Flexible Ramping Products

Draft Final Proposal

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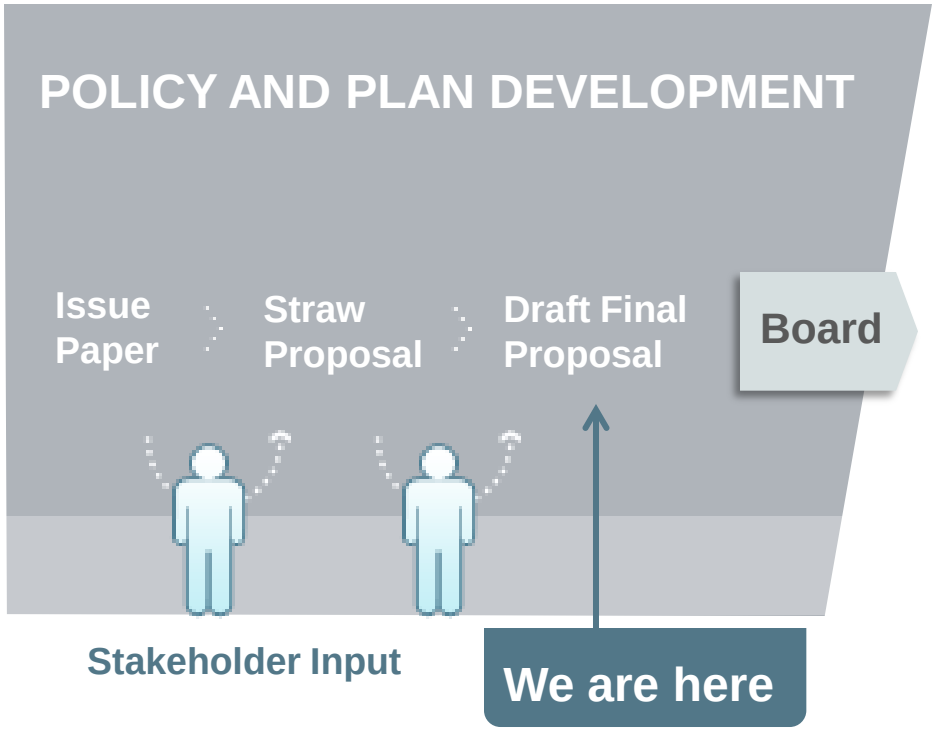
Agenda

Time	Topic	Presenter
10:00 – 10:10	Introduction	Chris Kirsten
10:10 – 12:00	Product Design	Lin Xu
12:00 – 1:00	Lunch Break	
1:00 – 2:45	Product Design (continued)	Lin Xu
2:45 – 3:45	Cost Allocation	Don Tretheway
3:45 – 4:00	Wrap-up and Next Steps	Chris Kirsten

ISO Policy Initiative Stakeholder Process



Flexible ramping product

- What is flexible ramping product?
  - 5-minute ramping capability
- What flexible ramping product can do
  - Improve real-time dispatch flexibility
    - Handle variability and uncertainties happening on 5-minute time frame in the market
    - Reduce power balance violations
  - Mange market cost effectiveness
- What flexible ramping product cannot do
  - Cannot replace ancillary services

Characteristics of flexible ramping products (1 of 2)

- Fast ramping
  - Based on 5-minute ramping capability
  - Ancillary services are based on 10-minute ramping capability

- Dispatched in RTD on a regular basis
  - Ancillary services are not dispatched in RTD on a regular basis
    - Regulation services are controlled by AGC
    - Operating reserves are dispatched in real-time contingency dispatch (RTCD) after major system disturbance
    - Day-ahead non-contingent spinning reserve may be dispatched in RTD, but only when it is over-procured

Characteristics of flexible ramping products (2 of 2)

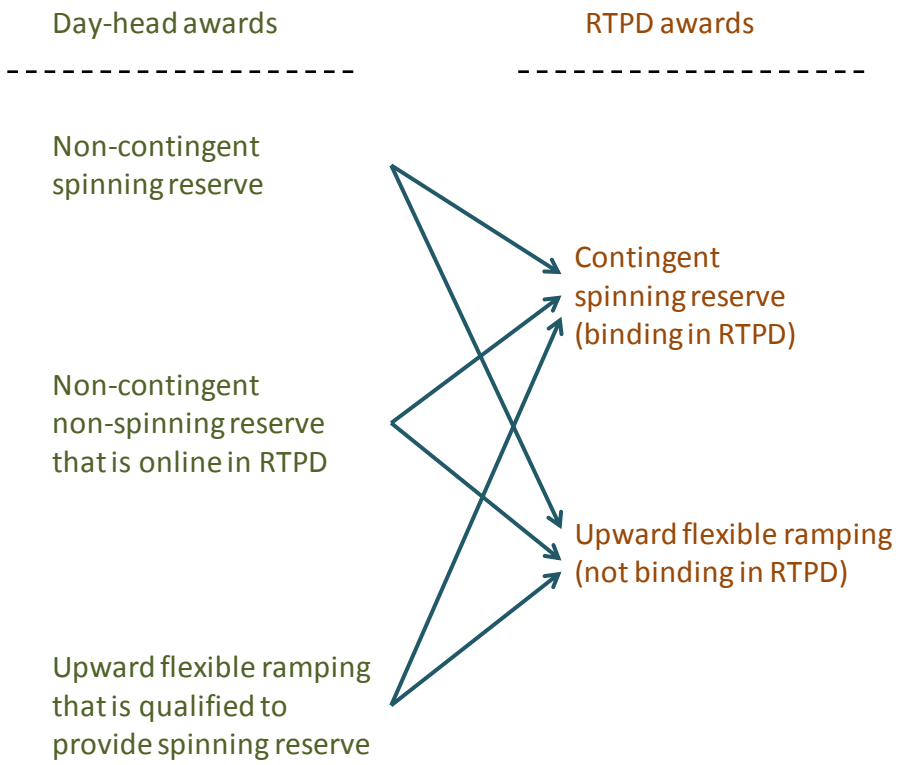
- Flexible ramping capacity preserved now to be used in the future
  - IFM flexible ramping is capacity preserved in IFM to be used in RTD
  - RTD flexible ramping is capacity preserved in the current RTD interval to be used in the next RTD interval
  - Ancillary services are capacity set aside for a trade interval, and to be used for the same trade interval if certain condition is triggered

Flexible ramping products design

- Upward product and downward product
- Any resource that is 5-minute dispatchable can provide flexible ramping
- Awards based on how much a resource can ramp in 5 minutes
- Allow explicit flexible ramping bid
- Flexible ramping procurement process
  - Day-ahead market: co-optimized with energy and ancillary services, and the IFM procurement is financially binding
  - RTUC: co-optimized with energy and ancillary services to create headroom, but the headroom is not financially binding
  - RTD: co-optimized with energy, and the RTD procurement is financially binding.
- Flexible ramping utilization
  - In RTD, procured flexible ramping capacity is utilized in response to realized imbalance

Flexible ramping in RTUC

- Create flexible ramping headroom on a 15-minute interval basis
- Day-ahead flexible ramping awards will be protected
- Determine conversions between non-contingent spinning reserve and upward flexible ramping
  - Only apply to day-ahead awards
  - Spinning reserve converted from day-ahead flexible ramping is financially binding
  - Flexible ramping converted from day-ahead non-contingent spinning reserve is not financially binding in RTUC, but will be re-evaluated in RTD



Flexible ramping capacity bidding rules

- Allow explicit flexible ramping bids (must have economic energy bids)
  - No explicit flexible ramping bid will be assumed to have zero $/MWh bid for flexible ramping
- System wide bid cap = $250/MWh, bid floor = $0/MWh
- SC self provision
  - Only allowed in IFM
  - Real-time energy offer obligation
    - Upward flexible ramping award =>real-time energy offer not higher than min{2*DEB, $300/MWh}
    - Downward flexible ramping award =>real-time energy offer not lower than $0/MWh
- Additional bidding element in IFM
  - Resource specific energy bid cap and floor for real-time energy

Requirement

- ISO performs statistical analysis on imbalance distribution
  - Distribution of RTD net load deviation from RTUC net load:
    - Upward: max{RTD_*i* net load – RTUC net load} over {*i*=1,2,3}
    - Downward: min{RTD_*i* net load – RTUC net load} over {*i*=1,2,3}
  - Distribution of RTD net load change from previous RTD net load
- Being able to cover the imbalance with high confidence
  - Day-head: 60% confidence interval to cover RTD net load deviation from RTUC net load
  - RTUC: 95% confidence interval to cover RTD net load deviation from RTUC net load
  - RTD: to cover the minimum of RTUC confidence interval for the next 5 minutes from the current RTD net load and the 95% confidence interval of the next RTD interval net load change from current RTD

Requirement relaxation and penalties

- Allow requirement relaxation at penalties
  - requirement relaxation from 0 MW to 100 MW, penalty price $100
  - requirement relaxation from 100 MW to 200 MW, penalty price $150
  - requirement relaxation from 200 MW to 300 MW, penalty price $200
  - requirement relaxation above 300 MW, penalty price $250
- Requirement and relaxation enforced in both binding and advisory intervals
- Requirement may be system wide and/or regional
  - Regional flexible ramping cost is subject to regional cost allocation

Factoring energy cost into flexible ramping cost

- Extreme energy bids will be factored into flexible ramping cost
  - Flexible ramping capacity with extreme energy bids will appear to be more expensive
  - Upward: energy bid above $300 factored in with 2.5% probability
  - downward: energy bid below $0 factored in with 2.5% probability
- In real-time markets
  - The energy bid being factored in is the segment at the last MW of the flexible ramping capacity award
- In the day-ahead market
  - The energy bid being factored in is the resource specific bid-in real-time energy cap and floor
  - Resource bid-in real-time energy cap factored into day-ahead upward flexible ramping cost
  - Resource bid-in real-time energy floor factored into day-ahead downward flexible ramping cost

Flexible ramping settlement

- Day-ahead
  - Day-ahead flexible ramping award settled at day-ahead price
- RTUC
  - Spinning reserve converted from day-ahead upward flexible ramping settled at RTUC spinning reserve price minus RTUC upward flexible ramping price
  - Flexible ramping headroom in RTUC including the amount converted from day-ahead non-contingent spinning reserve is not settled
- RTD
  - Incremental flexible ramping award from day-ahead award (the remaining amount if part of the day-ahead flexible ramping award has been converted into spinning reserve in RTPD) settled at RTD flexible ramping marginal price
- Bid cost recovery
  - Flexible ramping bid cost and revenue will be included in bid cost recovery
  - ISO committed resources to provide flexible ramping are allowed to recover total bid cost

Avoid false opportunity cost payment

Capacity	Procure time	Dispatch time	Possible energy lost opportunity	Price includes energy opportunity cost	False lost opportunity cost payment if it is settled	Capacity Settlement
RUC capacity	Day-ahead after IFM	Current RTD	No	No	No	Yes
DA flex ramp	In IFM	Current RTD	IFM	Yes	No	Yes
RTUC flex ramp	In RTUC	Current RTD	No	Yes	Yes	No
RTD flex ramp	In RTD	Next RTD	Current RTD	Yes	No	Yes

The flexible ramping settlement does not create false lost opportunity cost payment.

Flexible ramping compliance

- No pay charges
  - Flexible ramping products have lower payment priority than ancillary services, so no pay charge applies to flexible ramping first before it applies to ancillary services
  - Categories
    - undispatchable capacity (availability limited and ramp limited)
    - undelivered capacity
      - No pay charge only applies to undelivered amount measured by deviation from dispatch instruction
    - unavailable capacity (due to improper generation level)
    - unsynchronized capacity
- Disqualification
  - ISO may check units' ramp rate, and disqualify a resource from providing flexible ramping if the ramp rate cannot be confirmed

Changes from cost allocation straw proposal

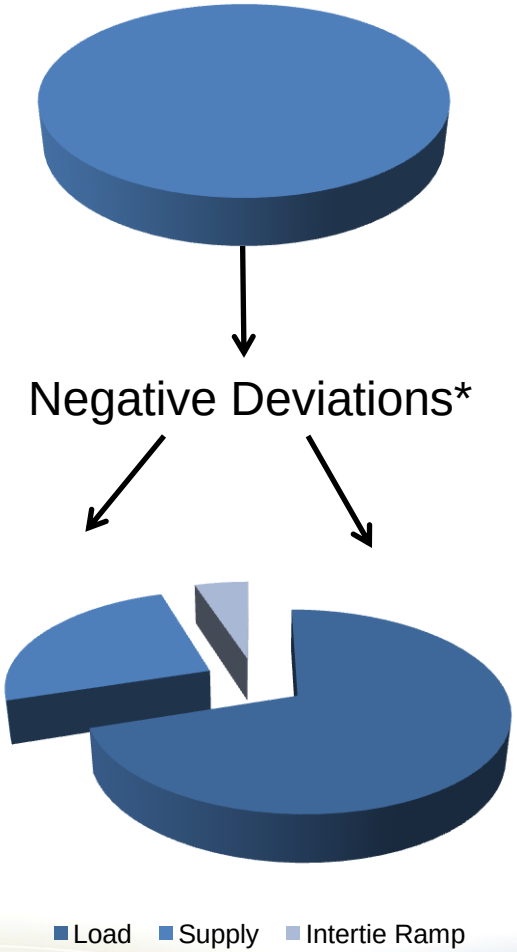
- Supply and intertie ramp netted prior to initial split of costs
- Four daily segments for cost allocation
  - Day: 12:00-18:00
  - Night: 0:00-6:00
  - Morning Ramp: 6:00-12:00
  - Evening Ramp: 18:00-24:00
- Design for regional procurement and allocation
  - The same cost allocation methodology but initial pie is regional versus system
- Spreadsheet example posted on website

Cost allocation guiding principles

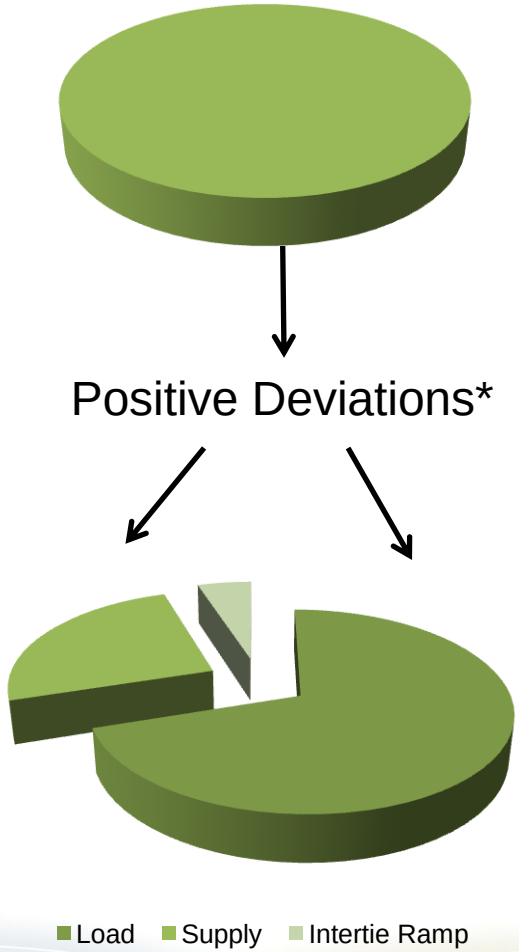
- Causation
- Comparable Treatment
- Accurate Price Signals
- Incentivize Behavior
- Manageable
- Synchronized
- Rational

Allocate flexible ramping product costs consistent with guiding principles

Flexible Ramping Up



Flexible Ramping Down



* Sum of each 10 minute interval

Summary of cost allocation

		Profile	Baseline	Actual	Deviation	Allocation
1	Load	ISO 15 Minute Forecast	Convert Profile to 10 Min	ISO 10 Minute Observed Demand	Net Across LSEs	Load ratio share
2	Variable Energy Resource	Resource's 15 Minute Forecast	Convert Profile to 10 Min	10 Minute Meter	Net Across All Supply Resources	Gross Deviation
	Internal Generation	N/A	Dispatch	10 Minute Meter		Gross UIE
	Interties Operational Adjustments	N/A	N/A	Deemed Delivered		Gross OA
3	Interties Ramp	20 Minute Ramp Modeled	Convert Profile to 10 Min	Assumed Delivered	Net Across SCs	Gross SC Deviation

- Monthly re-settlement of cost allocation
- Functionality to assign costs at resource level

Next steps

Item	Date
Post Flexible Ramping Product Draft Final Proposal	April 9, 2012
Stakeholder Meeting	April 16, 2012
Stakeholder Comments Due	April 23, 2012
Board Meeting	May 16, 2012

Send comments to FRP@caiso.com

Questions

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Upcoming ISO Training Offerings

Date	Training
May 2, 3	New Scheduling Coordinator Certification training (on-site)
June 5	Introduction to ISO Markets (on-site)
June 6, 7	Market Transactions (on-site)
July 10	Settlements Training (on-site)
July 11	Convergence Bidding (on-site)

Training calendar - http://www.caiso.com/participate/Pages/Training/default.aspx
Contact us - markettraining@caiso.com