Residual Supply Metrics for Transmission Congestions

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Residual Supply Index (RSI)

- RSI is for each congested constraint
- For *i*-th congestion
  - Shift Factor SF(*k*,*i*): resource *k*'s shift factor on *i*-th congestion
  - Schedule MW(*k*): resource *k*'s output (Energy)
  - Pmax(*k*): resource *k*'s maximum output
- Dispatched counter flow of resource *k* for SF(*k*,*i*) < 0:

  D_CFlow(*k*) = SF(*k*,*i*)*MW(*k*)

- Counter flow supply of resource *k* for SF(*k*,*i*) < 0 :

  S_CFlow(*k*) = SF(*k*,*i*)*Pmax(*k*)

Residual Supply Index (RSI)

- Total dispatched counter flow from market participant *P*

  D_CFlow(P) = ∑D_CFlow(k) where *k* belongs to P

- Total dispatched counter flow from all resources

  Total_D_CFlow = ∑D_CFlow(k) for all *k*

- Total counter flow supply from all resources

  Total_S_CFlow = ∑S_CFlow(k) for all *k*

$$\text{RSI(0)} = \frac{Total\_S\_CFlow}{Total\_D\_CFlow} = \frac{\sum_k S\_CFlow(k)}{\sum_k D\_CFlow(k)}$$

Pivotal Residual Supply Index (RSI)

- RSI(1) = $\frac{Total\_S\_CFlow - S\_CFlow(P1)}{Total\_D\_CFlow}$

- RSI(2) = $\frac{Total\_S\_CFlow - S\_CFlow(P1) - S\_CFlow(P2)}{Total\_D\_CFlow}$

- RSI(3) = $\frac{Total\_S\_CFlow - S\_CFlow(P1) - S\_CFlow(P2) - S\_CFlow(P3)}{Total\_D\_CFlow}$

Potential Refinement/Challenges for CPA

- Transmission limits in market operation different from CPA model due to factors such as bias (especially in HASP and RTD)
- Transmission de-rate due to outage
- Transmission outage, leading to new transmission constraints
  - New constraints by default non-competitive, but can indirectly effect competitive constraints)
- Enforce/Un-enforce transmission constraints (may change binding constraints)
- Switch between enforcing contingency and nomogram
- Enforcement of contingency
- Topology change