Reserve Requirement Identification with the Presence of Variable Generation

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Regulation

- **MISO Regulation Requirements**
  - MISO requirement is a bidirectional value varying between 300 MW to 500 MW depending on load level and time of the day
- **Impact of Variable Generation**
  - In general is little to none
  - Wind Generation can impact the net load variability and uncertainty
    - One minute wind generation variation has very little impact on net load one minute variability
    - Standard deviation of Short-term wind generation forecast error is between 0.5% to 1% of wind generation capacity
    - The impact of short-term wind forecast error in net load uncertainty is low

Contingency Reserve(s)

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- **MISO Contingency Reserve Requirement**
  - Criterion: largest generation unit / unit + transmission corridor
  - It is set to 2000 MW
  - Approx. 50% is set as spinning reserve
  - The rest is the supplement reserve (provided by on-line and off-line resources including Demand Response Resources)
  - Due to the deliverability issues there are zonal requirements
    - Up to seven zones
  - Main Characteristics of the Contingency Event
    - Occur very quickly (seconds)
    - Needs to be compensated in 10 minutes
  - Current RTO / ISO practice does not use the contingency reserve for other shortages in the system

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Contingency Reserve(s) – Cont'd

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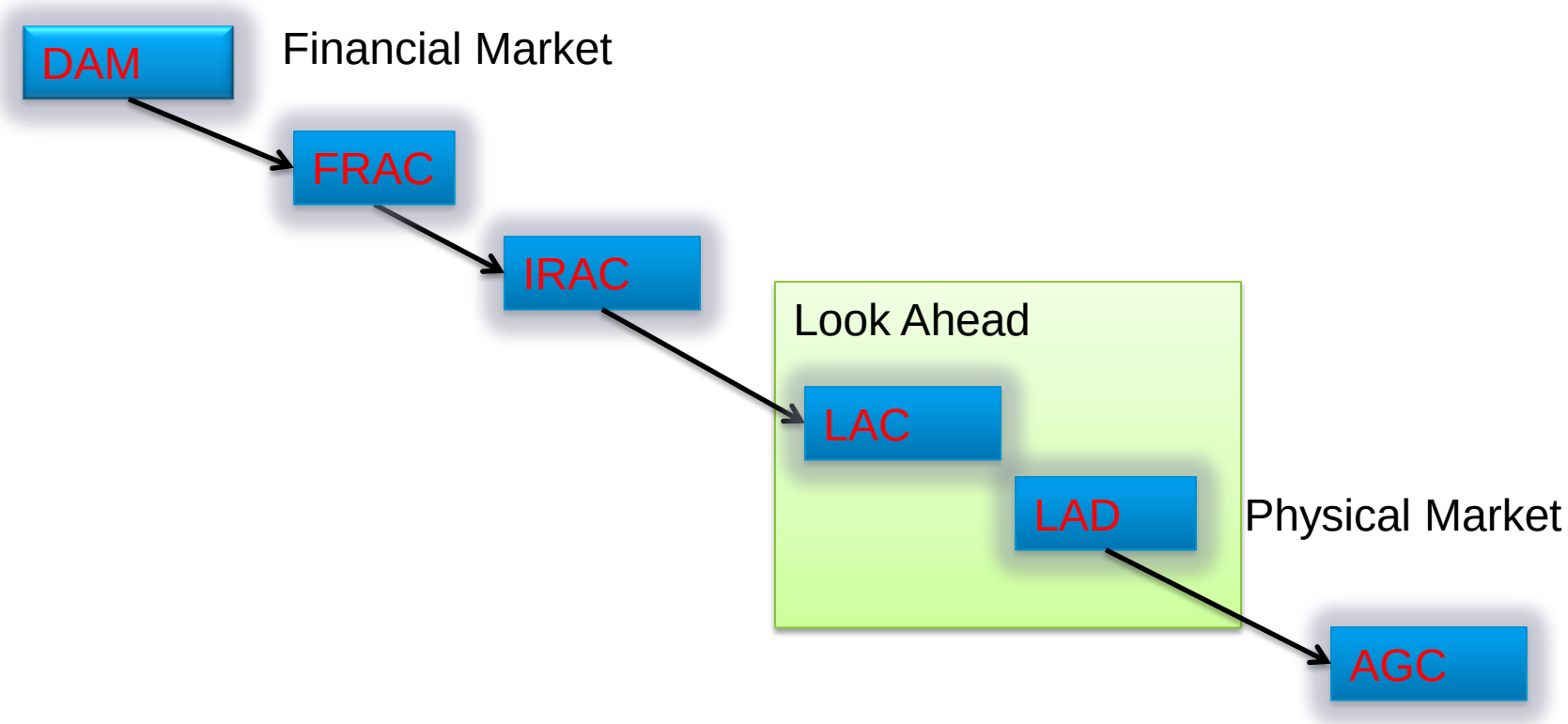
- **Impact of Variable Generation**
  - None. Unless a single wind farm is exceeding the current 2000 MW (system wide) or zonal requirement
  - Forecasted wind generation (and / or actual wind generation) variability has its own latency much longer than a contingency event
    - MISO has experienced loosing wind generation in the magnitude of 6000 to 7000 MW in about 8 hours (majority of these drops were forecasted) – In opposite direction to the load variation
    - Wind generation variation of +/- 2000 MW in 20 minutes (rare events)

Market Systems and Applications



DAM	Day Ahead Market
FRAC	Forward Reliability Assessment Commitment
IRAC	Intra day Reliability Assessment Commitment
LAC	Look Ahead Commitment
LAD	Look Ahead Dispatch (Currently UDS)
AGC	Automatic Generation Control

Fundamental Issue

- **No increase in the conventional reserve requirement**
- **What is the most challenging issue in the day to day operation?**
  - *Ramping Capability*
    - Keeping enough rampable capacity in the system to go after the net load variability and uncertainty
  - Enforcing system wide Ramp Up and Down capacity constraints in the Day Ahead process (partly covering intra-hour ramp requirements)
  - Intra Day RAC process updates commitment of the generation resources to make sure upon changes in the system conditions there is enough headroom in the system
  - Following the ramp needs close to the real-time and committing fast start up units if needed
  - Enforcing an offset value in the dispatch function partly to enforce specific positioning of the units

Recent and Planned Enhancements

- **LAC Phase I in the production system**
  - Ability to have automated near real-time commitment decisions
  - On-line system study
  - Intra-hour Commitments / decommitments
  - Transmission System constraint analysis
- **LAC Phase II and LAD**
- **Ramp Products**
  - Under investigation

Ramp Products - Business Drivers

- **Aid reliable operations by keeping sufficient ramp capability available for use in RT dispatch**
  - Manage System Flexibility
- **Incentivize resources to provide ramp capability to be used in the real time market**
- **Ensure price volatility in Real Time is less impacted by transitory ramp shortages and reflects true market economics**
- **Ensure reliable and economical operation in the presence of renewable resources and the potential impacts associated with the EPA mandates**

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Ramp Products - Methodology

- **The Up Ramp Capability and Down Ramp Capability products that enable creation of additional rampable capability to better meet variable net load**
  - Extends the concept of Headroom/Ramp Constraints currently implemented in Day Ahead Commitment function
- **Ramp Capability Requirements in Real Time will address both observed variations in forecasted NSI, load and renewable generation and also uncertainty due to forecast errors**
- **Ramp Capability Requirements in Day Ahead market will fulfill anticipated ramp capability needed in Real Time**

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Ramp Products - Payments and Charges

- **Pricing**
  - Dispatch solutions produces Ramp Capability clearing prices for the incremental cost of additional Ramp Capability products
  - Prices include opportunity costs and demand curves if not fully cleared
- **Payments**
  - Similar to AS products
  - Awarded Ramp Capability is paid product clearing price
- **Charges**
  - Similar to AS products
  - Load charges are increased to compensate for Ramp capability payments to resources however reduced scarcity pricing decreases load payments (*causing an overall production cost saving*)

Questions ?