California ISO
Shaping a Renewed Future

Flexible Ramping Product

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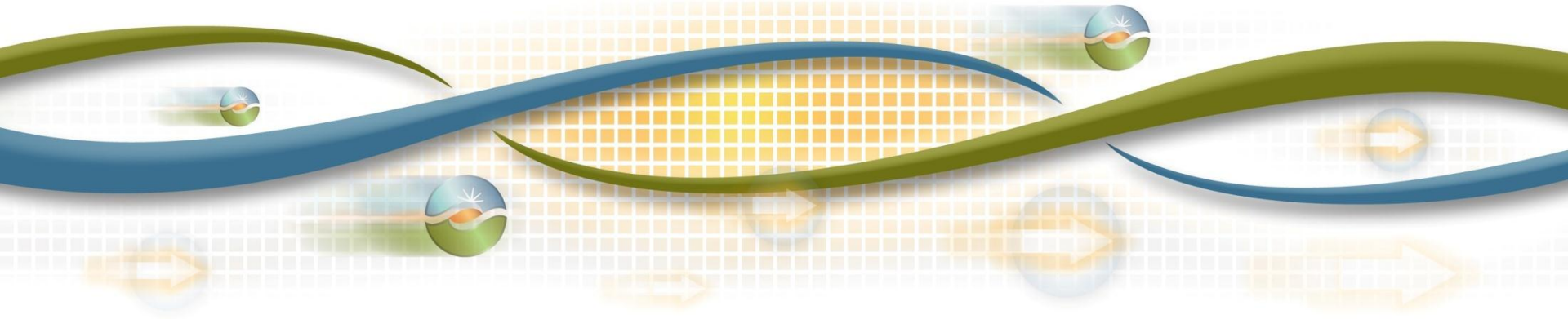
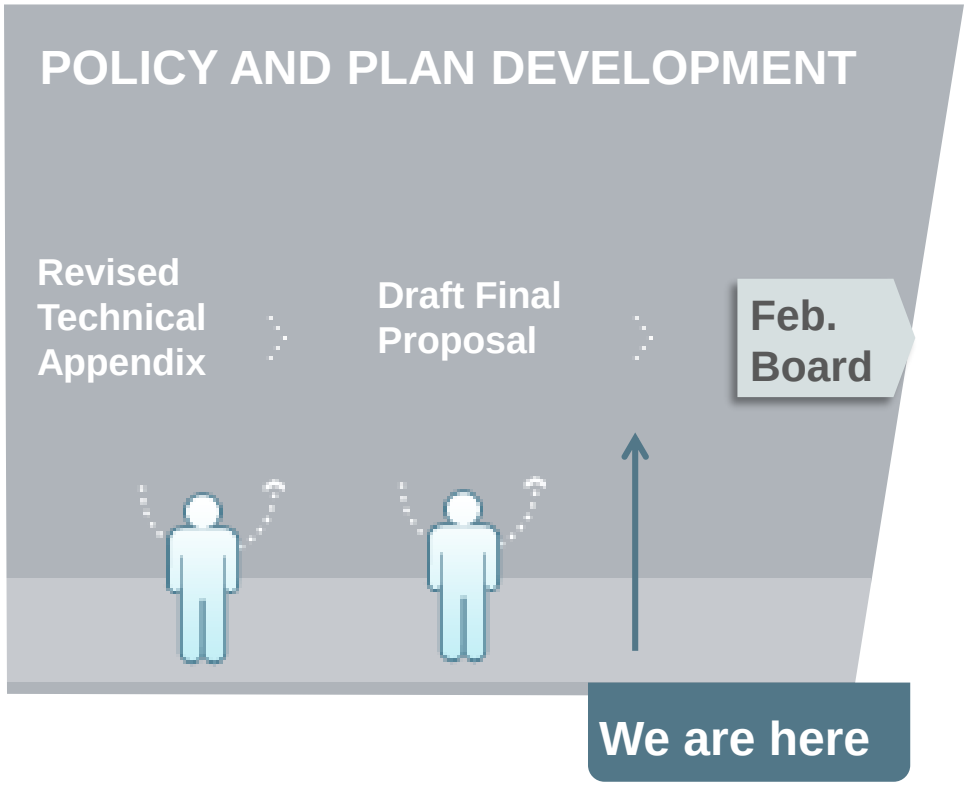


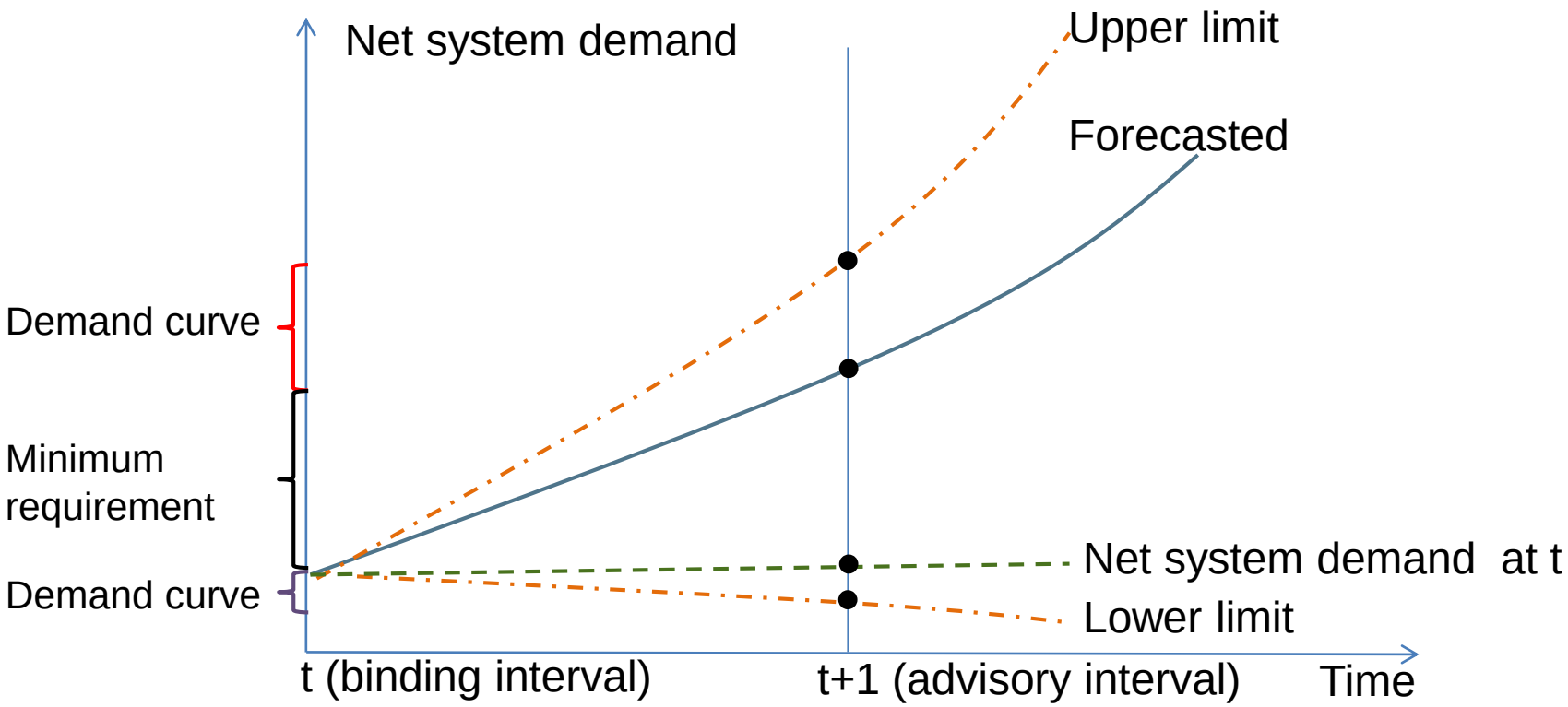
Agenda

Time	Topic	Presenter
1:00 – 1:10	Introduction	Kristina Osborne
1:10 – 2:50	Changes to FRP design	Don Tretheway
2:50 – 3:00	Next steps	Kristina Osborne

ISO Policy Initiative Stakeholder Process

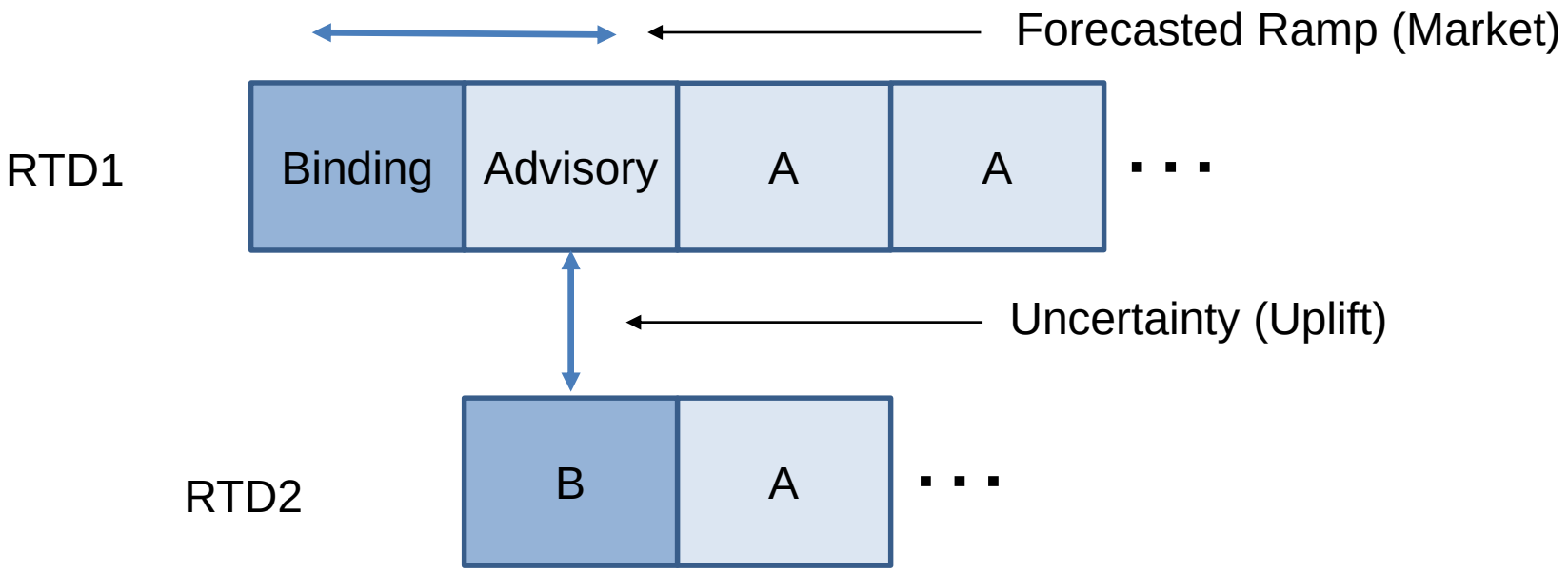


Fundamental FRP design in real-time market



Flexible Ramping Product to meet real ramping need

Forecasted ramp is settled through the market, uncertainty is an uplift



Modify the capacity constraints to allow netting of FRU and FRD to allow for a more flexible dispatch

From:

$$\left.\begin{aligned} &LOL_{i,t+1} \le EN_{i,t} + AF\ FRD_{i,t} \\ &EN_{i,t} + AF\ FRU_{i,t} + NR_{i,t+1} + SR_{i,t+1} \le \min\left(UOL_{i,t+1}, CL_{i,t+1}\right) \\ &LEL_{i,t+1} - AF\ FRD_{i,t} \le EN_{i,t} \le UEL_{i,t+1} - AF\ FRU_{i,t} \end{aligned}\right\} \forall i, t = 1,2, \dots, N-1$$

To:

$$\left.\begin{aligned} &LOL_{i,t+1} \le EN_{i,t} + AF\ \left(FRU_{i,t} + FRD_{i,t}\right) \\ &EN_{i,t} + AF\ \left(FRU_{i,t} + FRD_{i,t}\right) + NR_{i,t+1} + SR_{i,t+1} \le \min\left(UOL_{i,t+1}, CL_{i,t+1}\right) \\ &LEL_{i,t+1} - AF\ \left(FRU_{i,t} + FRD_{i,t}\right) \le EN_{i,t} \le UEL_{i,t+1} - AF\ \left(FRU_{i,t} + FRD_{i,t}\right) \end{aligned}\right\} \forall i, t$$
$$= 1,2, \dots, N-1$$

- The resource can be awarded FRU/FRD so that EN can be optimally determined based on energy requirements.
- The modification accounts for a gap from the previous formulation for the changing forecast for VERs in each binding interval.

Ramp granularity can result in ramp deviations that are settled between FMM and RTD – corrected table

	HE 02						HE 03					
	RTD7	RTD8	RTD9	RTD10	RTD11	RTD12	RTD1	RTD2	RTD3	RTD4	RTD5	RTD6
Prescribed hourly ramp (Avg. MW)	100.00	100.00	100.00	100.00	106.25	118.75	131.25	143.75	150.00	150.00	150.00	150.00

	FMM3	FMM4	FMM1	FMM2
FMM Non-Dispatchable Energy	100.00	108.33	141.67	150.00
FMM Ramp Award (MW)	8.33	33.33	8.33	0.00

FMM Ramp Award (MW)	2.78	2.78	2.78	11.11	11.11	11.11	2.78	2.78	2.78	0.00	0.00	0.00
RTD Incremental Ramp Award (MW)	-2.78	-2.78	-2.78	-4.86	1.39	1.39	9.72	3.47	-2.78	0.00	0.00	0.00
Final Ramp	0.0	0.0	0.0	6.25	12.5	12.5	12.5	6.25	0.00	0.00	0.00	0.00

Hourly block import increasing from 100MW to 150MW

Data release update

- Resource specific movement and uncertainty (CMRI) available starting December 4th

- Requirement calculation (CSV) still pending

Please provide comments on following items to be included in Board comments matrix

- Overall design
- Procurement only in real-time market
- Settlement of forecasted movement
- Settlement of uncertainty
- Demand curve for uncertainty
- Double payment rules
- Other

Next Steps

Item	Date
Revised Draft Final Proposal	December 17, 2015
Stakeholder Call for Revised Draft Final Proposal	January 5, 2016
Stakeholder Comments	January 12, 2016
Board of Governors Decision	February 3-4, 2016

Please submit written comments using the template on the initiative webpage to initiativecomments@caiso.com by close of business January 12.

Materials related to this initiative are available on the ISO website at http://www.caiso.com/informed/Pages/StakeholderProcesses/FlexibleRampingProduct.aspx