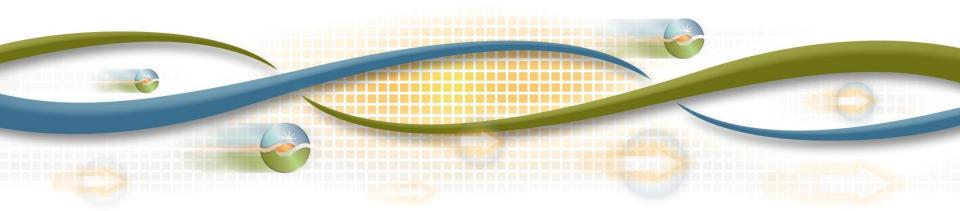


#### Convergence bidding

Engaging in convergence bidding

Hedging examples – using a virtual demand bid to hedge demand



#### Module objectives

 By the end of this module, student will be able to discuss how a virtual demand bid can be utilized to hedge against both demand and supply deviations in the realtime vs day-ahead markets.



#### Why engage in virtual bidding? Base example - demand

- Lori is a Load Serving Entity with 1,000 MW of load
- She schedules 850 MW of her actual load into the dayahead market
- The metered value is 950 MW
- She does not submit any virtual bids

#### Why engage in virtual bidding? Base example – demand

Total net settlement (charge)

Physical load schedule (850MW*\$100)	<u>\$ 85,000</u>
Real-time meter = 950MW RT UIE = meter – Total expected energy = 950-850 = 100	
UIE charge = 100MW*\$120	\$ 12,000

Presented in ISO Settlements format. Positive value = charge;
 Negative value = payment



\$ 97.0

#### Why engage in virtual bidding? Hedging example - demand

- What if Lori had a 100 MW virtual demand bid?
  - buy at the day-ahead price and sell in FMM



### Why engage in virtual bidding? Hedging example - demand

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Day-arread Scriedule	
Physical load schedule 850MW*\$100	\$ 85,000
Virtual demand award 100MW*\$100	10,000
Total day-ahead charge	
	\$ 95,000
Real-time meter = 950MW	
RT UIE = Meter – Total expected energy(Physical)	
= 950MW - 850MW = 100MW	
UIE charge 100MW*\$120	\$ 12,000
Liquidation of virtual demand award 100MW*\$120	( 12,000)
Total real-time payment	0

Total settlement (charge) <u>\$ 95,000</u>



# Why engage in virtual bidding? Hedging example - demand

	Without Convergence Bidding	After Convergence Bidding
Day-Ahead Settlement	\$85,000	\$95,000
RT UIE	12,000	12,000
Virtual Award Liquidation	0	(12,000)
Total Settlement (Charge)	\$97,000	\$95,000

Saved \$2,000 by buying at the DA Price



- Victor is a merchant generator who owns an aging resource with a 400 MW Pmax
- Victor is concerned about a newly found steam tube leak having the potential to force his unit off-line before he can schedule a planned outage
- Victor often self schedules his resource to Pmax

#### Day-ahead schedule

Physical supply schedule (-400MW\*\$50) (\$ 20,000)

Total day-ahead payment (\$ 20,000)

Real-time meter = 250MW

RT UIE = Meter – Total expected energy (Physical)

= 250-400 = -150

UIE charge = -150MW\*\$65 9,750

Total net settlement (payment) (\$\frac{10,250}{}

Presented in ISO Settlements format. Positive value = charge;
 Negative value = payment



- Victor uses virtual bids to hedge against the possibility of a forced outage.
- If he buys at the day-ahead price, he can potentially offset some of his exposure to the FMM prices if his resource actually has an outage.



Day-ahead	schedul	le
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Physical supply schedule -400MW*\$50		(\$ 20,000)
Virtual demand award	200MW*\$50	10,000
Total day-ahead payment		(\$ 10,000)

#### Real-time meter = 250MW

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RT UIE = Meter – Total expected energy (physical)
= 250MW – 400MW = -150MW
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UIE Charge	-150MW*\$65	9,750
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RT liquidation of awarded virtual bid

200 MW\*\$65 (<u>13,000</u>)

Total real-time payment (\$3,250)

Total settlement (payment) (\$\frac{\$13,250}{}\)



	Without Convergence Bidding	After Convergence Bidding
Day-Ahead Settlement	\$20,000	\$10,000
RT UIE	9,750	(9,750)
Virtual Award Liquidation	0	13,000
Total Settlement (Payment)	\$10,250	\$13,250

Made \$3,000 with a 200 MW Virtual Demand Bid



#### Defining convergence bidding Module summary

- Virtual bids are financial position (not physical delivery) at a location (price node) in the day-ahead market
- Virtual awards are paid or charged in the day-ahead market and are liquidated in the real-time market
- Virtual demand buys in the day-ahead and sells back in the real-time (long position)
- Virtual supply sells in the day-ahead and buys back in the real-time (short position)
- Allows participants to hedge prices between the dayahead market and the real-time market

## Defining convergence bidding Module summary

- Virtual bids not used in the market power mitigation process or in the residual unit commitment process of the day-ahead market
- Virtual bids are used in the integrated forward market process
- Virtual bids impact how physical supply is committed in both the integrated forward market and in the residual unit commitment process