Deliverability Overview

ATC Customer Meeting

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Thomas Dagenais

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Day 2 and Deliverability

- Day 1 study of "delivery" to a specific load is replaced by Day 2 test for "deliverability" of aggregate Network Resources to aggregate network loads.
- Delivery service for Network Customers from Designated Network Resources is a matter of ensuring that a reliable dispatch of aggregate Network Resources to aggregate Network Load can be achieved.
  - ➢ In other words, pockets of generation must not be bottled up.

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Deliverability Overview

Per FERC Orders 2003 and 2003A:

- Generation Resources designated as Network Resources must be deliverable to load within MISO
- Assessment of deliverability is performed as a new resource seeks Network Resource Interconnection Service (NRIS)
- Units are studied to establish the deliverability of the aggregate of Network Resources to the aggregate of Network Load during peak.
- Once a unit is certified as deliverable, no separate delivery study to specific customer is required when the customer designates the unit as a Network Resource for meeting reserve requirements.

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Deliverability Study Overview

Deliverability Studies

- Show that the excess generation in an area can be exported to other areas that may be deficient
- Ensure that the installation of transmission and generation is coordinated such that the probability of loss of load shall not be greater, on the average, than one day in ten years.

$$LOLE \leq 0.1 \text{ days/year}$$

- Are performed as part of the Generator Interconnection Study and Transmission Expansion Planning Study processes.
- Act to complement rather than replace Day 1 transmission planning processes.

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Deliverability Studies – Procedure

Steps involved in deliverability analysis:

- Set up the base case
- Run linear contingency analysis
- Screen to determine list of potential constraints to deliverability
  - Determine list of generators impacting each constraint by ± 5%
- Create "Severe yet Credible" dispatch scenario for each potential constraint
- Determine loading adjustments to constraint
  - Post-contingent flow
  - Severe yet credible dispatch impact
  - Other unit impacts
- Validate constraint flow with AC Analysis

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Base Case Setup

MISO MTEP Baseline study 2009 model.

- Alter dispatch in the case
  - Must meet peak load and MISO export requirements
  - Turn off ER status units and units without Interconnection Agreement (IA)
  - Dispatch NR's at PGen = PMax * (~90%)
  - ER's can be turned on to meet load and export requirements

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Severe Yet Credible Dispatch

Find all potential constraints, and list all units with 5% or greater impact in either the contributing or counter-flow direction.

- Sort the unit list from most contributing impact to most counter-flow.
- Turn on a subset of units at the top of the list until the probability of the units being available at maximum output is not less then 20% (multiply availability rates of units). This subset is the "severe yet credible" dispatch list.
  - Calculate Σ (Pmax-Pgen)*DF
  - Add sum of impacts to flow on limiting element
- Calculate adder to account for offline units that are not included in the "severe yet credible" list.
  - Calculate Σ 0.85*(Pmax)*DF
  - Add sum of impacts to flow on limiting element
- If flow on limiting element is greater than the rating of that element, this constraint limits deliverability (pending AC verification).

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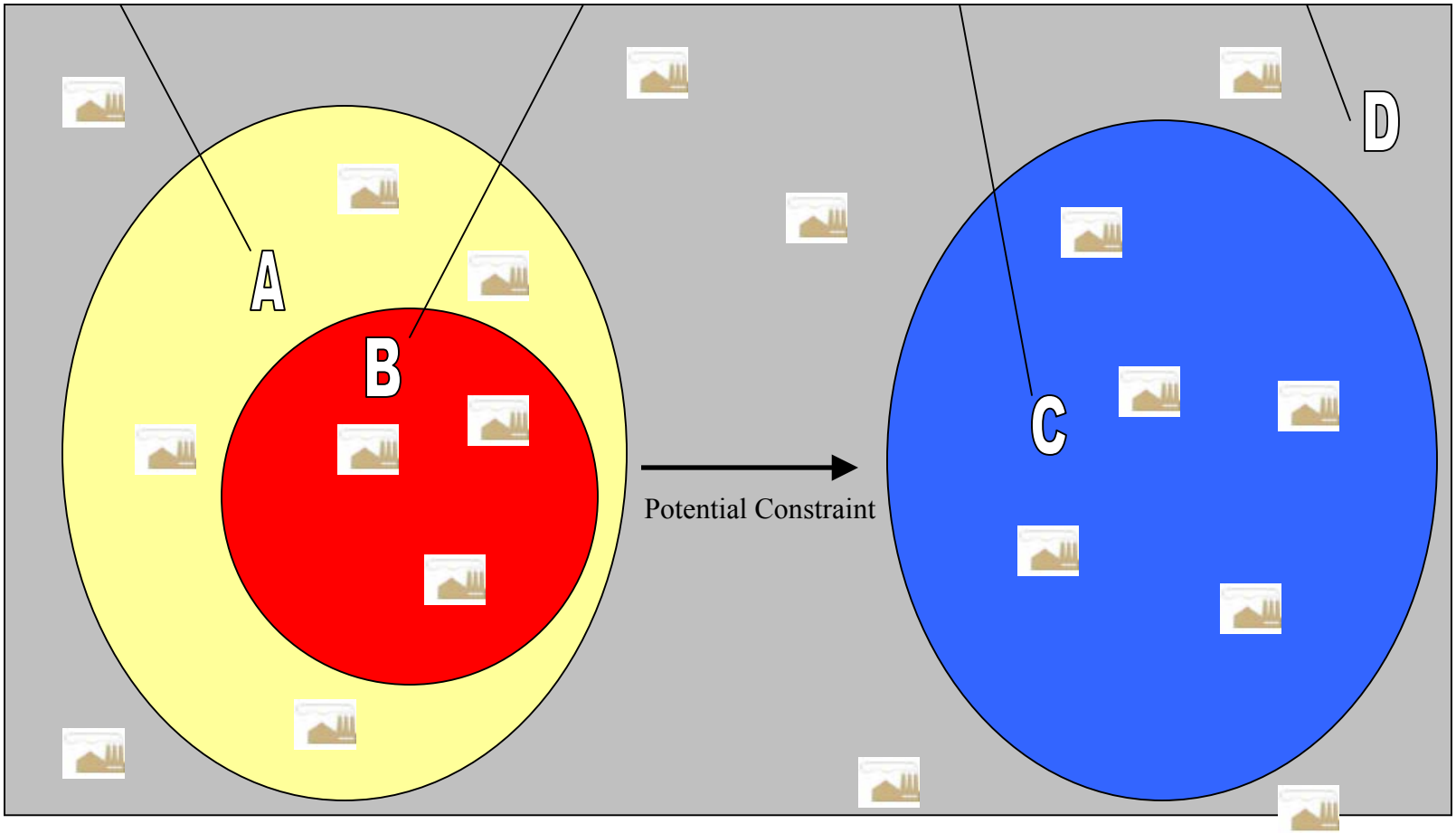
Severe yet credible dispatch – Graphic Concept

A: Units contributing to constrained flow by ≥ 5% TDF. These units are eligible to be included in the "severe yet credible" dispatch list (B).

B: 'Severe yet credible' list - high impact units ramped to PMax to add stress to the constraint. Probability is >20% that all these units will be available to be on-line at PMax.

C: Units providing counterflow to the potential constraint at ≥ 5% TDF.

D: All other units in the MISO market footprint with less than 5% TDF on the potential constraint.



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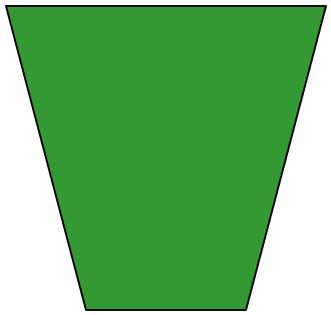
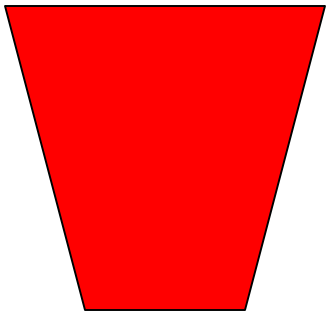
Deliverability Results

Generation is sorted into "buckets"

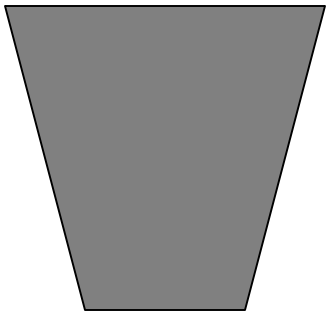
Green Bucket:
Previously NR
&
Passed
Deliverability Test



Red Bucket:
Never a NR
&
Not Pass
Deliverability Test



Gray Bucket:
Previously a NR
& Not Pass
Deliverability Test
Or
Never a NR &
Passed
Deliverability Test



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Slide info from www.midwestmarket.org website

Passing result (Green bucket)

- **Green Bucket**
  - Once a unit becomes certified as deliverable, it will remain certified as deliverable in the future.
  - Unit can be designated as a network resource (NR) for any MISO market participant w/o further study
    - Market participants can nominate these units to meet Module E resource adequacy requirements.
    - Certification does not guarantee a resource to serve a specific load during real-time operation.
  - Actual operation subject to Module C congestion management
    - Certification does not guarantee a resource to operate during any particular set of operating circumstances.
    - Certification makes no guarantee as to price of available resources; congestion charges may, in fact, be very high.

Failing Result (Red bucket)

- **Red Bucket**
  - Unit cannot be a NR w/o further study (i.e. Unit does not qualify as a resource under Module E w/o further study)
  - Unit can bid into market, will run as bid is accepted and operate under security constrained economic dispatch
  - Further study can certify the unit as deliverable once:
    - System upgrades are made to solve the constraint; or
    - Other generators contributing to the same constraint elect not to apply for deliverability certificates thus solving the constraint

Local Capacity Resource (Gray Bucket)

- Existing NR but has not fully passed the deliverability test:

  Options:

  – Present network customer can nominate as a NR – meeting Model E resource adequacy requirements

  OR

  – The portion of the unit that has passed the deliverability test gets "green bucket" treatment – i.e. can be nominated as a NR by any market participant

  – Remaining portion can bid into the Energy Market subject to congestion management protocols in Module C – but cannot be nominated as a NR for resource adequacy requirements

- Fully passed deliverability test but is not currently a NR:

  – Eligible to be nominated as a NR by any market participant under Model E resource adequacy requirements per conditions noted below[1]

1) NR status requires a market participant to enter into a contractual agreement with the generator (i.e. a PPA) that has an executed interconnection agreement (IA), existing "Day 1" delivery service or passed the deliverability test, and has been tested for all applicable control area reliability criteria.

Red or Gray Bucket → Green Bucket

In order for a non-deliverable unit (red or gray bucket) to become fully deliverable, the following must take place:

- Generator Interconnection Request for NRIS must be submitted
  - Note in a cover letter to MISO that this is an existing generator and requiring evaluation for deliverability, normally not requiring reevaluation of stability or short circuit reliability.
- A feasibility and impact study will be performed to determine the constraints to be mitigated to become a DNR
- A facilities study will be performed to determine the schedule and cost of the mitigation
- Once the constraints are mitigated, the unit can qualify as a DNR – i.e. green bucket classification

Market Transition Deliverability Test

MTDT:

- Performed in March, 2005
- Model used: MISO MTEP (Midwest Transmission Expansion Plan) Baseline study 2009 model.
- Identified existing units, or portions thereof, that did not meet the new aggregate deliverability test standards.
- Existing units were evaluated in two phases:
  * Registered Generation Resources with NR delivery service (executed IA granting designated Resource Status).
  * Registered Generation Resources with Day 1 service but without designated Network Resource status.
- Results posted on Midwest ISO website.

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What happens next?

With the MTDT completed, MISO has begun to process the Generator Interconnection Request queue.

- No results posted yet
- ATC has brought up concerns regarding honoring Local Capacity Resource rights in the studies
- ATC plans to continue to mirror the MISO process in order to verify results

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Slide info from www.midwestmarket.org website