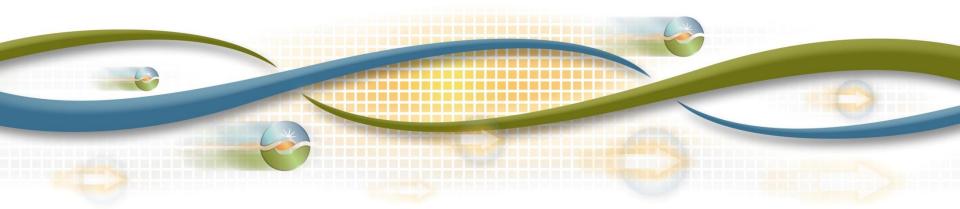# Flexible Ramping Product

2ND Revised Straw Proposal

Lin Xu, Ph.D.
Senior Market Development Engineer

Don Tretheway
Senior Market Design and Policy Specialist
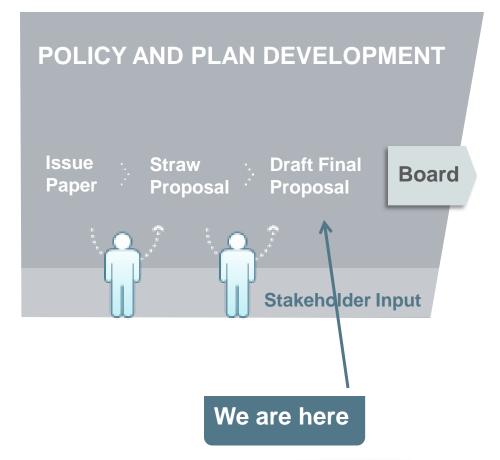
# Agenda

| Time | Topic | Presenter |
|------|-------|-----------|
| 10:00 – 10:10 | Introduction | Chris Kirsten |
| 10:10 – 11:00 | Proposed Market Design Timeline | Don Tretheway |
| 11:00 – 12:00 | 15 Minute Scheduling and Settlement Discussion | Don Tretheway |
| 12:00 – 1:00 | Lunch Break | |
| 1:00 – 2:30 | 15 Minute Scheduling and Settlement Discussion | Don Tretheway |
| 2:30 – 2:45 | Break | |
| 2:45 – 3:55 | Flexible Ramping Product | Lin Xu |
| 3:55 – 4:00 | Wrap-up and Next Steps | Chris Kirsten |

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# ISO Policy Initiative Stakeholder Process



**POLICY AND PLAN DEVELOPMENT**

**Issue Paper** → **Straw Proposal** → **Draft Final Proposal** → **Board**

**Stakeholder Input**

**We are here**

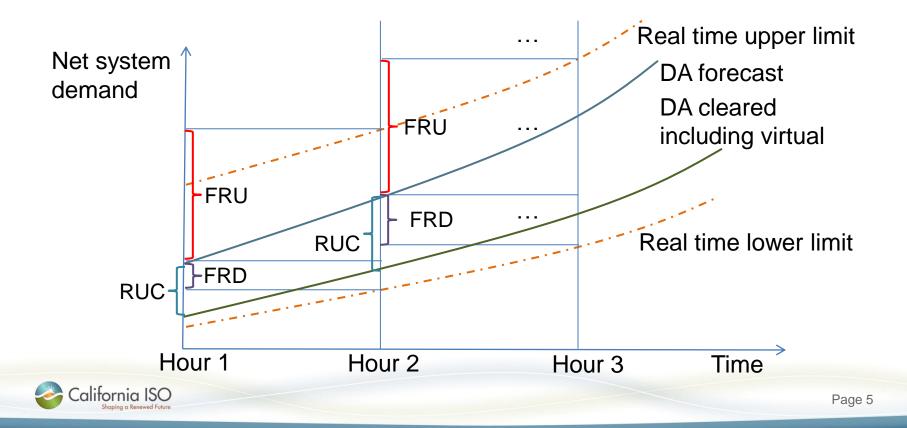California ISO
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# Topics

- Capacity bids
  - Only allow flex ramp capacity bids in day-ahead market
  - Do not allow flex ramp capacity bids in real-time market
- Day-ahead flex ramp procurement
- Downward flex ramp examples

# Day-ahead maximum procurement

- Flex ramp covers potential net movement between net demand forecast in hour t and real-time band in hour t+1
- RUC covers the difference between day-ahead net demand forecast and the cleared net demand in hour t
- Flex ramp capacity reserved on top of RUC schedule

# Day-ahead maximum procurement example

|  | IFM Hour h | RUC Hour h | RT lower limit Hour h+1 | RT upper limit Hour h+1 |
|---|---|---|---|---|
| load | 10000 | 12000 | 11500 | 12500 |
| renewable | 1000 | 2000 | 3000 | 1000 |
| self schedule | 2000 | 2000 | 2000 | 2000 |
| net virtual gen | 200 | 0 | 0 | 0 |
| Net demand | 6800 | 8000 | 6500 | 9500 |
| Requirement |  | RUC | FRD | FRU |
|  |  | 1200 | -1500 | 1500 |

# Downward flex ramp RTD examples

- Demonstrate properties and benefits of downward flex ramp under the assumption that net demand change is accurately predicted
- Four scenarios
    - Scenario 1: single interval RTD optimization without downward flex ramp
    - Scenario 2: single interval RTD optimization with downward flex ramp
    - Scenario 3: two-interval RTD optimization without downward flex ramp
    - Scenario 4: two-interval RTD optimization with downward flex ramp

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# Scenario 1 and scenario 2

Generator data

| Gen | EN Bid | FRU bid | FRD bid | En init | Ramp rate | Pmin | Pmax |
|-----|--------|---------|---------|---------|-----------|------|------|
| G1 | 25 | 0 | 0 | 300 | 10 | 0 | 500 |
| G2 | 30 | 0 | 0 | 100 | 100 | 0 | 500 |

EN – energy     FRU – flexible ramping up     FRD – flexible ramping down

## Scenario 1: no flex ramp down

| | Interval t  (LMP=$30) | | |
|-----|--------|-------------------|-------------------|
| gen | Energy | Flex-ramp up | Flex-ramp down |
| G1 | 350 | | |
| G2 | 30 | | |

## Scenario 2: with flex ramp down

| | Interval t  (LMP=$25, FRDP=$5) | | |
|-----|--------|-------------------|-------------------|
| gen | Energy | Flex-ramp up | Flex-ramp down |
| G1 | 260 | | 50 |
| G2 | 120 | | 120 |

# Scenario 3: look ahead without flex ramp

| gen | Interval t (LMP=$30) | | | Interval t+5 (LMP=$20) | | |
|---|---|---|---|---|---|---|
| | Energy | Flex-ramp up | Flex-ramp down | Energy | Flex-ramp up | Flex-ramp down |
| G1 | 260 | | | 210 | | |
| G2 | 120 | | | 0 | | |

- Price consistency
  - Price consistent with bid over the horizon, but not on single interval basis
  - How about price consistency over time with settling the first interval
    - If net system demand is slightly higher in RTD interval t+5, the binding RTD LMP for interval t+5 will be $25 set by G2. In this case, G1 is over paid $5 in interval t.
    - If net system demand is slightly lower in RTD interval t+5, the binding RTD LMP for interval t+5 will be -$35 as a result of power balance violation due to insufficient downward ramp. However, if RTD had created more downward ramping capability in interval t, we could have prevented the power balance violation.

# Scenario 4: look ahead with flex ramp

| gen | Interval t (LMP=$25, FRDP=$5) | | | Interval t+5 (LMP=$25) | | |
|-----|--------|------------------|--------------------|--------|------------------|--------------------|
|     | Energy | Flex-ramp up | Flex-ramp down | Energy | Flex-ramp up | Flex-ramp down |
| G1  | 259.99 |                  | 50                 | 210    |                  |                    |
| G2  | 120.01 |                  | 120.01             | 0      |                  |                    |

- Price consistency is maintained for both intervals with downward flex ramp requirement slightly higher than the expected system movement
  - How about price consistency over time with only settling the first interval
    - If net system demand is slightly higher in RTD interval t+5, the binding RTD LMP for interval t+5 will be $25 set by G1.  In this case, price is consistent with bid over time.
    - If net system demand is slightly lower in RTD interval t+5, the binding RTD LMP for interval t+5 will still be $25. In this case, price is also consistent with bid over time.
- With flex ramp, the RTD price is less volatile, and fully support the schedule in this example without causing any bid cost recovery

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# Next Steps

| Item | Date |
| --- | --- |
| Post 2nd Revised Draft Final Proposal | October 24, 2012 |
| Stakeholder Meeting | October 30, 2012 |
| Stakeholder Comments Due | December 1, 2012 |
| Resume Stakeholder Initiative | June 2013 |
| Board of Governors Meeting | Fall 2013 |

ISO will hold technical conference in early 2013 on iDAM

Submit written comments to FRP@caiso.com

# Questions

Product design:
Lin Xu
lxu@caiso.com
916-608-7054


Cost Allocation:
Don Tretheway
dtretheway@caiso.com
916-608-5995

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