



Intelligent Reserve Deployment Education

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Operating Committee
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- Price operational actions and improve performance during spin events.
- Consistent usage of tools by operators throughout the event.
- Ensure timely recovery from event.

Event	Date	Start Time	End Time	Duration	Region	Tier 1 Estimate (MW)	Tier 1 Response (MW)
1	07/06/20	17:22	17:32	00:10	RTO	1464.0	526.1
2	07/23/20	21:03	21:12	00:09	RTO	1562.7	852.8
3	07/25/20	12:39	12:50	00:11	MAD	868.4	421.6

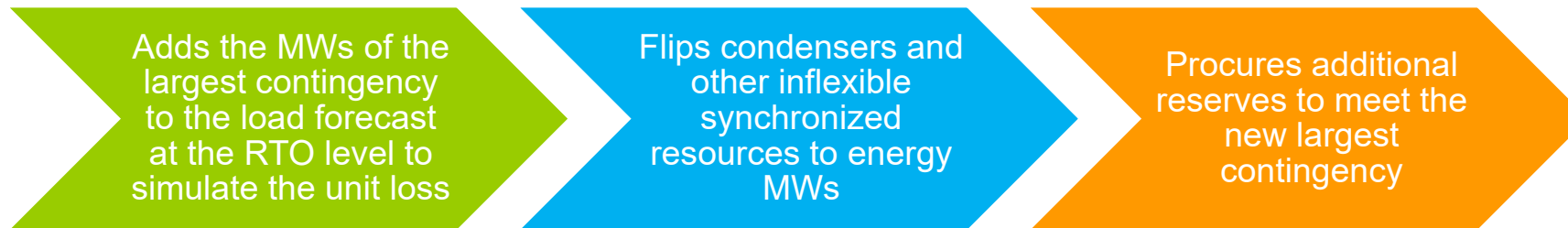
Event	Date	Start Time	End Time	Duration	Region	Tier 1 Estimate (MW)	Tier 1 Response (MW)
1	09/09/20	20:19:34	20:29:04	00:09:30	RTO	1275.4	453.6

- Price the deployment of reserves in a spin event.
- Using SCED to deploy reserves where needed and ideally not create other operational issues.
 - Generally have enough reserves at the start of events
 - Reduce deployment of excess reserves
- Improve unit response by having consistent pricing and basepoints throughout the event.
 - Avoid sudden interruptions when following PJM dispatch
 - Align pricing and dispatch to reduce conflicting messages

- Initial phase with internal changes for PJM dispatch, no changes in expected performance during events.
 - Timeline to be communicated at future meeting
- Ensure proper event recovery with IRD prior to implementing more impactful changes.
- Collect data on results to make informed decisions on future enhancements to IRD and market design.
- Future phases based on initial phase results and stakeholder feedback.

- All-call to load 100% SR in MAD/RTO.
- System energy price from last priced RTSCED case.
 - Case would not have seen lost MWs
- Stale basepoints.
 - Could update if RTSCED case is approved during spin.
 - May require two cases to see lost unit due to five minute execution
- Manual actions for constraint control.

- Intelligent Reserve Deployment (IRD)
 - IRD is a SCED case that simulates the loss of the largest generation contingency. Approval of the case will trigger a spin event.
 - Economic dispatch based on real-time input including constraints
 - Converts inflexible Tier-2 reserve MWs to energy
 - Readily available for use, no lag time



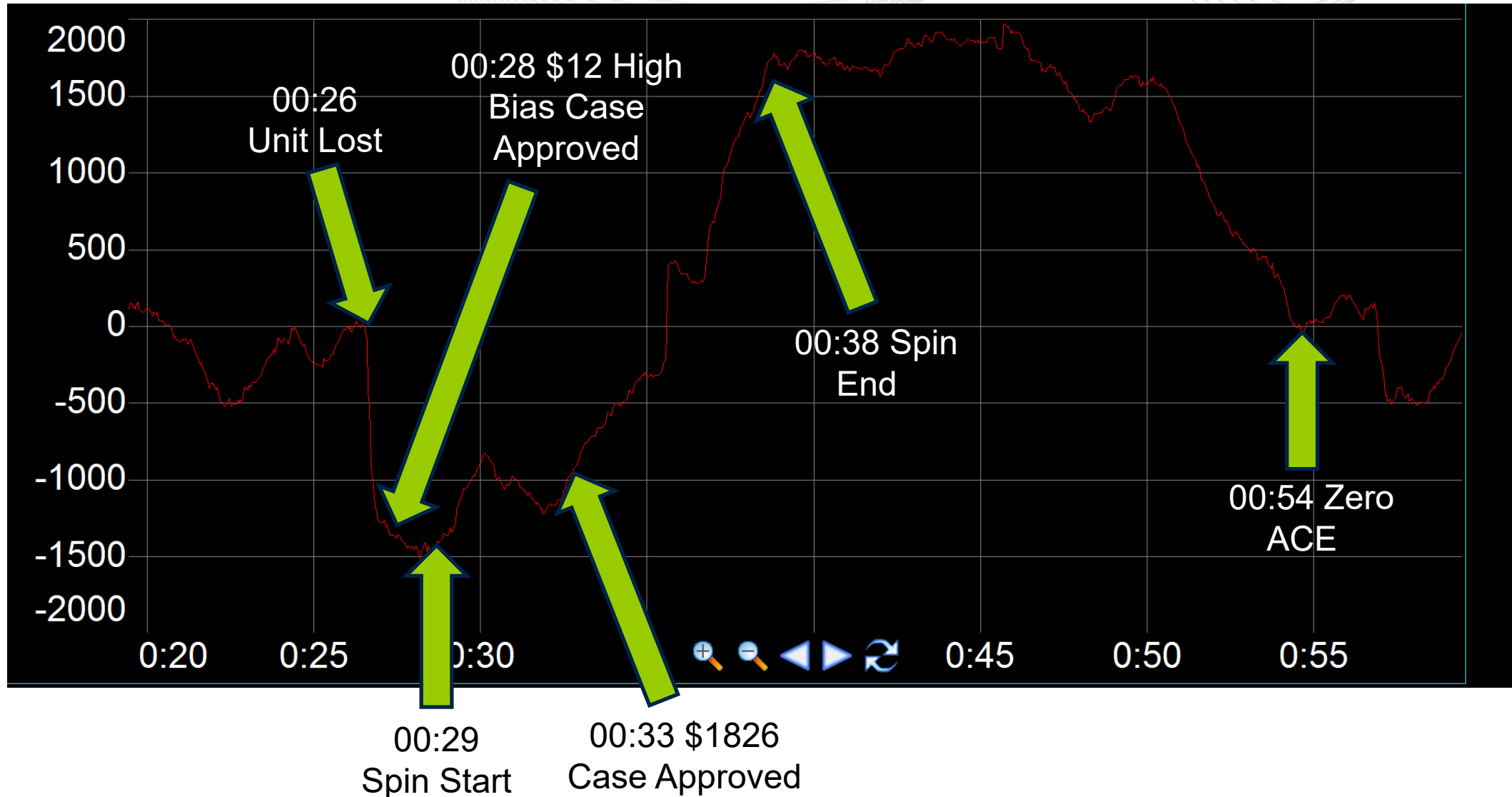
- Improved functionality and visibility to dispatch during events.
- IRD case readily available for improved pricing during events.
 - 5-min dispatch change to execution frequency leads to longer time for RTSCED to see loss
 - Similar to approving high bias case
- Constraint control relaxed to prioritize event recovery.
- Loss of largest unit applied as RTO bias.
 - Moved from zonal bias based on stakeholder and IMM feedback

- Constraint control percentages aligned with RTSCED.
 - Changed from 100% to allow consistent control throughout event
- Loss of largest unit applied as RTO bias.
 - Moved from zonal bias based on stakeholder and IMM feedback
- Base RTSCED case to be used as starting point for bias.
 - Previously used 0 as starting point
- Exploring governing document additions for added clarity.

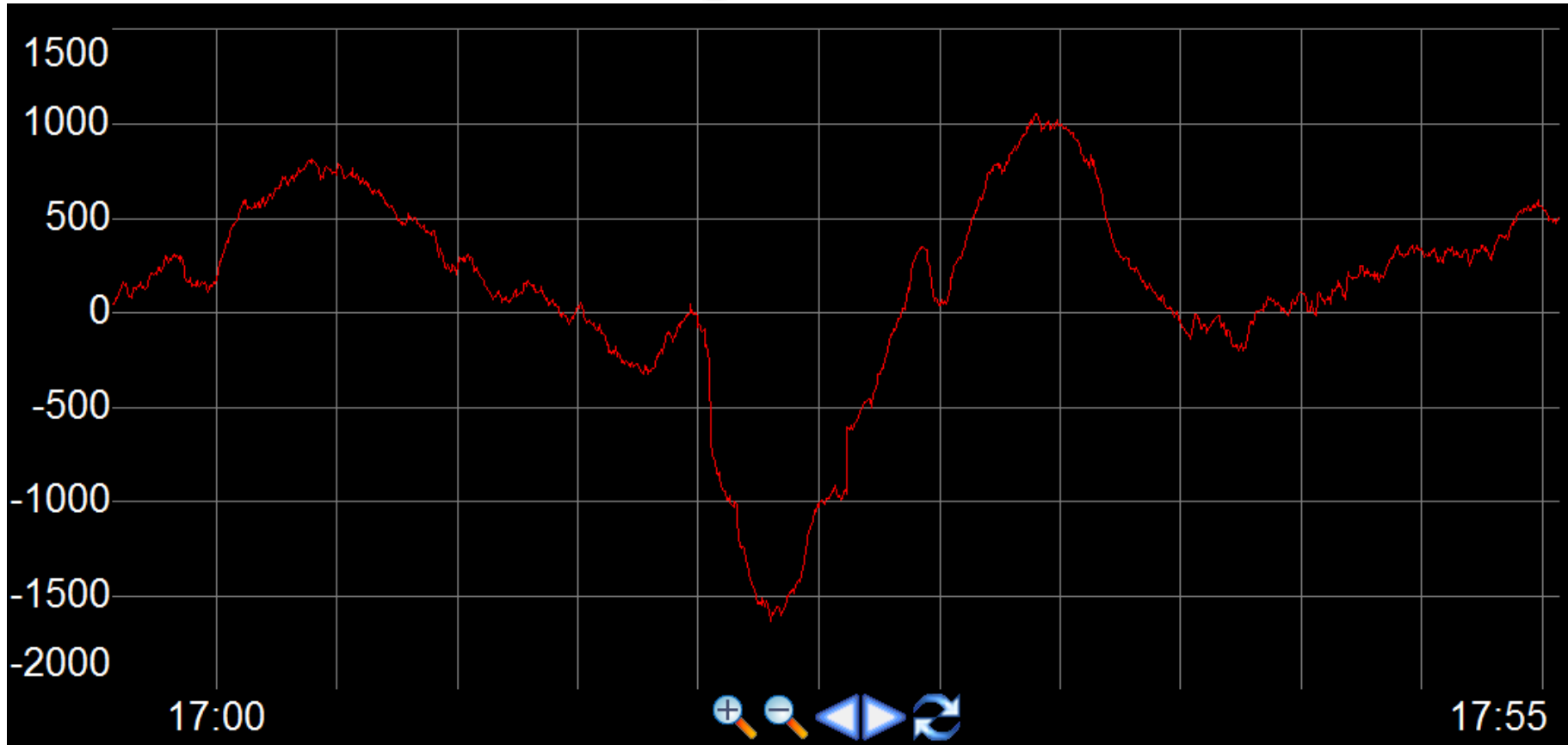
- Recent sample of 3173 IRD cases using production data.
- 480 shortage cases, 15% of all IRD cases.
 - In spirit of FERC Order 825
- Average system energy price across cases \$248.
 - Existing transient shortage adder of \$300+
- No failed cases, solve times in line with existing RTSCED cases.

- 14 events this year, 1 had the actual largest unit.
- Loss of a significant unit would trigger an event.
 - System conditions at the time of unit loss is taken into account
 - NERC standard for 80% DCS
 - Loss or ramp down of multiple smaller units

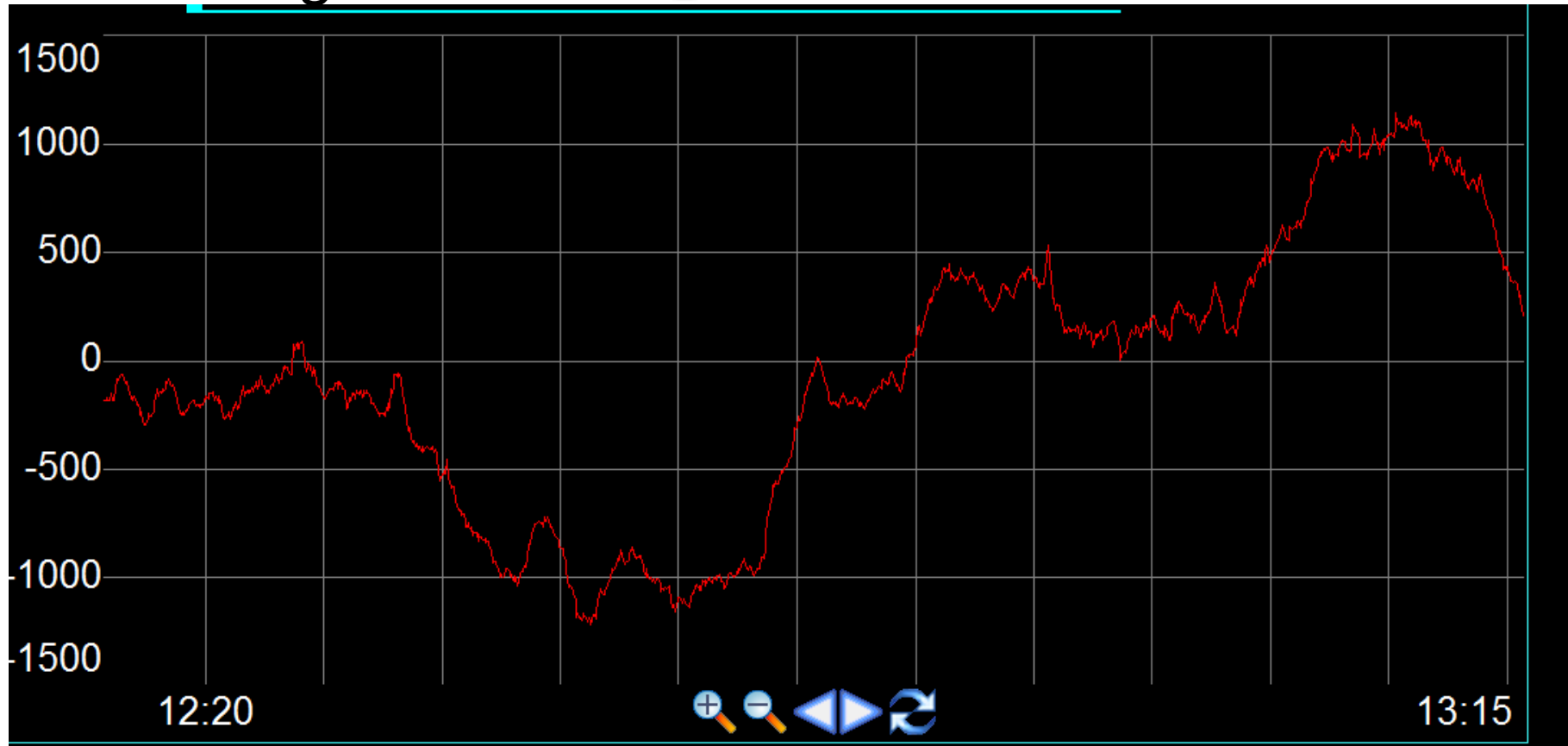
- RTO event from 10/12, lost 1 unit (1150MW), -1507 ACE.
- Largest contingency was 1348 MWs used by IRD.
- System energy price was \$12 at time of loss. IRD spin price \$632.
- \$1826 transient shortage case approved half way into event.
 - Case reflected actual unit lost.
- +1971 ACE after recovery.



- 950 MW loss across two units. Energy price \$64. Staggered response.



- Combination of factors led to low ACE. Energy price \$25. Delayed response. Usage of MAD as mechanism for constraint control.



- Design with upcoming Market Initiatives in mind.
- Reserve Price Formation/ORDC changes work in conjunction with IRD.
 - IRD for deployment of reserves
 - ORDC for clearing reserves



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