Reserve Market Lost Opportunity Cost Credit Settlement Education

Suzanne Coyne
Principal Consultant
Reserve Certainty Senior Task Force
February 11, 2026

Objectives

- Provide education on the existing reserve market Lost Opportunity Cost (LOC) Credit calculations
- Highlight areas where further evaluation / discussion is needed as part of the RCSTF solutions

Reserve Market Lost Opportunity Cost Credit Settlements – Status Quo

Reserve Market Lost Opportunity Cost Credits

- provide a make whole mechanism in the Reserve Markets.
- are paid separately by Reserve Market (SR, SecR, NSR)

LOC credit is paid when revenues do not exceed the following costs:

- DA and Balancing Reserve Market offers
- DA and Balancing opportunity costs (forgone energy profit due to backing down to make room for the reserve assignment) - ensures that resources are indifferent to providing energy or reserves
- Any Reserve Market buy-back, unless the resource's own actions cause the decrease in assignment

A single LOC credit by reserve market accounts for both DA and RT market costs and revenues.

Synchronized Reserve Lost Opportunity Cost Credit

See Manual 28, Section 6.2 for additional calculations and details

Synchronized Reserve LOC Credit =

SR Costs

- DA SR Offer Amount
- \+ RT SR Offer Amount
- \+ DA SR Opportunity Cost
- \+ Real-time SR Opportunity Cost

−

SR Revenues

- DA SR MCP
- \+ Market Revenue Neutrality Offset
- \+ SR Opportunity Cost Credit Owed
- \+ Balancing SR Clearing Credit
- − SR Opportunity Shortfall Charge

DA SR Offer Amount = DA SR Offer Price x DA SR Offer Price	**RT SR Offer Amount** = RT SR Offer Price x (Max (Capped RT SR Assignment – DA SR Assignment), 0)	**DA SR Opportunity Cost** = (DA LMP x reduction in energy MW to provide DA SR Assignment) – (DA Energy offer cost for reduction in energy MW)

RT SR Opportunity Cost = (RT LMP x ***Deviation MW*** to provide reserves) – RT Energy offer cost for ***Deviation MW*** to provide reserves

Deviation MW Amount

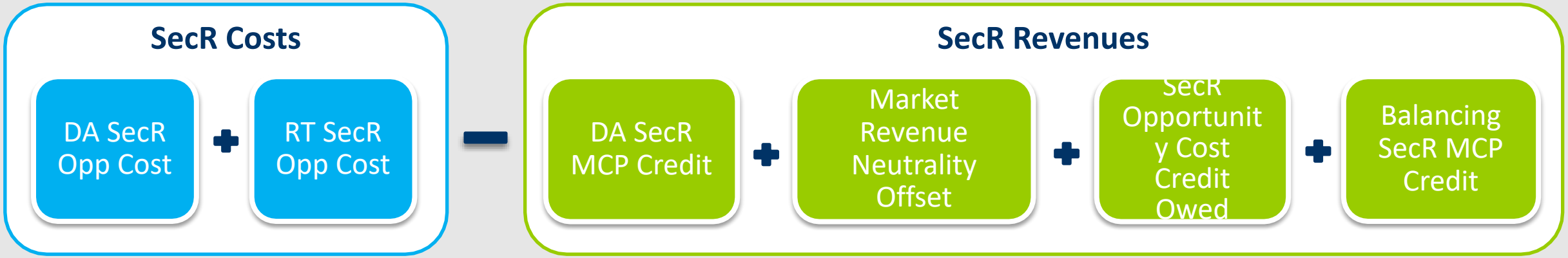
- only non-zero if RT SR MW > DA SR MW
- is the additional amount of MWs that the resource was backed down to provide reserves as compared to the DA MW output to provide the DA reserve assignments.

Note: *Both DA and RT SR Opportunity Costs consider SecR assignments in the Deviation MW to prevent double counting.*

Secondary Reserve Lost Opportunity Cost Credit

See Manual 28, Section 19.2 for additional calculations and details

Secondary Reserve LOC Credit =



DA SecR Opportunity Cost = (DA LMP x reduction in energy MW to provide DA SecR Assignment) – (DA energy offer cost for reduction in energy MW)

RT SecR Opportunity Cost = (RT LMP x ***Deviation MW*** to provide reserves) – RT Energy offer cost for ***Deviation MW*** to provide reserves

Deviation MW amount

- only non-zero if RT SecR MW > DA SecR MW
- is the additional amount of MWs that the resource was backed down to provide reserves as compared to the DA MW output to provide the DA reserve assignments.

Note: *Both DA and RT SecR Opportunity Costs consider SR assignments in the Deviation MW to prevent double counting.*

Non-Synchronized Reserve Lost Opportunity Cost Credit

See Manual 28, Section 7.2 for additional calculations and details

Non-Synchronized Reserve LOC Credit =

NSR Costs

0

−

NSR Revenues

Day-ahead NSR Clearing Credit ($)

+

Market Revenue Neutrality Offset ($)

+

NSR Opportunity Cost credit owed ($)

+

Balancing NSR Clearing Credit ($)

- Non-Synchronized Reserves has no offer, nor an opportunity cost for MW committed as reserves rather than energy.
- Resource is still eligible to be made whole for any reserve market buy-back, unless the resource's own actions cause the decrease in assignment

Opportunity Costs

Opportunity cost captures the forgone energy profit from the day-ahead and/or real-time energy markets in order to provide reserves.

A non-zero reserve market opportunity cost will only exist when LMP supports the resource operating at greater output for energy than where it needs to operate in order to provide the reserve assignment.

The forgone energy profit calculation is A - B

- **A =** the energy revenue that would otherwise be received for the deviation MW between where the resource is operating to provide reserves up to where the resource would have been operating for energy absent a reserve assignment
- **B =** the incremental energy cost (area under the curve) for the same deviation MW above in A

Opportunity Cost complexities and interactions

The forgone profit is calculated for:

- The DA reserve assignment
- Any *additional* reserves assigned in the RT market (RT MW – DA MW)
- MW when the resource is backed down in order to provide the assignment

The forgone profit calculation occurs ***separately*** for the Synchronized Reserve and Secondary Reserve products

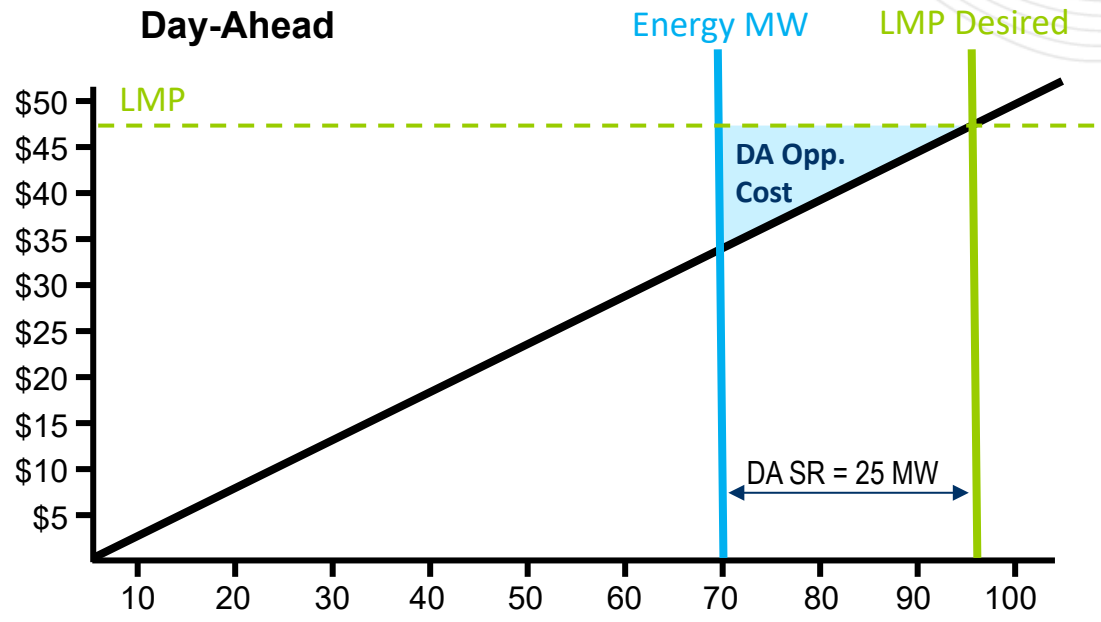
This introduces some complexities in settlements as illustrated in the following examples.

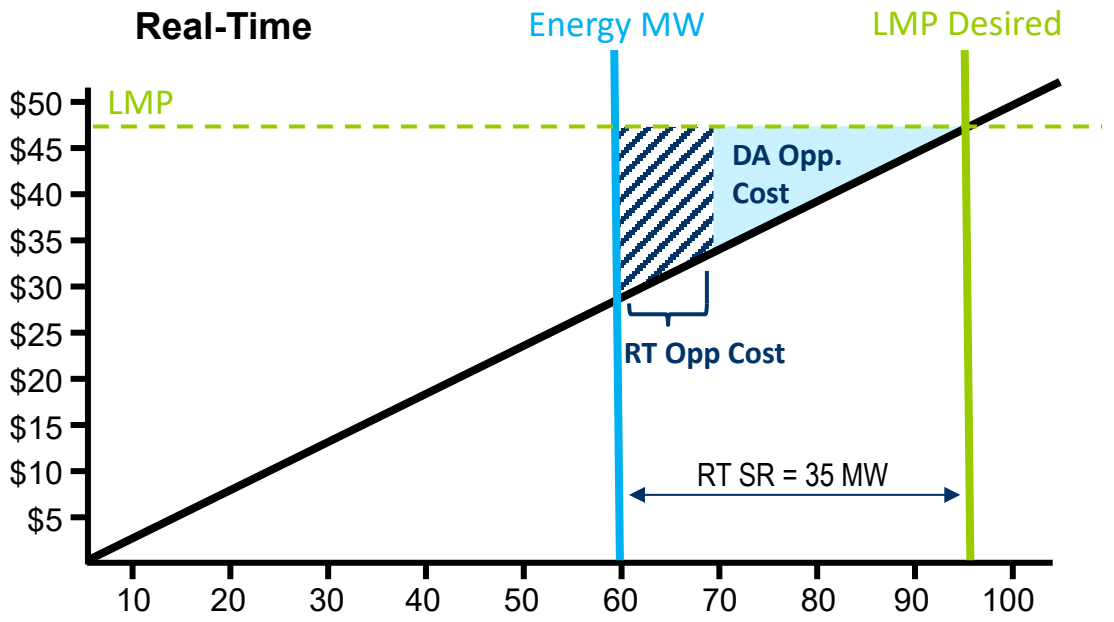
DA and RT Interactions

Scenario

In the **DA Market**, resource was reduced from its economically desired output of 95 MW to provide a **25 MW SR** assignment.

In the **RT Market**, resource was reduced from its economically desired output of 95 MW to provide a **35 MW SR** assignment.





Key Takeaways – DA Reserve Market

- Backed down to provide reserves
- DA SR Assignment = 25 MW
- DA Opp Cost evaluated from 70 MW to 95 MW

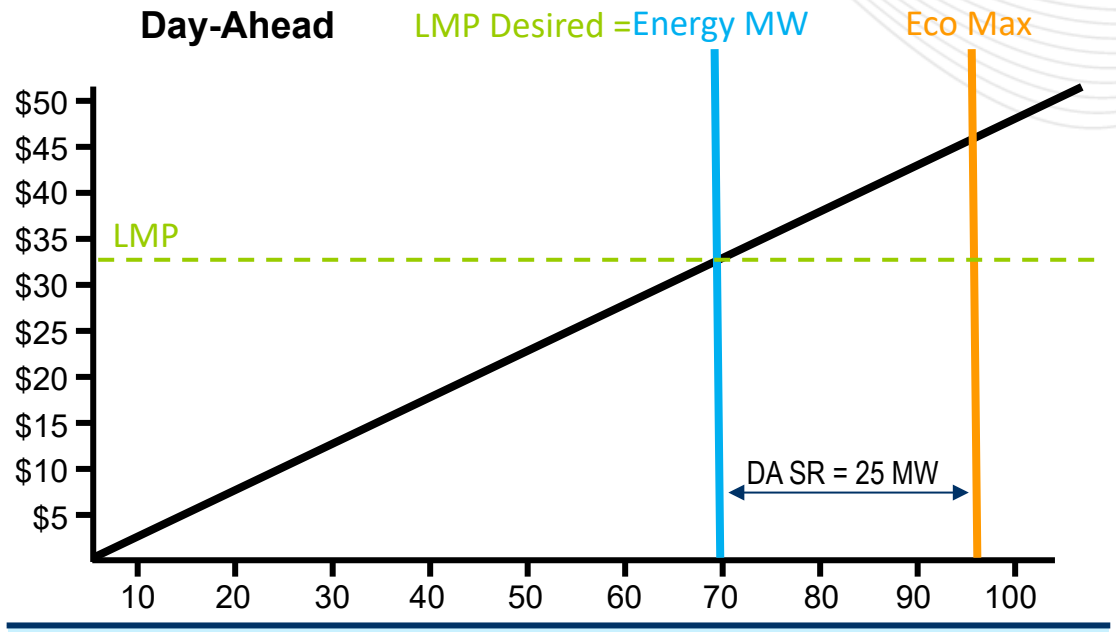
Key Takeaways – RT Reserve Market

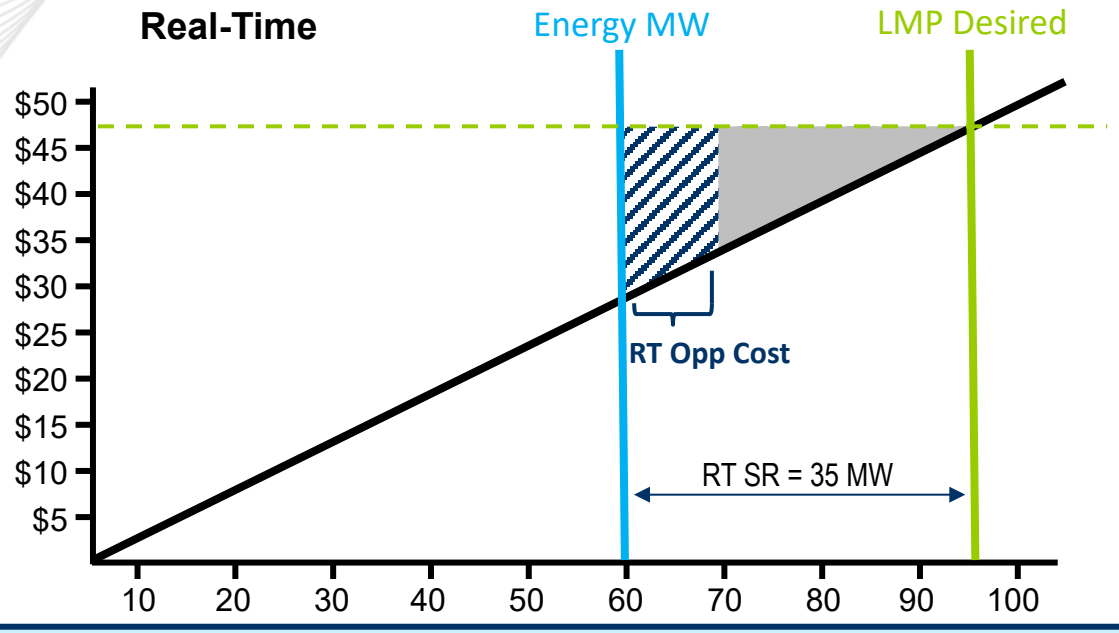
- Backed down to provide additional reserves
- RT SR Assignment = 35 MW
- RT Opp Cost evaluated for additional MW to provide reserves from 60 MW to 70 MW

Scenario

In the **DA Market**, resource has headroom to provide a **25 MW SR** assignment and is not required to reduce from its economically desired output to provide the reserves.

In the **RT Market**, resource was reduced from its economically desired output of 95 MW to provide a **35 MW SR** assignment.





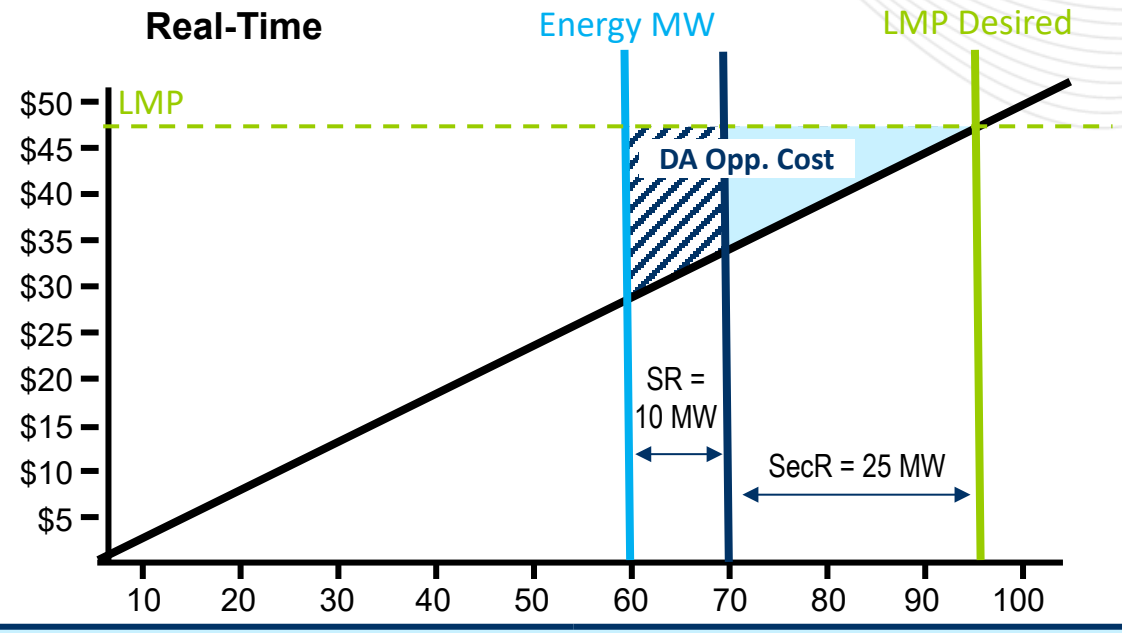
Key Takeaways – DA Reserve Market

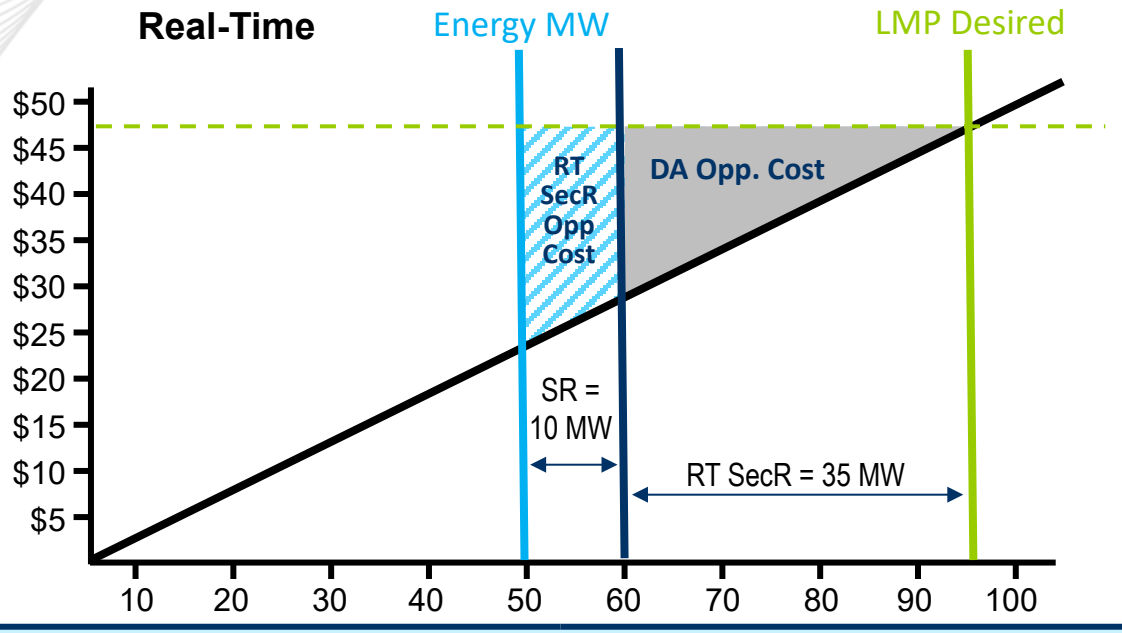
- DA SR Assignment = 25 MW
- Resource did not forgo energy revenues to provide reserves (LMP Desired = Energy MW)
- DA Opp Cost = $0

Key Takeaways – RT Reserve Market

- RT SR Assignment = 35 MW
- Resource backed down from LMP desired of 95 MW to provide reserves
- RT Opp cost is calculated for the additional 10 MW deviation from its DA output of 70 MW to provide the reserve assignment
- RT Opp Cost evaluated from 60 MW to 70 MW

Scenario	In the **DA Market,** resource was reduced from its economically desired output of 95 MW to provide a **25 MW SecR** assignment and **10 MW SR** Assignment.	In the **RT Market,** the resource was reduced from its economically desired output of 95 MW to provide a **35 MW SecR** assignment and **10 MW SR** assignment.





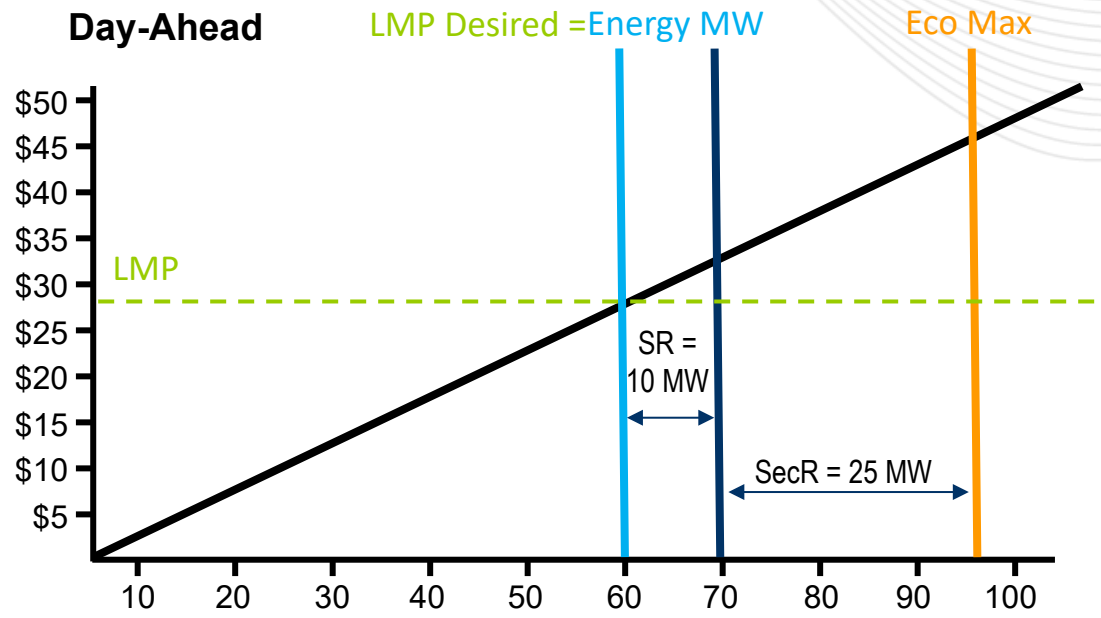
Key Takeaways – DA Reserve Market

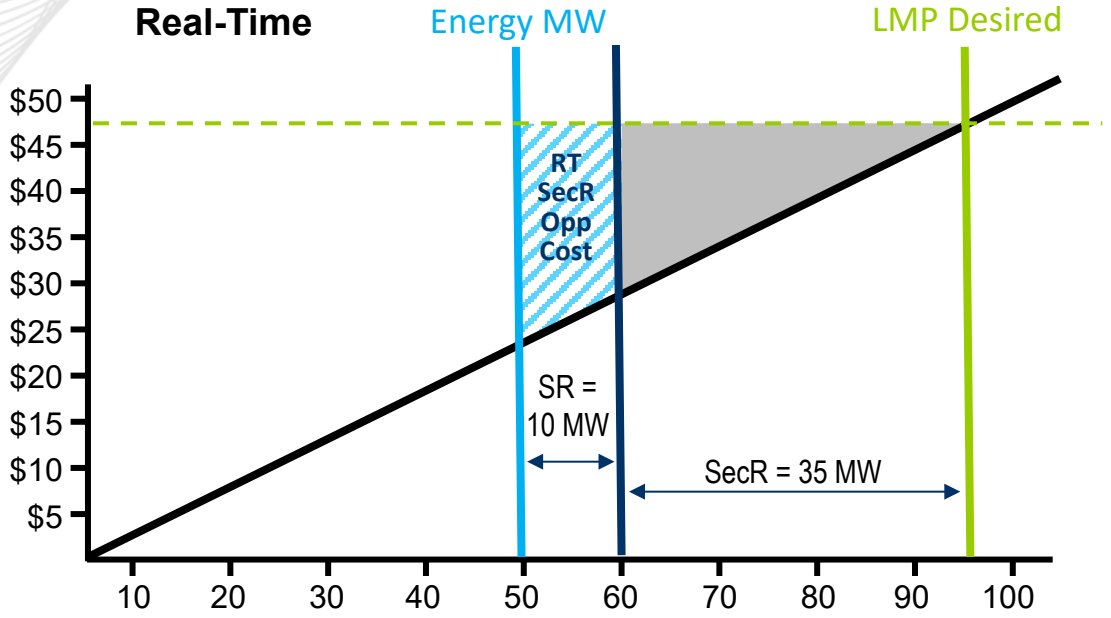
- Backed down to provide reserves
- DA SR Assignment = 10 MW
- DA SecR Assignment = 25 MW
- DA SR Opp Cost evaluated from 60 to 70 MW
- DA SecR Opp Cost evaluated from 70 to 95 MW

Key Takeaways – RT Reserve Market

- Backed down to provide reserves
- RT SR Assignment = DA SR Assignment = 10 MW
- RT SR opp cost = $0
- RT SecR Assignment = 35 MW
- RT SecR Opp Cost evaluated for **additional** deviation in MW to provide RT SecR assignment, from 50 to 60 MW

Scenario	In the **DA Market**, resource has headroom to provide a **25 MW SecR** assignment and **10 MW SR** assignment and is not required to reduce from its economically desired output to provide reserves.	In the **RT Market**, resource was reduced from its economically desired output of 95 MW to provide a **35 MW SecR** assignment and **10 MW SR** assignment.





Key Takeaways – DA Reserve Market

- DA SR Assignment = 10 MW
- DA SecR Assignment = 25 MW
- Resource did not forgo energy revenues to provide reserves (LMP Desired = Energy MW)
- DA SR Opp Cost = $0
- DA SecR Opp Cost = $0

Key Takeaways – RT Reserve Market

- Backed down to provide reserves
- RT SR Assignment = DA SR Assignment = 10 MW
- RT SecR Assignment = 35 MW
- RT SR Opp Cost = $0
- RT SecR Opp Cost evaluated from 50 MW to 60 MW
- RT Opp cost is calculated for the additional 10 MW deviation from its DA output of 60 MW to provide the reserve assignment

Key Observations from the Prior Examples

- Resources can be simultaneously assigned for more than one reserve product.
- Reserve product assignments can shift between the DA market and RT markets resulting in a shift in RT opportunity cost settlements between products.
- Settlements for RT Opportunity costs is a balancing methodology
  - If a resource is not backed down in the DA market to provide reserves and is backed down in the RT market to provide reserves, this can result in $0 opportunity costs.

Market Revenue Neutrality Offset

- The Market Revenue Neutrality Offset is the calculation we use to ensure a resource isn't made whole for costs recovered via another market.

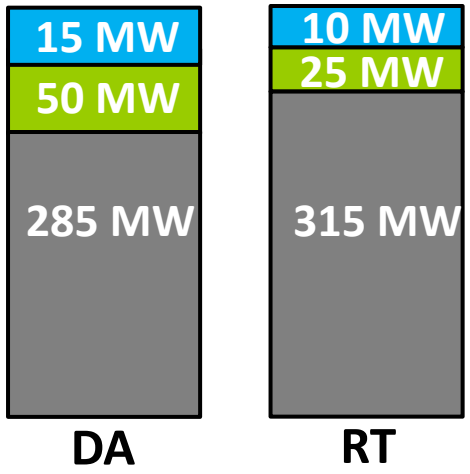
- The Market Revenue Neutrality Offset calculation recognizes any additional profit (revenue above cost) earned in the market(s) with the increased real-time assignment(s) to offset any cost incurred from buying back its day-ahead reserve assignments in the markets where the assignment was decreased in real-time.

- The Market Revenue Neutrality Offset is added to the revenue side of the Lost Opportunity Cost Credit calculation (which shrinks the amount of the buy back they are owed)

Market Revenue Neutrality Offset Example

- Resources are made whole for buying out of their day-ahead reserve positions when that buy out occurred because of PJM's instructions
- The SR and SecR LOC credits for the buy backs are reduced by any profit they earned from the increase in their energy MW so there is no double counting.

Balancing Settlement = (RT MW – DA MW) * RT Price



Synch Reserve = -25 MW * $25 = ($625)

Sec Reserve = -5 MW * $9 = ($45)

Energy = 30 MW * $50 = $1,500

Use profit (any of this revenue above cost) to offset these losses.

Opportunity Cost Credit Owed

- If a resource's own action causes the RT assignment to be less than the DA assignment, the cost of the buy back from the day-ahead reserve assignment becomes the Market Seller's responsibility.
- The Opportunity Cost Credit Owed value captures this cost responsibility and ensures the resource is not made whole for that cost.
- Opportunity Cost Credit Owed is added on the revenue side of the LOC Credit calculation to reduce the amount of LOC Credit the resource will receive.
- Resources will either have a Market Revenue Neutrality Offset value (if eligible) or an Opportunity Cost Credit Owed value (if ineligible). They will not have both offsets in the LOC credit calculation.
- Pool-scheduled resources may also be eligible for energy make whole payments (Balancing Operating Reserves). Any Market Revenue Neutrality Offset profit transferred to reserves is also accounted for in the energy make whole calculations.

Potential Reserve LOC Credit Settlement Reforms

Create a unified reserve calculation for the LOC credit across all reserve markets, rather than calculating LOC Credits for each individual reserve market

Opportunity to simplify settlements opportunity cost calculation

Evaluate opportunities to reduce complexity that stems from the day-ahead and balancing opportunity cost to ensure RT opportunity costs are being recognized, where appropriate.

Review and update buy-back eligibility rules and calculations, where applicable, to ensure only actions resulting from following PJM's directives are compensated.

Contact

Facilitator:
Lisa Morelli, Lisa.Morelli@pjm.com

Secretary:
Amanda Egan, Amanda.Egan@pjm.com

SME/Presenter:
Suzanne Coyne,
Suzanne.Coyne@pjm.com

Member Hotline

(610) 666 – 8980

(866) 400 – 8980

custsvc@pjm.com

Reserve Market LOC Settlement Education

Acronyms

Acronym	Term & Definition
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.
SR	**Synchronized Reserves** are reserves provided by resources that are synchronized to the grid and can response within 10 minutes.
SecR	**Secondary Reserves** are reserve capability that can be converted fully into energy within a 10- to 30-minute interval following the request of PJM. Equipment providing secondary reserve need not be electrically synchronized to the power system.
NSR	**Non-Synchronized Reserves** are reserves provided by offline resources that are able to respond within 10 minutes.

PJM Glossary

PROTECT THE POWER GRID

THINK BEFORE YOU CLICK!

pjm

BE ALERT TO MALICIOUS PHISHING EMAILS

Report suspicious email activity to PJM.

Call (610) 666-2244 or email it_ops_ctr_shift@pjm.com