

Operating Reserve Clarification Issue - PJM/IMM Proposal

Market Implementation Committee
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Problem (Status Quo)

- **Units are eligible to receive BOR credits (uplift) when “operating as requested by PJM.” This qualification has led to disagreements between PJM and the IMM regarding the payments made to units that do not follow dispatch.**
 - **PJM’s interpretation is that operating as requested means coming online and offline as requested.**
 - **The IMM believes units must also follow dispatch in order to be eligible.**

Solution

- **PJM and the IMM developed a solution to address the problem with the status quo.**
 - **A new metric (Tracking Ramp Limited Desired or TRLD) will be developed.**
 - **TRLD will be used to measure how well a unit follows dispatch across consecutive intervals (current metrics do not accomplish that). TRLD will replace all current metrics.**
 - **Using TRLD, uplift payments will not exceed the amount a unit would have received if it had followed PJM's instructions.**
- **As part of solution development, PJM and the IMM identified, reviewed and proposed changes in other areas that have been overlooked or that benefit from clarification. Some decrease uplift. Some increase uplift.**

Other Areas

- **Eligibility start and end**
- **Offsets from ancillary services net revenue and other uplift payments**
- **BOR treatment of flexible resources**
- **Revenues during soak time**
- **Limited dispatchable range / fixed gen**
- **PLS violations**
- **Deviations**
- **Reactive credits**
- **Market suspension**

IMM Position

- **Status quo is not an option going forward.**
- **Failure to address status quo will result in continued disagreement between PJM and the IMM.**
 - **FERC involvement may be necessary to resolve dispute.**
 - **FERC enforcement may be necessary to avoid excessive uplift paid to units not following dispatch.**
- **Failure to address issues with status quo will continue to pay uplift to units that fail to follow dispatch while failing to recognize costs and revenues from units that follow PJM's directives (e.g. postponed starts, early releases).**

TRLD

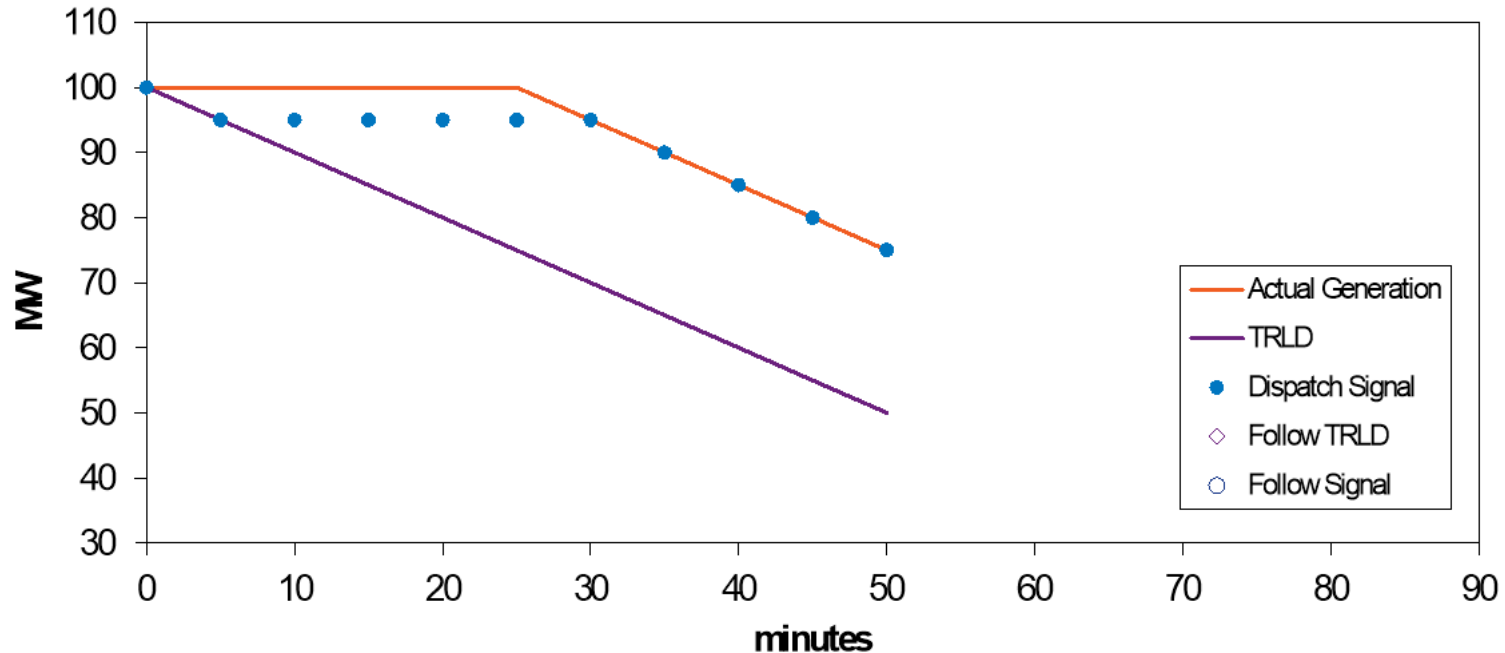
- **TRLD was developed to address the main problem with status quo: excessive uplift paid to units that fail to follow dispatch.**
- **TRLD reflects the costs and revenues that a unit would have received if it had followed dispatch.**
- **TRLD will reflect what a unit should have done if it followed dispatch during the entire commitment.**
- **In the short term (5 minutes), following the dispatch signal is the best economic decision a resource can make.**

TRLD Concerns

- **Some generators expressed concerns about the use of TRLD.**
- **Some generators expressed concerns that the use of TRLD could create an incentive to not follow dispatch.**
- **The next example show the incentives that a unit would face on a five minute basis.**

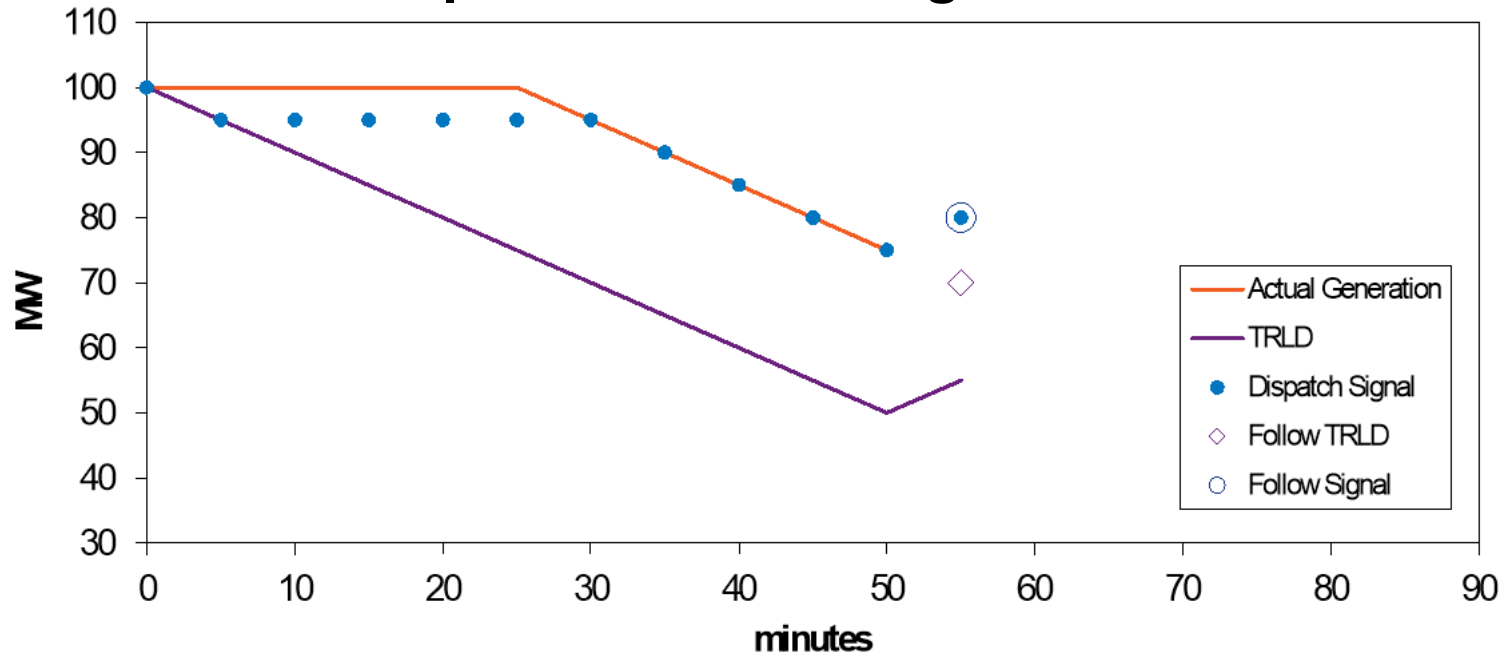
Dispatch Sequence (1 of 4)

- Unit is late to react to dispatch signal.



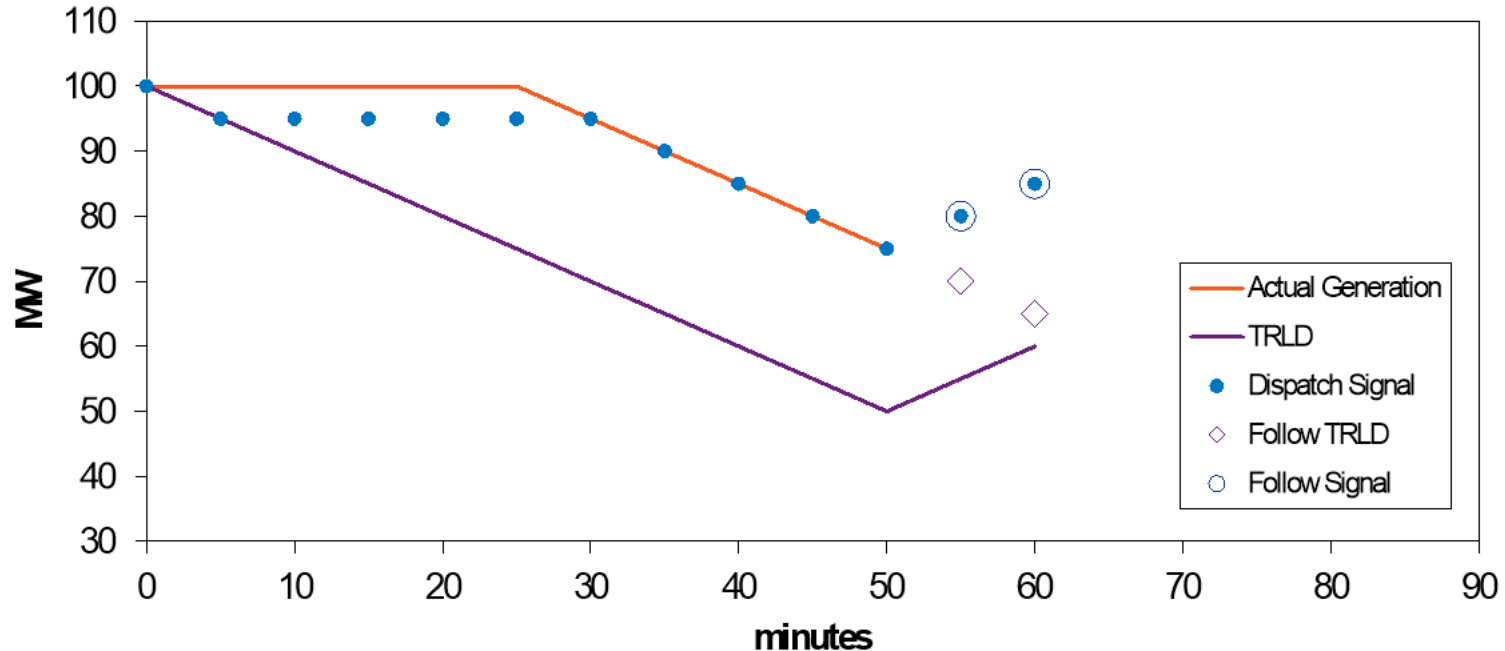
Dispatch Sequence (2 of 4)

- After consecutive signals to ramp down, unit is dispatched up. The circle represents following dispatch. The diamond represents following TRLD.



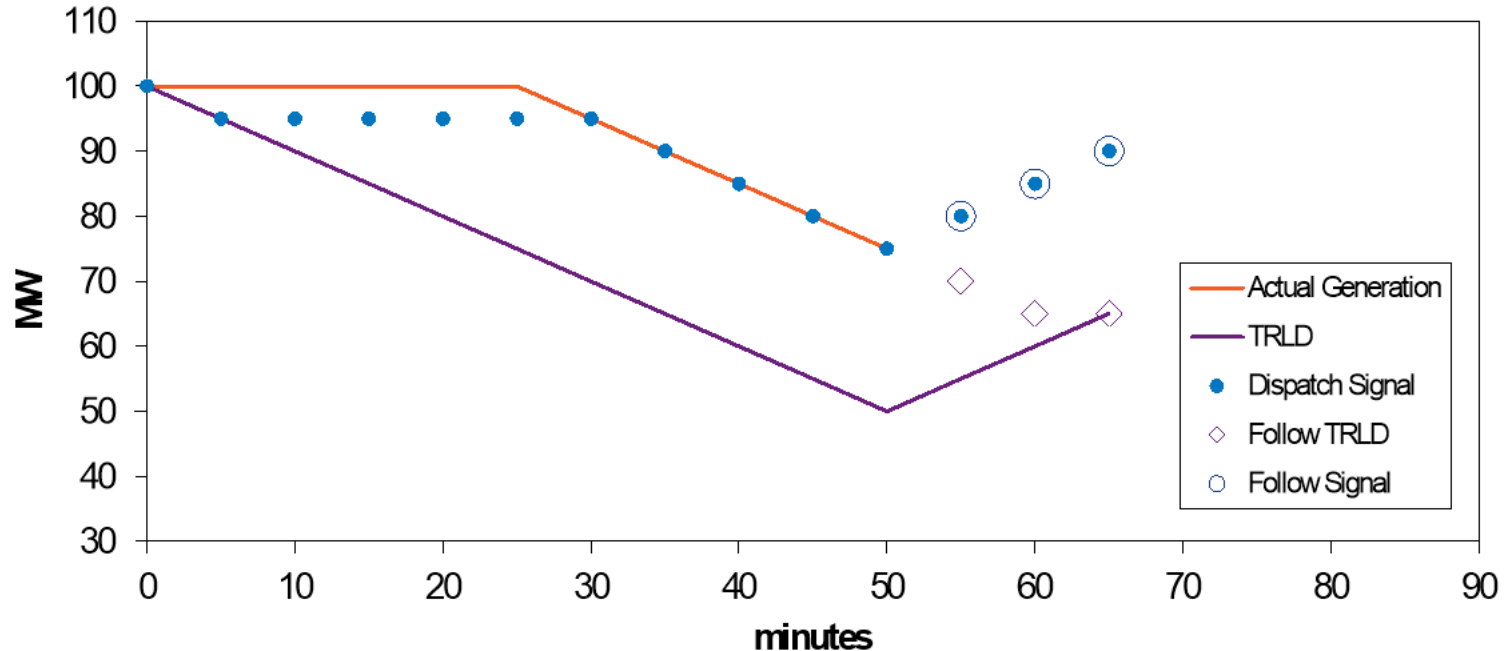
Dispatch Sequence (3 of 4)

- After consecutive signals to ramp down, unit is dispatched up. The circle represents following dispatch. The diamond represents following TRLD.



Dispatch Sequence (4 of 4)

- After consecutive signals to ramp down, unit is dispatched up. The circle represents following dispatch. The diamond represents following TRLD.



Dispatch Sequence

- **Following in the direction of the dispatch signal results in more net revenues compared to following the opposite direction.**
 - **The dispatch signal ramps units up when it is economic to do so (i.e. $LMP > \text{Incremental Offer}$).**
 - **The dispatch signal ramps units down when it is economic to do so (i.e. $LMP < \text{Incremental Offer}$), absent reserve assignments.**

Dispatch Sequence

- In the sequence above (assuming LMPs of \$120/MWh and offer of \$100/MWh), the unit makes \$425 during those three intervals when it followed the dispatch signal, compared to \$333 following the opposite direction (TRLD).

Minute	Following TRLD		Following Signal	
	MW	Net Revenue	MW	Net Revenue
55	70	\$117	80	\$133
60	65	\$108	85	\$142
65	65	\$108	90	\$150
Total		\$333		\$425

- The unit is better off following the dispatch signal.

Real Time Dispatch

- **PJM's dispatch instructions are based on the conditions (e.g. load) expected in the next five minutes.**
- **PJM's dispatch is a single interval dispatch, it does not solve for multiple intervals, meaning that it does not consider the conditions beyond the next five minutes.**
- **Refer to the appendix for different scenarios that account for multiple intervals.**
- **PJM's expectation and units' responsibilities are to follow PJM's five minute dispatch signal unless told otherwise.**
- **The proposed solution to the uplift issue does not change that expectation and responsibility.**

Conclusion

- Under the proposal, uplift will not be increased by the unit's failure to follow dispatch. Uplift will be limited by TRLD.
- TRLD was developed to pay uplift based on what PJM would have requested, based on the current dispatch model.
- TRLD does not provide any incentive to ignore the dispatch signal that does not exist today.
 - The current incentive is based on the fact that dispatch signals are based on one five minute interval, not multiple intervals.
- Multi-interval dispatch would result in better dispatch, but is not needed to correct current uplift rules flaws.

1.7.20 Communication and Operating Requirements.

- **Units are currently required to follow dispatch.**

(b) Market Sellers selling from generation resources and/or Economic Load Response Participant resources within the PJM Region shall: report to the Office of the Interconnection sources of energy and Economic Load Response Participant resources available for operation; supply to the Office of the Interconnection all applicable Offer Data; report to the Office of the Interconnection generation resources and Economic Load Response Participant resources that are self-scheduled; with respect to generation resources, report to the Office of the Interconnection bilateral sales transactions to buyers not within the PJM Region; confirm to the Office of the Interconnection bilateral sales to Market Buyers within the PJM Region; **respond to the Office of the Interconnection's directives to start, shutdown or change output levels of generation units**, or change scheduled voltages or reactive output levels of generation units, or reduce load from Economic Load Response Participant resources; continuously maintain all Offer Data concurrent with on-line operating information; and ensure that, where so equipped, generating equipment and Economic Load Response Participant resources are operated with control equipment functioning as specified in the PJM Manuals.

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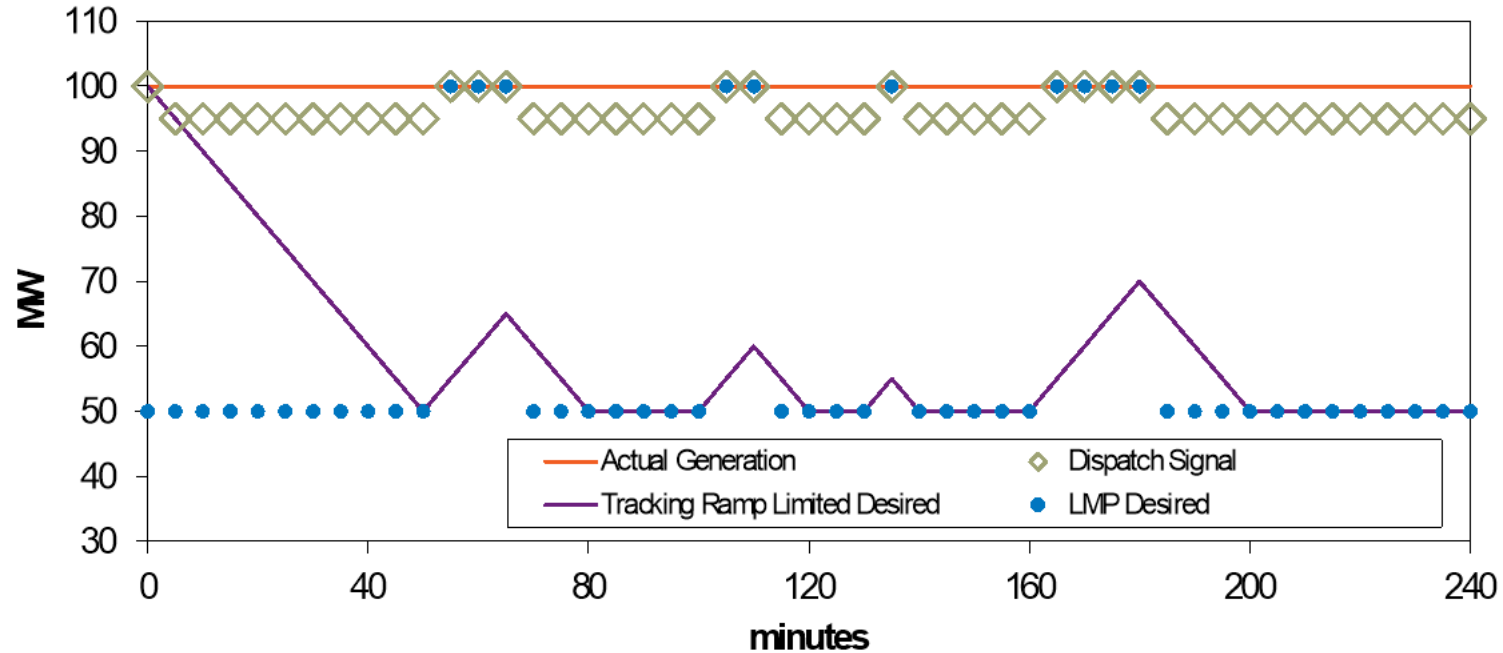


APPENDIX



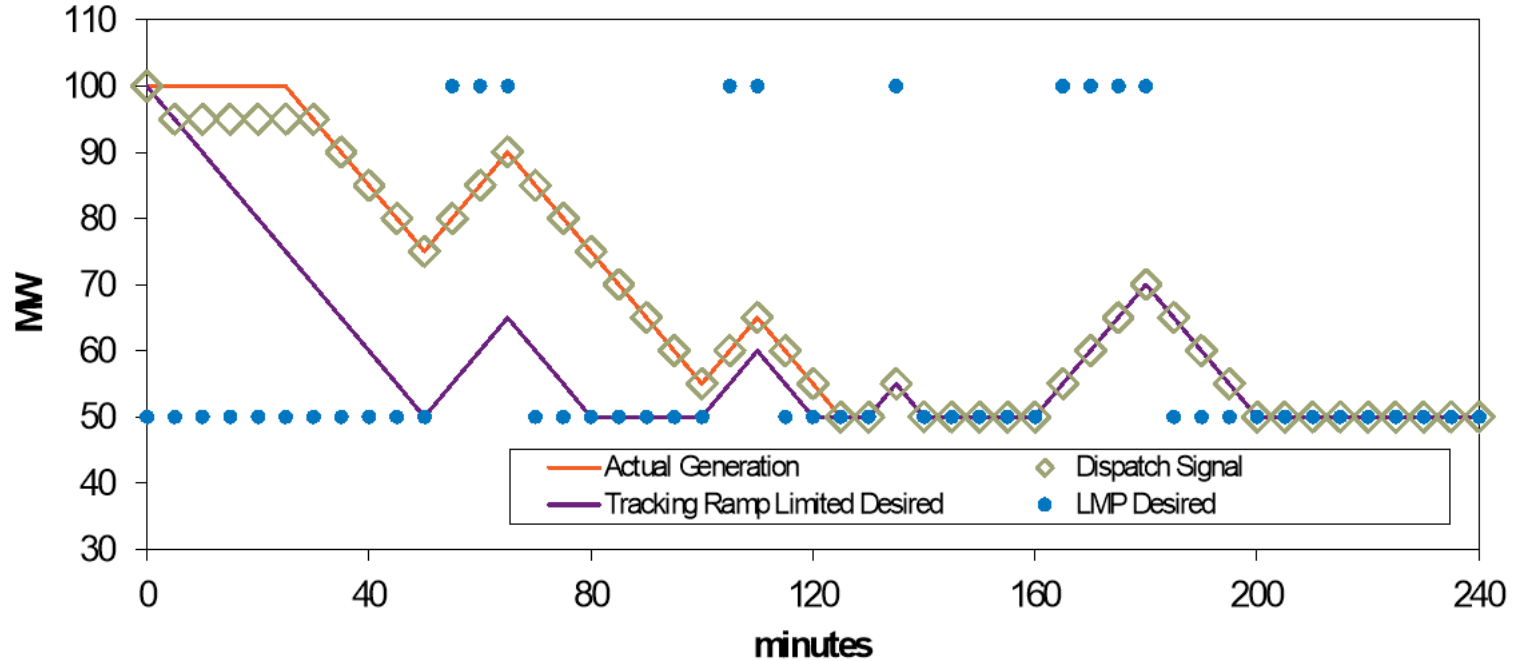
Scenario 1.a

- Unit mostly out of the money, does not follow dispatch.



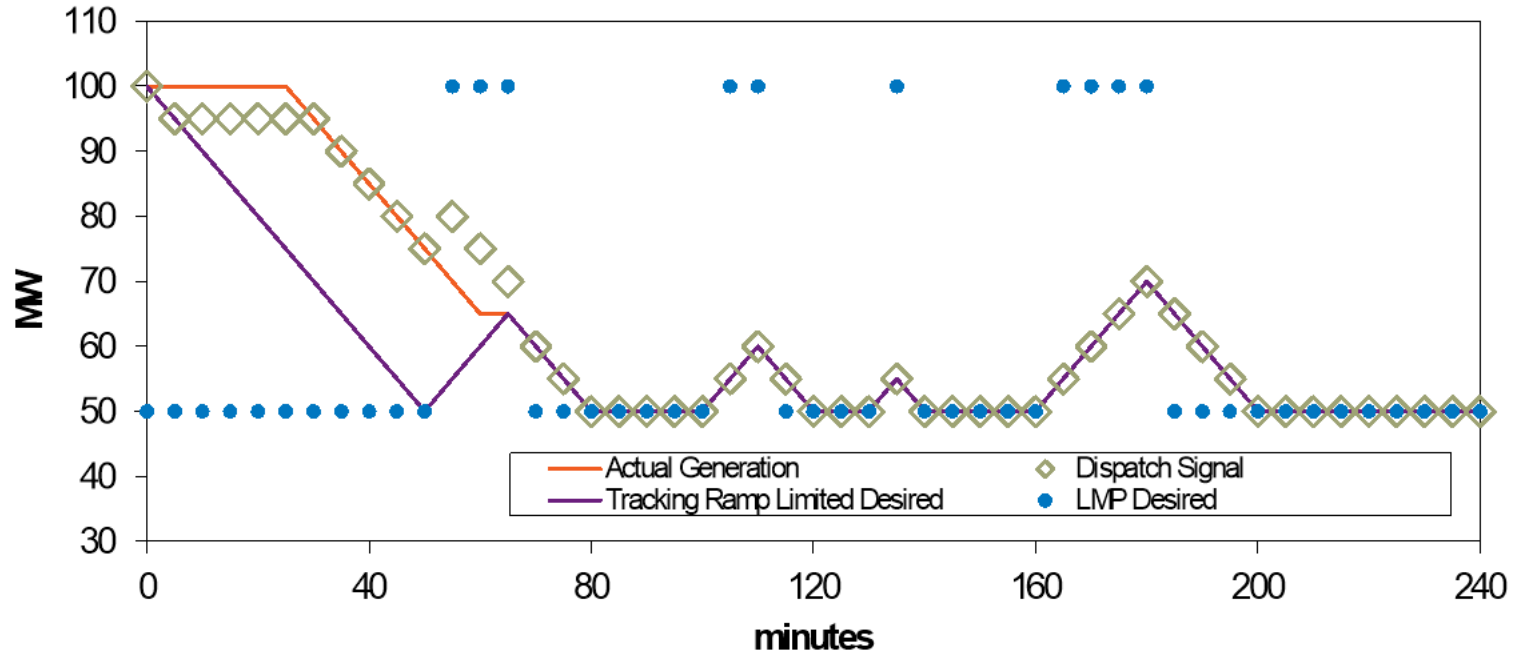
Scenario 1.b

- Unit mostly out of the money, follows late.



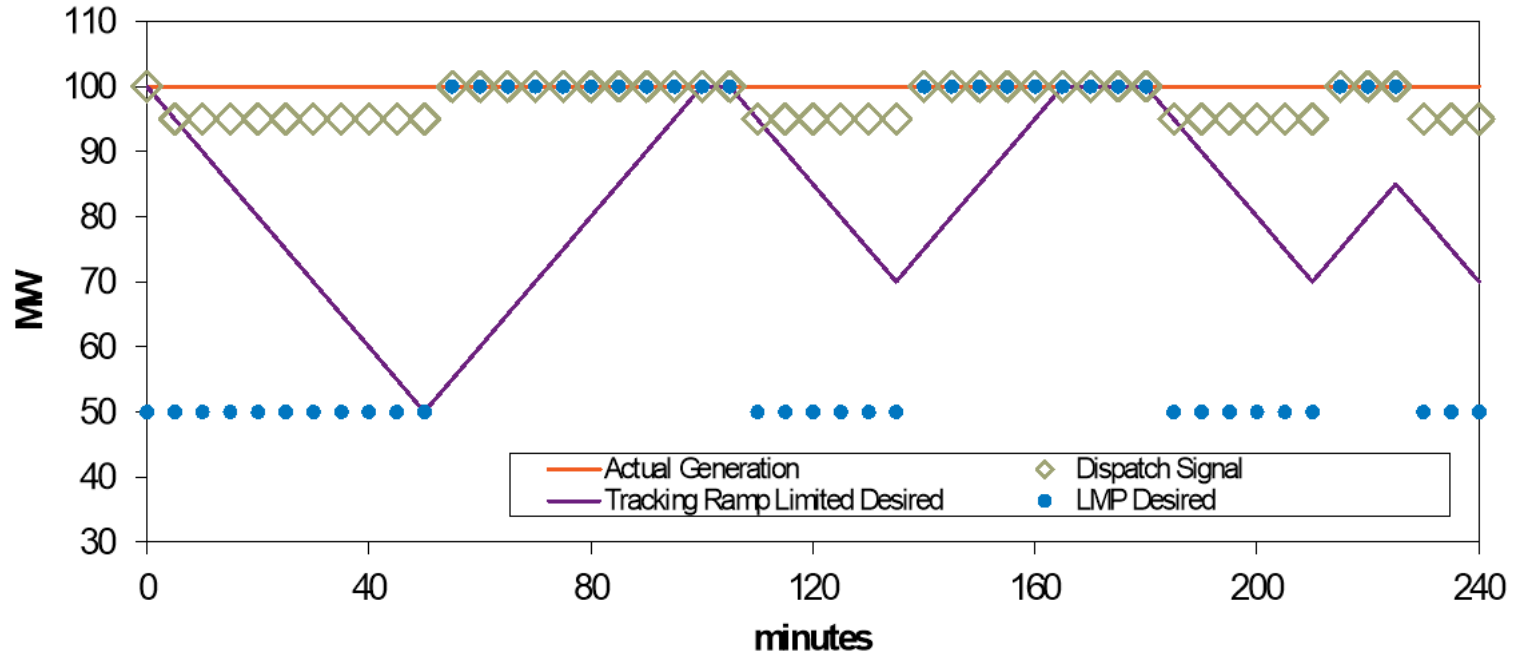
Scenario 1.c

- Unit mostly out of the money, follows TRLD.



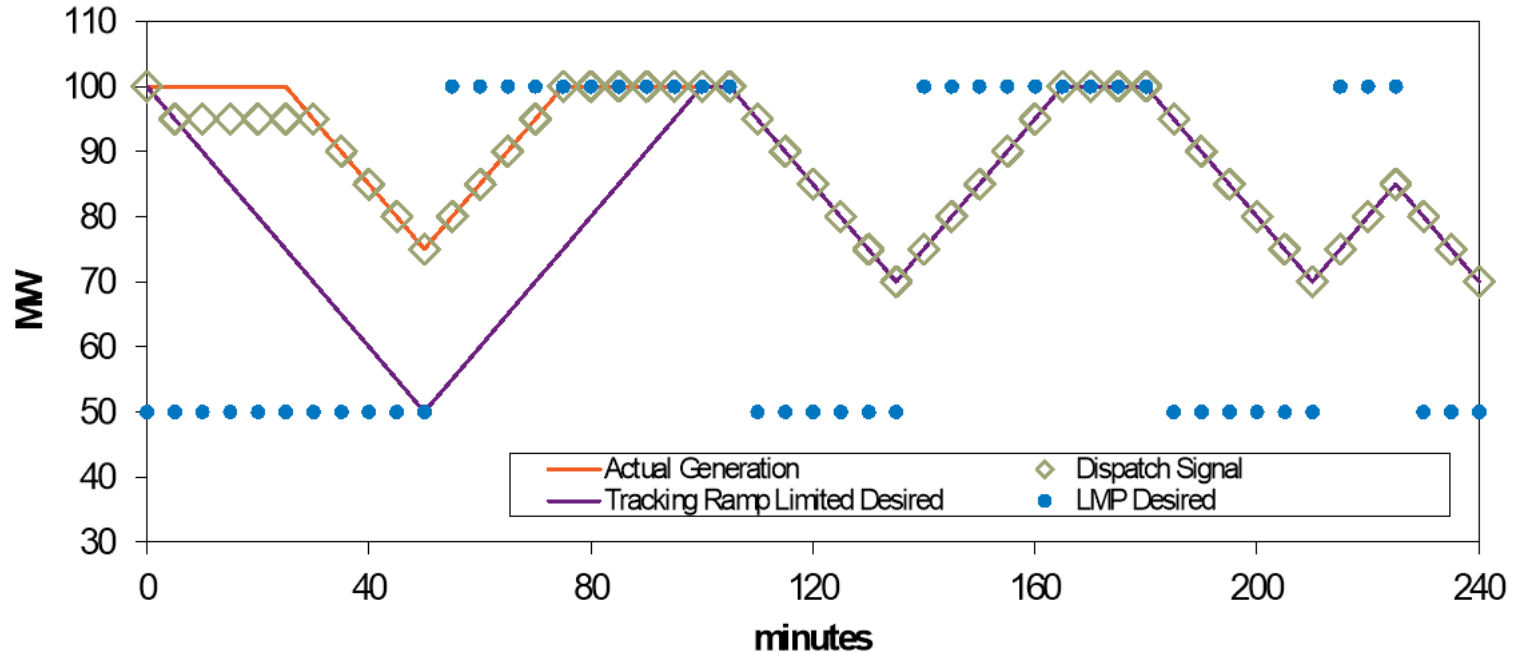
Scenario 2.a

- Unit mostly in the money, does not follow.



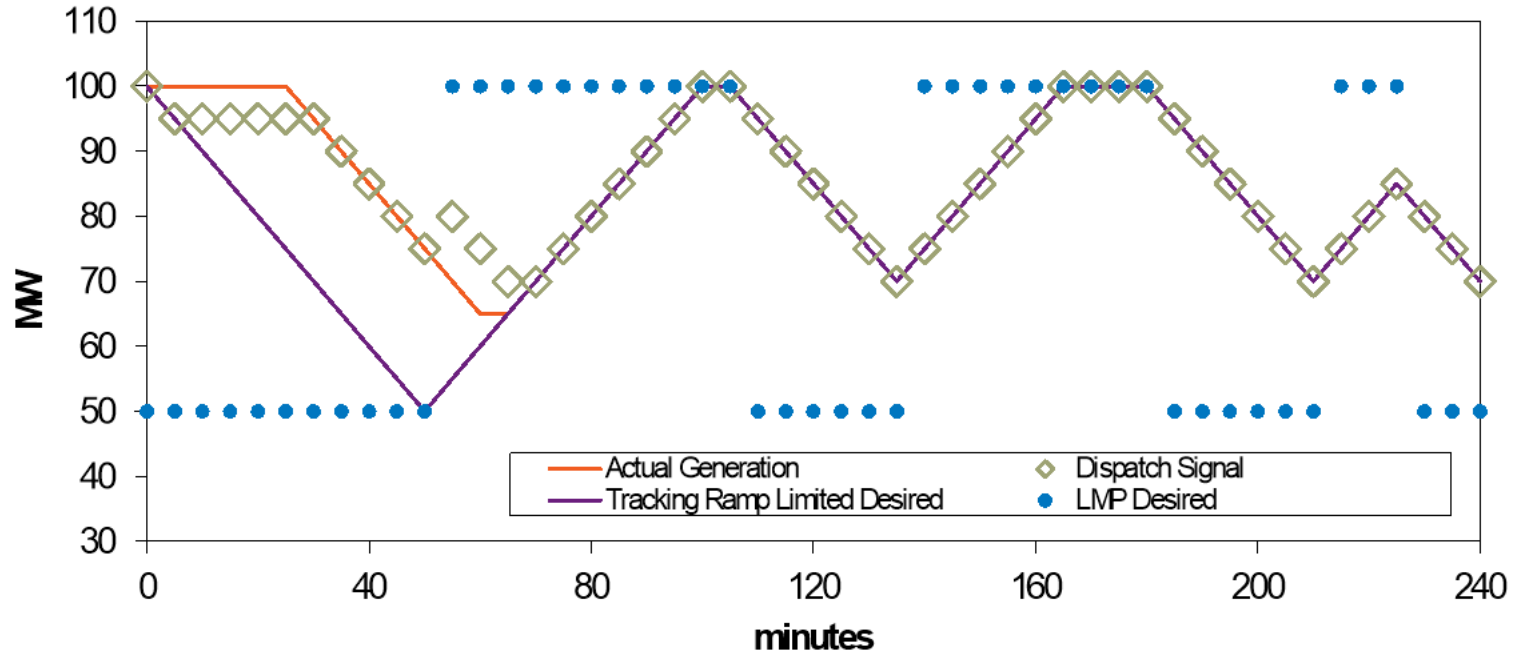
Scenario 2.b

- Unit mostly in the money, follows late.



Scenario 2.c

- Unit mostly in the money, follows TRLD.



Scenarios Summary

Scenario	Description	Step 1	Step 2	Step 3	Energy Revenues	Uplift	Offer	Net Revenue
1.a	Out of the money - Not Following	\$15,250	\$20,000	\$15,250	\$29,000	\$15,250	\$49,000	(\$4,750)
1.b	Late Reaction - Followed Signal After	\$15,250	\$16,225	\$15,250	\$19,400	\$15,250	\$35,625	(\$975)
1.c	Late Reaction - Followed TRLD then Signal	\$15,250	\$15,883	\$15,250	\$18,075	\$15,250	\$33,958	(\$633)
2.a	In the money - Not Following	\$12,233	\$13,500	\$12,233	\$35,500	\$12,233	\$49,000	(\$1,267)
2.b	Late Reaction - Followed Signal After	\$12,233	\$12,608	\$12,233	\$31,850	\$12,233	\$44,458	(\$375)
2.c	Late Reaction - Followed TRLD then Signal	\$12,233	\$12,867	\$12,233	\$30,300	\$12,233	\$43,167	(\$633)

- **The unit needs uplift because the offer (including no load and start costs) is greater than revenues.**
- **Step 1 is uplift needed using TRLD.**
- **Step 2 is uplift needed using actual generation.**
- **Step 3 is the lower of step 1 and step 2.**

Scenarios - Conclusion

- **Scenario 1.c shows that following TRLD instead of the dispatch signal results in lower losses, that is the result of the unit being out of the money most of the time.**
- **Scenario 2.c shows that following TRLD instead of the dispatch signal results in higher losses, that is the result of the unit being in the money most of the time.**
- **Following TRLD does not result in guaranteed higher net revenues (or lower losses). Following expected market conditions and having those conditions realized is the cause for higher net revenues.**
 - **Operation will result in higher net revenues if expected conditions are realized.**
 - **Operation will result in lower net revenues if expected conditions are not realized.**

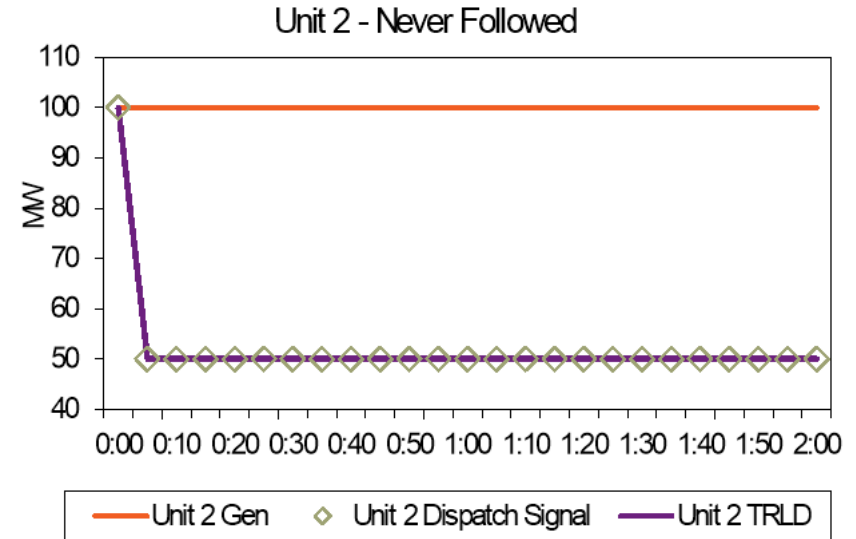
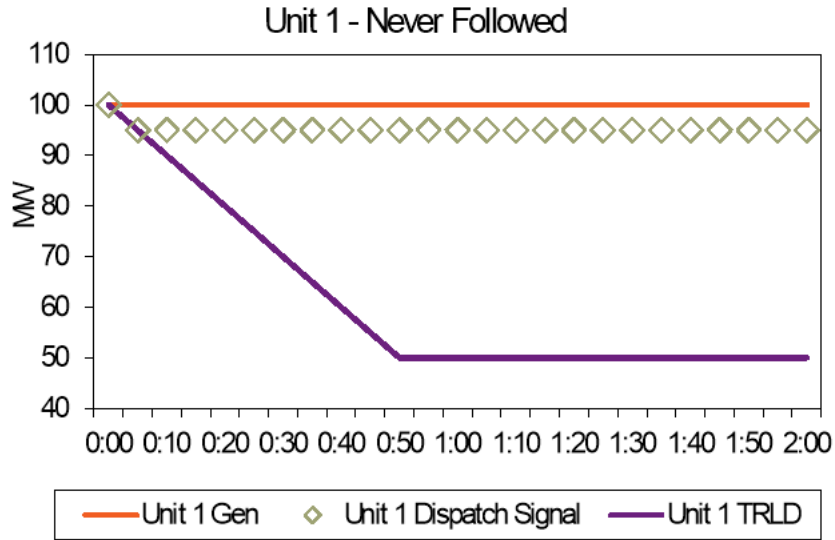
Deviations Examples

- **Two units**
 - **Unit 1 (slow)**
 - **Unit 2 (fast)**

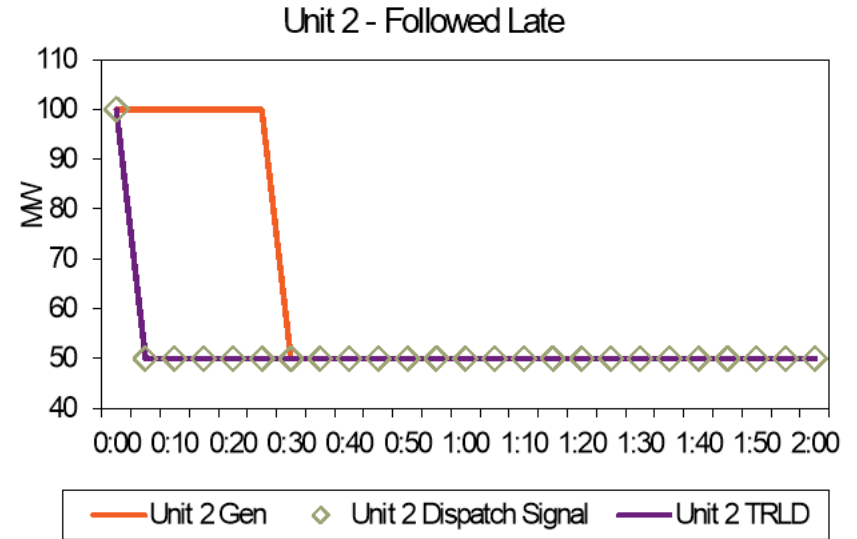
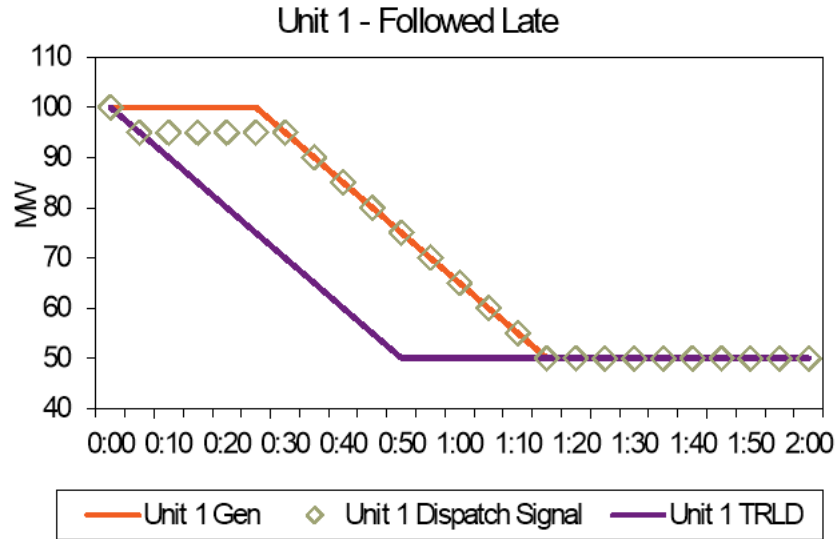
Parameters	Unit 1	Unit 2
Eco Min MW	50	50
Eco Max MW	100	100
Ramp Rate (MWminute)	1	10

- **Two scenarios:**
 - **Units dispatched down and never followed.**
 - **Units dispatched down and followed late.**

Deviations – Never Followed



Deviations – Followed Late



Deviations - Results

Deviations (Percentage)	Unit 1	Unit 2
Never Followed - Compared to Dispatch Signal	5%	100%
Never Followed - Compared to TRLD	68%	100%
Followed Late - Compared to Dispatch Signal	2%	21%
Followed Late - Compared to TRLD	18%	21%

Deviations (MWh)	Unit 1	Unit 2
Never Followed - Compared to Dispatch Signal	0	100
Never Followed - Compared to TRLD	81	100
Followed Late - Compared to Dispatch Signal	0	21
Followed Late - Compared to TRLD	20	21

Operating Reserve Deviation Rates (2024)	
Average	\$0.2885
Max	\$4.4713

Deviation Charges (Using TRLD)	Unit 1	Unit 2
Using Average Rate - Never Followed Scenario	\$23	\$29
Using Max Rate - Never Followed Scenario	\$361	\$447
Using Average Rate - Followed Late Scenario	\$6	\$6
Using Max Rate - Followed Late Scenario	\$89	\$93

Deviations - Conclusion

- **Current deviation metrics allow units with slower ramp rates to be excused from deviations because their slow ramping speed makes them appear as if they are following dispatch.**
- **In both scenarios, unit 1 is exempt from deviations even though it had the same behavior as unit 2.**
- **Under the IMM/PJM proposal deviations will be based on TRLD. In these examples, both units will be assessed deviations using TRLD.**
 - **For units with fast ramp rates, deviations from TRLD would not persist as soon as they start following dispatch.**
 - **For units with slow ramp rates, deviations from TRLD would not persist based on how long it takes them to follow. The longer it takes them to follow dispatch, the longer it will take them to catch up. Short slips from following dispatch will likely fall within the 10% exemption.**