Defining the Reserve Requirement and the Penalty Factor

SPWG

October 15, 2009

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Defining the Reserve Requirement: Preconditions to Implementation

- **Accurate and dependable measurement of the reserves available on a 5 minute basis**
  - **Primary reserves (150% of largest contingency)**
    - **Primary Reserves (150% of first contingency) is currently not actively controlled for**
      - Sync, Non-Sync, DR (as Tier 2) can contribute
    - **Currently not measured or known on a 5 minute basis**
    - **Not part of SPREGO optimization**
- **Need to resolve measurement issue in all reserves prior to any implementation**

Defining the Reserve Requirement: Primary Reserve

- **The ORDC/RCPFC should represent the willingness to "go short" primary reserves**
  - **Reserve requirement under consideration is the Primary Reserve Requirement (150% of first contingency):**
    - **Primary Reserves (150% of first contingency) is currently not actively controlled for**
      - Sync, Non-Sync, DR (as Tier 2) can contribute
    - **Sync Reserve Requirement (100% of first contingency) is actively controlled for**
      - Sync (including DR as Tier 2) can contribute

Defining the Reserve Requirement: Primary Reserve

- **The ORDC/RCPFC represents the willingness to "go short" primary reserves**
  - **Theoretically, primary reserves (150% Requirement) can be met via sync reserves (including DR)**
  - **Where Primary = Sync + DR + Non Sync**
    - **A minimum amount of Sync (Tier 1 and Tier 2) required (100% of largest contingency)**
    - **Current restriction on max DR contribution towards Sync target (100% Requirement) is 25% (can only be Tier 2)**
    - **Remainder of Primary Reserve target is currently "met" via Non-sync quick start and excess Tier 1**
      - "Remainder" not part of the SPREGO optimization

Defining the Reserve Requirement: Primary Reserve

- **The ORDC/RCPFC represents the willingness to "go short" primary reserves**
  - **Optimization should find the least cost combination of resources to meet the requirement given the "characteristic" constraints**
    - **One penalty factor for violating the target**

Defining the Reserve Requirement: Primary Reserve

- **Sync Requirement Component of Primary Reserve Target**
- **Under current rules Tier 2 assignment is made in the prior hour based on expectations of system conditions and expected available Tier 1 reserves in the coming hour**
  - **Tier 2 assignment = Sync reserve requirement – expected Tier 1**
    - **Could change to Tier 2 Assignment = Primary reserve requirement – expected Tier 1 – expected Non-Sync**
  - **Tier 2 assignments locked for the coming hour**
  - **Tier 2 is a combination of Sync and DR**

Defining the Reserve Requirement: Primary Reserve

- **Under this methodology, “cooptimization” within the hour would see Tier 2 as a “given”**
  - **Contributing towards the Primary Reserve Target (150% Target)**
- **Remainder of requirement can be via a combination of “Tier 1” Sync and Non-sync (observing minimum total Sync requirement)**
  - **One reserve requirement/target**
  - **One penalty factor in play**

Defining the Reserve Requirement: Primary Reserve

- **Subsequent redispatch (if any) to maintain reserves would be done with within-hour resources**
  - **Any shortage would be determined relative to Reserve Requirement net of Tier 2 carried into the hour**
  - **Single reserve requirement being maintained: Primary Reserves**
  - **One penalty factor: No nesting within zone**

Defining the Reserve Requirement: Sync Requirement

- **The ORDC/RCPFC should represent the willingness to "go short" Sync Reserves**
  - **Reserve requirement under consideration is the Sync Reserve Requirement (100% of first contingency):**
    - **Primary Reserves (150% of first contingency) is currently not actively controlled for**
      - Sync, Non-Sync, DR (as Tier 2) can contribute
    - **Sync Reserve Requirement (100% of first contingency) is actively controlled for**
      - Sync (including DR as Tier 2) can contribute

Defining the Reserve Requirement: Sync Requirement

- **The ORDC/RCPFC represents the willingness to "go short" Sync reserves**
  - **Where Sync = Tier 1 + Tier 2**
    - **Combination of Sync (Tier 1 and Tier 2) required (100% of largest contingency)**
    - **Current restriction on max DR contribution towards Sync target (100% Requirement) is 25% (can only be Tier 2)**
    - **Currently part of the SPREGO optimization**

Defining the Reserve Requirement: Sync Requirement

- **The ORDC/RCPFC represents the willingness to "go short" Sync reserves**
  - **Optimization should find the least cost combination of resources to meet the requirement given the "characteristic" constraints**
    - **One penalty factor for violating the target**

Defining the Reserve Requirement: Sync Requirement

- **Under current rules Tier 2 assignment is made in the prior hour based on expectations of system conditions and expected available Tier 1 reserves in the coming hour**
  - **Tier 2 assignment = Sync reserve requirement – expected Tier 1**
  - **Tier 2 assignments locked for the coming hour**
  - **Tier 2 is a combination of sync and DR**

Defining the Reserve Requirement: Sync Requirement

- **Under this methodology, "cooptimization" within the hour would see Tier 2 as a "given"**
  - **Contributing towards the Sync Reserve Target (100% Target)**
  - **Remainder of requirement can be via a combination of "Tier 1" Sync**
  - **One reserve requirement/target**
  - **One penalty factor in play**

Defining the Reserve Requirement: Sync Requirement

- **Subsequent redispatch (if any) to maintain reserves would be done with within-hour resources**
  - **Any shortage would be determined relative to Reserve Requirement net of Tier 2 carried into the hour**
  - **Single reserve requirement being maintained: Sync Reserves**
  - **One penalty factor: No nesting within zone**

Defining the Reserve Requirement Penalty Factor: Considerations

- **The penalty factor sets a cap on the willingness to pay for reserves (max opportunity cost).**
  - **Setting the cap too low may cause a divergence between actual dispatch practice and "cooptimization" model**
- **The penalty factor will affect LMP during scarcity**
  - **Purpose is to signal scarcity and attract resources**
  - **In the context of RPM's role, purpose is to attract "uncommitted resources"**
  - **Setting the price too high may result in a wealth transfer, rather than meaningful increase in resources availability**

Defining the Reserve Requirement Penalty Factor: Considerations

- **No evidence that the scarcity signal in the energy market need exceed $1,000**
  - **Resources, emergency and otherwise, have responded well below that level in the past**
  - **Years of empirical data have indicated that market results in the context of the $1000 cap has attracted imports, max gen, DR**
  - **Last and "only" scarcity event reached $1000 due to administrative process, not by the value of the most expensive *marginal* resource**
  - **If the most expensive resource available is $150:**
    - **The value of using $850 to force prices to $1000 is unclear, value of $1700 in penalty factors is less clear**
    - **The opportunity cost for re-dispatched resources should be less than $850 in this scenario**

Defining the Reserve Requirement Penalty Factor: Dispatch Issues

- **Many of the issues that PJM is attempting to address with the proposed $850 adder are a result of:**
  - **Inflexible units in the dispatch**
  - **PJM identification of the marginal units, in the context of this inflexibility**
  - **Subsequent price formation**

Defining the Reserve Requirement Penalty Factor: Dispatch Issues

- **"High" caps on opportunity cost are "required" when *very* high cost units set price and *much* lower cost units are dispatched down to meet reserves**
  - **Reason: Limited flexibility of higher cost units**
- **Issue is exacerbated if, subsequently, there is a reserve shortage, and lower cost units become the marginal units for energy:**
  - **Absent the penalty factor, LMP drops while reserves are converted to energy from the lowest cost unit**
  - **Reason: Lowest cost unit is now the marginal unit**

Defining the Reserve Requirement Penalty Factor: Dispatch Issues

- **At issue:**
  - **High priced, inflexible units (or units that are ramp constrained during times of reserve constraint violation) have been dispatched and are obviously needed**
  - **Inflexibility negates marginal status and confers it on to lower cost flexible resources**
  - **Not an issue of failing to account for emergency DR or emergency generation**

Defining the Reserve Requirement Penalty Factor: Dispatch Issues

- **Current proposal of $850 is avoiding the central issue:**
  - **Inflexibility negates marginal status and confers it on to lower cost flexible resources**

Dispatch Issues: Possible Fix (Option 1)

- **Possible approaches to address:**
  - **Use the logic that allows inflexible, but needed CTs to be marginal**
    - **Apply to all needed, inflexible otherwise marginal units**
  - **Would still need the opportunity cost to be effectively "uncapped" prior to scarcity**
  - **Going short "Penalty factor" addition to marginal unit bus LMP**
    - **Adder = $1000 – Marginal Offer at marginal unit bus**
      - Pegs LMP at $1000 during scarcity event
      - Maintain control through dispatch incentives between energy and reserves (opportunity cost is being calculated relative to $1000 derived marginal unit effect on LMP)

Dispatch Issues: Possible Fix (Option 2)

- **During shortage replace the offers of low cost marginal units with the offers of *needed* (for energy and already dispatched) high cost inflexible units.**
  - **Only during reserve shortage**
  - **Would need to make sure "flexibility" limitations are legitimate (by class of unit, historical performance)**
  - **Would need to make sure that "need" is not a function of limited run times**
  - **$1000 "cap" on opportunity cost *prior* to shortage**
    - **Re-dispatch is "unconstrained" under current bid cap**

Dispatch Issues: Possible Fix (Option 2)

- **During shortage penalty factor set equal to the difference between $1000 and the offer of the highest priced unit applied to the marginal unit.**
  - **Marginal "offer" (replaced offer) is $800, penalty factor is $200, LMP is $1000 at marginal bus.**

Dispatch Issues: Possible Fix (Option 2)

- **During shortage replace the offers of low cost marginal units with the offers of *needed* (and already dispatched) high cost inflexible units**
  - **Would eliminate the need for "excessive" penalty factors applied to LMP to reflect scarcity and control dispatch**
  - **Would set LMP consistent with current resource offer caps**
  - **Would ensure full resource stack is dispatched**