SHORTAGE COST PRICING MODEL (SCPM)

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OVERVIEW

Shortage Cost Pricing for energy during the Summer months has been identified as a key issue for Summer 2003.

This presentation describes a model that will:

- be a post-processor to SCD, running as soon after SCD as is practicable;
- implement Reserve Shortage Cost Pricing;
- allow the bids of EDRP and SCR resources that have been directed to curtail their consumption to be eligible to set real-time energy prices.

The model will only be run if SCR or EDRP resources have been curtailed or if there is a 10-minute total reserve shortage.

The data requirements for the model include:

- Estimated SCR/EDRP response by location
- Offer prices and dispatchable capacity for the set of available generation resources
  - all on-line on dispatch generation
  - off-line quick start GTs not scheduled to provide 10-minute reserves
  - proxy resources representing the curtailed SCR/EDRP loads
  - possibly other generation resources that were not committed by BME
- First ideal dispatch generation basepoints, monitored line flows, penalty factors and shift factors
- SCD prices from the second ideal dispatch

SCPM will solve two additional least-cost dispatches to meet estimated curtailed SCR and EDRP load using the set of available generation resources.

The two dispatches would correspond to the first and second ideal dispatches of the hybrid pricing logic currently implemented in SCD.

The model would take the first ideal dispatch solution from SCD as a given and then perform an incremental dispatch to meet the additional load that would have been present had the SCR and EDRP loads not been curtailed.

By extracting the shift factors and flows out of SCD's first ideal dispatch for all the monitored transmission elements SCPM's incremental dispatch could maintain a security constrained price consistent with the methodology applied in SCD today. The impact of additional loads and incremental generation on the monitored elements could be modeled directly using the shift factors.

The load balance equation for the dispatch will be:

$$\sum_i (LOAD_i \times PF_i) = \sum_j (GEN_j \times PF_j)$$

Where:

$LOAD_i$: the estimated EDRP/SCR response at location i

GEN_j : the incremental generation resources at location j in the SCPM dispatch that can be dispatched to meet the incremental EDRP/SCR load.

PF_k : the penalty factor at location k

The transmission line flows and transmission limits for all monitored elements would be extracted from the first ideal dispatch of SCD and used as initial conditions for the SCPM dispatches. For each monitored facility m there is a flow constraint:

$$FLOW_m - \sum_i (LOAD_i \times SF_{im}) + \sum_j (GEN_j \times SF_{jm}) \leq LIM_m$$

Where:

m : the set of monitored constraints in SCD

$FLOW_m$: the flow on monitored element m from the first ideal dispatch of SCD

LIM_m : the flow limit on monitored element m from the first ideal dispatch of SCD

SF_{km} : the shift factor of location k on monitored element m

The objective function is to minimize the cost of the additional generation dispatched to meet the EDRP/SCR load.

$$MIN\left(\sum_{j} C\left(GEN_{j}\right)\right)$$

Where:

C(GENj) : the cost function associated with the incremental generation on resource j.

SCPM would implement the dual dispatch consistent with its application in SCD today. SCD's dual dispatch uses the second pricing dispatch from the previous SCD run to set upper and lower dispatch limits. This allows capacity that is ramped down because of GT block loading to still be considered in setting prices.

The first time the SCPM SCR/EDRP model is run for an SCR/EDRP event, the dual dispatch in SCPM will use the second pricing dispatch from the last SCD run to set the upper and lower dispatch limits.

In subsequent runs of the SCPM SCR/EDRP model spanning the same SCR/EDRP event, the dual dispatch in SCPM will use the second pricing dispatch from the previous SCPM run to set upper and lower dispatch limits.

In each case, the dispatch limits are set consistent with the prices from the previous real-time dispatch interval.

SCPM would implement the hybrid pricing methodology consistent with its application in SCD today.

Further decisions need to be made regarding which resources would be available for dispatch in SCPM and which of those resources could be blocked on by the hybrid pricing methodology when they were uneconomic in the first SCPM dispatch.

- If all resources including imports, exports, off-dispatch units and 30 minute GTs are available to be dispatched by SCPM then the SCR and EDRP resources may not need to be blocked on by the hybrid.
- If the set of resources available to be dispatched by SCPM is restricted relative to the options that would have been available to BME then the SCR and EDRP resources may need to be blocked on by the hybrid.

SCPM will produce outputs that can be passed into existing LBMP calculation and posting tools.

SCPM outputs will also be passed to the real-time mitigation process.

SCPM will overlay reserve shortage cost pricing rules onto the energy prices of either the SCPM incremental dispatch results (if the SCPM dispatches are run) or the original SCD dispatch results (if the SCPM dispatches are not run).

- The reserve shortage pricing will apply only to the Eastern and pool-wide ten-minute total reserve constraints.
- NYISO operators are required to convert 10-minute non-spinning reserve into energy to maintain 10-spinning reserve so temporary spin shortages do not necessarily reflect conditions that would warrant shortage cost prices.

RESERVE SHORTAGE — Inputs

The inputs to the Reserve Shortage Cost Pricing component of the SCPM model would be:

- Reserve Comparator output indicating the level of Eastern and pool-wide ten-minute total reserves
- Prices from either the SCPM or SCD dispatches
- Components of the SCPM and SCD prices including the reference bus price, penalty factors, shift factors and constraint shadow prices
- A set of rules governing the determination of energy prices in various reserve shortage conditions
  - The rules may implement a single shortage cost price for any degree of reserve shortage or may implement a reserve shortage cost curve where small shortages result in lower prices than large reserve shortages.

An example of a pricing rule for a pool-wide shortage of ten-minute total reserve would be to set the reference bus price to a value, assuming no congestion in the state, such that the New York City zonal price would be $1,000/MWh.

These prices would be compared to the SCR/EDRP SCPM or SCD dispatch energy prices and the higher of the two prices would be posted for every location.

RESERVE SHORTAGE

Eastern Shortage

An example of a pricing rule for a shortage of ten-minute total reserve in the East would be to set the prices in the East, such that the New York City zonal price would be $500/MWh.

All shift factors on constraints in the East would be set to 0. A new proxy constraint would be added where all locations in the East would have a shift factor of 1. The reference bus price from the SCR/EDRP SCPM or SCD dispatch would be held fixed and the shadow price of the new proxy constraint would be increased until the NYC zonal price reached $500/MWh.

The resulting prices would then be compared to the SCR/EDRP SCPM or SCD dispatch energy prices and the higher of the two prices would be posted for every location.

RESERVE SHORTAGE Implementation

We need to define the circumstances under which the reserve shortage cost pricing rule would be applied. Special situations in which different rules may need to be considered include:

- immediately following the end of reserve pickups
- while emergency sales are being made to other control areas out of 10-minute reserves
- during schedule changes at the top of an hour

How the reserve comparator determines the level of available reserves is important to understanding what modifications may need to be made to the general reserve shortage pricing rules to address each of these situations.

LOST OPPORTUNITY Implementation

Having changed the energy prices according to either the SCR/EDRP dispatch or the reserve shortage cost modeling, the lost opportunity costs paid to units scheduled for reserves would also change.

There may be units that are dispatched down by SCD consistent with their bid curves (and the original SCD prices), that are not scheduled to provide reserves and that, under today's rules, would receive no lost opportunity cost payments.

To maintain the correct incentives for all units to follow their basepoints once the prices are changed by SCPM, all on-dispatch units carrying latent 10-minute spinning reserves, whether scheduled to provide reserves by BME or not, should receive lost opportunity cost payments consistent with the energy prices determined by the SCPM model.

- The next steps in the development of this model are:
  - –Complete a Concept of Operations document
  - –Get BIC approval in December to proceed
  - –Complete a Functional Requirement Specification
  - –Get MC Committee and Board approval in January
  - –Tariff language submitted to FERC by late February
  - –Fine tune the business rules and adjust NYISO manuals as necessary – using the Committee process where approriate