-specific heat rate degradation due to operating at lower loads (RegDn only) and $6 margin adder

Mileage ($/ΔMW)
The incremental cost of megawatt movement that includes cost increase due to heat rate increase during non-steady-state operation and cost increase in VOM (non-energy resource only)

Price
Up to **50 $/MWh** as described in M11, Section 3.2.1

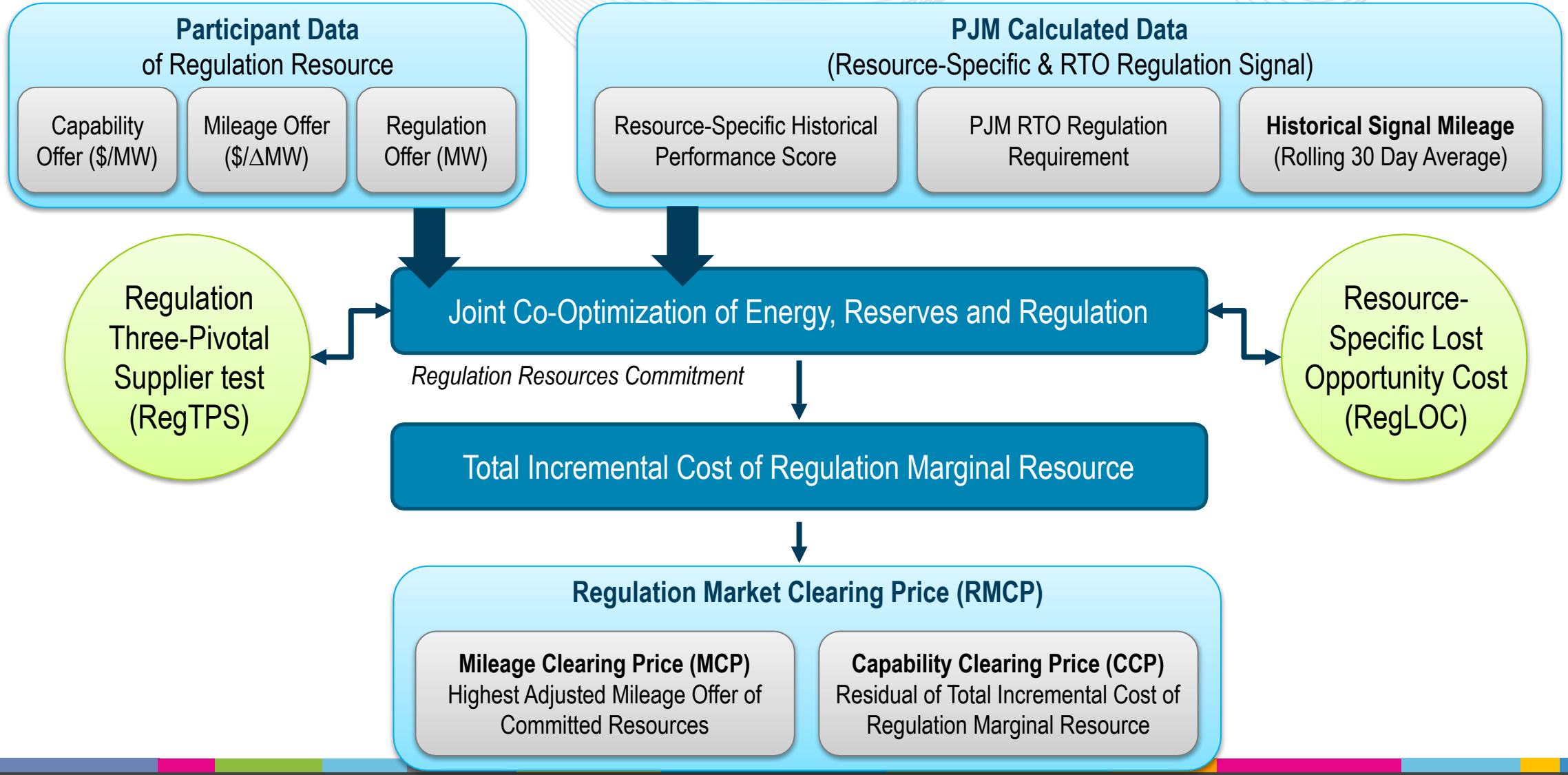
Capability ($/MW)
The price to reserve megawatts for regulation

Mileage ($/ΔMW)
The price to provide regulation movement

- VOM is removed from offers, except for Regulation-only resources.
- Under RegUp and RegDn products, the offer changes by:
  - Price is now $50/MWh per product (currently $100/MWh for bidirectional).
  - Margin adder is now $6 per product (currently $12 for bidirectional).
  - The cost for operating at lower loads is only realized for RegDn.

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Regulation Market Clearing Process



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Regulation Rank Price

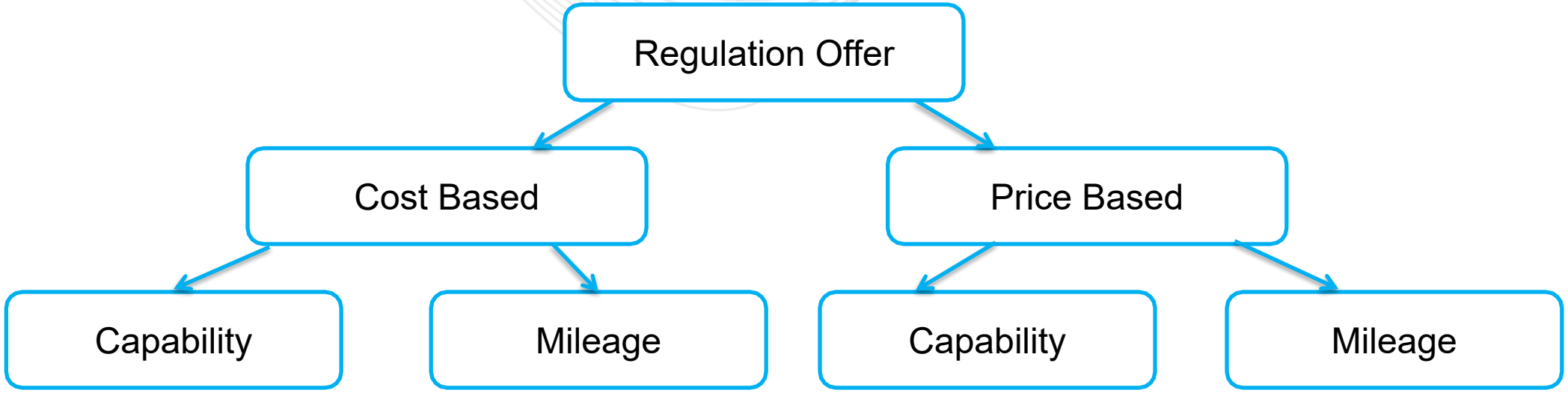
The Regulation Market clears at the marginal price, which is the highest rank-price of the resources providing regulation.

LOC of the marginal resource is on average about 90% or more of the Regulation Market clearing price.

Regulation Resource's Rank Price = adjusted Capability Offer + adjusted Mileage Offer + adjusted Lost Opportunity Cost

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Regulation Offers – Cost and Price-Based



One of the initial steps in clearing is to offer-cap resources.

- Least of (Capability Cost + Mileage Cost), (Capability Price + Mileage Price)
- If resource owner FAILED RegTPS test, offer-cap remains for final solve.
- If resource owner PASSED RegTPS test, offer is switched to price based for final solve.

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Regulation Three Pivotal Supplier (RegTPS) Test

1. Utilized to mitigate Regulation Market power as detailed in section 3.2.2A.1 of the PJM Tariff
2. Conducted for each Regulation clearing interval
3. Applied on a Regulation supplier basis (not a resource-by-resource basis)
4. Performed on all valid and available supplies within 150% of cost-based RMCP – eligible to clear resources

- A Regulation supplier fails the RegTPS test in any interval in which such Regulation supplier and the two largest Regulation suppliers are jointly pivotal.
- When RegTPS score is less than or equal to 1.0, then the three suppliers are jointly pivotal and fail the RegTPS.
  - Any resource owner that failed the RegTPS test will be offer-capped.
  - Resources are offer-capped at the lesser of their adjusted cost-based or adjusted price-based Regulation offer price.
- Resources that do not submit a cost-based Regulation offer price cannot provide regulation.

$$RegTPS_Score = \frac{Total\ Competive\ Supply - (Supplier1 + Supplier2 + SupplierN)}{Regulation\ Requirement}$$

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Determining Eligibility

If resource Rank ≤ 150% * Cost RMCP
→ Eligible for RegTPS test

If resource Rank > 150% * Cost RMCP
→ Not Eligible for RegTPS test

Not eligible means resource cannot provide Regulation for that interval.	Not eligible resources have effective megawatts set to zero.	Not the same as resources failing RegTPS test

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RegTPS Calculation Example

			Reg Requirement	50		
No.	**TPS Owner**	**Resource**	**Available Effective RegMW**	**Supplier Sum**	**RegTPS Score**	**RegTPS Result**
1	Alpha	A	15	25	0.8	Fail
		B	10			
2	Bravo	C	25	40	Largest Supplier	Fail
		D	15			
3	Charlie	E	5	5	1.2	Pass
4	Delta	F	15	15	1	Fail
5	Gamma	G	20	35	Larger Supplier	Fail
		H	5			
		K	10			
6	Theta	L	10	20	0.9	Fail
		M	10			
			Total Supply	140		

$$RegTPS_{Score} = \frac{TotalCompetitiveSupply\ -(Supplier1 + Supplier\ 2 + Supplier\ N)}{Regulation\ Requirement}$$

$$RegTPS_{Score_Theta} = \frac{140\ -(40 + 35 + 20)}{50} = 0.9$$

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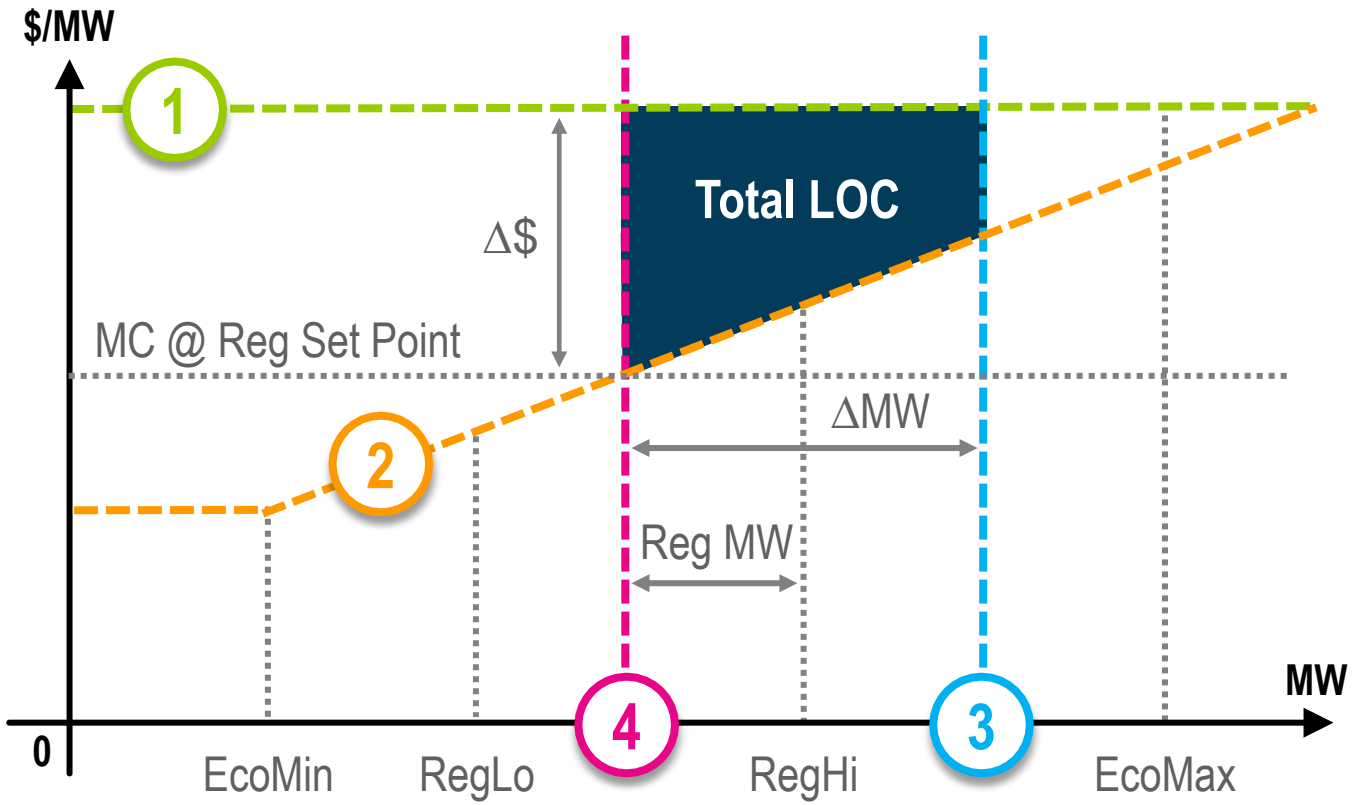
Regulation Lost Opportunity Cost

Regulation Lost Opportunity Cost (RegLOC) is the resource's foregone revenue or increase in cost relative to the energy market for providing regulation.

- Calculated only for pool-scheduled Regulation resource providing energy and Regulation services simultaneously, and only within the resource's economic limits (EcoMin to EcoMax)
- Inclusion of the RegLOC in the regulation resource's effective price (rank price) allows the resource to be indifferent to where its megawatt is being use, energy only or energy plus regulation, as its total revenue would be at least that from the energy market.
- The Regulation set point is the reference megawatt for calculating the RegLOC.

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Lost Opportunity Cost – Unit Held Down Uneconomically

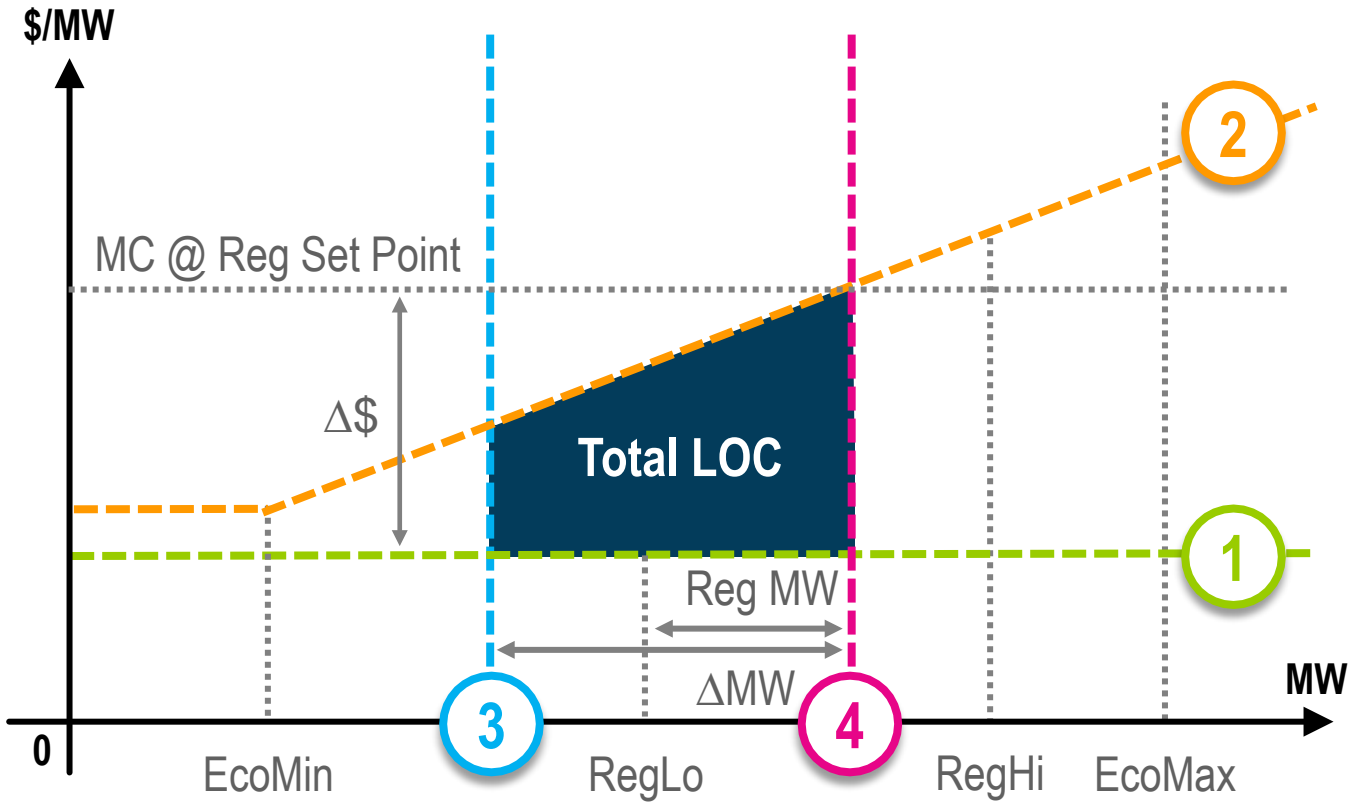


Total LOC Formulation ($) area bounded by:

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 Regulation set point

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Lost Opportunity Cost – Unit Raised Uneconomically (Uplift)

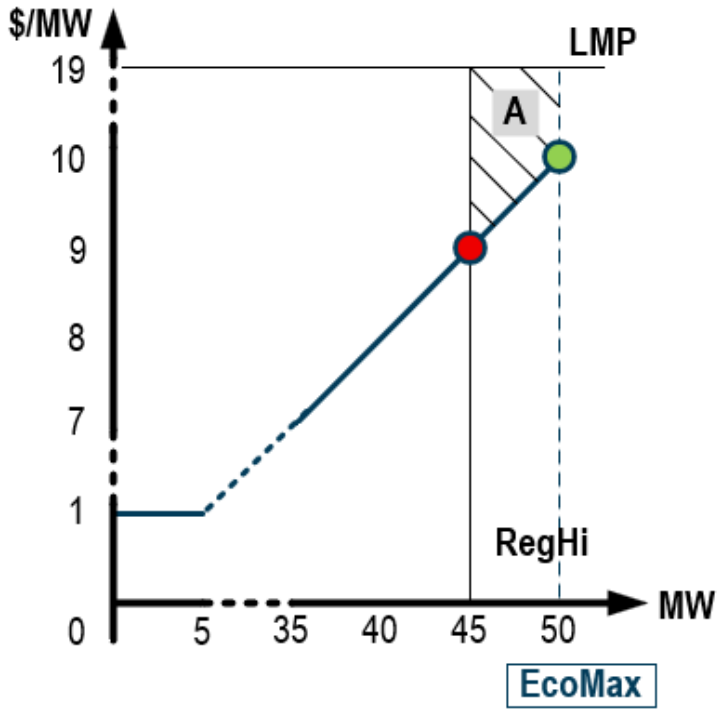


Total LOC Formulation ($) area bounded by:

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 Regulation set point

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RegLOC | EcoMax = RegHi | LMP >= Price



LMP = 19
EcoMax = 50
RegHi = 50
Energy expected output = 50
Performance Score = 1

Product	Reg Set Point	RegMW	LOC, $/MW
Bidirectional	**45**	**5**	**9.5**
RegUp Only	**45**	**5**	**9.5**
RegDn Only	**50**	**5**	**0**
RegUp & RegDn	**45**	**5, 5**	**9.5 + 0**

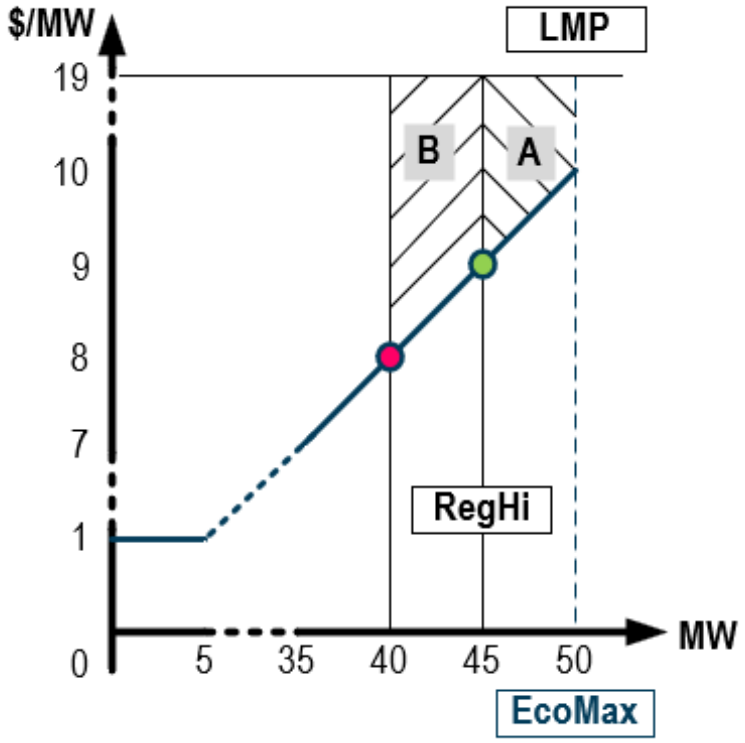
RegLOC = (Δ$ x ΔMW) / (RegMW x PS) = $\frac{\text{Area A}}{PS * RegMW}$

Area A = (9*5)+(0.5*5*1) = 47.5

Key Takeaway: *RegLOC bidirectional = RegUpLOC + RegDnLOC*

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RegLOC | EcoMax > RegHi | LMP >= Price



LMP = 19
EcoMax = 50
RegHi = 45
Energy expected output = 50
Performance Score = 1

Product	Reg Set Point	RegMW	LOC, $/MW
Bidirectional	**40**	**5**	**20**
RegUp Only	**40**	**5**	**20**
RegDn Only	**45**	**5**	**9.5**
RegUp & RegDn	**40**	**5, 5**	**15.25 + 4.75**

$$\text{RegDnLOC} = \frac{Area\,A}{PS * (RegUp\,MW + RegDn\,MW)} = \frac{47.5}{10} = 4.75$$

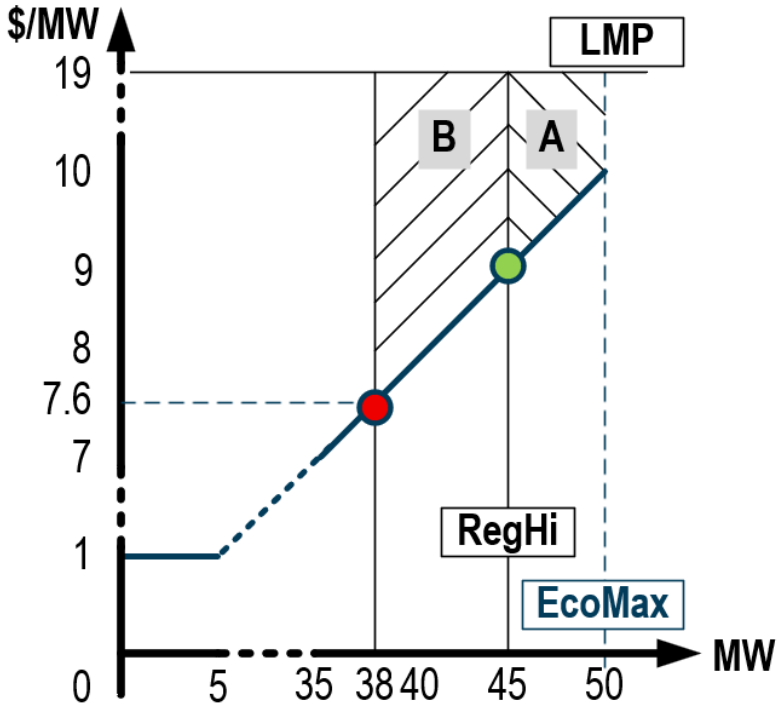
$$\text{RegUpLOC} = \frac{Area\,A}{PS * (RegUp\,MW + RegDn\,MW)} + \frac{Area\,B}{PS * RegUp\,MW} = 4.75 + \frac{52.5}{5} = 15.25$$

Area A = (9*5)+(0.5*5*1) = 47.5 | Area B = (10*5)+(0.5*5*1) = 52.5 | Area A&B = (9*10)+(0.5*10*2) = 100

Key Takeaway: *LOC in the common area A eliminates potential double counting.*

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RegLOC | EcoMax > RegHi | LMP >= Price



LMP = 19
EcoMax = 50
RegHi = 45
Energy expected output = 50
Performance Score = 1

Product	Reg Set Point	RegMW	LOC, $/MW
Bidirectional	40	5	20
RegUp Only	38	7	17.49
RegDn Only	45	3	15.83
RegUp & RegDn	38	7, 3	15.45 + 4.75

$$\text{RegDnLOC} = \frac{Area\,A}{PS * (RegUp\,MW + RegDn\,MW)} = \frac{47.5}{10} = 4.75$$

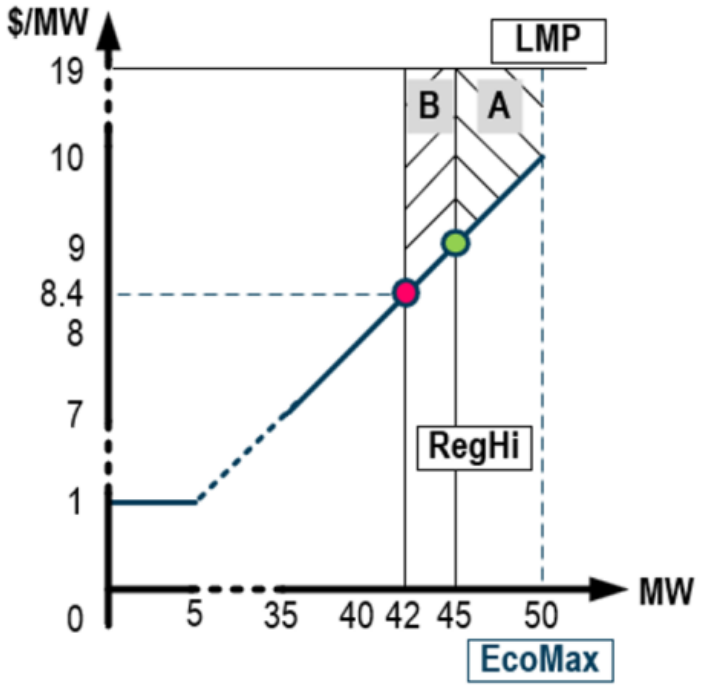
$$\text{RegUpLOC} = \frac{Area\,A}{PS * (RegUp\,MW + RegDn\,MW)} + \frac{Area\,B}{PS * RegUp\,MW} = 4.75 + \frac{74.9}{7} = 15.25$$

Area A = (9*5)+(0.5*5*1) = 47.5 | Area B = (10*7)+(0.5*7*1.4) = 74.9 | Area A&B = (9*12)+(0.5*12*2.4) = 122.4

Key Takeaway: *Slight increase in the RegUp LOC in the RegUp/RegDn because of an increase in the uneconomic Regulation set point.*

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RegLOC | EcoMax > RegHi | LMP >= Price



LMP = 19
EcoMax = 50
RegHi = 45
Energy expected output = 50
Performance Score = 1

Product	Reg Set Point	RegMW	LOC, $/MW
Bidirectional	40	5	20
RegUp Only	38	3	26.13
RegDn Only	45	7	6.79
RegUp & RegDn	38	3, 7	15.05 + 4.75

$$\text{RegDnLOC} = \frac{Area\,A}{PS * (RegUp\,MW + RegDn\,MW)} = \frac{47.5}{10} = 4.75$$

$$\text{RegUpLOC} = \frac{Area\,A}{PS * (RegUp\,MW + RegDn\,MW)} + \frac{Area\,B}{PS * RegUp\,MW} = 4.75 + \frac{30.9}{3} = 15.25$$

Area A = (9*5)+(0.5*5*1) = 47.5 | Area B = (10*3)+(0.5*3*0.6) = 30.9 | Area A&B = (9*8)+(0.5*8*1.6) = 78.4

Key Takeaway: *Note the decrease in RegUp LOC in the RegUp/RegDn because of a decrease in the uneconomic Regulation set point in a scenario of the same resource clearing asymmetrically.*

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Hydro LOC Calculation in Regulation Clearing and Pricing

Hydro Type & Condition	Energy Schedule	RegLOC
Pump Storage & Run-Off River	Scheduled MW > 0	Max[LMP – ED, 0]
	Scheduled MW <= 0	Max[ED – LMP, 0]
Spill Condition	RegLOC = Max[LMP, 0]	

LMP

- LMP at the hydro unit pnode
- Forecasted value is used in the regulation clearing in ASO.
- Actual value is used in the real-time 5-minute pricing in LPC and Settlement.

ED

- The average of LMPs at the hydro unit pnode for the appropriate on-peak or off-peak period excluding those hours during which all available units at the hydro plant were operating
- Day-ahead LMPs are used to calculate ED in the regulation clearing and in the real-time pricing.
- Real-time LMPs after-the-fact are used in Settlement.

- A hydro resource can only receive a non-zero LOC calculation for the RegUp product as the resource can only be held down to provide this product.

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Regulation for Intermittent Resources

For intermittent resources such as wind and solar units, the assumption is those resources are already operating close to or at their Economic Maximum most of the time.

If such resources are participating in RegDn, these resources would still be dispatched economically up to their Economic Maximum.

These resources would reduce their output when the RegDn signal is deployed below the zero crossing.

If such resources are also participating in RegUp, these resources would still be dispatched economically, but now while considering the megawatts of headroom needed between the dispatch basepoint, the RegUp assignment and the Economic Maximum.

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Regulation Settlements

Disclaimer: While materials are current at the time of publishing, applicable requirements may change. PJM Governing Documents control.

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Agenda

1. Regulation Clearing Price Credits
2. Regulation Lost Opportunity Cost Credits
3. Regulation Charges
4. MSRS Reports
5. Phase 2 Settlements Information

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Impact Summary

Regulation Phase 2 Settlements Impacts:	
1.	Regulation settlement details can be found in Manual 28, Section 4.
2.	No new Billing Line Items, all Phase 2 billing will be handled via the existing Regulation Billing Line Items.
3.	MSRS Reports: • Updates to 3 Existing Reports • Creation of 3 New Reports

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Regulation Clearing Price Credits (BLI 2340)

Calculated for each 5-minute interval

If actual 5-minute performance score for product type < 0.25, credit = $0

Regulation Market **Capability** Clearing Price credit **by product type**

RegUp MW x RegUp Actual Performance Score x $\frac{\text{RegUp RMCCP}}{12}$

RegDn MW x RegDn Actual Perf Score x $\frac{\text{RegDn RMCCP}}{12}$

Regulation Market **Mileage** Clearing Price credit **by product type**

RegUp MW x RegUp Actual Perf Score x $\frac{\text{RegUp Actual Mileage}}{\text{RegUp Daily Historic Mileage}}$ x $\frac{\text{RegUp RMMCP}}{12}$

RegDn MW x RegDn Actual Perf Score x $\frac{\text{RegDn Actual Mileage}}{\text{RegDn Daily Historic Mileage}}$ x $\frac{\text{RegDn RMMCP}}{12}$

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Regulation Lost Opportunity Cost Credit (BLI 2340)

Regulation LOC Credit accounts for both product types

If a pool-scheduled resource is not compensated for its offers plus any opportunity costs via the clearing prices, a resource receives an uplift credit referred to as the Lost Opportunity Cost Credit.

Lost Opportunity Cost Credit =

$$\frac{\text{(Regulation Offers + Intra-Commitment Opportunity Cost * Actual Performance Score + Shoulder Opportunity Cost)}}{12} - \text{Regulation Clearing Price Credits}$$

Calculated for each 5-minute interval

If the applicable actual 5-minute performance score < 0.25, credit = $0

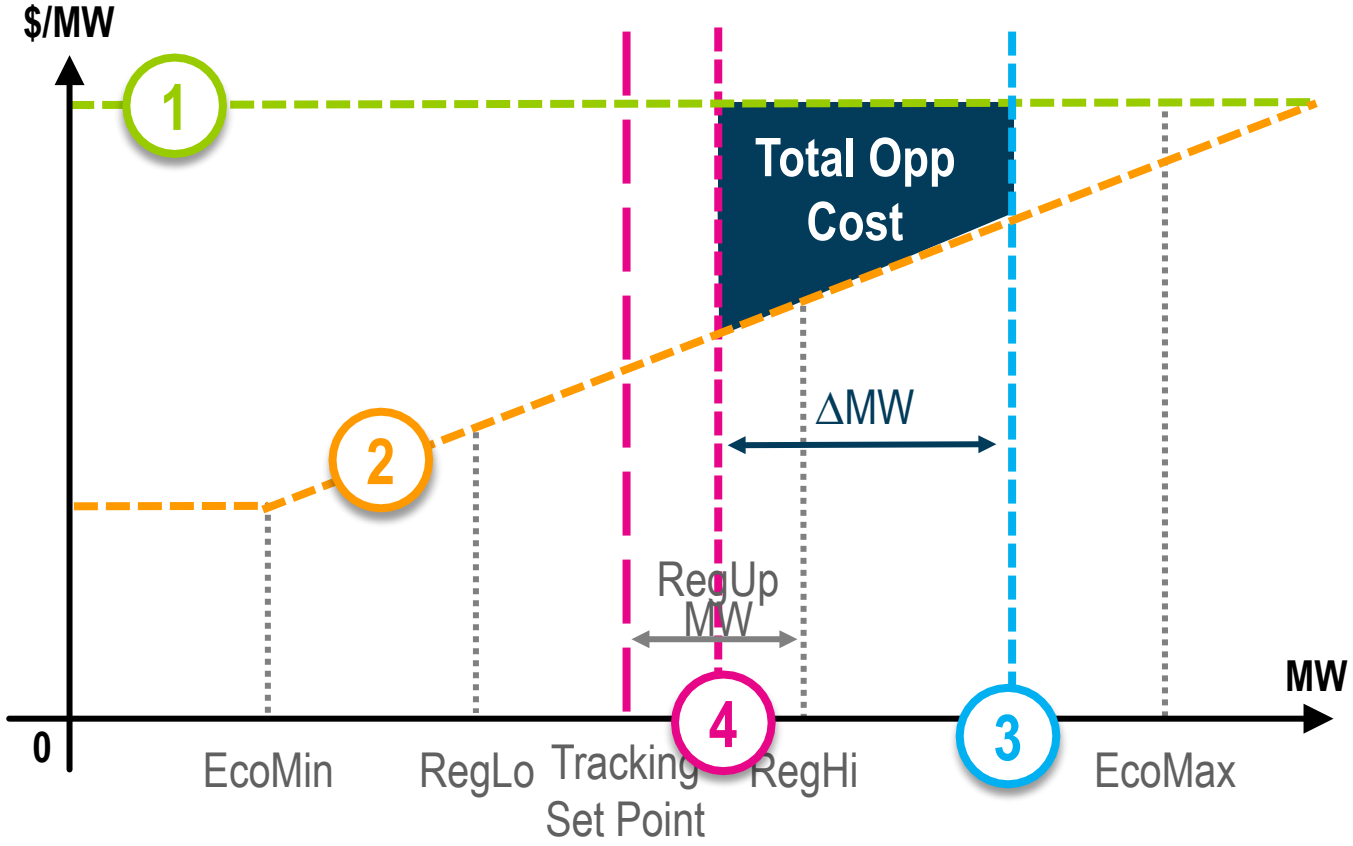
- If a resource is assigned both RegUp and RegDn products in the interval,
  - Regulation Offers = RegUp Offer + RegDn Offer
  - Regulation Clearing Price credits = RegUp Clearing Price credits + RegDn Clearing Price credits
  - A single intra-commitment opportunity cost is calculated and the weighted average of the RegUp and RegDn performance scores is used.
- Intra-commitment opportunity costs and shoulder interval opportunity costs for Economic Load Response Participant resources and regulation-only resources are zero.

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Intra-Commitment Opportunity Costs

Unit Held Down Uneconomically (Forgone Profit)

Scenario: RegUp requested during the 5-minute interval: Bias factor represents a partial raise



Total opportunity cost formulation ($)

area bounded by:

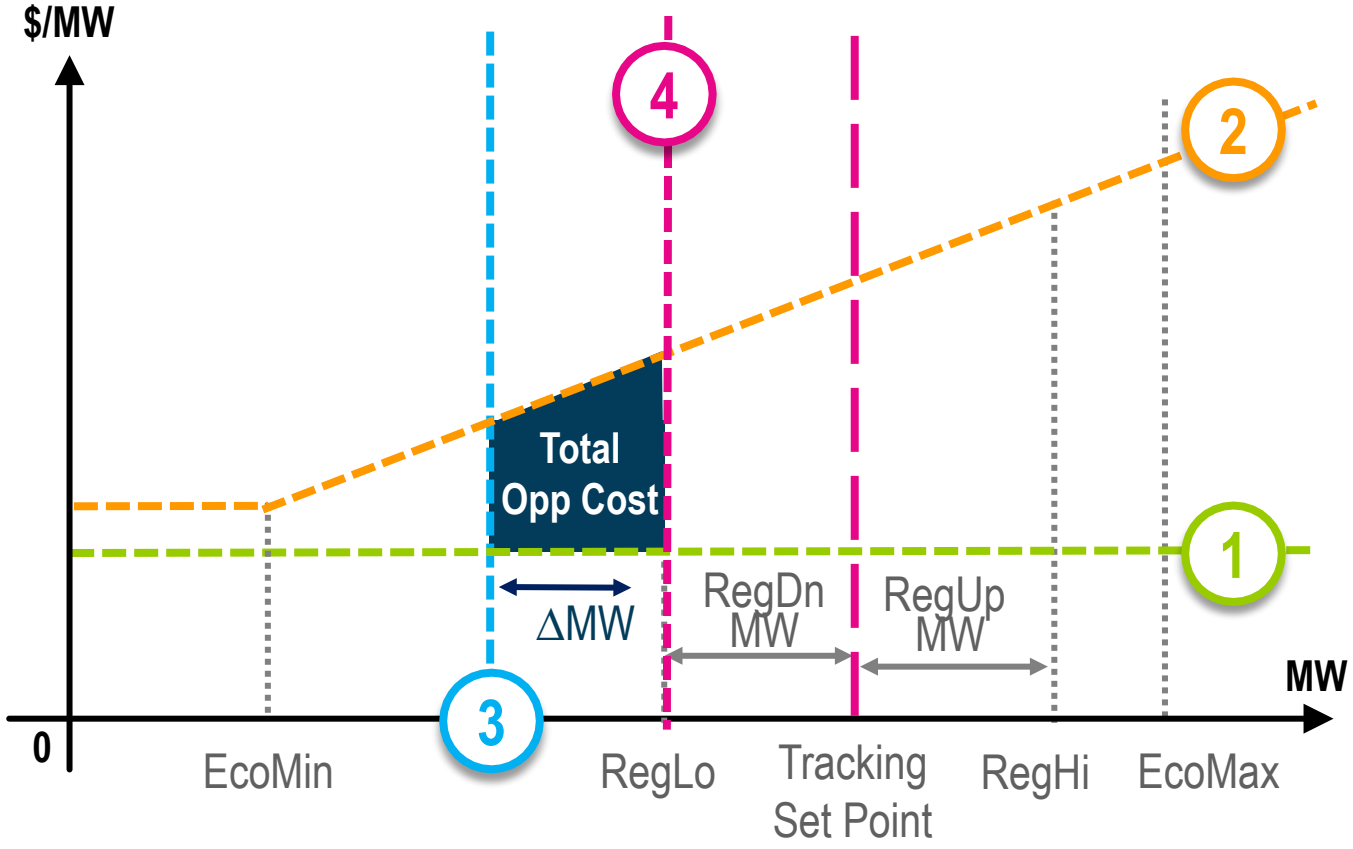
1. The LMP
2. The resource's energy final offer
3. The generation resource's tracking ramp-rate limited expected output level if it had been dispatched in economic merit order
4. The generation resource's **bias adjusted** tracking set point

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Intra-Commitment Opportunity Costs

Unit Raised Uneconomically (Make Whole)

Scenario: RegDn requested during the 5-minute interval: Bias factor represents a full lower (all RegDn requested)



Total opportunity cost 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 **bias adjusted** tracking set point

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Bias Adjusted Tracking Set Point (Non-hydro)

Assignment	Bias Factor	Bias Adjusted Tracking Set Point
RegUp Only	RegUp bias factor is a value between 0 and 1	Tracking set point + (RegUp MW * RegUp bias factor)
RegDn Only	RegDn bias factor is a value between 0 and -1	Tracking set point + (RegDn MW * RegDn bias factor)
RegUp and RegDn	Bidirectional bias factor is a value between -1 and 1	
	If bidirectional bias factor > 0	Tracking set point + (RegUp MW * bidirectional bias factor)
	If bidirectional bias factor < 0	Tracking set point + (RegDn MW * bidirectional bias factor)

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Intra-Commitment Opportunity Costs (Hydro)

Hydro Type & Condition	Day-Ahead Energy Schedule	Opportunity Cost
Pump Storage & Run-Off River	Scheduled MW > 0	Hydro Deviation MW * Max [RT LMP – Average LMP, 0]
	Scheduled MW <= 0	Hydro Deviation MW * Max [Average LMP – RT LMP, 0]
Spill Condition	Not Applicable	Hydro Deviation MW * Real-Time LMP

Average LMP = The average of Real-Time LMPs at the hydro unit pnode for the appropriate on-peak or off-peak period excluding those hours during which all available units at the hydro plant were operating

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Bias Adjusted Hydro Deviation MW

Assignment	Bias Factor	Hydro Deviation MW
RegUp Only	RegUp bias factor is a value between 0 and 1	RegUp MW * (1 - RegUp bias factor)
RegDn Only	RegDn bias factor is a value between 0 and -1	ABS (RegDn MW * RegDn bias factor)
RegUp and RegDn	Bidirectional bias factor is a value between -1 and 1	
	If bidirectional bias factor >= 0	RegUp MW * (1- bidirectional bias factor)
	If bidirectional bias factor < 0	RegUp MW + (RegDn MW * ABS(bidirectional bias factor))

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Shoulder Opportunity Cost Eligibility

Eligibility Requirements

Ramp-in shoulder intervals: Regulation assignment starts at the top of the hour (HH:00 – HH:05), or the Regulation assignment starts at the bottom of the hour (HH:30 – HH:35).

Ramp-out shoulder intervals: Regulation assignment ends at the top of the following hour (HH:55 – HHnext:00), or the Regulation assignment ends at the bottom of the hour (HH:25 – HH:30).

Regulation assignment is pool scheduled only.

CTs, Diesels, Hybrids, Solar, Wind, Storage/ESR, Nuclear and Hydro **are NOT eligible.**

Resource is:

- Not regulating in the shoulder five-minute intervals
- Online and generating in the shoulder five-minute intervals

Tracking ramp rate limited desired MW from the shoulder interval is not already within regulation limits.

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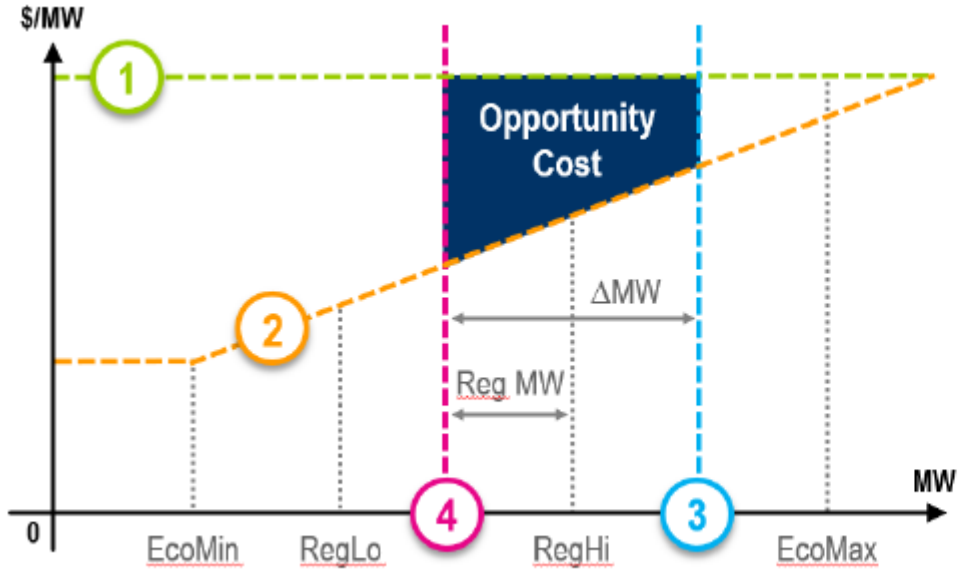
Shoulder Opportunity Costs: Forgone Profit

Opportunity cost equals the forgone profit when the resource is moving to a:

Regulation tracking set point that is less than the tracking ramp limited desired MW for the shoulder interval (ramp-in)

OR

Tracking ramp limited desired MW for the shoulder interval that is greater than the Regulation tracking set point (ramp-out)



Total shoulder opportunity cost ($) area bounded by:

1. The RT LMP from shoulder intervals
2. The final offer from shoulder interval
3. The tracking ramp limited desired MW in shoulder intervals
4. The tracking regulation set point for first or last interval of regulation assignment.

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Shoulder Opportunity Costs: Make Whole

Opportunity cost equals a make whole amount when the resource is moving to a:

Regulation tracking set point that is greater than the tracking ramp limited desired MW for the shoulder interval (ramp-in)

OR

Tracking ramp limited desired MW for the shoulder interval that is less than the Regulation tracking set point (ramp-out)



Total shoulder opportunity cost ($) area bounded by:

1. The RT LMP from shoulder intervals
2. The final offer from shoulder interval
3. The tracking ramp limited desired MW in shoulder intervals
4. The tracking regulation set point for first or last interval of regulation assignment.

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Regulation Charge (BLI 1340)

RMCCP Charge and RMMCP Charge

- LSEs, or other Regulation buyers, are charged hourly obligation ratio share of total hourly RMCCP credits and RMMCP credits for each product.
- Calculated hourly for each product type

Lost Opportunity Cost Charge

- Net Regulation Purchasers are charged hourly purchase ratio share of total hourly Lost Opportunity Cost Credits.
- Calculated hourly

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Regulation Obligation

Hourly Obligations equal the real-time load ratio share of total effective Regulation that hour.
Hourly Adjusted Obligations equal obligations adjusted by product specific bilateral transactions.

RegUp Obligation =	Total Effective RegUp x	$\frac{\text{RT Load}}{\text{Total PJM RT Load}}$
RegDn Obligation =	Total Effective RegDn x	$\frac{\text{RT Load}}{\text{Total PJM RT Load}}$

Total Effective Regulation by product type is the hourly integrated sum of the 5-minute interval Regulation MW multiplied by the actual performance score for all pool-scheduled and self-scheduled resources.

RegUp Adjusted Obligation =	RegUp Obligation + RegUp Bilateral Sale – RegUp Bilateral Purchase
RegDn Adjusted Obligation =	RegDn Obligation + RegDn Bilateral Sale – RegDn Bilateral Purchase

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Regulation Clearing Price Charge (BLI 1340)

Hourly Regulation Clearing Price Charges by Product Type

RegUp Capability Clearing Price Charge =	Total RegUp RMCCP Credits x	RegUp Adjusted Obligation / Total PJM RegUp Adjusted Obligation
RegUp Mileage Clearing Price Charge =	Total RegUp RMMCP Credits x	RegUp Adjusted Obligation / Total PJM RegUp Adjusted Obligation

RegDn Capability Clearing Price Charge =	Total RegDn RMCCP Credits x	RegDn Adjusted Obligation / Total PJM RegDn Adjusted Obligation
RegDn Mileage Clearing Price Charge =	Total RegDn RMMCP Credits x	RegDn Adjusted Obligation / Total PJM RegDn Adjusted Obligation

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Regulation Lost Opportunity Cost Charge (BLI 1340)

RegUp Purchases =	Max (RegUp Adjusted Obligation – RegUp Self Scheduled Regulation MW, 0)
RegDn Purchases =	Max (RegDn Adjusted Obligation – RegDn Self Scheduled Regulation MW, 0)
Reg Lost Opportunity Cost Charge =	Total Lost Opportunity Cost Credits x $\frac{\text{RegUp Purchases + RegDn Purchases}}{\text{Total PJM RegUp and RegDn Purchases}}$

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MSRS – New Phase 2 Reports

MSRS Report	New Phase 2 Information
Regulation Hydro Opportunity Cost Details	Supporting details for hydro intra-commitment opportunity cost calculations
Regulation Intra-Commitment Opportunity Cost Details	Supporting details for intra-commitment opportunity cost calculations for non-hydro generators
Regulation Shoulder Opportunity Cost Details	Supporting details for shoulder opportunity cost calculations

MSRS Report Documentation for new reports has been posted on pjm.com.
Report documentation (Description, CSV and XML) is also posted with May MSS materials.

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Regulation Hydro Opportunity Cost Details (New)

This report displays the customer account's 5-minute Regulation Opportunity Cost Details for hydro generation units.

The following columns will appear in the body of the report:

Online and CSV Column Name	XML Column Name	Column Number	Data Type
Customer ID	CUSTOMER_ID	4000.01	INTEGER
Customer Code	CUSTOMER_CODE	4000.02	VARCHAR2(6)
EPT Interval Ending	EPT_INTERVAL_ENDING	4001.40	VARCHAR2(40) mm/dd/yyyy HH24:MM format (Displays first interval of the day as hour 0 minute 05 and last interval of the day as hour 24 minute 00)
GMT Interval Ending	GMT_INTERVAL_ENDING	4001.41	VARCHAR2(40) mm/dd/yyyy HH24:MM format (Displays first interval of the day in relation to EPT interval as hour 04 minute 05 or hour 05 minute 05 (EDT/EST depending) and last interval of the day as hour 04 minute 00 of the next day or hour 05 minute 00 of the next day (EDT/EST depending))
Regulation Duration (% 5 Min Interval)	REG_DURATION	2340.72	NUMBER
Unit ID	UNIT_ID	4000.63	NUMBER(8,0)
Unit Name	UNIT_NAME	4000.64	VARCHAR2(75)
Unit Ownership Share	UNIT_OWNERSHIP_SHARE	3000.80	NUMBER
PJM-Assigned RegUp MW	PJM_ASSIGNED_REGUP_MW	2340.68	NUMBER
PJM-Assigned RegDn MW	PJM_ASSIGNED_REGDN_MW	2340.69	NUMBER
RegUp Bias Factor	REGUP_BIAS_FACTOR	2340.73	NUMBER
RegDn Bias Factor	REGDN_BIAS_FACTOR	2340.74	NUMBER
Reg Bidirectional Bias Factor	REG_BIDIR_BIAS_FACTOR	2340.75	NUMBER
Regulation Deviation MW	REGULATION_DEVIATION_MW	2340.76	NUMBER
Hydro Spill Indicator	HYDRO_SPILL_INDICATOR	4000.67	VARCHAR2(1) See possible values below
DA Scheduled MWh	DA_SCHD_MWH	3000.32	NUMBER
Hydro Average LMP ($/MWh)	HYDRO_AVG_LMP	2340.62	NUMBER
RT LMP ($/MWh)	RT_LMP	3000.25	NUMBER
Opportunity Cost ($)	OPPORTUNITY_COST	2340.96	NUMBER
Prorated Opportunity Cost ($)	PRORATED_REG_OPP_COST	2340.77	NUMBER
Version	VERSION	4000.07	VARCHAR2(12)

Hydro Spill Indicator: Y or N

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Regulation Intra-Commitment Opportunity Cost Details (New)

This report displays the customer account's 5-minute Regulation Intra-Commitment Opportunity Cost Details for non-hydro generation units.

The following columns will appear in the body of the report:

Online and CSV Column Name	XML Column Name	Column Number	Data Type
Customer ID	CUSTOMER_ID	4000.01	INTEGER
Customer Code	CUSTOMER_CODE	4000.02	VARCHAR2(6)
EPT Interval Ending	EPT_INTERVAL_ENDING	4001.40	VARCHAR2(40) mm/dd/yyyy HH24:MM format (Displays first interval of the day as hour 0 minute 05 and last interval of the day as hour 24 minute 00)
GMT Interval Ending	GMT_INTERVAL_ENDING	4001.41	VARCHAR2(40) mm/dd/yyyy HH24:MM format (Displays first interval of the day in relation to EPT interval as hour 04 minute 05 or hour 05 minute 05 (EDT/EST depending) and last interval of the day as hour 04 minute 00 of the next day or hour 05 minute 00 of the next day (EDT/EST depending))
Regulation Duration (% 5 Min Interval)	REG_DURATION	2340.72	NUMBER
Unit ID	UNIT_ID	4000.63	NUMBER(8,0)
Unit Name	UNIT_NAME	4000.64	VARCHAR2(75)
Unit Ownership Share	UNIT_OWNERSHIP_SHARE	3000.80	NUMBER
RT Schedule Id	RT_SCHED_ID	3002.19	NUMBER
Economic Min MW	ECON_MIN_MW	3002.22	NUMBER
Economic Max MW	ECON_MAX_MW	3002.23	NUMBER
Regulation Min MW	REG_MIN_MW	3004.41	NUMBER
Regulation Max MW	REG_MAX_MW	3004.42	NUMBER
Reg Min MW Used	REG_MIN_MW_USED	2340.78	NUMBER
Reg Max MW Used	REG_MAX_MW_USED	2340.79	NUMBER
PJM-Assigned RegUp MW	PJM_ASSIGNED_REGUP_MW	2340.68	NUMBER
PJM-Assigned RegDn MW	PJM_ASSIGNED_REGDN_MW	2340.69	NUMBER
RegUp Bias Factor	REGUP_BIAS_FACTOR	2340.73	NUMBER
RegDn Bias Factor	REGDN_BIAS_FACTOR	2340.74	NUMBER
Reg Bidirectional Bias Factor	REG_BIDIR_BIAS_FACTOR	2340.75	NUMBER
Tracking Ramp Limit Desired MW	TRLD_MW	2340.80	NUMBER
Tracking Regulation Set Point MW	TRLD_AS_MW	2340.81	NUMBER
Biased Regulation Set Point MW	BIASED_REG_SET_POINT_MW	2340.82	NUMBER
LOC Indicator	LOC_IND	3004.60	VARCHAR2(1) See possible values below
Make Whole Indicator	MAKE_WHOLE_IND	3004.61	VARCHAR2(1) See possible values below
RT LMP ($/MWh)	RT_LMP	3000.25	NUMBER
Begin Point MW	BEGIN_POINT_MW	2340.83	NUMBER
End Point MW	END_POINT_MW	2340.84	NUMBER
Begin Energy Offer Price ($/MWh)	BEGIN_ENGY_OFFER_PRICE	2340.85	NUMBER
End Energy Offer Price ($/MWh)	END_ENGY_OFFER_PRICE	2340.86	NUMBER
RT Energy Offer Amount ($)	RT_ENERGY_OFFER_AMT	3001.88	NUMBER
Opportunity Cost ($)	OPPORTUNITY_COST	2340.96	NUMBER
Prorated Opportunity Cost ($)	PRORATED_OPP_COST	2340.77	NUMBER
Version	VERSION	4000.07	VARCHAR2(12)

LOC Indicator: Y or N
Make Whole Indicator: Y or N

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Regulation Shoulder Opportunity Cost Details (New)

This report displays the customer account's 5-minute Regulation Shoulder Opportunity Cost Details for generation units.

The following columns will appear in the body of the report:

Online and CSV Column Name	XML Column Name	Column Number	Data Type
Customer ID	CUSTOMER_ID	4000.01	INTEGER
Customer Code	CUSTOMER_CODE	4000.02	VARCHAR2(6)
EPT Interval Ending	EPT_INTERVAL_ENDING	4001.40	VARCHAR2(40) mm/dd/yyyy HH24:MM format (Displays first interval of the day as hour 0 minute 05 and last interval of the day as hour 24 minute 00)
GMT Interval Ending	GMT_INTERVAL_ENDING	4001.41	VARCHAR2(40) mm/dd/yyyy HH24:MM format (Displays first interval of the day in relation to EPT interval as hour 04 minute 05 or hour 05 minute 05 (EDT/EST depending) and last interval of the day as hour 04 minute 00 of the next day or hour 05 minute 00 of the next day (EDT/EST depending))
Unit ID	UNIT_ID	4000.63	NUMBER(8,0)
Unit Name	UNIT_NAME	4000.64	VARCHAR2(75)
Unit Ownership Share	UNIT_OWNERSHIP_SHARE	3000.80	NUMBER
EPT Shoulder Interval Ending	EPT_SHLD_INTERVAL_ENDING	4001.46	VARCHAR2(40) mm/dd/yyyy HH24:MM format (Displays first interval of the day as hour 0 minute 05 and last interval of the day as hour 24 minute 00)
Ramp In Indicator	RAMP_IN_INDICATOR	3004.60	VARCHAR2(1) See possible values below
Ramp Out Indicator	RAMP_OUT_INDICATOR	3004.61	VARCHAR2(1) See possible values below
RT Schedule Id	RT_SCHED_ID	3002.19	NUMBER
Economic Min MW	ECON_MIN_MW	3002.22	NUMBER
Economic Max MW	ECON_MAX_MW	3002.23	NUMBER
Regulation Min MW	REG_MIN_MW	3004.41	NUMBER
Regulation Max MW	REG_MAX_MW	3004.42	NUMBER
Reg Min MW Used	REG_MIN_MW_USED	2340.78	NUMBER
Reg Max MW Used	REG_MAX_MW_USED	2340.79	NUMBER
PJM-Assigned RegUp MW	PJM_ASSIGNED_REGUP_MW	2340.68	NUMBER
PJM-Assigned RegDn MW	PJM_ASSIGNED_REGDN_MW	2340.69	NUMBER
Tracking Ramp Limit Desired MW	TRLD_MW	2340.80	NUMBER
Tracking Regulation Set Point MW	TRLD_AS_MW	2340.81	NUMBER
RT LMP ($/MWh)	RT_LMP	3000.25	NUMBER
Begin Point MW	BEGIN_POINT_MW	2340.83	NUMBER
End Point MW	END_POINT_MW	2340.84	NUMBER
RT Energy Offer Amount ($)	RT_ENERGY_OFFER_AMT	3001.88	NUMBER
Shoulder Opportunity Cost ($)	SHLD_OPPORTUNITY_COST	2340.97	NUMBER
Version	VERSION	4000.07	VARCHAR2(12)

Ramp In Indicator: Y or N
Ramp Out Indicator: Y or N

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MSRS Reports – Existing Reports

MSRS Report	Format changes	Phase 2 Impact
Regulation Market Credits	No	Phase 1 MSRS report designed to allow different product types • Phase 1 product type = Regulation • Phase 2 product types = RegUp or RegDn
Regulation Market Lost Opportunity Cost Credits	Yes	• Hydro details (Avg LMP, RT LMP) moved to new Hydro report • Additional details by product type (RegUp and RegDn)
Regulation Summary	Yes	Additional details by product type (RegUp and RegDn)
Hydro Peak Period Average LMP Details	No	No changes

MSRS report documentation (Description, CSV, and XML) is posted with May MSS materials.
MSRS Report Documentation on pjm.com for existing reports will be updated closer to implementation date.

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Regulation Market Credits (Existing)

Displays the Regulation Market Clearing Price Credit calculation details for Generation Resources and Load Response Registrations.

- No format changes
- Phase 2 Product types are RegUp and RegDn

The following columns will appear in the body of the report:

Online and CSV Column Name	XML Column Name	Column Number	Data Type
Customer ID	CUSTOMER_ID	4000.01	INTEGER
Customer Code	CUSTOMER_CODE	4000.02	VARCHAR2(6)
EPT Interval Ending	EPT_INTERVAL_ENDING	4001.4	VARCHAR2(40) mm/dd/yyyy HH24:MM format (Displays first interval of the day as hour 0 minute 05 and last interval of the day as hour 24 minute 00)
GMT Interval Ending	GMT_INTERVAL_ENDING	4001.41	VARCHAR2(40) mm/dd/yyyy HH24:MM format (Displays first interval of the day in relation to EPT interval as hour 04 minute 05 or hour 05 minute 05 (EDT/EST depending) and last interval of the day as hour 04 minute 00 of the next day or hour 05 minute 00 of the next day (EDT/EST depending))
Market Resource ID	MRKT_RESRC_ID	4001.16	NUMBER(15,0)
Market Resource Name	MRKT_RESRC_NAME	4001.17	VARCHAR2(75)
Market Resource Type	MRKT_RESRC_TYPE	4001.18	VARCHAR2(10) See possible values below
Resource Ownership Share	RESRC_OWN_SHARE	4001.19	NUMBER
Regulation Product Type	REG_PRODUCT_TYPE	4001.38	VARCHAR(30) See possible values below
PJM-Assigned Reg MW	PJM_ASSIGNED_REG_MW	2340.63	NUMBER
Self-Scheduled Reg MW	SELF_SCHEDULED_REG_MW	2340.64	NUMBER
Actual Mileage	ACTUAL_MILEAGE	2340.57	NUMBER
Historic Mileage	HISTORICAL_MILEAGE	2340.58	NUMBER
Mileage Ratio	MILEAGE_RATIO	2340.46	NUMBER
Performance Score	PERF_SCORE	2340.35	NUMBER
RMCCP ($/MWh)	RMCCP	3001.44	NUMBER
RMMCP ($/MWh)	RMMCP	3001.64	NUMBER
RMCCP Credit ($)	RMCCP_CREDIT	2340.36	NUMBER
RMMCP Credit ($)	RMMCP_CREDIT	2340.48	NUMBER
Total Regulation Clearing Price Credits ($)	TOT_RMCP_CREDIT	2340.49	NUMBER
Version	VERSION	4000.07	VARCHAR2(12)

Market Resource Types: GEN or LOADRESP
Regulation Product Type: RegUp or RegDn

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Regulation Market Lost Opportunity Cost Credits (Existing)

Displays the Regulation Lost Opportunity Cost Credit calculation details for Generation Resources and Load Response Registrations.

- Format changes
- Hydro details removed
- Additional details for RegUp and RegDn product types

The following columns will appear in the body of the report:

Online and CSV Column Name	XML Column Name	Column Number	Data Type
Customer ID	CUSTOMER_ID	4000.01	INTEGER
Customer Code	CUSTOMER_CODE	4000.02	VARCHAR2(6)
EPT Interval Ending	EPT_INTERVAL_ENDING	4001.40	VARCHAR2(40) mm/dd/yyyy HH24:MM format (Displays first interval of the day as hour 0 minute 05 and last interval of the day as hour 24 minute 00)
GMT Interval Ending	GMT_INTERVAL_ENDING	4001.41	VARCHAR2(40) mm/dd/yyyy HH24:MM format (Displays first interval of the day in relation to EPT interval as hour 04 minute 05 or hour 05 minute 05 (EDT/EST depending) and last interval of the day as hour 04 minute 00 of the next day or hour 05 minute 00 of the next day (EDT/EST depending))
Market Resource Id	MRKT_RESRC_ID	4001.16	NUMBER
Market Resource Name	MRKT_RESRC_NAME	4001.17	NUMBER(8,0)
Market Resource Type	MRKT_RESRC_TYPE	4001.18	VARCHAR2(75)
Resource Ownership Share	RESRC_OWN_SHARE	4001.19	NUMBER
PJM-Assigned RegUp MW	PJM_ASSIGNED_REGUP_MW	2340.68	NUMBER
PJM-Assigned RegDn MW	PJM_ASSIGNED_REGDN_MW	2340.69	NUMBER
RegUp Performance Score	REGUP_PERF_SCORE	2340.87	NUMBER
RegDn Performance Score	REGDN_PERF_SCORE	2340.88	NUMBER
Reg Weighted Avg Performance Score	REG_WEIGHTED_AVG_PERF_SCORE	2340.89	NUMBER
RegUp Offer Price ($/MWh)	REGUP_OFFER_PRICE	2340.90	NUMBER
RegDn Offer Price ($/MWh)	REGDN_OFFER_PRICE	2340.91	NUMBER
RegUp Offer Amount ($)	REGUP_OFFER_AMT	2340.92	NUMBER
RegDn Offer Amount ($)	REGDN_OFFER_AMT	2340.93	NUMBER
Ramp-In Regulation Opportunity Cost ($)	RAMP_IN_REG_OPP_COST	2340.38	NUMBER
Intra-Commitment Regulation Opportunity Cost ($)	COMMITMENT_REG_OPP_COST	2340.59	NUMBER
Intra-Commitment Adjusted Regulation Opportunity Cost ($)	ADJ_COMMITMENT_REG_OPP_COST	2340.94	NUMBER
Ramp-Out Regulation Opportunity Cost ($)	RAMP_OUT_REG_OPP_COST	2340.40	NUMBER
Total Regulation Opportunity Cost ($)	TOTAL_REG_OPP_COST	2340.60	NUMBER
Total Regulation Pool Scheduled Clearing Price Credits ($)	TOTAL_PJM_ASSIGNED_RMCP_CR	2340.95	NUMBER
Regulation Lost Opportunity Cost Credit ($)	REG_LOC_CREDIT	2340.24	NUMBER
Version	VERSION	4000.07	VARCHAR2(12)

Market Resource Types: GEN or LOADRESP

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Regulation Summary (Existing)

Displays the Regulation Charges hourly details and total hourly Regulation Credits.

- Format changes
- Additional details for the RegUp and RegDn product types

The following columns will appear in the body of the report:

Online and CSV Column Name	XML Column Name	Column Number	Data Type
Customer ID	CUSTOMER_ID	4000.01	INTEGER
Customer Code	CUSTOMER_CODE	4000.02	VARCHAR2(6)
EPT Hour Ending	EPT_HOUR_ENDING	4000.05	VARCHAR2(40) mm/dd/yyyyHH24 format (Displays first hour of the day as hour 1 and last hour of the day as hour 24)
GMT Hour Ending	GMT_HOUR_ENDING	4000.06	VARCHAR2(40) mm/dd/yyyy HH24 format (Displays first hour of the day as hour 1 and last hour of the day as hour 00 of the following day)
Total Effective RegUp (MWh)	TOTAL_EFFECTIVE_REGUP	1340.26	NUMBER
Total Effective RegDn (MWh)	TOTAL_EFFECTIVE_REGDN	1340.27	NUMBER
RT Load (MWh)	RT_LOAD	1340.19	NUMBER
Total PJM RT Load (MWh)	TOTAL_REG_PJM_RT_LOAD	1340.20	NUMBER
RegUp Obligation (MWh)	REGUP_OBLIGATION	1340.28	NUMBER
RegDn Obligation (MWh)	REGDN_OBLIGATION	1340.29	NUMBER
Bilateral RegUp Sales (MWh)	BILATERAL_REGUP_SALES	1340.30	NUMBER
Bilateral RegDn Sales (MWh)	BILATERAL_REGDN_SALES	1340.31	NUMBER
Bilateral RegUp Purchases (MWh)	BILATERAL_REGUP_PURCHASES	1340.32	NUMBER
Bilateral RegDn Purchases (MWh)	BILATERAL_REGDN_PURCHASES	1340.33	NUMBER
Adjusted RegUp Obligation (MWh)	ADJUSTED_REGUP_OBLIGATION	1340.34	NUMBER
Adjusted RegDn Obligation (MWh)	ADJUSTED_REGDN_OBLIGATION	1340.35	NUMBER
Total PJM Adjusted RegUp Obligation (MWh)	TOTAL_ADJ_REGUP_OBLIGATION	1340.36	NUMBER
Total PJM Adjusted RegDn Obligation (MWh)	TOTAL_ADJ_REGDN_OBLIGATIO N	1340.37	NUMBER
Total PJM RegUp RMCCP Credits ($)	TOT_PJM_UP_RMCCP_CR	1340.38	NUMBER
Total PJM RegDn RMCCP Credits ($)	TOT_PJM_DN_RMCCP_CR	1340.39	NUMBER
Total PJM RegUp RMMCP Credits ($)	TOT_PJM_UP_RMMCP_CR	1340.40	NUMBER
Total PJM RegDn RMMCP Credits ($)	TOT_PJM_DN_RMMCP_CR	1340.41	NUMBER
RegUp RMCCP Charge ($)	REGUP_RMCCP_CH	1340.05	NUMBER
RegDn RMCCP Charge ($)	REGDN_RMCCP_CH	1340.06	NUMBER
RegUp RMMCP Charge ($)	REGUP_RMMCP_CH	1340.07	NUMBER
RegDn RMMCP Charge ($)	REGDN_RMMCP_CH	1340.08	NUMBER
PJM-Assigned RegUp (MWh)	PJM_ASSIGNED_REGUP	2340.68	NUMBER
PJM-Assigned RegDn (MWh)	PJM_ASSIGNED_REGDN	2340.69	NUMBER
Self-Scheduled RegUp (MWh)	SELF_SCHEDULED_REGUP	2340.70	NUMBER
Self-Scheduled RegDn (MWh)	SELF_SCHEDULED_REGDN	2340.71	NUMBER
RegUp Purchase (MWh)	REGUP_PURCHASE	1340.42	NUMBER
RegDn Purchase (MWh)	REGDN_PURCHASE	1340.43	NUMBER
Total PJM RegUp Purchase (MWh)	TOTAL_PJM_REGUP_PURCHASE	1340.44	NUMBER
Total PJM RegDn Purchase (MWh)	TOTAL_PJM_REGDN_PURCHASE	1340.45	NUMBER
Total PJM Reg Lost Opportunity Credit ($)	TOTAL_PJM_REG_LOC_CREDIT	1340.17	NUMBER
Reg Lost Opportunity Cost Charge ($)	REG_LOC_CHARGE	1340.02	NUMBER
RMCCP Credit ($)	RMCCP_CREDIT	2340.32	NUMBER
RMMCP Credit ($)	RMMCP_CREDIT	2340.33	NUMBER
Reg Lost Opportunity Cost Credit ($)	REG_LOC_CREDIT	2340.16	NUMBER
Version	VERSION	4000.07	VARCHAR2(12)

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Phase 2 Settlements Information

MSRS Report Documentation

- Documentation for new reports available on the MSRS Reports Documentation page of pjm.com
- Documentation for changes to existing reports available on the May MSS materials page of pjm.com

MSRS Training Environment

Available for Market Participant Testing

Go-Live Information

MSRS Report changes effective
Dec 1, 2026

December 2026 bill issued on
Jan. 8, 2027
(1st invoice containing Regulation Phase 2 changes)

Settlement questions can be sent to: Mrkt_Settlement_Ops@pjm.com

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MIC Special Education Session
Regulation Redesign Phase 2



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Acronyms

Acronym	Term & Definition	PJM Glossary
ASO	**Ancillary Service Optimizer** – Performs the joint optimization function of Energy, Reserves and Regulation in the dispatch run. The main functions of ASO are the clearing and commitment of all Regulation resources for a half-hour time period and inflexible Reserve resources for a one-hour time period.	
MCP	**Market Clearing Price** – The price that is paid by all load and paid to all suppliers for the service received or provided	
LOC	**Lost Opportunity Cost** – In general, the foregone revenues resulting from following PJM's dispatch instructions to provide some type of Ancillary Service. Lost Opportunity Costs are calculated for generating units participating in many PJM markets.	
MW	**Megawatt** – A unit of power equaling one million watts (1 MW = 1 million watts) or one thousand kilowatts (1 MW = 1,000 kW). To put it in perspective, under non-severe weather conditions, one megawatt could power roughly 800 to 1,000 average-sized American homes.	
LMP	**Locational Marginal Price** is defined as the marginal price for energy at the location where the energy is delivered or received. For accounting purposes, LMP is expressed in dollars per megawatt-hour ($/MWh). LMP is a pricing approach that addresses Transmission System congestion and loss costs, as well as energy costs.	
TRLD	**Tracking Ram- Limited Desired Megawatt at LMP** – Reflects consecutive market conditions to form the real-time dispatch profile based on ramp rates, unit schedule and nodal LMP – independent of initial megawatts.	

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Acronyms (Cont.)

Acronym	Term & Definition	PJM Glossary
LPC	**Locational Pricing Calculator –** Determines the real-time LMP values and Ancillary Service Market Clearing Prices on a five (5)-minute basis. The LPC engine performs a pricing-run solution where Integer Relaxation is applied to eligible Fast-Start Resources only for the purposes of calculating LMPs and Ancillary Service MCPs. Real-time LMPs and Regulation and Reserve Clearing Prices are derived from the inputs of the latest approved Real-time Security Constrained Economic Dispatch (RT SCED) program solution, referred to as the reference case, for the target time at the end of the current five (5)-minute interval.	
RMCP	**Regulation Market Clearing Price** – The price that is paid by all load and paid to all suppliers for the Regulation service provided	
CCP	**Capability Clearing Price** – RMCP minus Mileage CP. It is the residual of total increment cost of Regulation marginal resource.	
Mileage CP	**MileageCP** – The highest adjusted mileage offer of the regulating resource in the current interval	

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