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Wholesale Markets 101





Greetings and Introductions



WebEx Tips

- Windows
- Buttons

Attendance

Questions / Chat







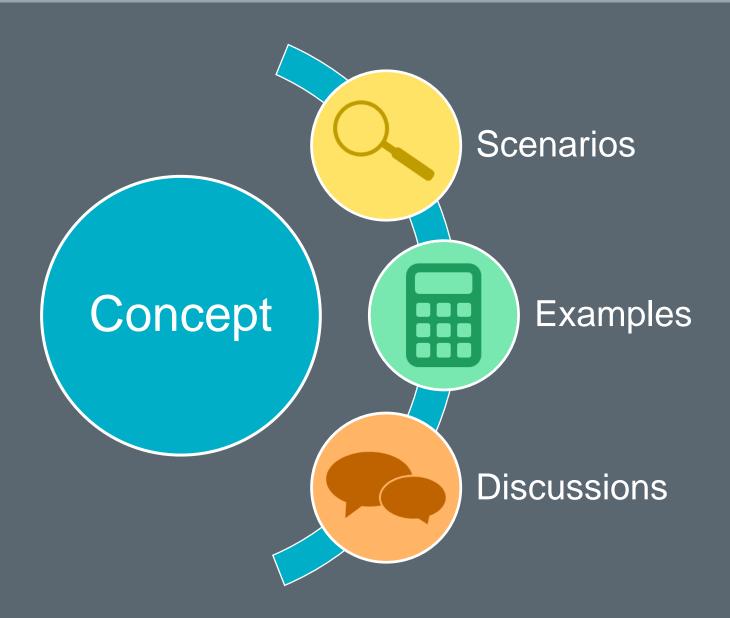
PROTOCOL DISCLAIMER

This presentation provides a general overview of the Texas Nodal Market and is not intended to be a substitute for the ERCOT Protocols, as amended from time to time. If any conflict exists between this presentation and the ERCOT Protocols, the ERCOT Protocols shall control in all respects.

For more information, please visit:

http://www.ercot.com/mktrules/nprotocols/







Topics in this course include:

- 1 Introduction
- 2 Real-Time Dispatch and Pricing
- 3 Forward Markets
- 4 Energy Settlements
 - 5 Congestion
- 6 Ancillary Services
- 7 System Capacity



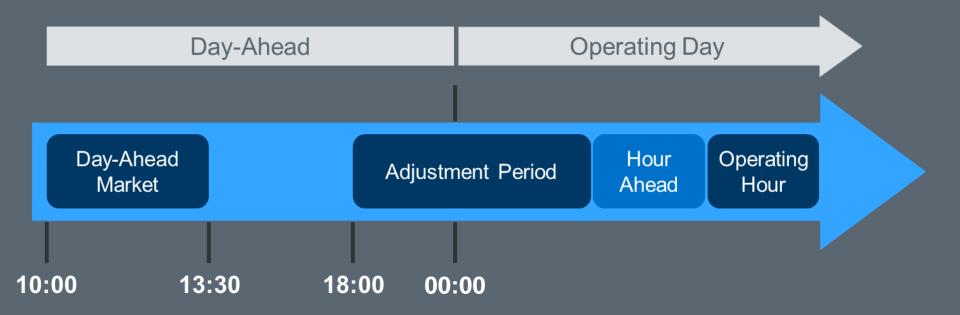
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Introduction

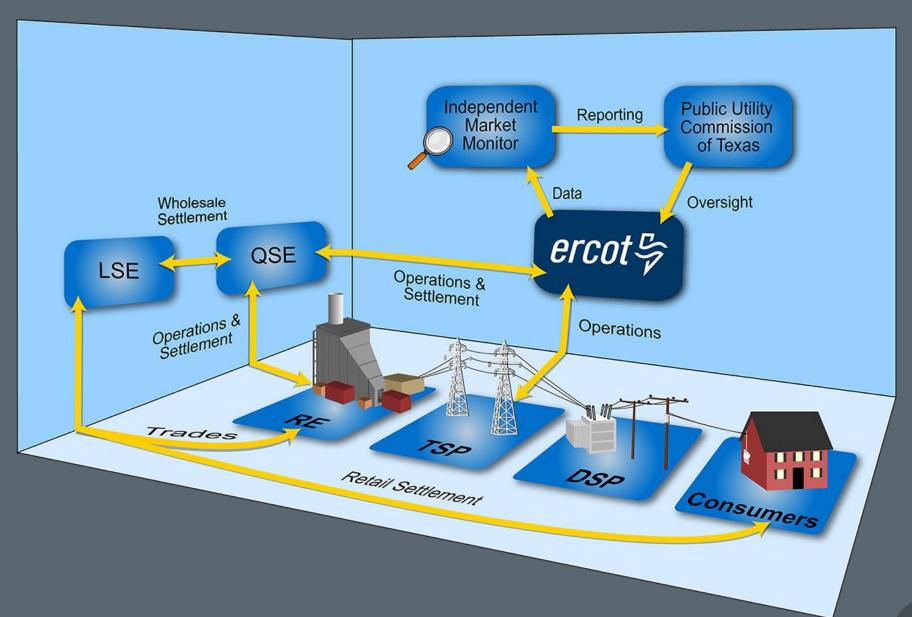




In general . . .

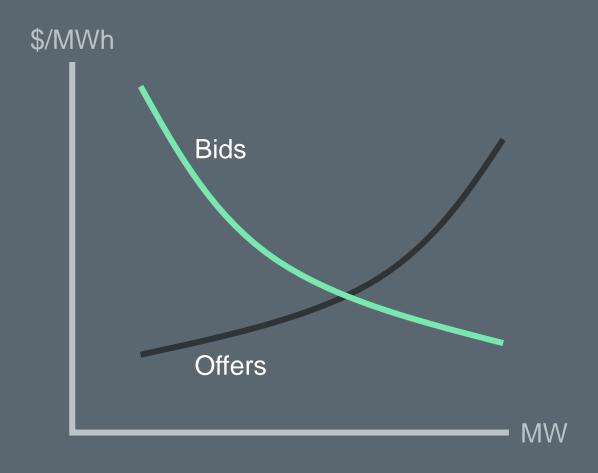








Supply and demand curves







Proposal to buy

- A Product
- At a Location
- For a Price

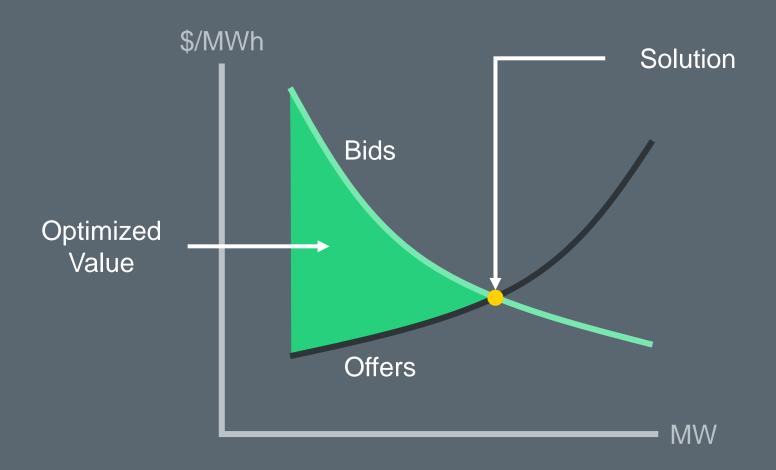
Proposal to Sell

- A Product
- At a Location
- For a Price



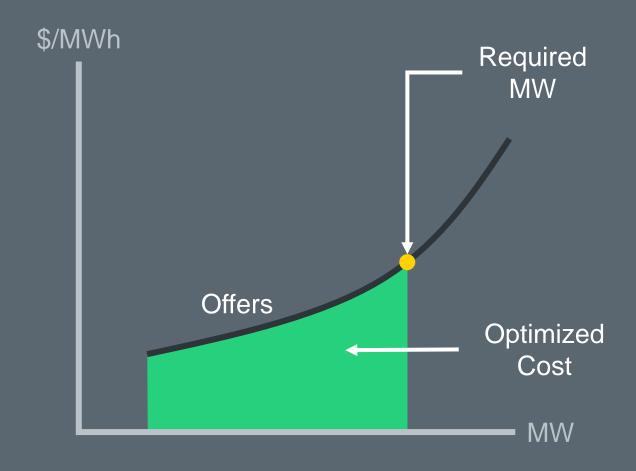


Some ERCOT processes are optimized for value

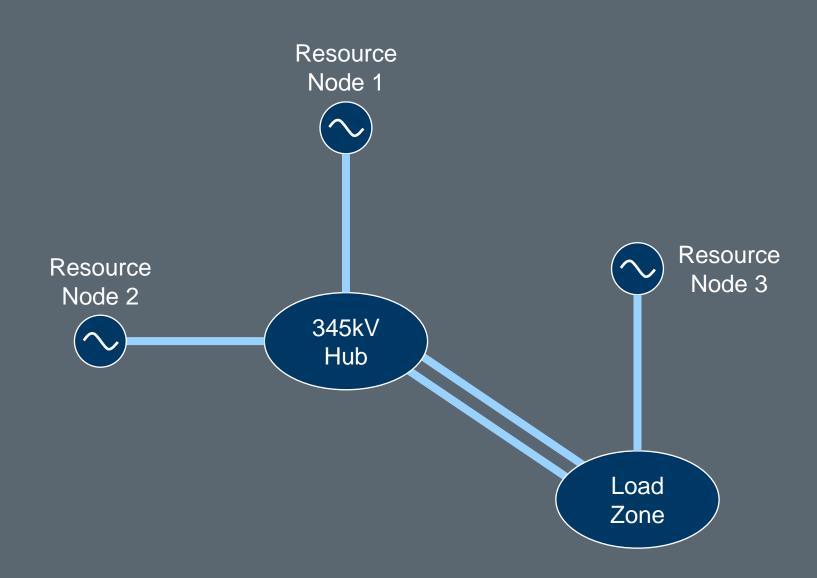




Other ERCOT processes are optimized for cost









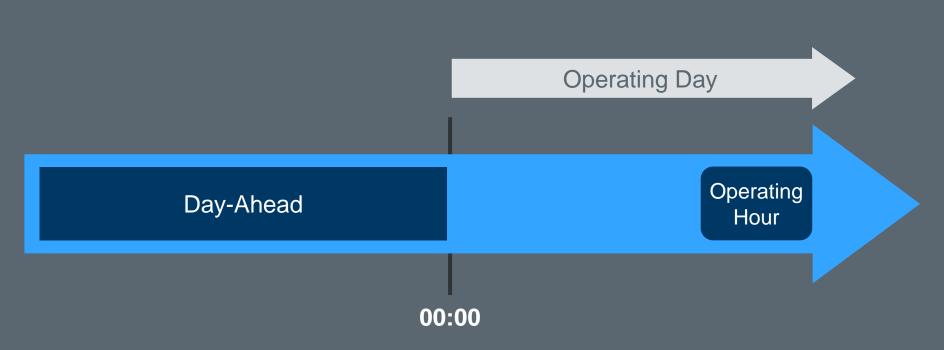


Real-Time Dispatch and Pricing





Timing





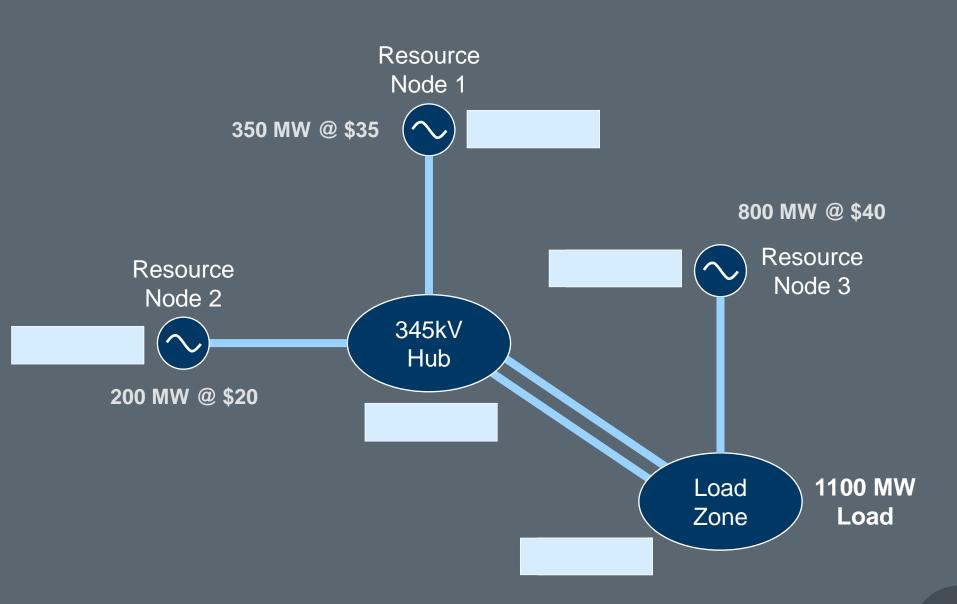
Goals

- Manage reliability
 - Match generation with demand
 - Keep transmission flows within limits
- Operate the system at least cost

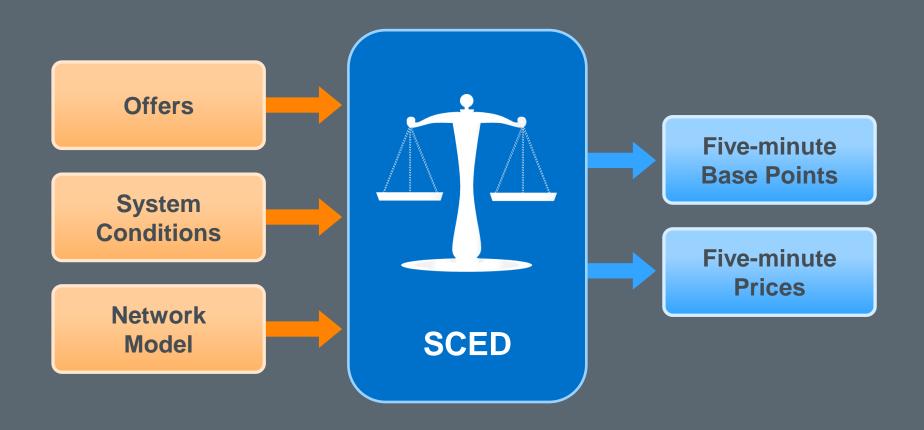








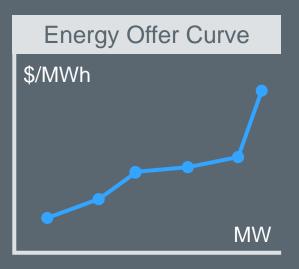






Energy Offer Curve

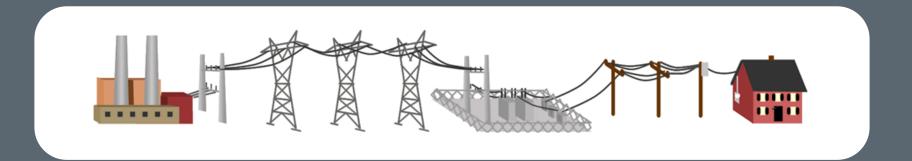
- Monotonically increasing curve
- Ten price/quantity pairs max
- One MW minimum quantity
- Prices between -\$250 and SWCAP





Monitored Conditions

What does SCED need to know?

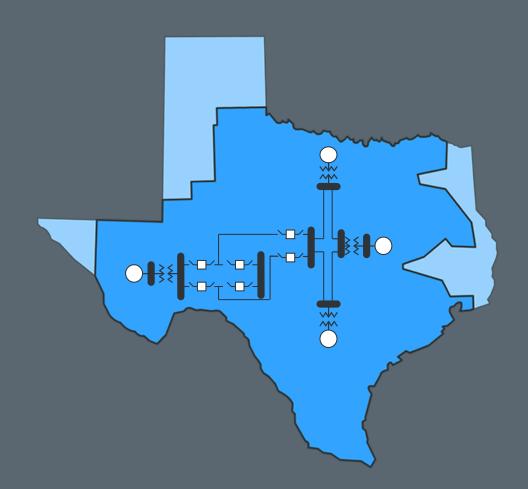




Represents physical transmission grid

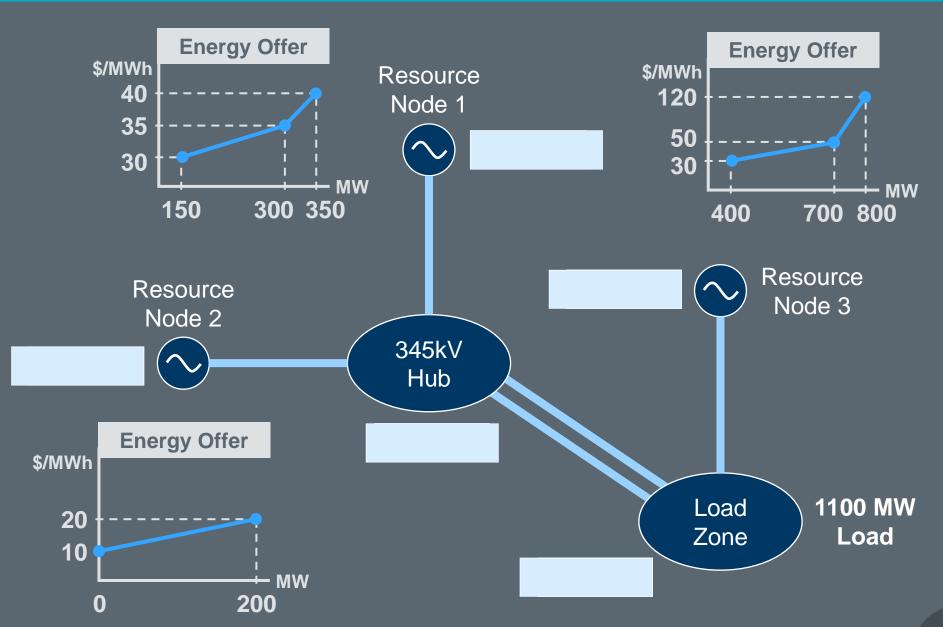
Used for:

- Reliability studies
- All Market Processes



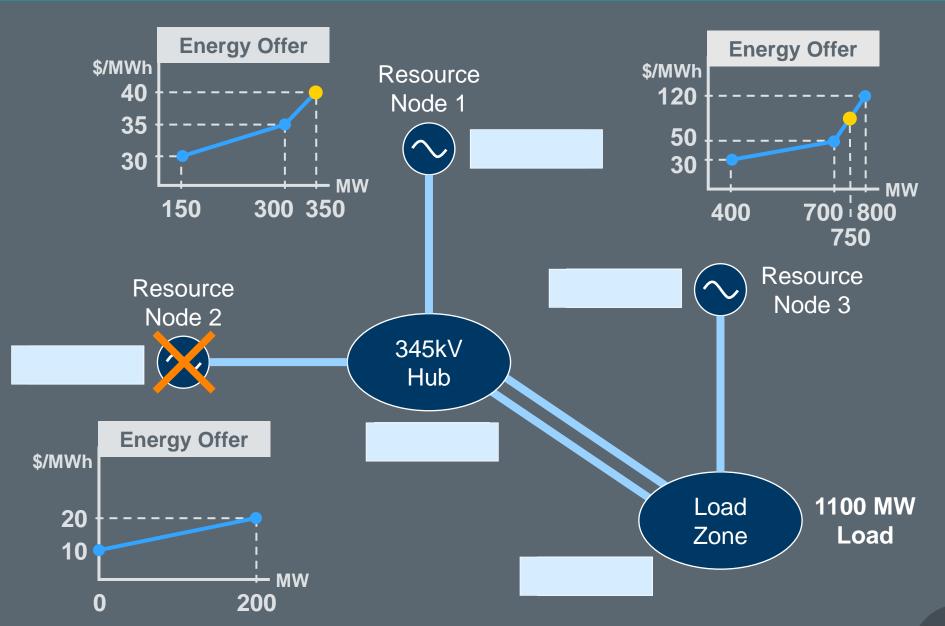














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Forward Markets



Hedging is transacting at a known price now ...





... to protect from having to transact at an unknown price later.



Break into teams:

Load Teams

- Given Load Forecast
- Determine Bid MWs and Bid Price

Generation Teams

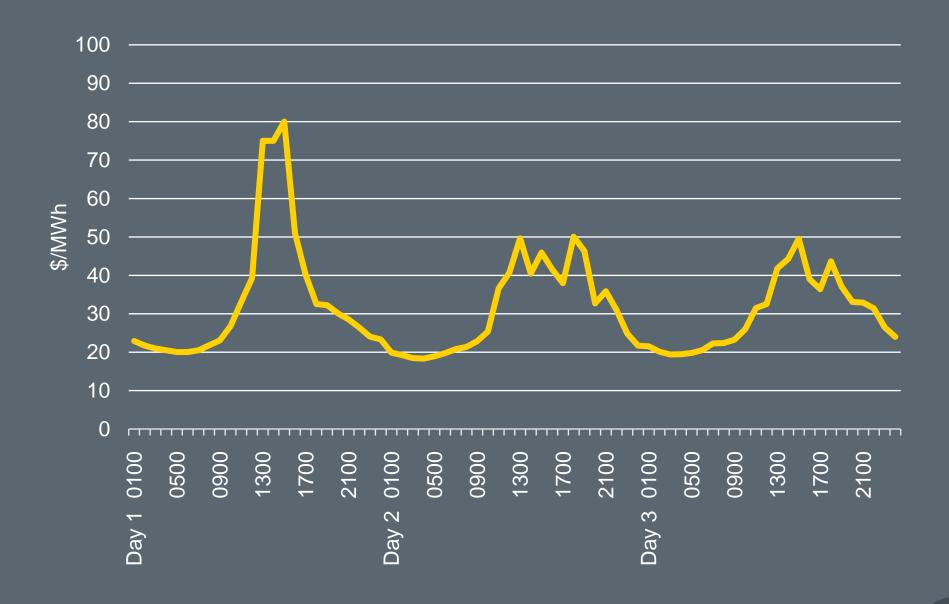
- Given MWs to offer
- Determine Offer MWs and Offer Price



Instructor will clear the market

Class will evaluate hedging "Success"







Day-Ahead Market



Bilateral Trades

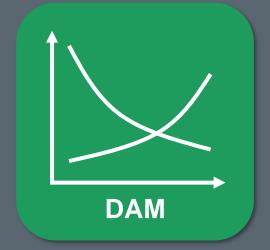


Centralized Forward Market

- Conducted daily
- Facilitated by ERCOT



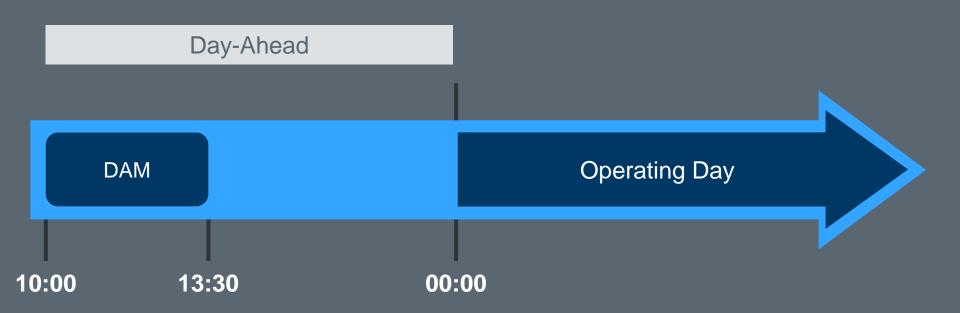






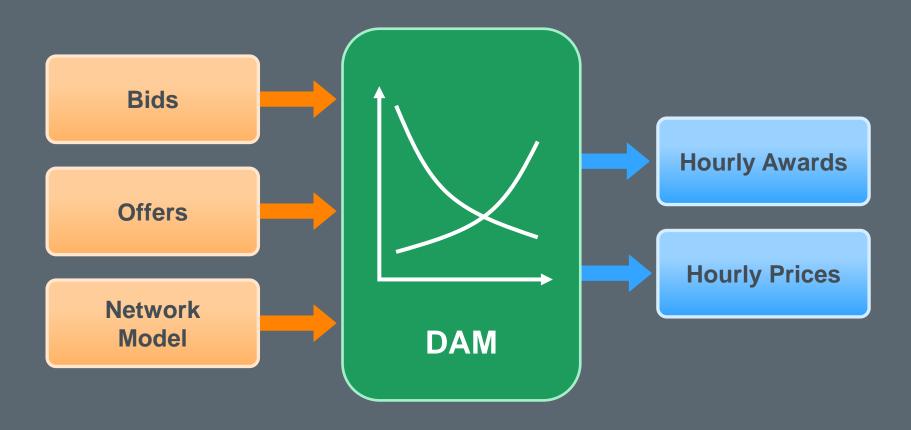


Timing



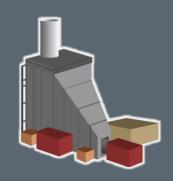


Transactions





Three-Part Supply Offer





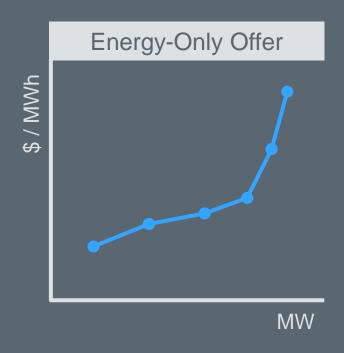






Day-Ahead Market Energy-Only Offer

- Proposal to sell energy in DAM
- Offered at any Settlement Point



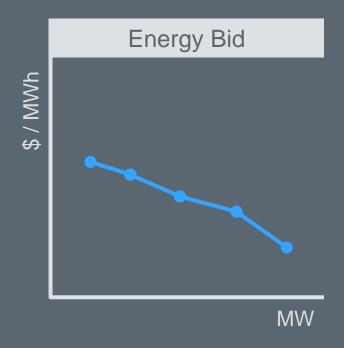


Financial obligation in Real-Time



Day-Ahead Market Energy Bid

- Proposal to buy energy in DAM
- Submitted at any Settlement Point





Financial credit in Real-Time

Day-Ahead Market



Bilateral Trades





Decentralized Forward Market

- QSE-to-QSE transactions
- Transfers settlement responsibility









Buyer and Seller QSE must confirm Trades

One QSE reports





Other QSE confirms





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Energy Settlement







QSEs settle their transactions



ERCOT settles



ERCOT settles



Charge for awarded Energy Bid

= Awarded MWs * DASPP

Payment for awarded Energy Offer

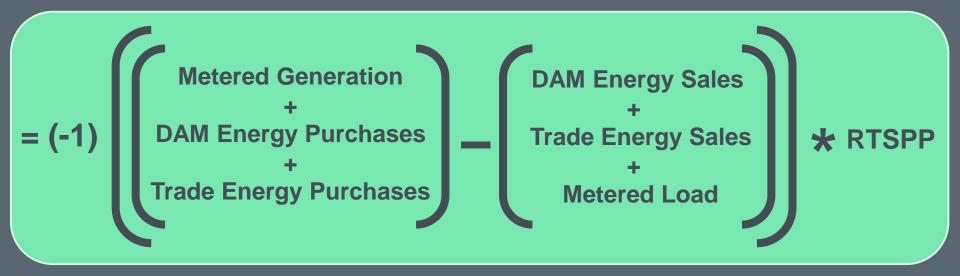
= (-1) * Awarded MWs * DASPP



Real-Time Energy Imbalance



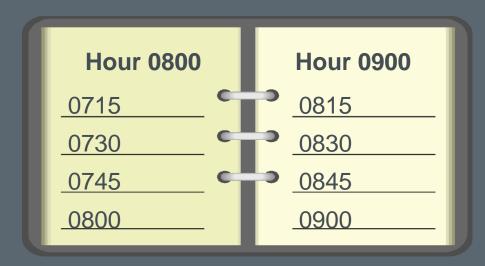
Real-Time Energy Imbalance Components



Each Settlement Point settled separately

DAM Awards & Trades in Real-Time Energy Settlements

- DAM awards and settles <u>hourly MWs</u>
- Energy Trades reported as <u>hourly MWs</u>
- Real-Time settles <u>15-minute MWhs</u>



Multiply DAM awards and Trades by ¼ hour

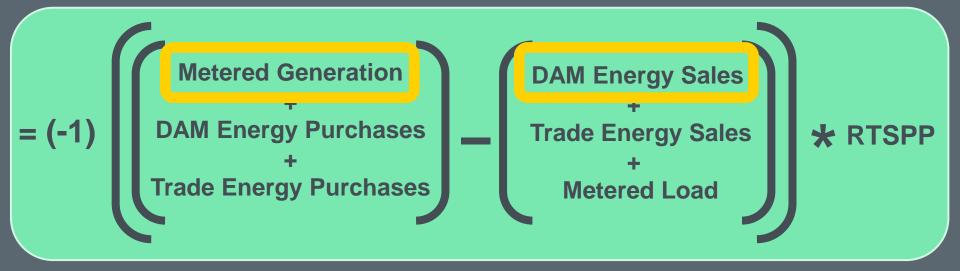




DAM Awarded Energy Offer at Resource Node		
Hour	MW	DASPP
0800	200	\$25 / MWh
Real-Time Metered Generation		
Interval	MWh	RTSPP
0715	45	\$20 / MWh



Real-Time Energy Imbalance for Interval 0715





Break into teams: Determine how team's energy settles

Load Teams

- Awarded Energy Bid in DAM
- Adjusted Metered Load in Real-Time

Generation Teams

- Awarded Energy Offer in DAM
- Metered Generation in Real-Time



DAM and Real-Time Results on Next Slide







DAM Awarded Energy Bid at Load Zone			
Hour	MW	DASPP	
1400	100	\$35 / MWh	
Real-Time Adjusted Metered Load			
Interval	MWh	RTSPP	
1315	24	\$30 / MWh	
1330	25	\$31 / MWh	
1345	26	\$75 / MWh	
1400	25	\$70 / MWh	



DAM Awarded Energy Offer at Resource Node			
Hour	MW	DASPP	
1400	300	\$35 / MWh	
Real-Time Metered Generation			
Interval	MWh	RTSPP	
1315	70	\$30 / MWh	
1330	72	\$31 / MWh	
1345	85	\$75 / MWh	
1400	85	\$70 / MWh	







DAM Award		Time nbalance	Net
	1315		
	1330		
	1345		
	1400		



DAM Award	Real-Time Energy Imbalance		Net
	1315		
	1330		
	1345		
	1400		

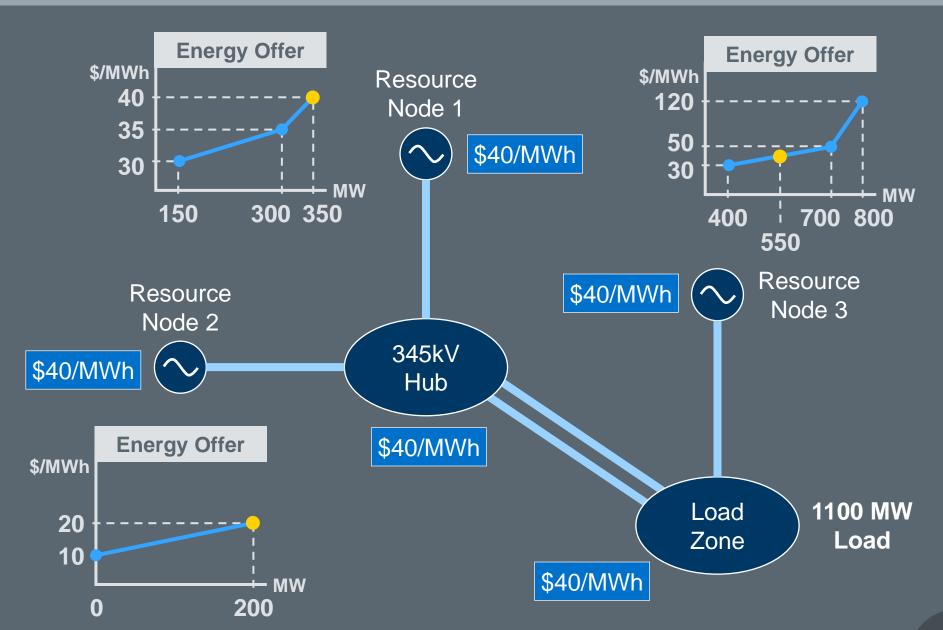


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Congestion

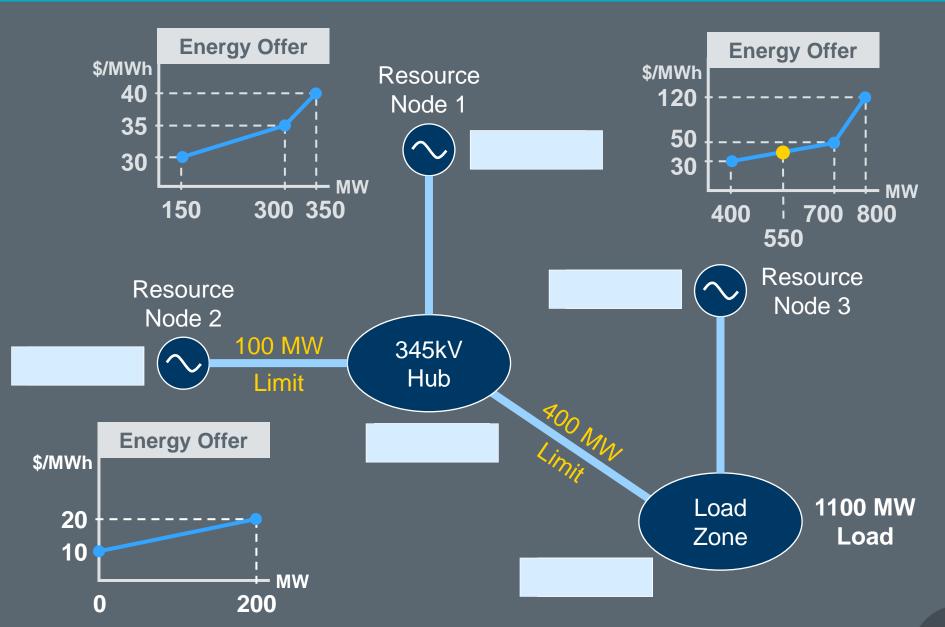






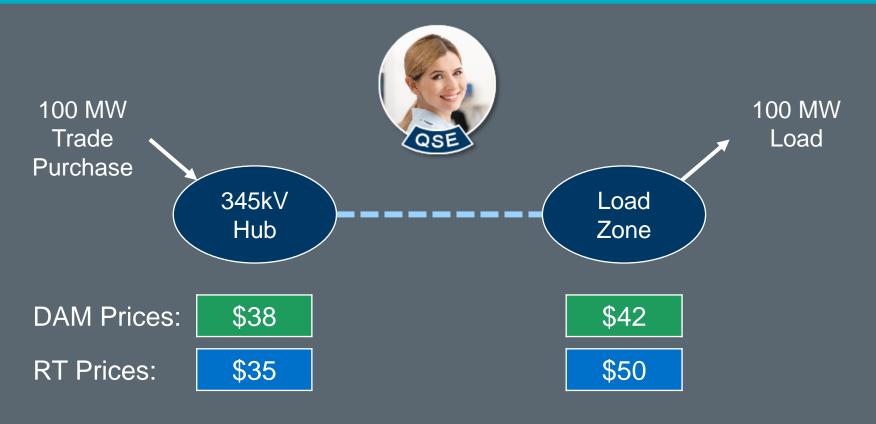








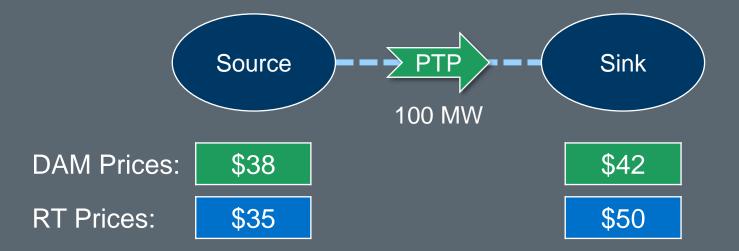




Settlement	Payment at Hub	Charge at Load Zone	Net Amount



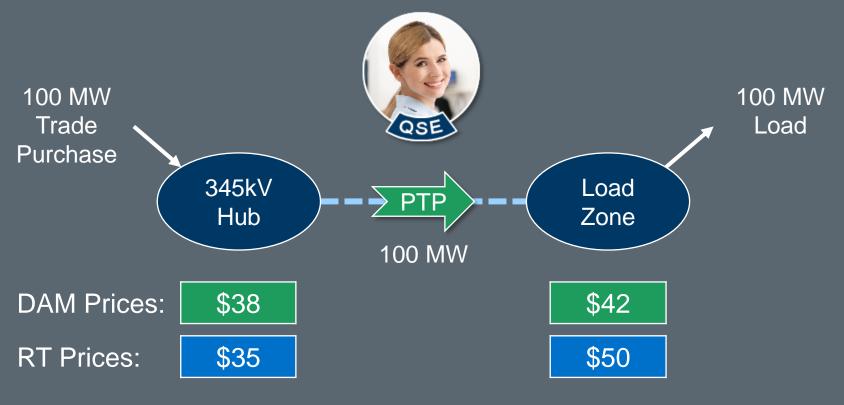
Introducing DAM Point-to-Point Obligations



Settlement	Sink minus Source Price	PTP Obligation Amount
DAM		
RT		

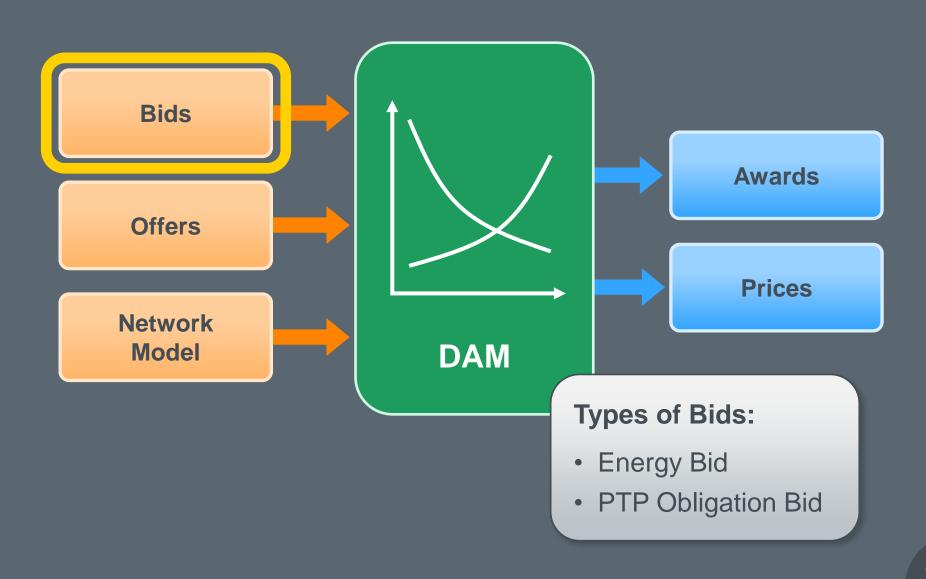






Settlement Type		Amount
DAM	PTP Obligation	
RT	Energy Imbalance	
KI	PTP Obligation	
Total		







Submitted between any two Settlement Points

Source	Sink	E	Bid
345kV Hub	Load Zone	MW	\$ / MW
Resource Node 1	Load Zone	MW	\$ / MW
Resource Node 2	Resource Node 3	MW	\$ / MW
Resource Node 1	345kV Hub	MW	\$ / MW



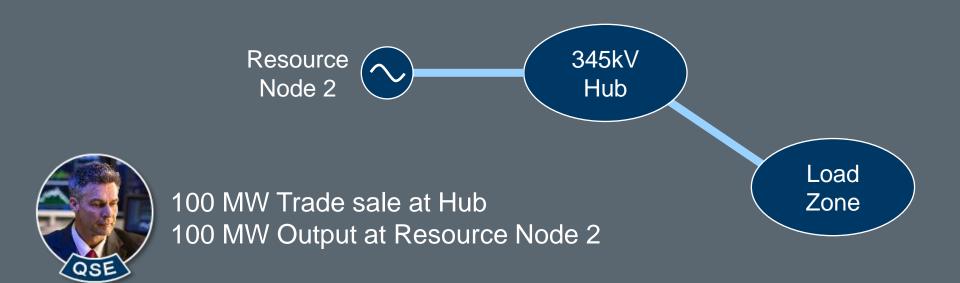
Payment or charge in Real-Time!



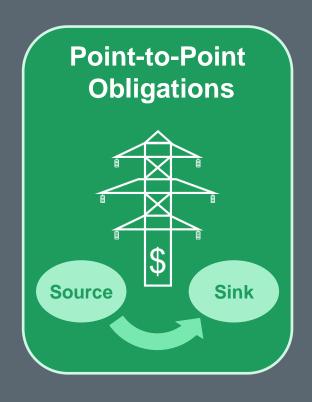


Break into teams: Optimize QSE's Revenues using DAM PTP Obligations

	Resource Node 2	345kV Hub	Load Zone
DAM SPP	\$36/MWh	\$38/MWh	\$40/MWh
Average RT SPP	\$15/MWh	\$35/MWh	\$42/MWh







Hourly Financial instruments

- Purchased at DAM price spread
- Settled at Real-Time price spread





Monthly Financial instruments

- Purchased at Auction Price
- Settled at DAM price spread





Two types of instruments

Point-to-Point Obligation

Payment or Charge in DAM

Point-to-Point Option

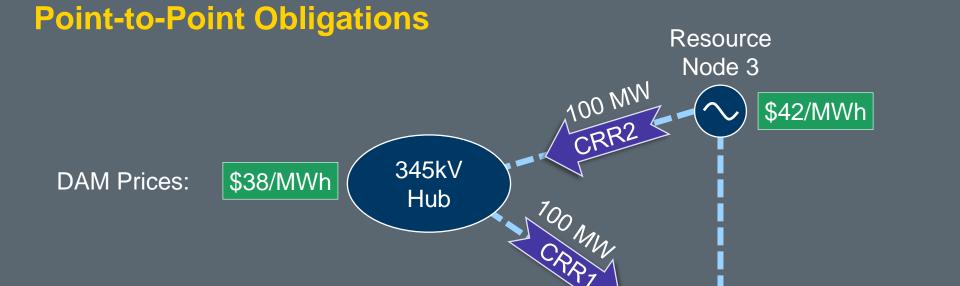
Payment only in DAM

\$42/MWh

Load

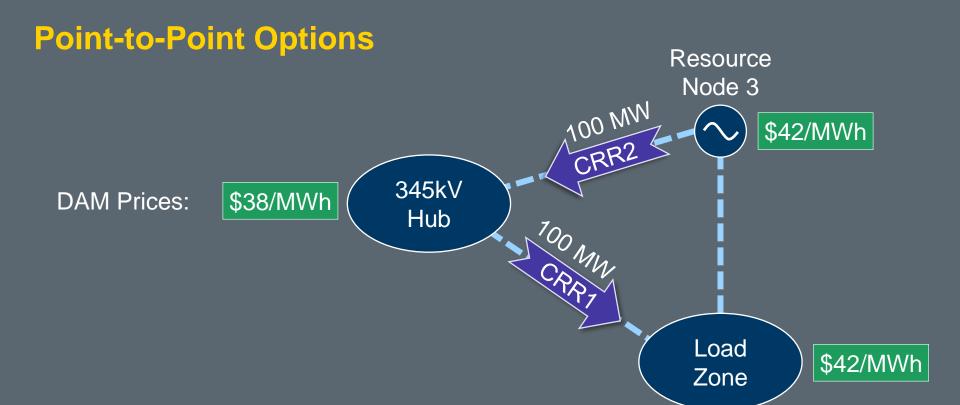
Zone





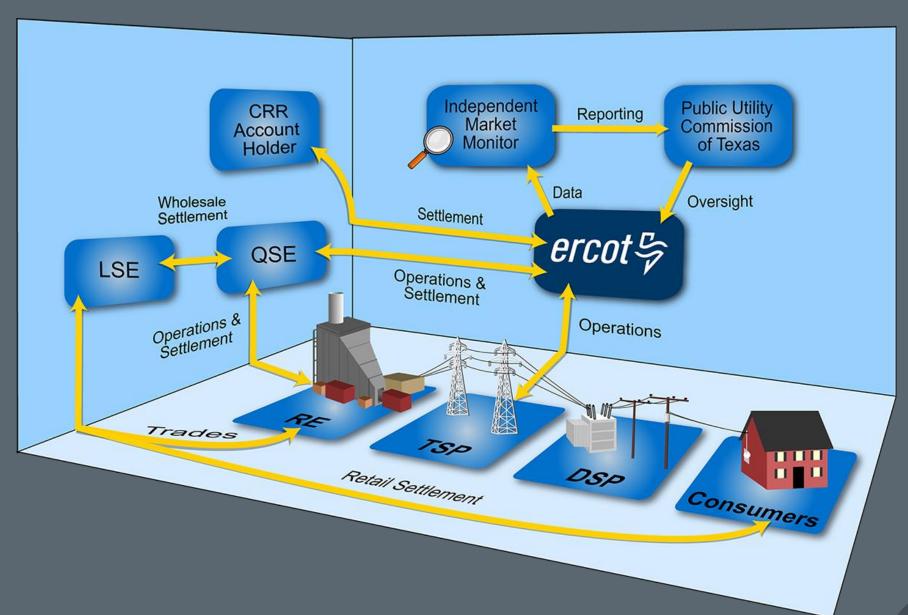
Settlement	Sink minus Source Price	CRR Amount
CRR1		
CRR2		





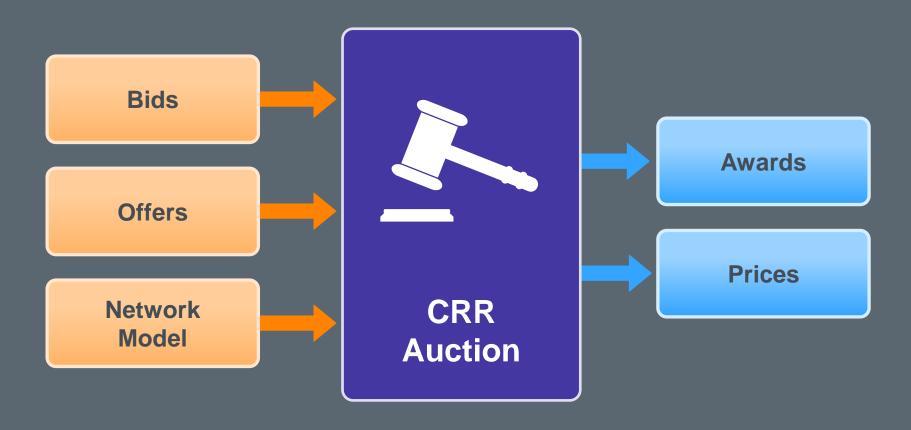
Settlement	Sink minus Source Price	CRR Amount
CRR1		
CRR2		







CRR Auction Transactions





CRRs are auctioned by:

- Time-of-Use Blocks
- One-month strips

Mon	Tues	Wed	Thurs	Fri	Sat	Sun
Off-Peak (0100 – 0600)						
Peak Weekday (0700 – 2200)					Peak Weekend (0700 – 2200)	
Off-Peak (2300 – 0000)						



Discussion: Congestion Costs Hedging – The Big picture







CRR Auction

Day-Ahead Market

Real-Time







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Ancillary Services

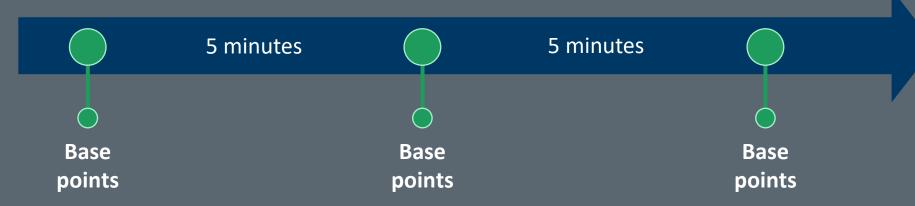




Security Constrained Economic Dispatch (SCED)

- Matches generation with demand
- Manages congestion
- Achieves least cost dispatch







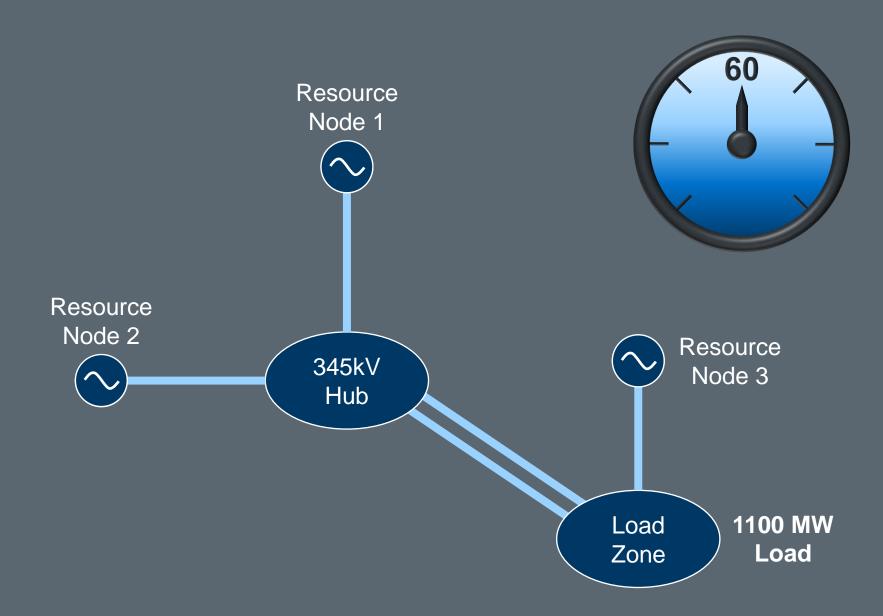










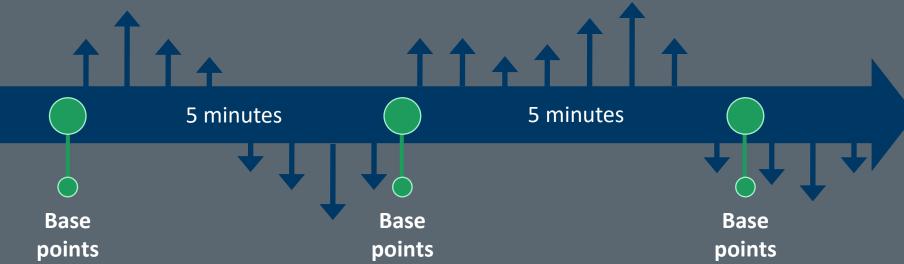




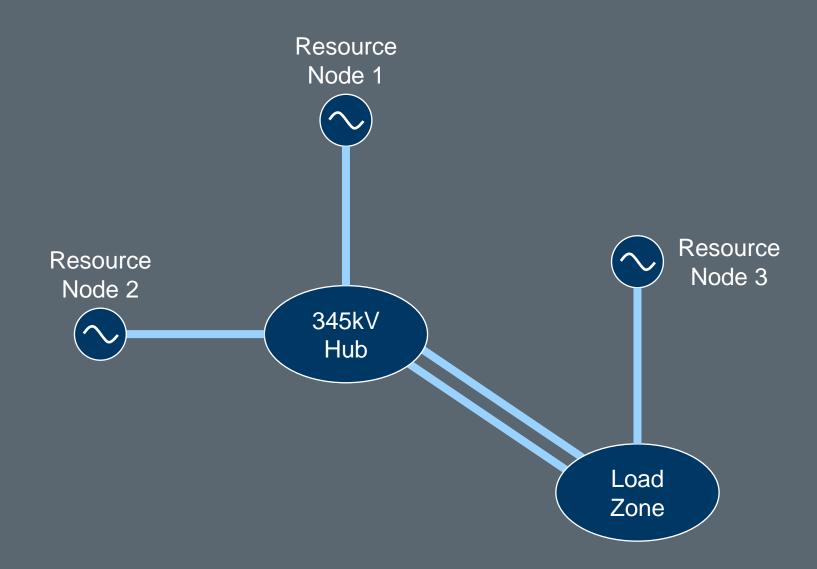
Regulation Service

- Matches generation with demand
- Responds to frequency deviations











Responsive Reserve Service



Possible Uses

- Loss of Generation
- Large load-ramps



ERCOT Contingency Reserve Service



Possible Uses

- Restoring Responsive Reserve
- Large renewable ramps

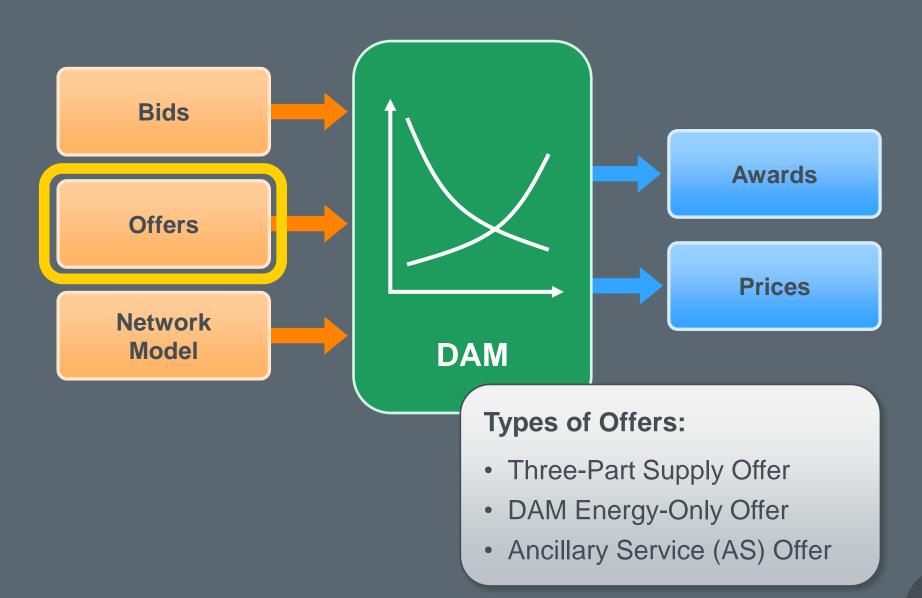


Non-Spinning Reserve Service



Possible Uses

- Larger load than expected
- Local transmission issues





Resource-Specific Offers for Each Service

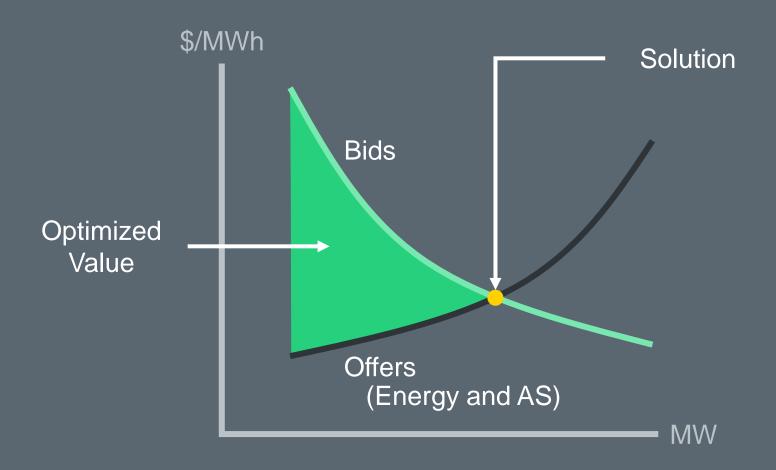
Type of Service	Offer	
Regulation Up	MW	\$ / MW
Regulation Down	MW	\$ / MW
Responsive Reserve	MW	\$ / MW
Contingency Reserve	MW	\$ / MW
Non-Spinning Reserve	MW	\$ / MW

Multiple offers from single Resource:

- Multiple Ancillary Services
- May be combined with Energy Offers



Energy and Ancillary Services are co-optimized





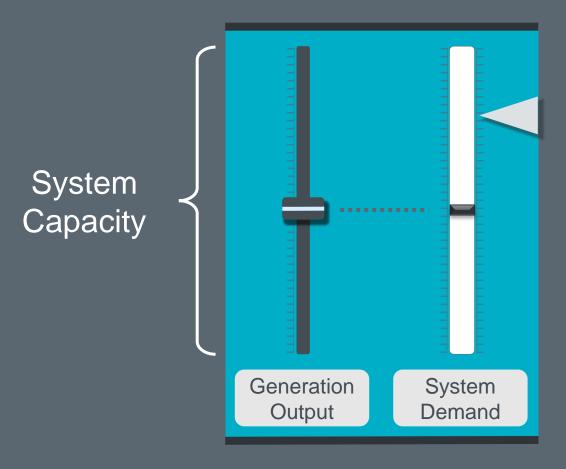
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System Capacity





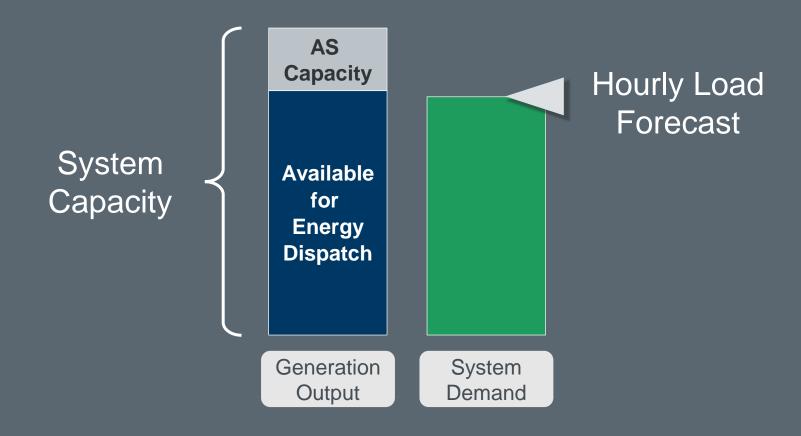
ERCOT dispatches Generation to follow Demand



Hourly Load Forecast



Two needs for Capacity



Current Operating Plan (COP)

Anticipated Resource operating conditions

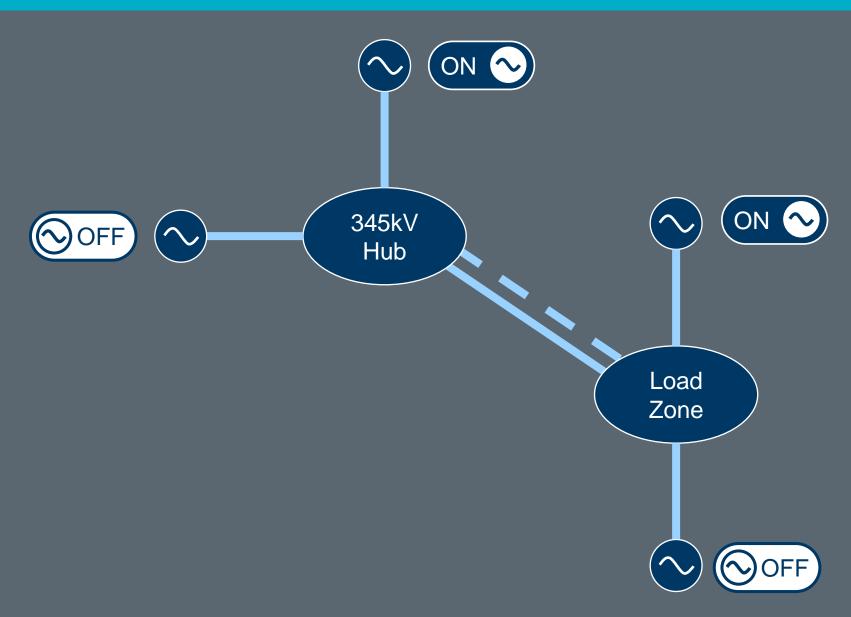
- Resource Status
- Resource Limits
- Ancillary Service Commitments



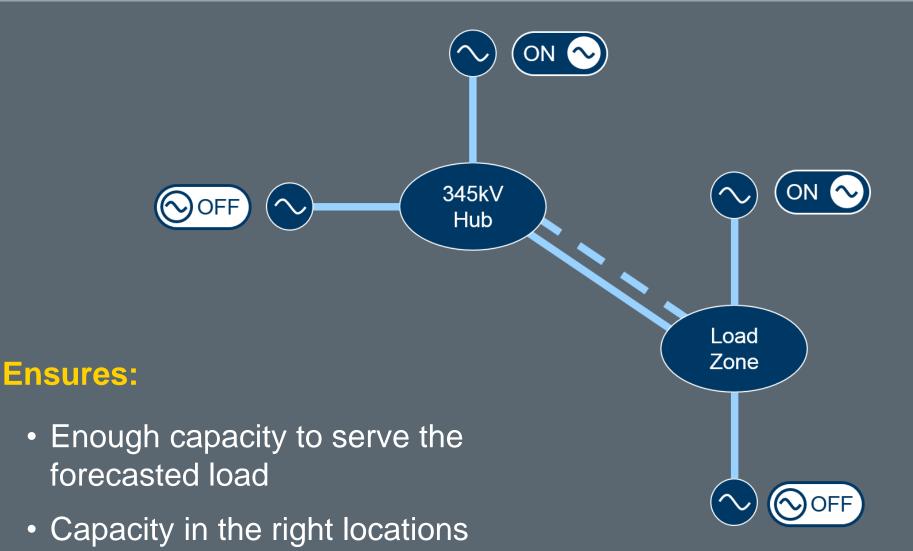
Resource QSEs must maintain a COP for each hour of the next 7 days



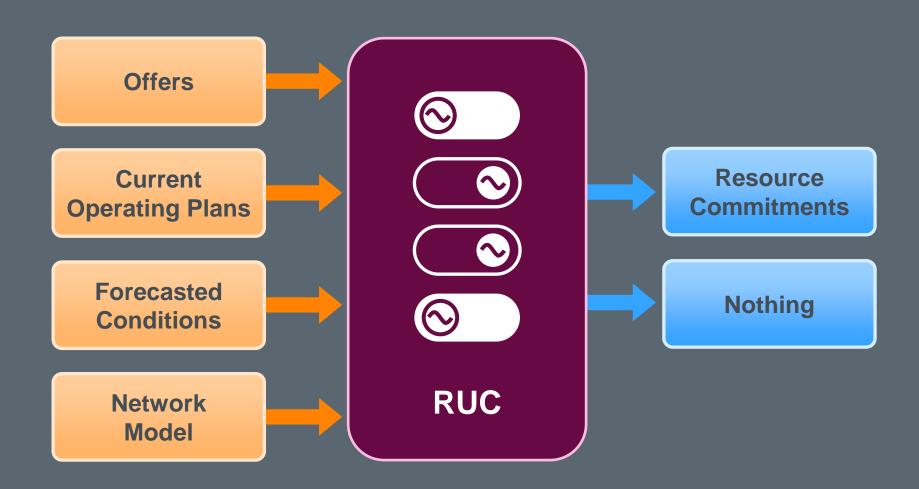






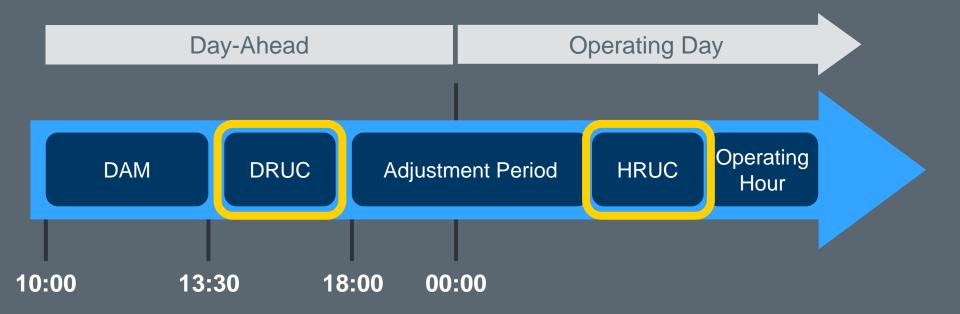








Timing



DRUC = Day-Ahead Reliability Unit Commitment

HRUC = Hourly Reliability Unit Commitment



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Summary and Conclusion



Wholesale Market Summary



CRR Auction

- · Buy monthly instruments
- PTP Option Bids
- PTP Obligation Bids

Day-Ahead Market

- · Centralized forward market
- · Energy Offers and Bids
- · PTP Obligation Bids
- · Ancillary Service Offers

Real-Time Operations

- Security Constrained Economic Dispatch (SCED)
- · Five-minute dispatch
- Ancillary Service deployments



CRR Auction



Bilatera



Day-Ahead Market



Reliability Unit Commitment





Real-Time Operations

Bilateral Trades

- · Decentralized forward market
- · QSE-to-QSE transactions
- · Transfer settlement responsibility

Reliability Unit

- · Ensures sufficient capacity
- · Studies forecast conditions
- · Commits capacity if needed

Settlement

- CRR Auction
- · Day-Ahead Market
- Real-Time Operations

Market Information System (MIS)

• System Conditions • Forecasts • Market Awards • Prices • ERCOT Applications • Settlement Data •



Also available on ercot.com



Available to all Market Participants



Available to specific Market Participant



FORWARD THINKING LET'S GET THE POINT? ANTS ON LARRY? ENOUGH ALREADY!

\$50

\$100

\$150

\$50

\$100

\$150

\$50

\$100

\$150

\$50

\$100

\$150

GET

REAL

\$50

\$100

\$150

\$50

\$100

\$150





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