Balancing Operating Reserve (BOR) Credit Reform: PJM / IMM Proposal Overview

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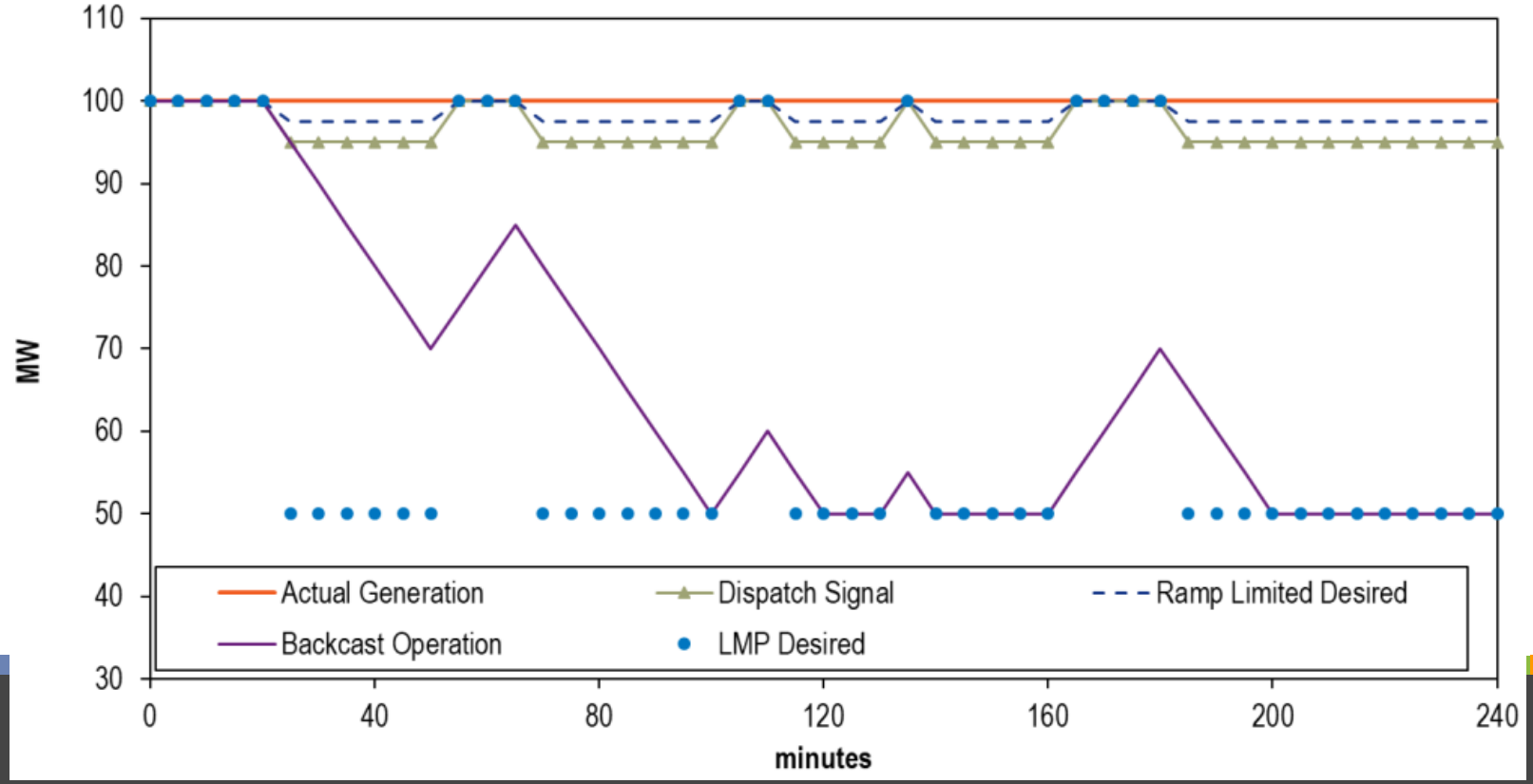
Issue Charge

- Clarify the rules around the payment of Balancing Operating Reserve (BOR) Credits to resources that do not operate as expected and strengthen incentives for resources to operate consistent with PJM's directions.
  - There is a need to address IMM and FERC concerns with the payment of significant BOR credits to resources that don't follow PJM dispatch instructions.

Root Causes of Elevated Uplift Paid to Units Not Following Dispatch

The existing metrics used to determine if a resource is following dispatch only measure how well a unit follows dispatch in a single interval. They cannot measure how well a unit follows dispatch across multiple intervals.

- As a result, a resource can fail to follow consistently over multiple intervals but still be flagged as following dispatch and therefore receive significant uplift payments for MW not otherwise desired and receive minimal to no deviation charges.



Compared to the dispatch signal or Ramp Limited Desired, actual generation is close to the desired MW and the unit looks like it is following dispatch

Backcast analysis that assumes the resource followed instructions from the beginning shows the resource did not operate where PJM would have wanted the unit.

Other Issues Associated With Units Not Operating as Requested by PJM

- The tariff lacks specificity around what it means to be "Operating as Requested by PJM" and therefore eligible to receive BOR credits.
- The consequences are unclear for the following scenarios:
  - Coming on late or early for a PJM commitment
  - Going offline early or too late
  - Taking a unit over as self-scheduled in the middle of a PJM commitment

Main Elements of the Proposed Solution

1	Use of a new Tracking Ramp Limited Desired MW metric to measure how well a unit follows dispatch across consecutive intervals.
2	Structural changes to the Balancing Operating Reserve Credit calculation
3	Adjustments to the periods for which resources will be eligible to receive Balancing Operating Reserve Credits
4	Conforming changes to the calculation of generator deviations

This proposal is jointly supported by PJM and the IMM.

Proposed Change to Desired MW

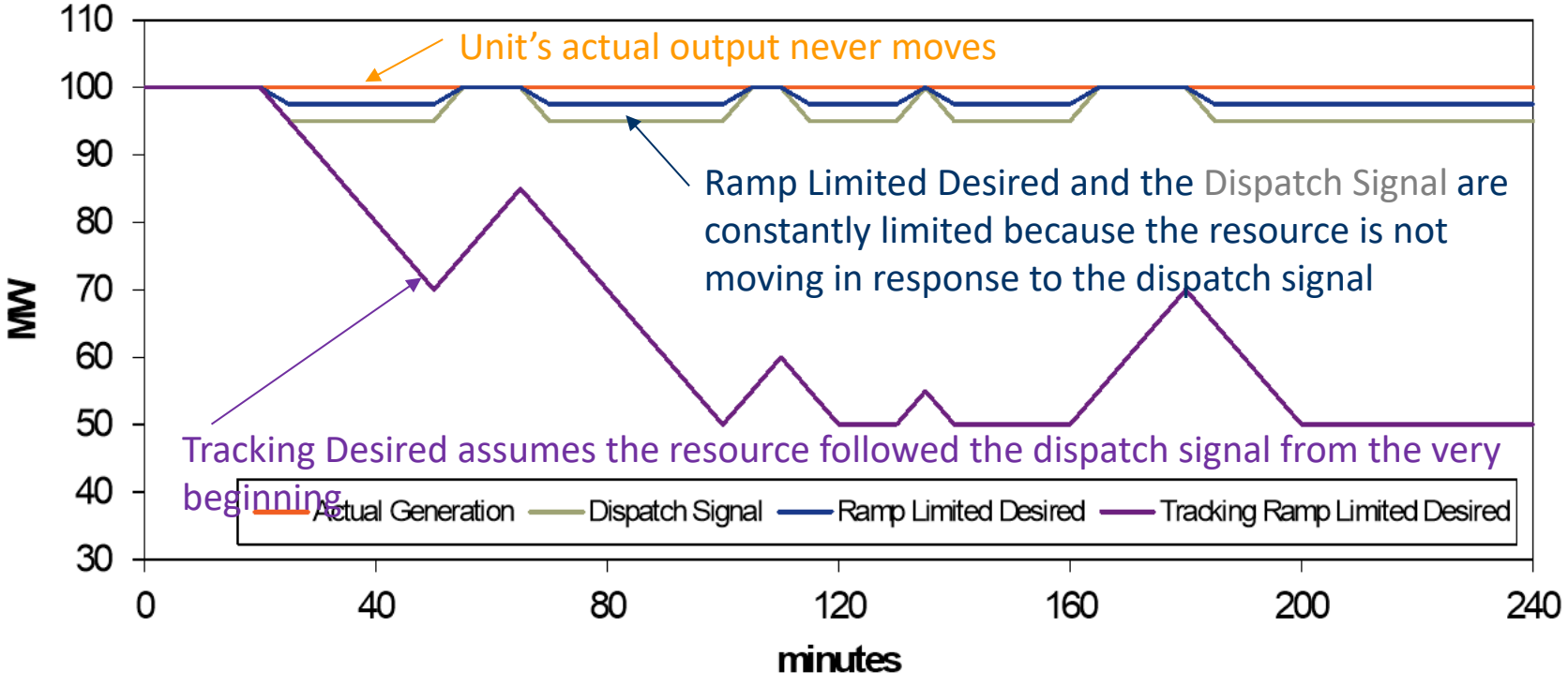
- A new Tracking Ramp Limit Desired (TRLD) MW metric will be created
  - FERC accepted the use of a tracking ramp limited desired metric in the Regulation Market Redesign filing
  - This proposal extends the use of this concept to BOR credits
    - The two metrics are similar, but not identical, as the metric used for BOR credits will be calculated after-the-fact based on actual system conditions and parameters.
- This value would replace ***all three*** of the existing desired MW values in the calculation of BOR credits and deviation charges

(Ramp Limited Desired MW, Dispatch Signal MW, LMP Desired MW (i.e. non-ramp limited desired MW))

Tracking Ramp Limited Desired MW Metric

Rather than using the unit's RT MW output as the starting point for the calculation, the new TRLD metric starts from the prior desired MW value.

This better accounts for what it looks like to follow dispatch over multiple intervals. TRLD and the dispatch signal will be exactly the same if unit follows dispatch from the start of the commitment.



TRLD is bound by LMP and the unit's bid in parameters:

- ramp rate
- min / max output
- incremental energy offer

(same as the dispatch signal)

TRLD enables units to be held more accountable to what the unit's bid in parameters state the unit should be able to do.

Tracking Ramp Limited Desired Calculation Details

The Tracking Ramp Limited Desired MW Calculation is:

- $D_t = D_{t-1}$ +/- $Ramp_t$

Where:

- D = Tracking Ramp Limited Desired MW
- t = Calculation interval. When t-1 = 0, D = Actual Output.
- *Ramp* = Increase/decrease in output based on market conditions. The ramp will be calculated using the dispatch LMPs solved in every RTSCED case and the ramp rates and eco min / max values submitted by the market participant.

Adjustments are then made to respect:

- Regulation and Reserve Assignments
- Manual dispatch instructions

Existing BOR Credit Calculation

The existing calculation limits the uplift paid to units that don't follow dispatch via the MW values used on the Cost and Revenue sides of the equation.

Make Whole Credit	=	Cost			-	Revenue (Value)								
↳	=	RT MW Used	*	$/MWh Offer	-	(Balancing Value MW Used	-	DA MW)	*	RT LMP	+	DA Revenue	+	DA Operating Reserve Credit and offsetting ancillary service revenues
↳	=	Min(Operating Reserve Desired MW, RT MW)	*	$/MWh Offer	-	(Max (Min(DA MW, Op Res Desired MW), RT MW)	-	DA MW)	*	RT LMP	+	DA MW * DA LMP	+	DA Operating Reserve Credit and offsetting ancillary service revenues

This minimizes the cost that can be recovered through the make whole calculation to no more than the MW actually desired by PJM. If the resource over generates, it will not be made whole for any MW beyond what was requested.

This maximizes the positive value that can be used to offset any costs, reducing the uplift when the resource over generates (a form of not following dispatch).

Similarly, when the resource generates below the desired MW (another form of not following dispatch), it excludes any negative buy out from the resource's DA position beyond what was needed to follow PJM's dispatch instructions, thus reducing uplift and shifting the cost responsibility to the generator.

Existing Calculation: Example for an Over Generating Unit

Example Assumptions

RT Generation MW = 100

Desired MW = 60

No DA Commitment

Make Whole Credit	=	Cost			-	Revenue (Value)					
	=	RT MW Used	*	$/MWh Offer	-	(Balancing Value MW Used	-	DA MW)	*	RT LMP	
	=	Min(Operating Reserve Desired MW, RT MW)	*	$/MWh Offer	-	(Max (Min(DA MW, Op Res Desired MW), RT MW)	-	DA MW)	*	RT LMP	

The **cost** to be made whole will be the cost of the **60 MW** desired.

The **revenue** used will be the revenue associated with the entire **100 MW** produced.

Using different MWs on the Cost and Revenue sides of the equation can result in using profits in the BOR credit calculation that exceed what the unit could have made if it followed dispatch perfectly.

Calculation Structure Change

The proposal will remove the complex MW comparisons in the BOR credit calculation and shift to a simplified, three part calculation:

- **Step 1:** Calculate BOR credits for the segment using **Tracking Desired MWh**.
  - Credit = Max (Cost @ Tracking Desired MWh – Revenue @ Tracking Desired MWh, 0)
  - This represents the amount of uplift the resource would have required if it produced the desired MW. This is the maximum amount of uplift PJM is willing to pay.

- **Step 2:** Calculate BOR credits for the segment using **Actual RT MWh**.
  - Credit = Max (Cost @ RT MWh – Revenue @ RT MWh, 0)
  - This is the amount of uplift the resource requires based on how it actually operated.

- **Step 3:** Compare and set the resource's credit equal to the lesser of the two values.

The effect of this change is that resources are made whole to their costs, but the make whole is limited to the amount of uplift the resource would have been entitled to *if the resource provided the desired MW*.

Benefits of the Calculation Change

- Removes the more punitive effects of the calculation that stem from asymmetric MW values being used on the cost and value sides of the equation
    - This portion of the change will increase uplift since it will no longer overstate profits or underestimate losses
- Increases transparency into how much uplift was forgone as a result of not providing the desired MW
- Simplifies the calculations
- The proposal also adds the opportunity costs that are paid through other markets to this list of offsetting revenues in the BOR credit calculation
    - This corrects the current understatement of revenues that results from ignoring opportunity costs which are paid through other credit streams and avoids double recovery of costs

Notable Revisions to **Start** and **End** of BOR Credit Eligibility

- Eligibility will begin at the start of the PJM commitment even if the unit is not online.
  - This allows better recognition of the costs and revenues that would have stemmed from operating as requested by PJM

- Eligibility will continue through the end of the DA commitment / RT min run time and terminate thereafter, rather than terminating immediately, if the unit stops running for PJM before the end of the commitment.

Other Elements of the Proposed Solution

- Conforming changes to generation deviations
  - Replace existing desired MW metrics with Tracking Ramp Limited Desired MW metric
  - Eliminate some automatic exemptions since Tracking Ramp Limited Desired MW will account for any deviation needed to provide another service, unlike the existing desired metrics
  - +/-5 MW and 10% percent exemption thresholds remain unchanged and still apply
- Conforming updates to Reactive Services Make Whole Credits

Other Elements of the Proposed Solution

- Clarify how the following actions impact the determination of following dispatch and BOR credits
  - Offering limited flexibility (using the Fixed Gen Flag or clamping min/max limits)
  - Violating parameter limits
- Address the determination of following dispatch during a Market Suspension

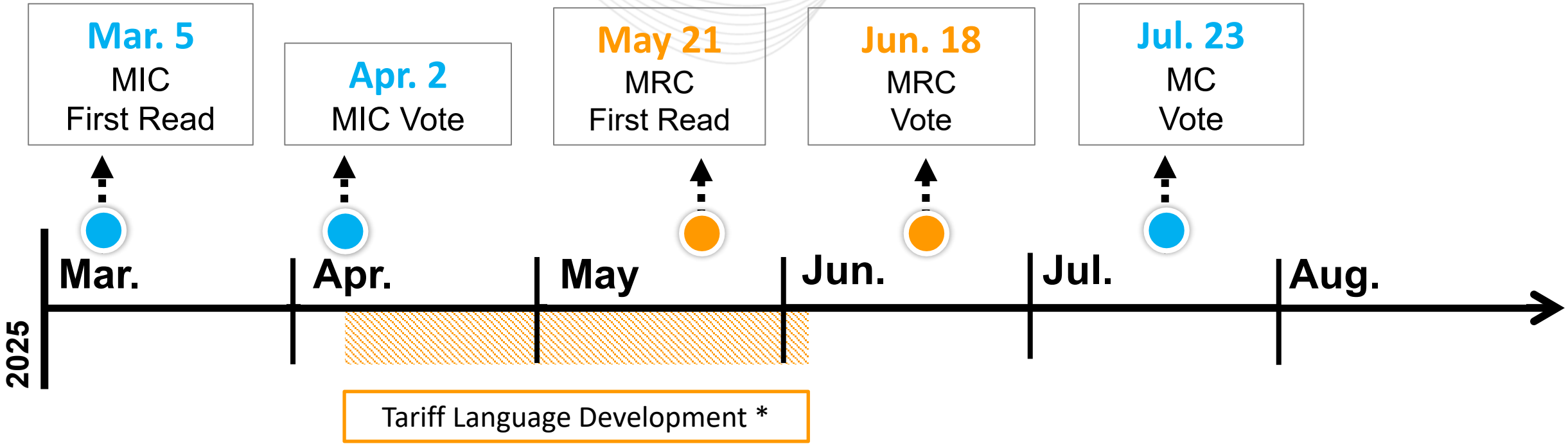
Overall Impact of Proposal on BOR Credits

Elements of the proposal will place both downward and upward pressure on uplift payments

- Overall, the proposal will reduce the uplift paid to units that consistently do not follow dispatch and will address the concerns raised by the IMM and FERC.
- Several elements of the proposal will counterbalance the reductions and in many instances could lead to units receiving additional uplift by correcting perceived flaws in the current calculation.

Change	Reduces uplift	Increases uplift
Use of Tracking Desired MW	X	X
Transition to Step 1 / Step 2 calculations	X	X
Changes to eligibility	X	X

Review/Endorsement Timeline



** Proposed tariff language may be posted following the MRC first read if additional time is needed for drafting*

Implementation Approach

A phased implementation approach is suggested to provide experience with the TRLD metric prior to its use in calculating balancing operating reserve credits and charges.

- TRLD soft launch at end of 2025 / early 2026 – TRLD will be calculated and published via MSRS reports, but not yet used in settlements
  - Allows time for participant training / learning and for participants to make adjustments to bid in parameters, if needed.
  - Also allows time for the TRLD calculation to be adjusted if review reveals edge cases with unintended outcomes.
- Implementation of the entire package of changes, including usage of TRLD in settlements, at the end of 2026 /early 2027

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BOR Credit Reform Proposal Overview

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Appendix

Other Materials Explaining the Proposal

- MIC Special Session Detailed Proposal Overview
- Consolidated BOR Credit Proposal Examples

- In response to stakeholder request, the following slides include information on balancing operating reserve deviation rates and MW allocations across resource types

Generator Share of Total Deviations

Balancing Operating Reserve Deviations charge are assessed to injection, withdrawal and generator deviations. Generators represented 14% of all deviations in 2024.

Deviation Category	Deviation (GWh)			Share		
	RTO	East	West	RTO	East	West
Withdrawal	209,406	96,267	111,165	71%	71%	71%
Injection	46,003	22,210	23,312	16%	16%	15%
Generation	39,996	18,011	21,985	14%	13%	14%
Total	295,404	136,488	156,462	100%	100%	100%

% of Generator Deviations by Unit Type

2024 Generator Deviations

Unit Type	Deviations (GWh)	% of Generation Deviations
AERO CT	207.9	1%
CC	9,196.0	23%
COAL	9,430.7	23%
FRAME CT	866.7	2%
HYDRO	5,066.1	13%
NUCLEAR	1,462.6	4%
OTHER	569.5	1%
RICE	61.8	0%
SOLAR	5,044.1	13%
STEAM OTHER	706.5	2%
WIND	7,714.5	19%
Total	40,326.5	100%

2024 Deviation Rates

Deviation Rate	Average ($/MWh)	Min ($/MWh)	Max ($/MWh)
RTO	0.260	0.000	4.431
East	0.047	0.000	1.879
West	0.009	0.000	0.337

Total Energy Uplift Credits by Unit Type

Unit Type	2023 Credits (Millions)	2024 Credits (Millions)	Change	Percent Change	2023 Share	2024 Share
Combined Cycle	$5.2	$11.8	$6.6	127.2%	3.3%	4.4%
Combustion Turbine	$92.2	$119.9	$27.7	30.0%	58.8%	44.4%
Diesel	$1.7	$2.0	$0.3	19.7%	1.1%	0.7%
Hydro	$0.2	$1.1	$0.9	410.6%	0.1%	0.4%
Nuclear	$0.0	$0.0	$0.0	0%	0.0%	0.0%
Solar	$0.3	$0.3	$0.0	0.6%	0.2%	0.1%
Steam - Coal	$33.9	$61.1	$27.1	80.0%	21.6%	22.6%
Steam - Other	$21.8	$71.1	$49.4	226.7%	13.9%	26.4%
Wind	$1.6	$2.6	$1.0	62.2%	1.0%	1.0%
Total	$156.9	$269.9	$113.0	72.0%	100.0%	100.0%