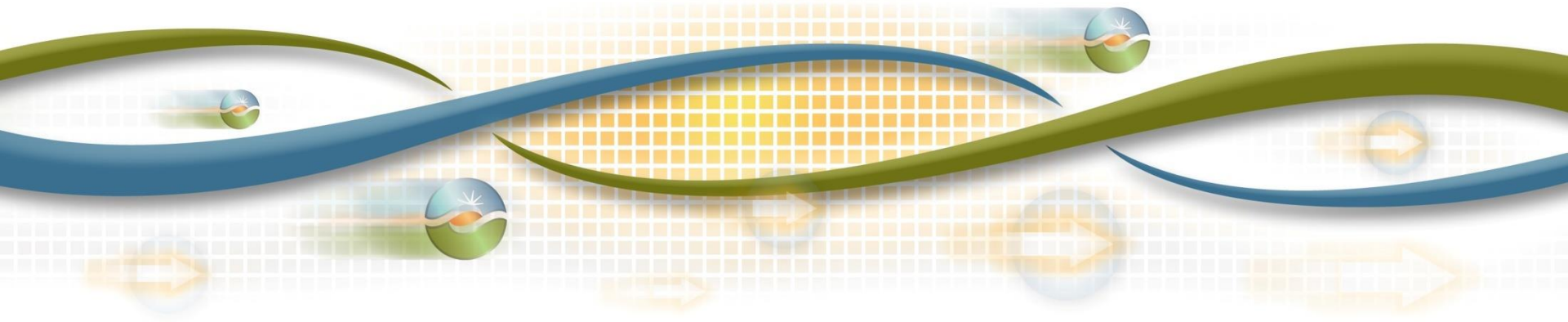


Convergence bidding

Participating in the market
Day-ahead market positions and
Liquidating in the real-time market



Module objectives

By the end of this section, you will be able to:

- Identify the basic structure of the energy bid curves for virtual supply and virtual demand.
- Identify the maximum number of bid segments for virtual bids.
- Describe how the real-time price is determined for the liquidation of virtual awards.

Bidding rules for virtual bids

- Virtual bids in the day-ahead market must have a price and quantity
- Virtual bidding provisions apply only to energy bids.
- Minimum bid is 1 MW for virtual bid
- Virtual supply bids (\$/MWh) would be submitted using monotonically increasing bid curve
- Virtual demand bids (\$/MWh) would be submitted using a monotonically decreasing bid curve

Bidding rules for virtual bids

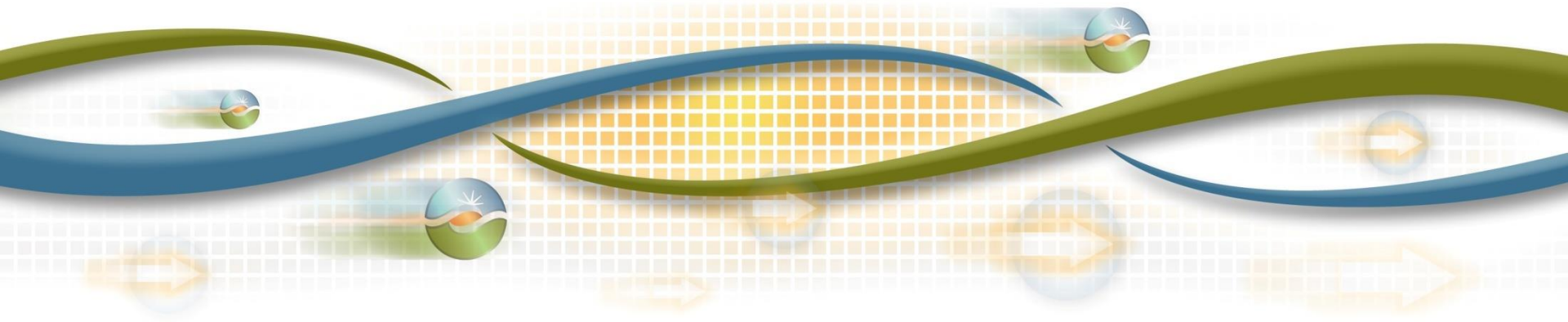
- Bid curve begins at zero (0)
- Maximum of 10 bid segments
- Virtual bids do not include start-up or minimum load costs
- Virtual bids are subject to the same energy bid caps as physical bids.
- Scheduling coordinator may only have one virtual supply bid and one virtual demand bid accepted for each virtual bidding location.

Convergence bids tab in SIBR

The screenshot shows the 'Convergence Bid Summary' page in a web browser. The browser title is '0:Convergence Bid Summary - Windows Internet Explorer'. The page header includes the California ISO logo and the tagline 'Shaping a Renewed Future'. The user name 'DWILKE' is visible. A navigation bar contains several tabs: 'Day Ahead Bids', 'Real Time Bids', 'Trades', 'Adv Submit', 'Portfolios', 'Ind Viewer', 'Convergence Bids' (highlighted with a red box), 'OTC Viewer', 'Energy Forecast', and 'Admin'. Below the navigation bar, there are two sub-tabs: 'Bid Summary' (highlighted with a red box) and 'Hourly Components'. The main content area displays 'Market: Convergence Bid' and 'Tuesday March 31, 2015'. It includes a 'Refresh?' checkbox, an 'Interval [secs]' input field set to '10', a 'Scheduling Coordinator' dropdown, a 'Resource Type' dropdown set to '[ALL]', a 'Location' dropdown set to '[ALL]', and a 'Display Mode' dropdown set to '[ALL]'. A 'Refresh' button is located to the right of these controls. At the bottom, there is a table header with columns: 'Location Name', 'Virtual Demand', 'Virtual Supply', 'EN', 'Submitted', 'Market Status', 'Bid Status', and 'Bid Credit Status'. The table currently shows 'No Rows'.

Convergence bidding

Submitting a virtual demand bid in SIBR



Submitting a virtual demand bid

0:Convergence Bid Summary - Windows Internet Explorer

California ISO
Shaping a Renewed Future

DWILKE

Convergence Bid Summary

Day Ahead Bids | **Convergence Bids** | Trades | Adv Submit | Portfolios | Ind Viewer | OTC Viewer | Energy Forecast | Admin

Market: Convergence Bid

Refresh? Interval [secs] 10

Scheduling Coordinator: ()

Tuesday March 31, 2015
03/31/15

Resource Type: [ALL] | Location: SEMDIO_6_N001

Display Mode: [ALL] | Virtual Demand

Virtual Demand	Virtual Supply	EN	Submitted
No Rows			

Virtual demand may be offered at supply nodes and trading hubs as well as at any other eligible Pnode.

Submitting a virtual demand bid

0:Hourly Bid Components - Windows Internet Explorer

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Shaping a Renewed Future

DWILKE

Hourly Bid Components

Day Ahead Bids Real Time Bids Trades Adv Submit Portfolios Ind Viewer **Convergence Bids** OTC Viewer Energy Forecast Admin

Bid Summary **Hourly Components**

Market: Convergence Bid

Tuesday March 31, 2015
03/31/15

Scheduling Coordinator: [dropdown]
Resource Type: Virtual Demand Location: 3EMIDIO_6_N001
Product Type: Energy
Display Mode: Edit New Bid(s)

Apply

Hourly Bid Components

HR	Location Name	Type	Price Curve
No Rows			

Select
"Energy"

Select
appropriate
location

Submitting a virtual demand bid

Market: Convergence Bid

Scheduling Coordinator:

Resource Type: Virtual Demand Location: _UNIT 2-APND Refresh

Product Type: Energy

Display Mode: [ALL]

Monday March 30, 2015
03/30/15

Hourly Bid Components

HR	Location Name	Type	Price Curve	Bid Status
clear 01	_UNIT 2-APND	D		Created
clear 02	_UNIT 2-APND	D		Valid
clear 03	_UNIT 2-APND	D		Created
clear 04	_UNIT 2-APND	D		Valid
clear 05	_UNIT 2-APND	D		Created
clear 06	_UNIT 2-APND	D		Valid
clear 07	_UNIT 2-APND	D		Created
clear 08	_UNIT 2-APND	D		Valid
clear 09	_UNIT 2-APND	D	109829510	Created

Price Curve

Qty	Price (\$)
0.00	\$65.00
10.00	\$65.00

Price

Price (\$)

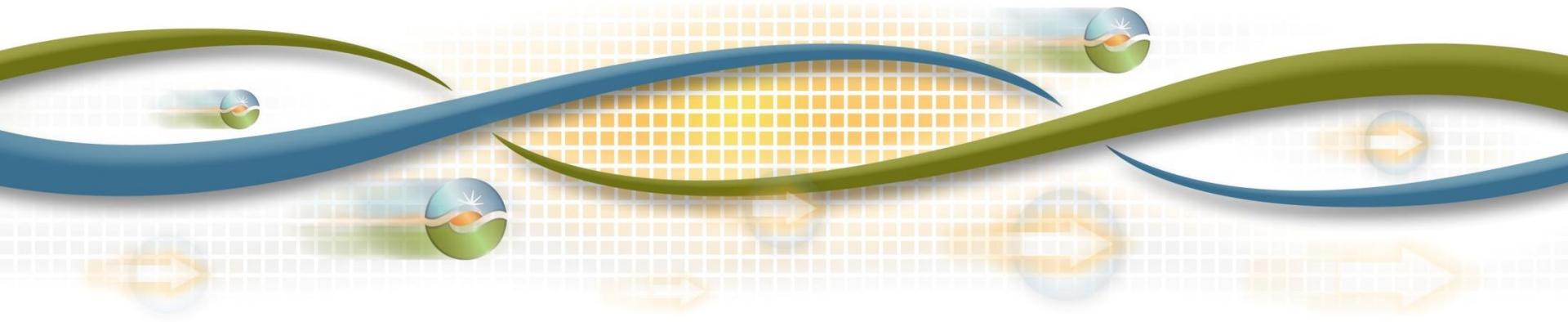
Qty

© SIEMENS AG 2001-2004 3/31/15 13:03:48 PDT

Selecting the graph for the applicable hour will display its price curve

Convergence bidding

Submitting a virtual supply bid



Submitting a virtual supply bid

Virtual supply may be offered at demand nodes and default LAPs as well as at any other eligible Pnode.

The screenshot displays the California ISO web interface for submitting a virtual supply bid. The interface includes the following elements:

- Header:** California ISO logo with the tagline "Shaping a Renewed Future" and the name "DWILKE".
- Navigation Tabs:** Day Ahead Bids, Real Time Bids, Trades, Adv Submit, Portfolios, Ind Viewer, **Convergence Bids** (highlighted), and OTC Viewer.
- Market Selection:** Markets: Convergence Bid. A dropdown menu is open showing "Hourly Components" (highlighted), "Product Display", and "Hourly Display".
- Date and Time:** Monday March 30, 2015, 03/30/15.
- Resource Type:** Virtual Supply (highlighted).
- Location:** TH_SP15_GEN_ONPEAK-APND (highlighted).
- Product Type:** energy.
- Display Mode:** Edit New Bid(s).
- Refresh Button:** Refresh.
- Hourly Bid Components Table:** A table with columns for HR, Location Name, Type, and Price Curve. The table contains 19 rows of data for the location TH_SP15_GEN_ONPEAK-APND, all with Type 'S' and Price Curve '109769449'.

HR	Location Name	Type	Price Curve
01	TH_SP15_GEN_ONPEAK-APND	S	
02	TH_SP15_GEN_ONPEAK-APND	S	
03	TH_SP15_GEN_ONPEAK-APND	S	
04	TH_SP15_GEN_ONPEAK-APND	S	
05	TH_SP15_GEN_ONPEAK-APND	S	
06	TH_SP15_GEN_ONPEAK-APND	S	
07	TH_SP15_GEN_ONPEAK-APND	S	
08	TH_SP15_GEN_ONPEAK-APND	S	
09	TH_SP15_GEN_ONPEAK-APND	S	
10	TH_SP15_GEN_ONPEAK-APND	S	109769449
11	TH_SP15_GEN_ONPEAK-APND	S	109769449
12	TH_SP15_GEN_ONPEAK-APND	S	109769449
13	TH_SP15_GEN_ONPEAK-APND	S	109769449
14	TH_SP15_GEN_ONPEAK-APND	S	109769596
15	TH_SP15_GEN_ONPEAK-APND	S	109769596
16	TH_SP15_GEN_ONPEAK-APND	S	109769596
17	TH_SP15_GEN_ONPEAK-APND	S	
18	TH_SP15_GEN_ONPEAK-APND	S	
19	TH_SP15_GEN_ONPEAK-APND	S	

Submitting a virtual supply bid

The screenshot displays the California ISO web interface for submitting a virtual supply bid. The main interface includes a navigation bar with tabs for Day Ahead Bids, Real Time Bids, Trades, Adv Submit, Portfolios, Ind Viewer, **Convergence Bids**, and OTC Viewer. The 'Convergence Bids' tab is active, showing a 'Market: Convergence Bid' and a 'Hourly Components' dropdown menu. The date is set to Monday, March 30, 2015. The 'Resource Type' is set to 'Virtual Supply' and the 'Location' is 'TH_SP15_GEN_ONPEAK-APND'. The 'Product Type' is 'Energy' and the 'Display Mode' is 'Edit New Bid(s)'. A 'Refresh' button is visible.

The 'Hourly Bid Components' table lists the following data:

HR	Location Name	Type	Price Curve
01	TH_SP15_GEN_ONPEAK-APND	S	
02	TH_SP15_GEN_ONPEAK-APND	S	
03	TH_SP15_GEN_ONPEAK-APND	S	
04	TH_SP15_GEN_ONPEAK-APND	S	
05	TH_SP15_GEN_ONPEAK-APND	S	
06	TH_SP15_GEN_ONPEAK-APND	S	
07	TH_SP15_GEN_ONPEAK-APND	S	
08	TH_SP15_GEN_ONPEAK-APND	S	
09	TH_SP15_GEN_ONPEAK-APND	S	
10	TH_SP15_GEN_ONPEAK-APND	S	109769449
11	TH_SP15_GEN_ONPEAK-APND	S	109769449
12	TH_SP15_GEN_ONPEAK-APND	S	109769449
13	TH_SP15_GEN_ONPEAK-APND	S	109769449
14	TH_SP15_GEN_ONPEAK-APND	S	109769596
15	TH_SP15_GEN_ONPEAK-APND	S	109769596
16	TH_SP15_GEN_ONPEAK-APND	S	109769596
17	TH_SP15_GEN_ONPEAK-APND	S	
18	TH_SP15_GEN_ONPEAK-APND	S	
19	TH_SP15_GEN_ONPEAK-APND	S	

An inset window titled '6: Siemens JSDK Test Application - Windows Internet Explorer' shows a 'Price Curve' graph. The graph plots Price (\$) on the y-axis (0 to 25) against Qty on the x-axis (0 to 500). The price is constant at \$15.00 until a quantity of 300, where it steps up to \$20.00. A table next to the graph shows the data points:

Qty	Price
0.00	\$15.00
300.00	\$20.00
400.00	\$20.00

Locating interchange OTC limits in SIBR

0:Limit Values - Windows Internet Explorer

California ISO
Shaping a Renewed Future

DWILKE

Limit Values

Dev. Ahead Bids | Real Time Bids | Trades | Adv. Submit | Portfolios | Ind Viewer | Convergence Bids | **OTC Viewer** | Energy Forecast | Admin

Limit Viewer

Refresh? Interval [secs] 10

Monday March 30, 2015
03/30/15

Interchange: [SET] Refresh

Hour: [ALL]

Limit Values

HR	Interchange Name	Import Limit	Export Limit	Cutoff Import Limit	Cutoff Export Limit	Isolated Tie Condition
No Rows						

Locating interchange OTC limits in SIBR

0:Limit Values - Windows Internet Explorer

California ISO
Shaping a Renewed Future

DWILKE

Limit Values

Day Ahead Bids Real Time Bids Trades Adv Submit Portfolios Ind Viewer Convergence Bids **OTC Viewer** Energy Forecast Admin

Limit Viewer

Refresh? Interval [secs] 10

Monday March 30, 2015
03/30/15

Interchange: [SET] Refresh

Hour: [ALL]

Limit Values

HR	Interchange Name	Import Limit	Export Limit	Isolated Tie Condition
No Rows				

- ADLANTO-SP_ITC
- ADLANTOVICTVL-SP_ITC
- AMARGO_ITC
- ARLVALRG_ITC
- BLYTHE_ITC
- CASCADE_ITC
- CFEROA_ITC
- CFETID_ITC
- CFE_ITC
- COTPISO_ITC
- CTW230_ITC
- ELDORADO_ITC
- GONDI99DC_ITC
- IID-SCE_ITC
- IID-SDGE_ITC
- IPPOCADLN_ITC
- IPPUTAH_ITC
- LAUGHLIN_ITC
- LLNL_ITC
- MALIN_CIRC_ITC
- MARBLE_ITC
- MCCUMKTPC_ITC
- MCCULLGH_ITC
- MEADMKTPC_ITC
- MEADTMEAD_ITC
- MEAD_ITC
- MERCHANT_ITC
- MERCURY_ITC
- MKTPCADLN_ITC

Locating interchange OTC limits in SIBR

0:Limit Values - Windows Internet Explorer

California ISO
Shaping a Renewed Future

DWILKE

Limit Values

Day Ahead Bids | Real Time Bids | Trades | Adv Submit | Portfolios | Ind Viewer | Convergence Bids | **OTC Viewer** | Energy Forecast | Admin

Limit Viewer

Refresh? Interval [secs] 10

Monday March 30, 2015

03/30/15

Interchange: ADLANTO-SP_JTC Refresh

Hour: [ALL]

HR	Interchange Name	Import Limit	Export Limit	Cutoff Import Limit	Cutoff Export Limit	Isolated Tie Condition
01	ADLANTO-SP_JTC	1401	733	1401	733	N
02	ADLANTO-SP_JTC	1401	733	1401	733	N
03	ADLANTO-SP_JTC	1401	733	1401	733	N
04	ADLANTO-SP_JTC	1401	733	1401	733	N
05	ADLANTO-SP_JTC	1401	733	1401	733	N
06	ADLANTO-SP_JTC	1401	733	1401	733	N
07	ADLANTO-SP_JTC	1401	733	1401	733	N
08	ADLANTO-SP_JTC	1401	733	1401	733	N
09	ADLANTO-SP_JTC	1401	733	1401	733	N
10	ADLANTO-SP_JTC	1401	733	1401	733	N
11	ADLANTO-SP_JTC	1401	733	1401	733	N
12	ADLANTO-SP_JTC	1401	733	1401	733	N
13	ADLANTO-SP_JTC	1401	733	1401	733	N
14	ADLANTO-SP_JTC	1401	733	1401	733	N
15	ADLANTO-SP_JTC	1401	733	1401	733	N
16	ADLANTO-SP_JTC	1401	733	1401	733	N
17	ADLANTO-SP_JTC	1401	733	1401	733	N
18	ADLANTO-SP_JTC	1401	733	1401	733	N
19	ADLANTO-SP_JTC	1401	733	1401	733	N
20	ADLANTO-SP_JTC	1401	733	1401	733	N
21	ADLANTO-SP_JTC	1401	733	1401	733	N
22	ADLANTO-SP_JTC	1401	733	1401	733	N
23	ADLANTO-SP_JTC	1401	733	1401	733	N
24	ADLANTO-SP_JTC	1401	733	1401	733	N

- Import and export limits may change hourly
- Limits may be different for the import direction than for the export direction

Day-ahead market mechanics – virtual bid aggregation

- Virtual bid aggregation to alleviate the potentially large number of virtual bids inundating the market software.
- For each bidding location, all virtual bids submitted for that location are aggregated together to be used in the Day-ahead market.
- One multi-segment virtual supply bid / one multi-segment virtual demand bid will be created for each node.
- The aggregated virtual supply bid and the aggregated virtual demand bid for each eligible location are used in the IFM process of the day-ahead market.

Day-ahead market mechanics virtual bid aggregation – example

- Andrew the CBE had his SC put in a virtual demand bid at Julie's Beagle Point resource.
- Julie, the merchant generator tries to hedge for a potential outage, also puts in a virtual demand bid at her Beagle Point resource.
- Suppose these two virtual demand bids came into the market for the same trade date and trade hour, both bids would be aggregated together to form one aggregated virtual demand bid.

Day-ahead market processes

- Virtual bids are considered during the MPM process but are not mitigated.
- Virtual bids are not eligible to participate in RUC.
- Virtual bids are only used in the IFM process
- IFM process clears bid in supply and bid in demand, regardless of whether the bids are virtual or physical
- Virtual bids have the ability to create or alleviate congestion
- Virtual bids may cause additional resources to be committed through the RUC process

Day-ahead market results

- Day-ahead market results are in CMRI and are financially binding.
- If a virtual bid is the marginal resource, it can set the price
- When a virtual bid is the marginal resource, the aggregated bid curve will be disaggregated and prorated according to total portion of a participant's MW offer divided by the total aggregated MW offer for the cleared volume

Day-ahead market mechanics virtual bid disaggregation – example

- If LMP at Beagle Point Pnode is \$75 and only 20MW cleared at that price, then bids will need to be disaggregated

Andrew's bid

Qty	Price [\$]
0	125
5	75
15	70
20	70

Julie's bid

Qty	Price [\$]
0	100
10	75
17	65
20	65



Aggregated bid curve

Qty	Price [\$]
0	125
5	100
15	75
32	70
37	65
40	65

Day-ahead market mechanics virtual bid disaggregation – example

- Andrew offered 15MW at \$75
- Julie offered 17MW at \$75
- Only 20 MW cleared at \$75
- Both virtual bid awards must be determined using a pro-rated value from the marginal segment, in addition to capacity with lower bid costs
- Total MW offered at \$75 = 32MW
- 20 MW awarded; 5 MW of which is pro-rated based on the 17 MW in the marginal bid segment.
 - Of the 20 MW that clears in IFM, 15 MW comes from higher bid segments. That leaves 5 MW as marginal.
- Andrew gets $5 + (10/17 * 5) = 7.94$ MW
- Julie gets $10 + (7/17 * 5) = 12.06$ MW

Day-ahead positions

Andrew's day-ahead position and settlement

- Long position
- Awarded 7.94 MW @
 $\$75.00/\text{MW} = \595.50
(charge)

Julie's day-ahead position and settlement

- Long position
- Awarded 12.06 MW @
 $\$75.00/\text{MW} = \904.50
(charge)

Liquidating day-ahead positions in the FMM

- All day-ahead positions are liquidated in the FMM.
- Virtual demand liquidates (sells) the position back to the market at the FMM price.
- Virtual supply liquidates (buys) the position back from the market at the FMM price.
- The price used to liquidate virtual awards is based on the average of the four 15-minute intervals for the trade hour.

Example - Liquidating day-ahead positions in the FMM

- Prices in the FMM have been volatile due to unexpected outages and a lightening strike which caused a fire that threatens a major transmission line.
- Fortunately, fire crews were able to contain the fire quickly.

IE:15	IE:30	IE:45	IE:00
76.68	109.80	186.57	165.13

FMM price to liquidate virtual awards = \$134.545

Liquidating the day-ahead positions - example

Andrew's day-ahead settlement

- Awarded 10 MW @
\$75.00/MW = \$750.00
(charge)
- FMM – liquidate 10 MW
@ \$134.545 = \$1,345.45
(payment)
- Net position = \$ 595.45
(payment)

Julie's day-ahead settlement

- Awarded 20 MW @
\$75.00/MW = \$1,500.00
(charge)
- FMM – liquidate 20 MW
@ \$134.545 = \$2,690.90
(payment)
- Net position = \$1,190.90
(payment)

Module summary

- Participants may submit a virtual supply and virtual demand bids at eligible locations including:
 - Internal supply nodes and scheduling points
 - Load nodes
 - Default LAPs
 - Trading hubs
- Virtual demand bid curves must be monotonically decreasing
- Minimum bid of 1.0 MW
- Incremental bid thereafter of 0.01MW
- Intertie position limits located in SIBR