Generator Contingency and Remedial Action Scheme Modeling (GCARM)

Pre-Market Simulation Webinar

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External Training and Readiness

Agenda

- Purpose of the GCARM initiative
- Timeline
- Review changes
- Market simulation activities

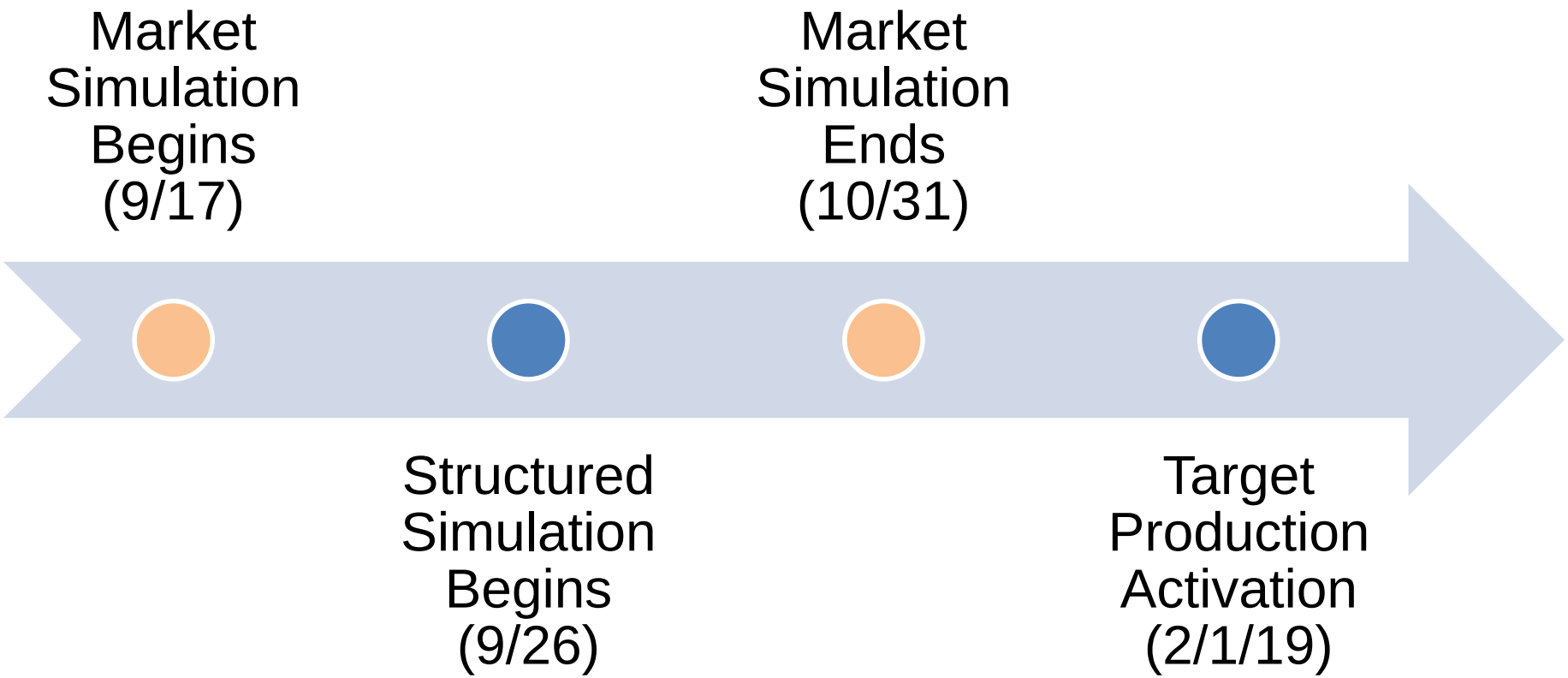
Purpose of the GCARM initiative

- This initiative enhances the ISO market's security constrained economic dispatch models to include the potential loss of individual generators and to model remedial action schemes (RAS)
- RAS are designed to automatically disconnect generators or load in the event of an unexpected loss of service of a transmission line to prevent system overloads

What does this initiative apply to?

- Enhancements apply to:
  - Day-ahead market
  - Real-time market
  - Congestion revenue rights (CRR) allocation and auction process
- EIM entities will have the option to have the ISO model generator contingencies and remedial action schemes in their respective balancing areas

When will the changes take place?

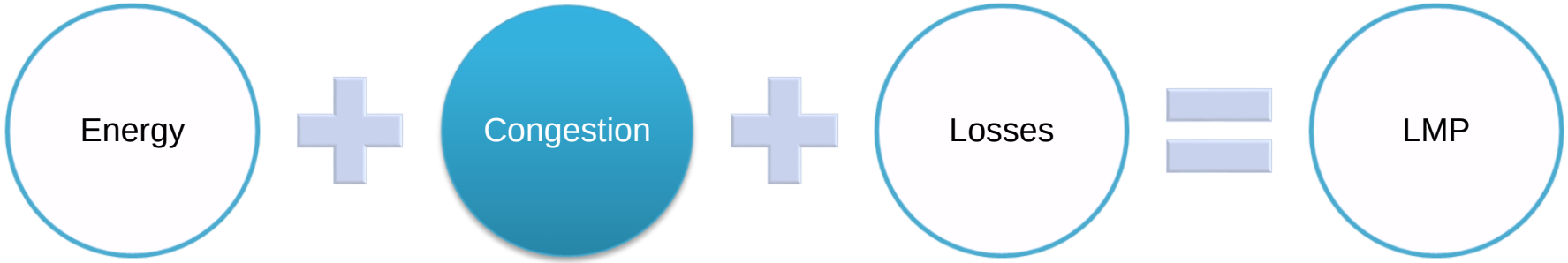


What is changing?

- Enhance the Security Constrained Economic Dispatch (SCED) to:
  - Model generation/load loss in the dispatch
  - Model transmission loss along with subsequent generation/load loss due to RAS operation in the dispatch
  - Model transmission reconfiguration due to RAS operation in the dispatch

What is changing?

- Update the congestion component of the Locational Marginal Price (LMP) so that it considers the cost of positioning the system to account for generator contingencies and RAS operations



What is changing?

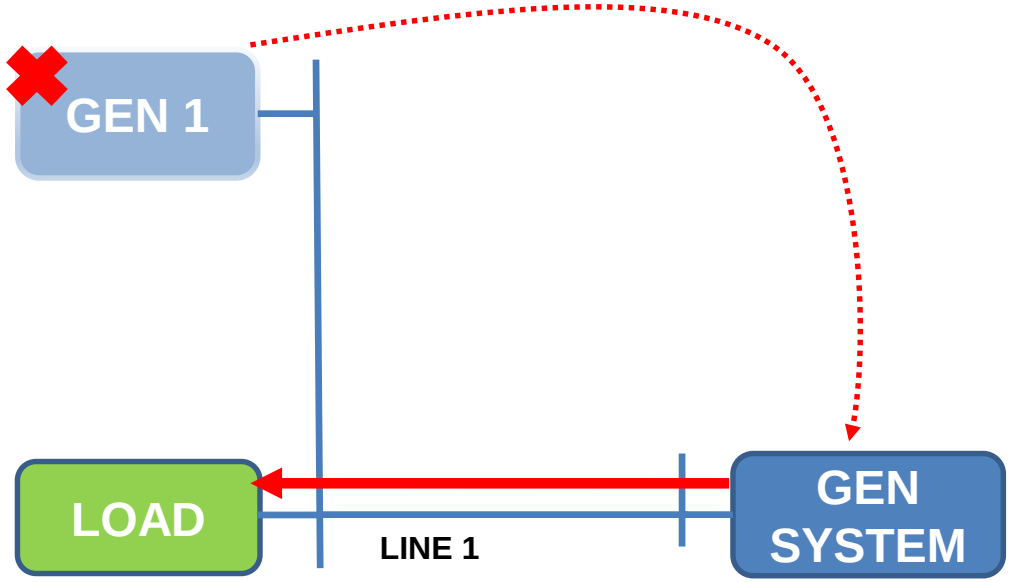
Enhance the Day-Ahead Market, Real-Time Market, and Energy Imbalance Market to support generator contingencies:

- An “N-1” preventive constraint enables the market to model and price the immediate impact of RAS operation on the transmission system
- Economic dispatch that will respect all emergency limits after loss of a generating unit or after RAS operation without the need for out of market intervention
- Does not focus on system response and state after the loss of a generating unit along with the subsequent deployment of contingency reserves

Generator contingency modeling

Model the "pick-up" effect of the system for a generator loss

- Consistent with reliability studies for generator loss
- Consistent with operator's real-time contingency analysis tool
- Incorporate the potential change in electrical flows into locational marginal prices



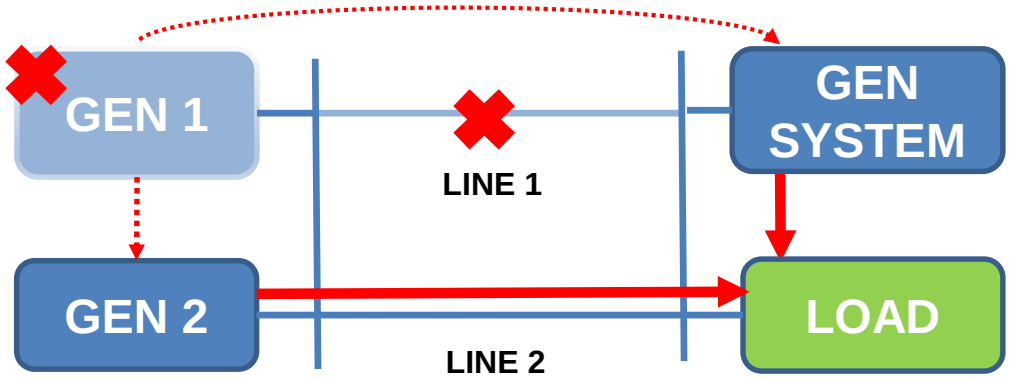
Loss of generation spread to other online resources to model transmission line flows.

GEN 1 output picked up by **GEN SYSTEM**.

GEN 1 locational marginal price considers flows on **LINE 1** due to pick-up by **GEN SYSTEM**.

Remedial action scheme modeling

Models that generator on remedial action scheme trips-off if line is lost



GEN 1 is part of remedial action scheme and trips off if **LINE 1** or **LINE 2** go out

GEN 2 is not on remedial action scheme

GEN 1 locational marginal price considers **that GEN 1** will not overload **LINE 1** or **LINE 2** if they go out.

Allows **GEN 1** to be dispatched to higher output than it would be without remedial action scheme modeling

Why is it changing?

- Currently, the ISO market models the potential unexpected loss of transmission lines to ensure that electrical flows do not exceed transmission system limits, but does not model the potential unexpected loss of a generator

- The ISO market currently only has limited means to account for remedial action schemes and does not explicitly model them

- Grid operators must manage the potential for generator contingencies and remedial action schemes mostly through manual actions

How does this benefit the market?

- Including the unexpected loss of a generator and remedial action schemes in the ISO market models will:
  - improve the market dispatch
  - decrease out-of-market actions
  - appropriately price each generator's contribution to congestion in the market
- These enhancements will also allow the market to more fully utilize generation that is part of a RAS

MARKET SIMULATION/ READINESS ACTIVITIES

Market simulation activities

Market Simulation: 9/17/18 – 10/31/18

- The purpose of market simulation is to provide customers with the ability to preview the enhancements
  - Day-Ahead Market
  - Real-Time Market
- Market simulation scenarios list:
  - What the ISO will do
  - What EIM and ISO market participants will do
  - Expected outcomes
  - Anticipated settlement outcome

Implementation readiness for generating resources

- Frequency Response (FR) flag added to network model
- The ISO will source FR capability data for all generators from the Western Electricity Coordinating Council (WECC)
- After implementation, new and existing generators will communicate FR data changes to the ISO through established process (e.g. interconnection or Master File processes)

California ISO

Questions?

REFERENCE MATERIAL

Reference Material

- Business Requirements Specification for Generator Contingency and Remedial Action Scheme Modeling:
  - http://www.caiso.com/Documents/BusinessRequirementsSpecification-GeneratorContingencyAndRemedialActionSchemeModeling.pdf
- Market Simulation Structured Scenarios:
  - http://www.caiso.com/Documents/StructuredScenarios-GeneratorContingencyandRemedialActionSchemeModeling.pdf
- Stakeholder Initiative Page:
  - http://www.caiso.com/informed/Pages/StakeholderProcesses/GeneratorContingency_RemedialActionSchemeModeling.aspx