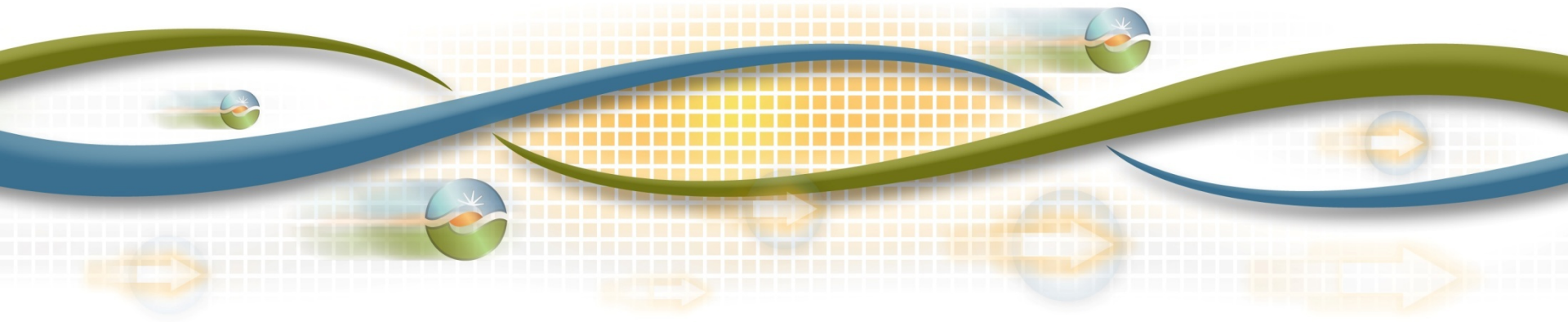


Flexible Ramping Products

Third Revised Straw Proposal, March 14, 2012

Lin Xu, Ph.D.

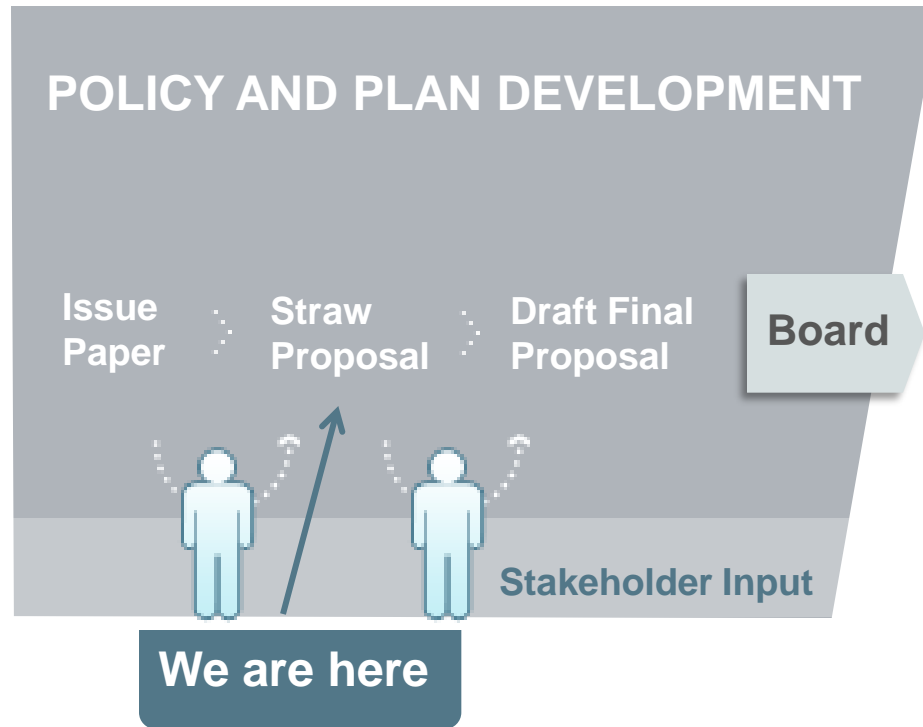
Senior Market Development Engineer



Agenda

Time	Topic	Presenter
1:00 – 1:15	Introduction	Chris Kirsten
1:15 – 2:45	Product Design	Lin Xu
2:45 – 3:00	Next Steps	Chris Kirsten

ISO Policy Initiative Stakeholder Process



Topics addressed in the third revised straw proposal

New design element	Stakeholders comments
Bid cap	SCE, DMM
Self provision	PG&E
Relaxation penalty	SCE, DMM
Factoring expected energy cost into flexible ramping cost	PUC
Linking day-ahead flexible ramping award and real-time energy offer	SCE
No pay rules	SCE
Clarification or discussion	Stakeholders comments
Conversion v.s. substitution	SCE, NRG, PUC
Discussion of false opportunity payment in IFM, RTUC, RTD	PG&E, SCE, PUC, DMM, WPTF, NRG
Flexible capacity certification	PG&E
Market power mitigation for flexible ramping products	DMM

Characteristics of flexible ramping products

- 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 dispatched by AGC in real-time
 - Operating reserves are dispatched in RTCD after major system disturbance
 - Day-ahead non-contingent spinning reserve may be dispatched in RTD, but only when it is over procured
- 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 capacity bidding rules

- Bid cap
 - \$250/MWh
 - The spinning reserve bid if it is available
- Self provision
 - Only allowed in IFM
 - If a resource chooses to self provide upward flexible ramping capacity, its real-time energy offer cannot exceed
 - Two times its default energy bid
 - \$300/MWh
 - If a resource chooses to self provide downward flexible ramping capacity, its real-time energy offer cannot be lower than
 - \$0/MWh

Flexible ramping requirement relaxation penalties

- requirement violation from 0 MW to 100 MW, penalty price \$100
- requirement violation from 100 MW to 200 MW, penalty price \$150
- requirement violation from 200 MW to 300 MW, penalty price \$200
- requirement violation above 300 MW, penalty price \$250

Certification and market power mitigation

- Certification
 - Any resource with economic energy bid can provide flexible ramping capacity
 - No need to have certified capacity
 - The ISO has the right to check ramp rate and disqualify a resource from providing flexible ramping if the actual ramp rate differs significantly from the bid/registered ramp rate
 - Flexible ramping award is subject to no pay rules (to be discussed)
- Market power mitigation
 - Bid cap, implicit offer rule, and requirement relaxation are able to address the market power concern
 - The ISO is not proposing sophisticated mitigation mechanism now, but may do so in the future if the need arises

Conversion vs substitution

- Substitution describes relationship between products
 - Directional: e.g. product A is substitutable for product B
 - Quality implication: product A of higher quality than product B
 - Due to the differences (discussed on slide 5), flexible ramping products and ancillary services are not substitutable for each other
- Conversion
 - Let real-time optimization make a second decision about the day-ahead capacity awards
 - Use the capacity in a more valuable way
 - It does not apply on a product basis
 - Will not harm the bidder
- Bid replacement
 - Stakeholders want to use non contingent spinning reserve bid for upward flexible ramping capability if cheaper than the upward flexible ramping bid
 - This is neither substitution nor conversion, rather this is bid replacement
 - This can be achieved by implementing the bidding rule that flexible ramping bid should be lower than non contingent spinning reserve bid

Discussion of 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

Factoring energy cost into flexible ramping cost

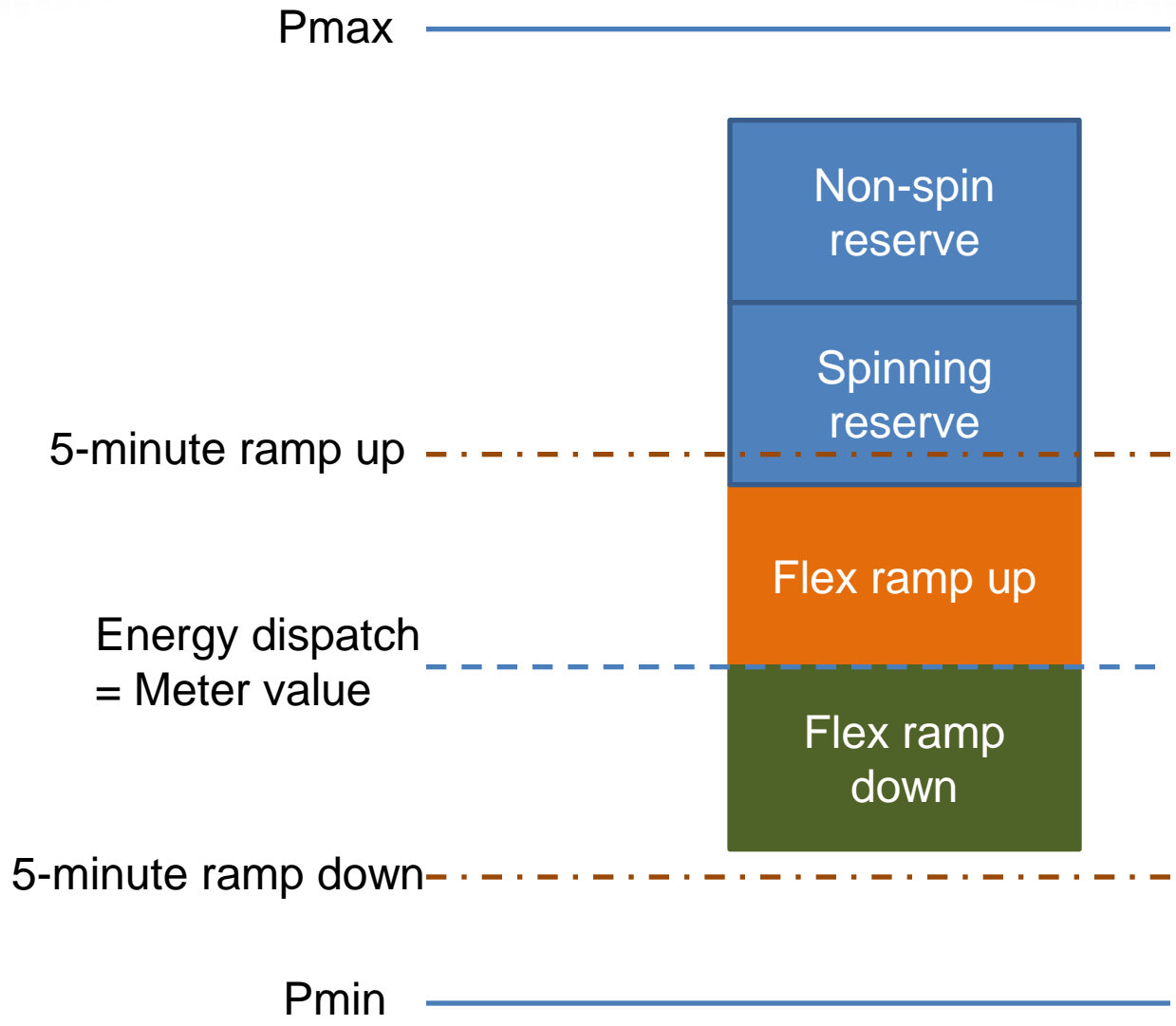
- Awarding flexible ramping should consider not only the capability bid, but also the energy dispatch cost
 - Same capability bid, but different energy bid will result in different overall cost
 - Optimization should award resources with lower overall cost
- Extreme energy bids will be factored into 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
- Will not necessarily increase procurement cost
 - Resource should anticipate the energy cost adder and reduce the capacity bid to keep the composite flexible ramping cost the same

Linking day-ahead flexible capacity award and real-time energy bids

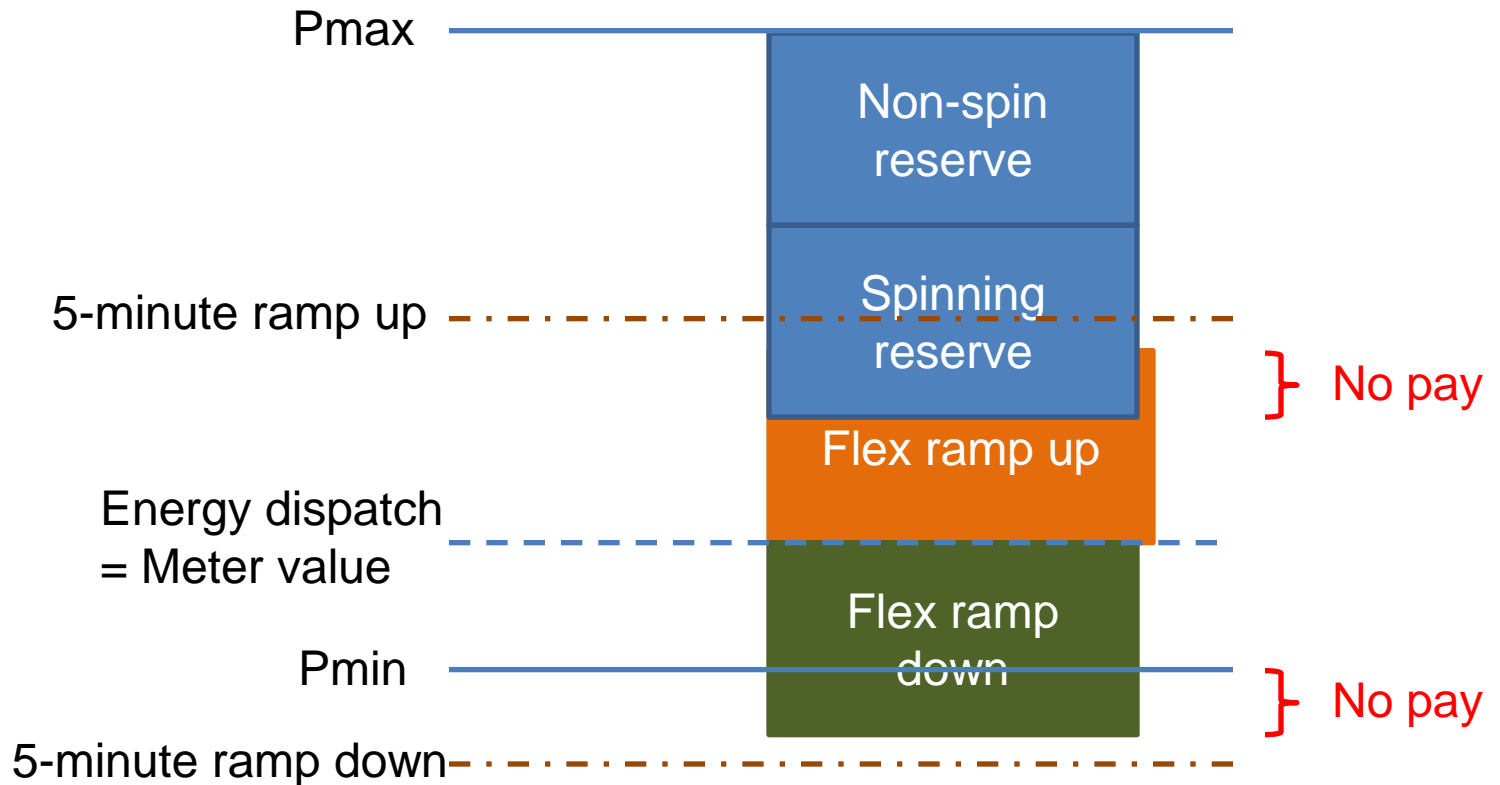
- Resources with day-ahead flexible ramping awards may strategically change energy bids in real-time markets
- Stakeholders oppose locking day-ahead energy bid in real-time markets
- Alternative solution
 - A resource can offer in IFM a real-time energy bid range [bid floor, bid cap] that it must comply with in real-time markets
 - The resource specific bid cap will be used to calculate the composite upward flexible capacity cost in IFM
 - The resource specific bid floor will be used to calculate the composite downward flexible capacity cost in IFM
 - A resource has incentive to accurately estimate the real-time bid range
 - Too wide range will reduce the likelihood of being awarded flexible ramping capacity in IFM
 - Too narrow range will restrain the real-time energy bids

Flexible capacity no pay rules

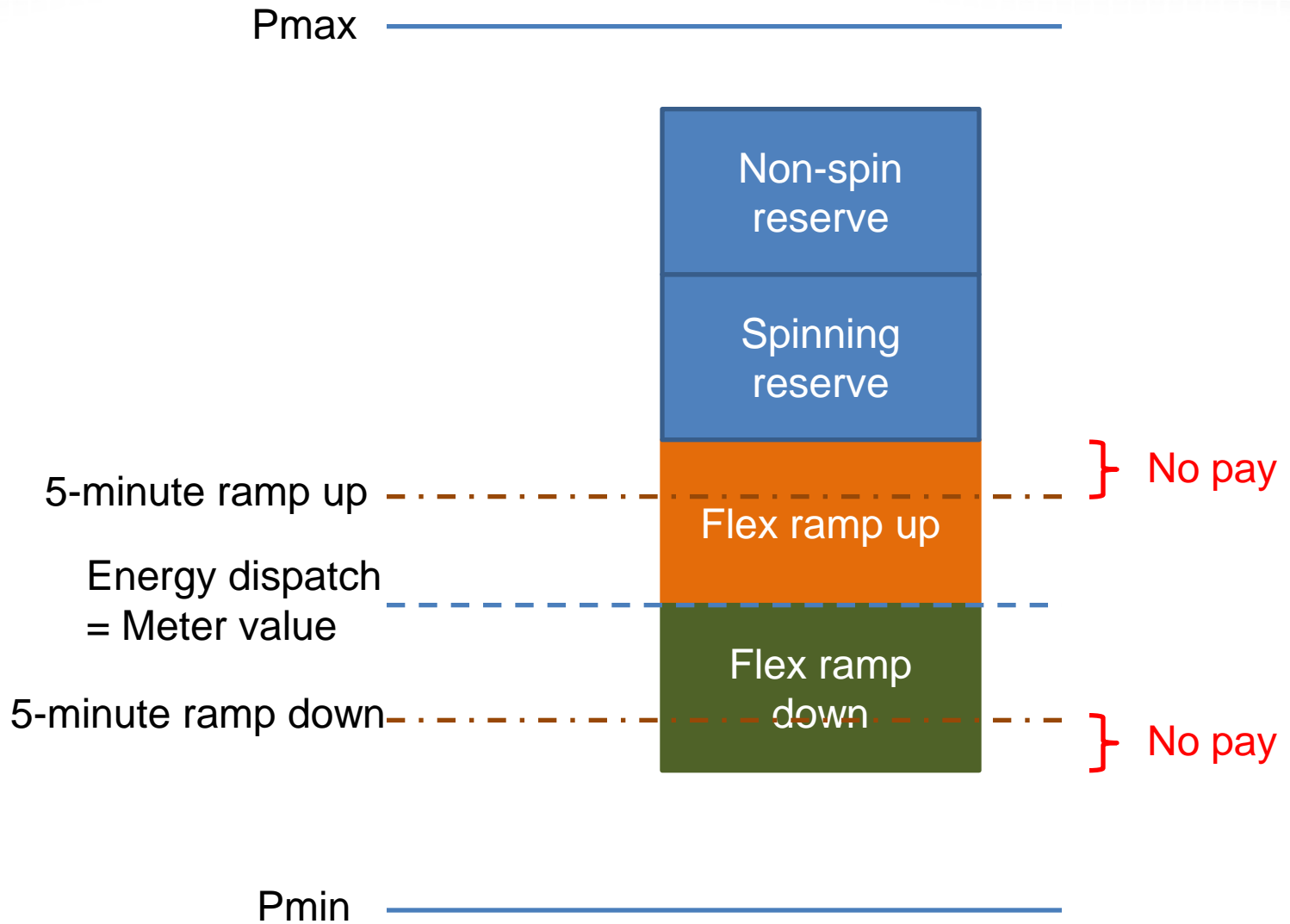
- Categories
 - undispatchable capacity
 - Availability limited
 - Ramp limited
 - undelivered capacity
 - unavailable capacity
 - Due to uninstructed deviations
 - unsynchronized capacity
 - No pay if the resource does not comply with the synchronization standards
- Priority
 - Flexible ramping products have a lower priority than ancillary services



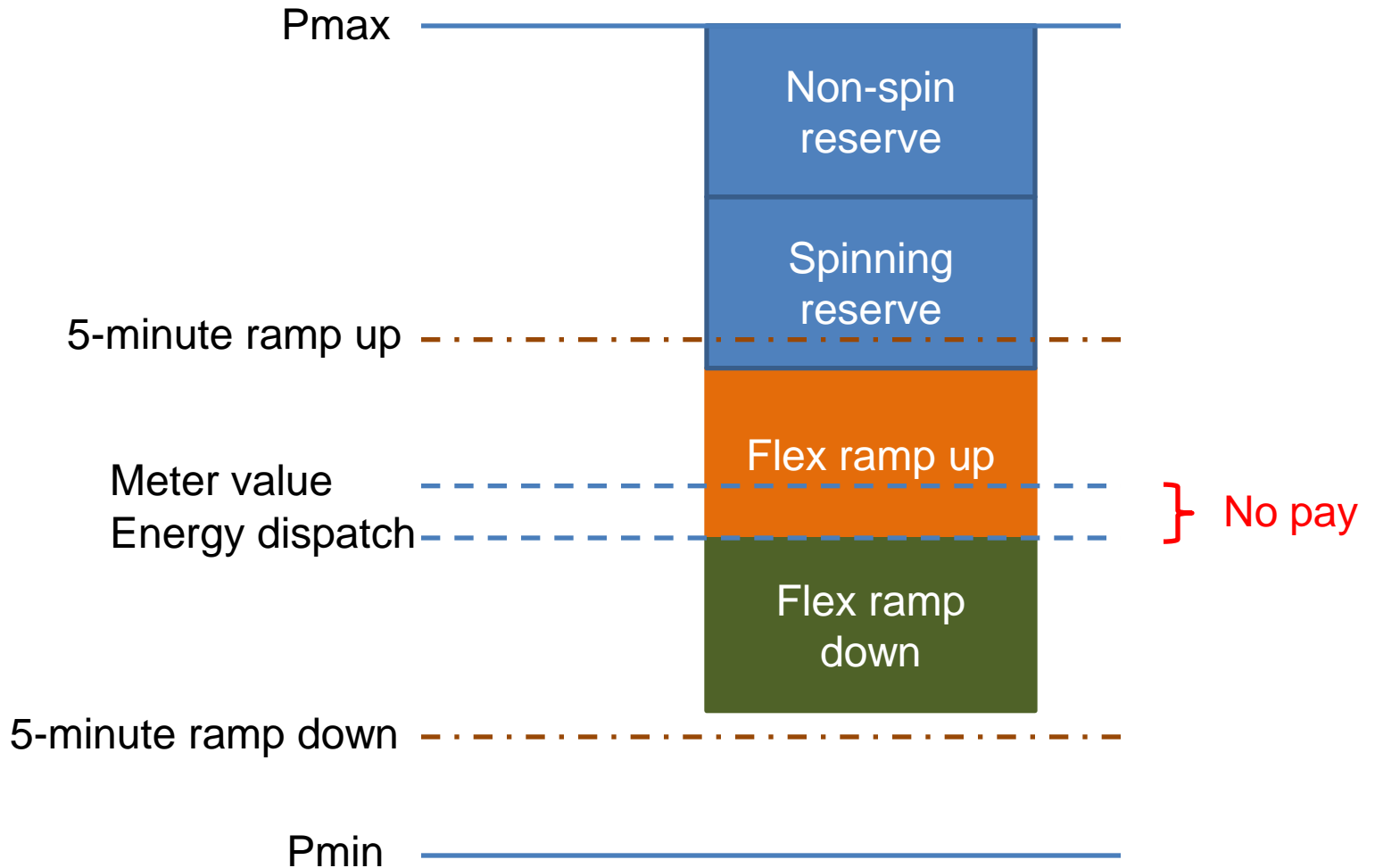
Normal case (no payment rescissions)



Availability limited capacity no-pay



Ramp limited capacity no-pay



Unavailable capacity no-pay

Undelivered capacity no pay

- For a trade day
 - Ramp up 5-minute intervals T+
 - t in T+ if expected energy(t+5) > expected energy(t)
 - Ramp down 5-minute intervals T-
 - t in T- if expected energy(t+5) < expected energy(t)
- Upward flexible capacity no pay for ramp up intervals if negative uninstructed deviation at t+5 exceeds 10% of upward flexible ramping award at t

$$\frac{\sum_{t \in T+} UIE_5^-}{\sum_{t \in T+} FRU} > 10\%$$

- Downward flexible capacity no pay for ramp down intervals if positive uninstructed deviation at t+5 exceeds 10% of downward flexible ramping award at t

$$\frac{\sum_{t \in T-} UIE_5^+}{\sum_{t \in T-} FRD} < 10\%$$

- 5-minute meter value options
 - Flat: same as 10-minute meter value
 - Pro rata: proportional to 5-minute expected energy

Next steps

Item	Date
Post Third Revised Straw Proposal	March 7, 2012
Stakeholder Conference Call	March 14, 2012
Stakeholder Comments Due	March 21, 2012
Post Flexible Ramping Product Design Draft Final Proposal	April 2, 2012
Stakeholder Meeting	April 9, 2012
Stakeholder Comments Due	April 16, 2012
Board Meeting	May 16, 2012

Questions:
Product design:
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Upcoming ISO Training Offerings

Date	Training
March 26	Non-Generator Resource Regulation Energy Management (NGR-REM) (Web conference)
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)

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