



# Load Serving Entities LSE201

*Class begins at 8:30*



2023\_11 LSE

**Greetings  
and  
Introductions**

## WebEx Tips

- Windows
- Buttons

## Attendance

## Questions / Chat



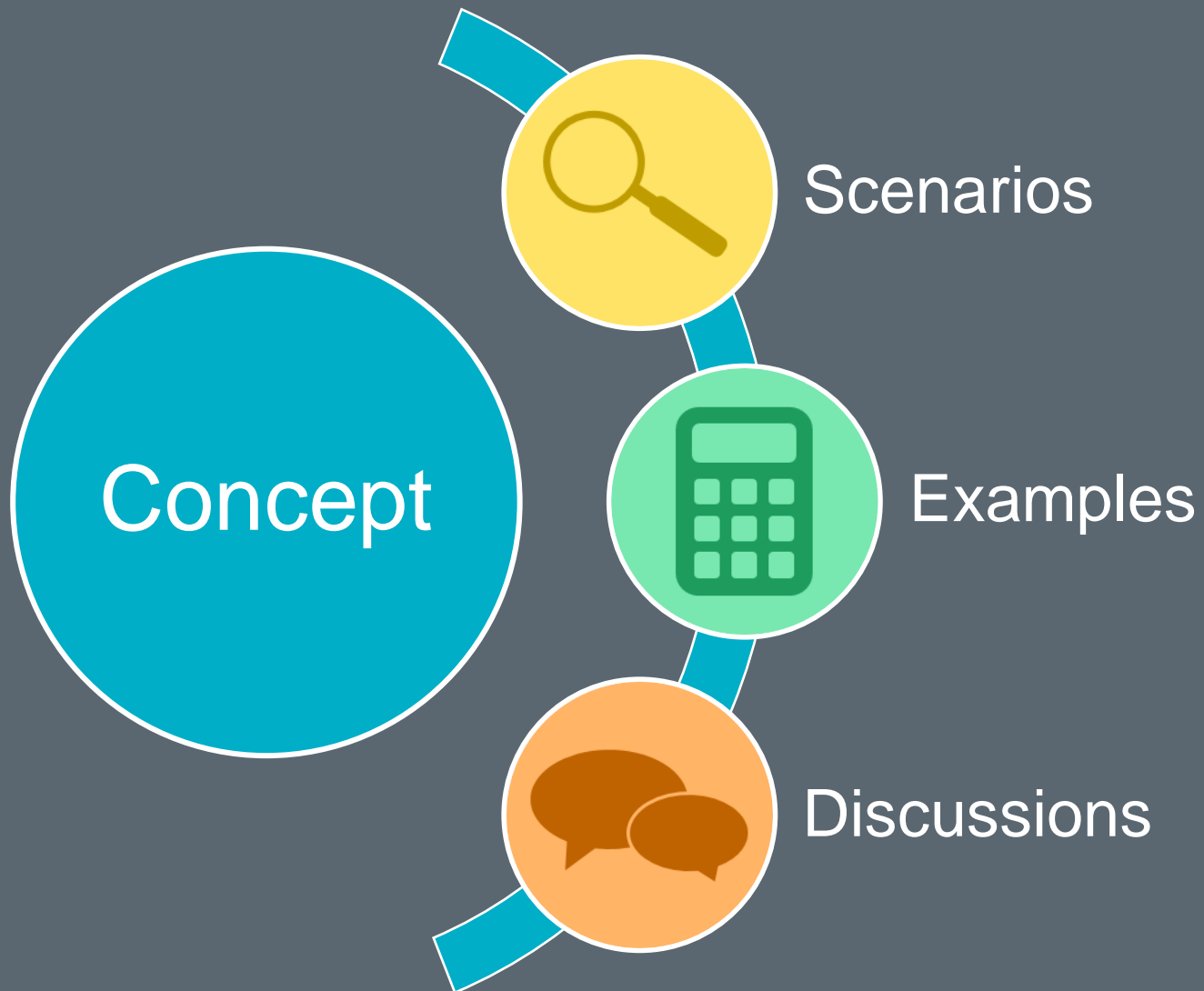
Unmute ▾ Start video ▾ Share [Smiley Face] [More] [Close] Participants Chat

## 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

Market Products for Hedging Costs

3

Credit Overview

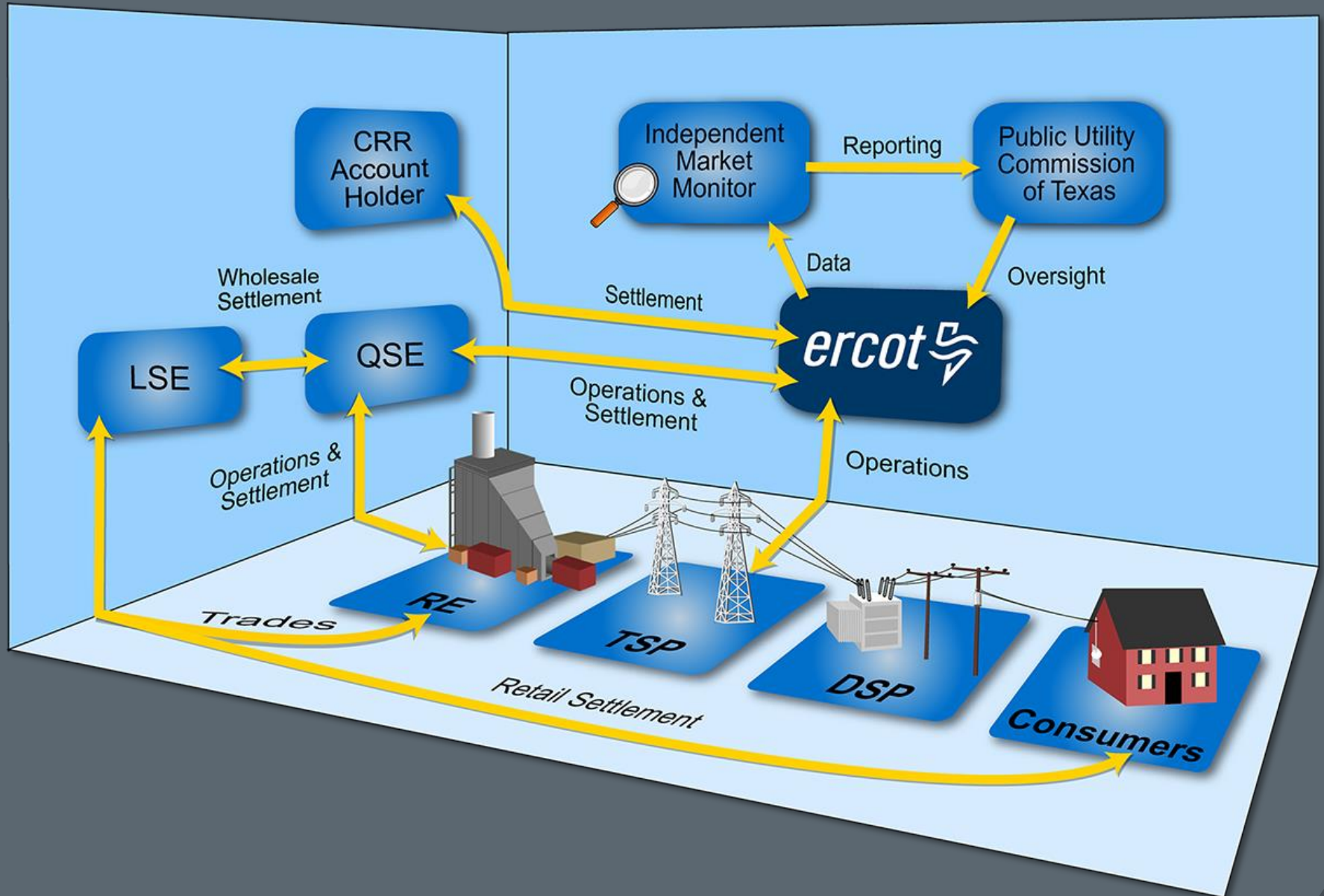
4

Using Market Products for Hedging Costs

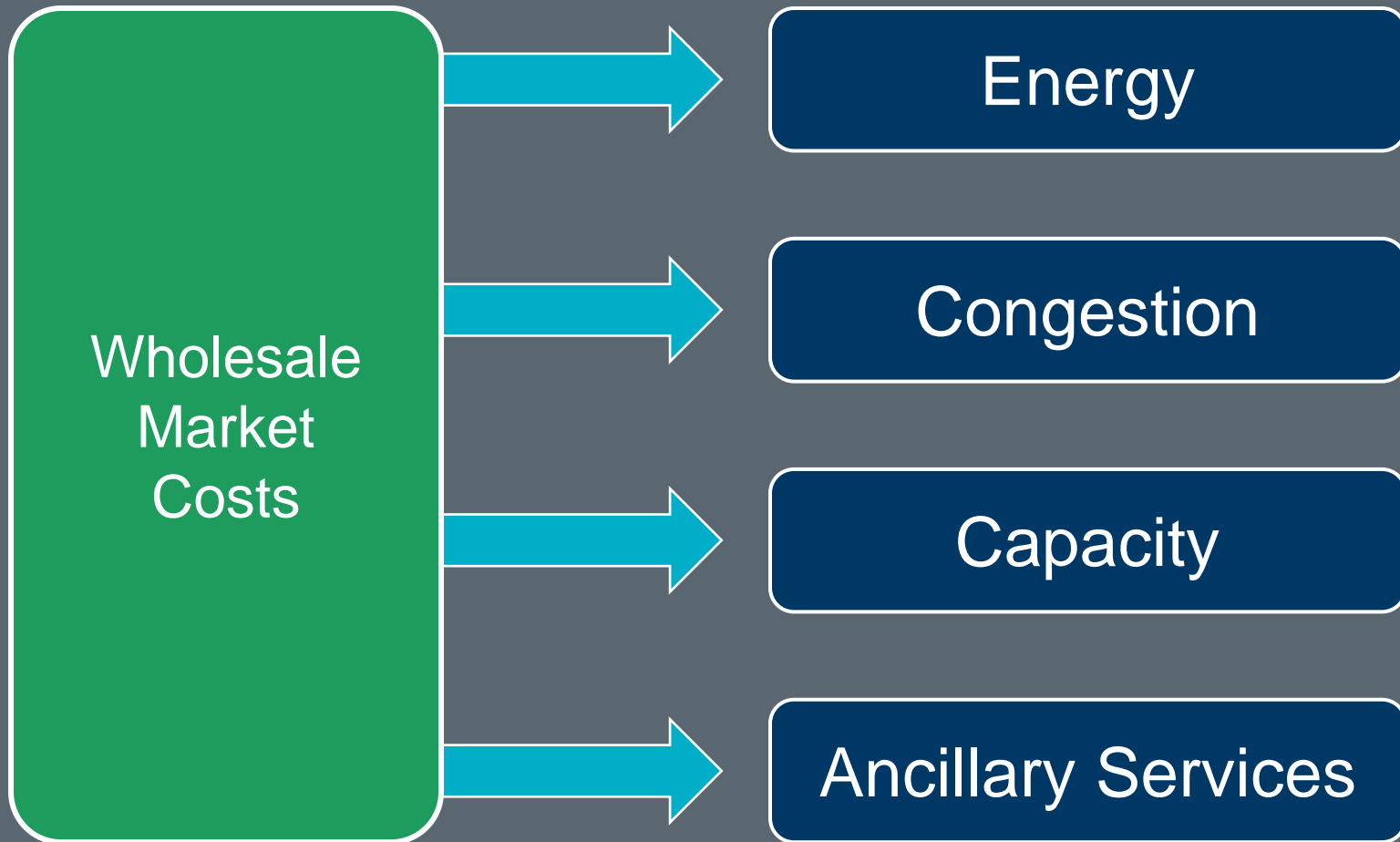
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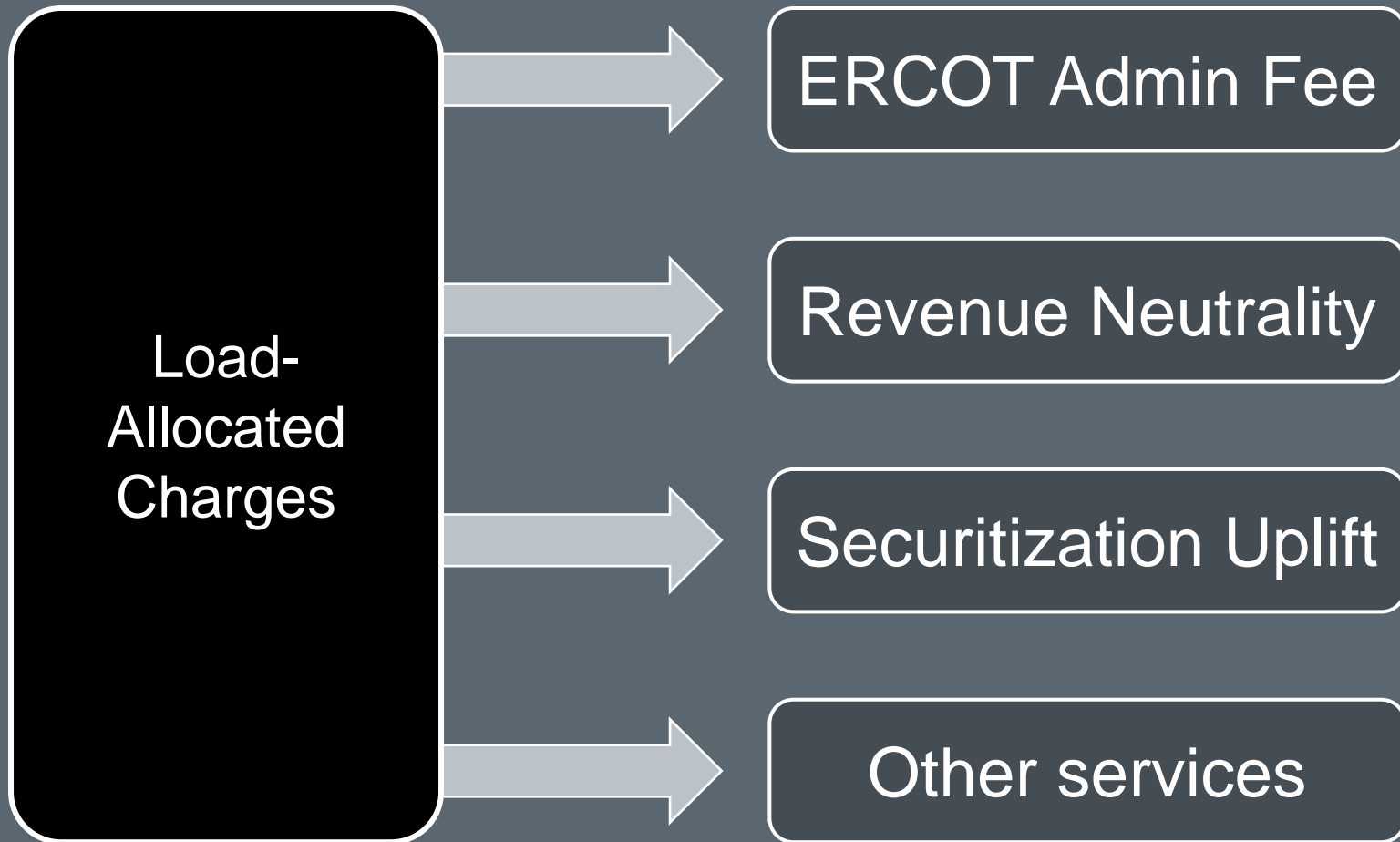
A Few Other Risks and Rewards

# Introduction











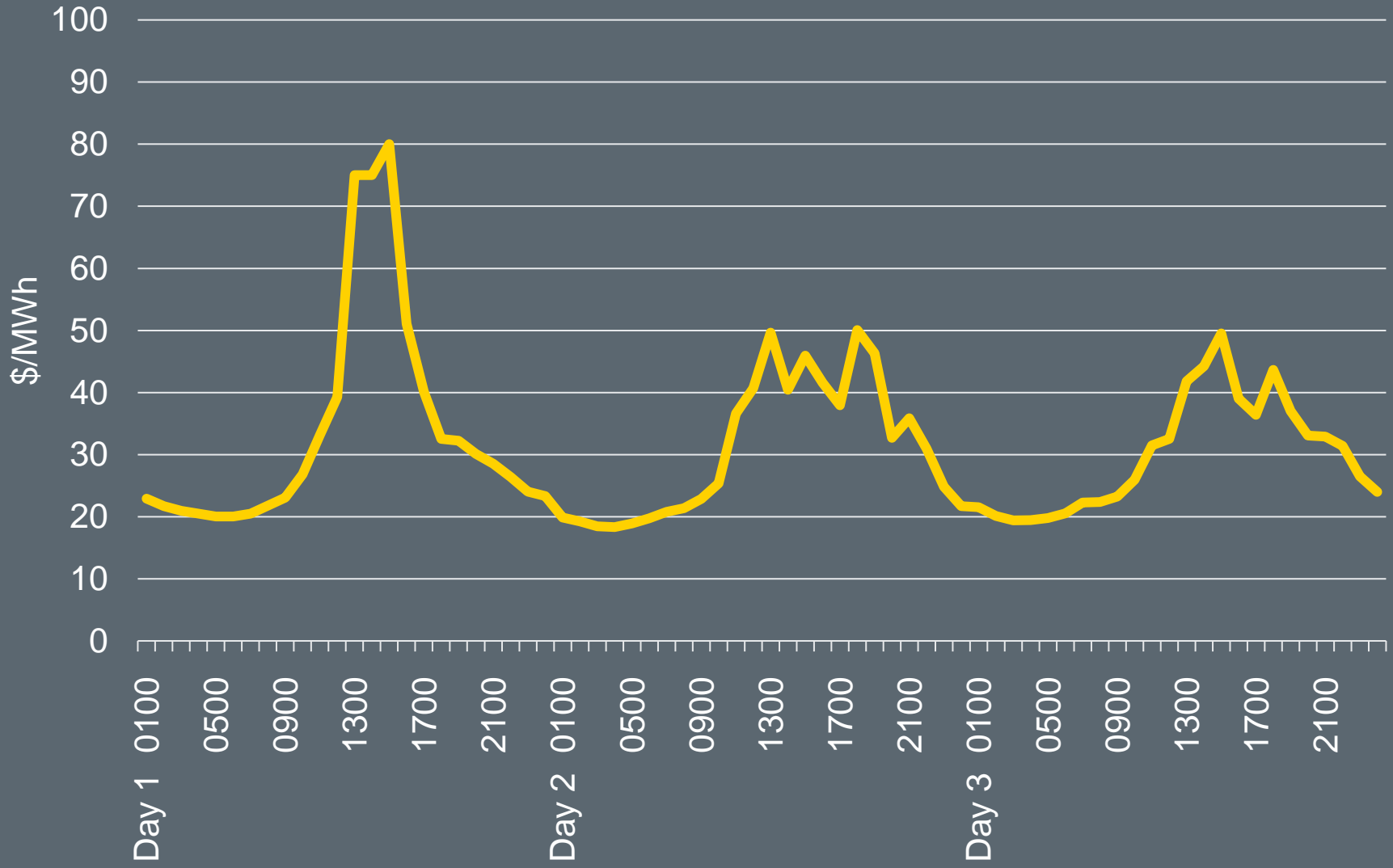
## You have Load to serve during Hour 1500:

- 100 MW forecast at West Load Zone
- Pricing data provided
  - Recent Real-Time prices
  - Available forward prices



## You must choose:

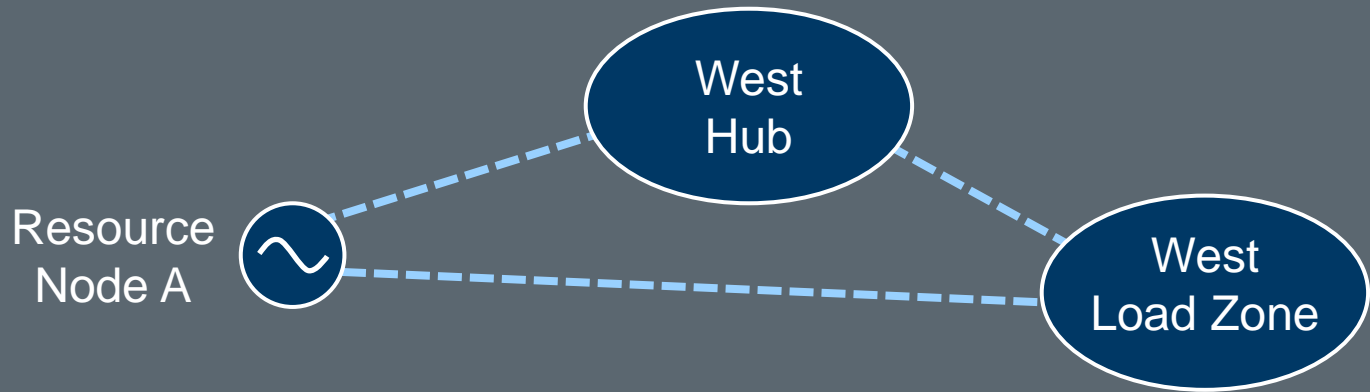
- Buy one of the forward prices
- Buy in Real-Time



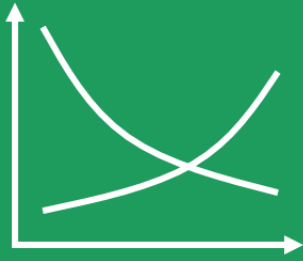


# Available Forward Prices for Hour 1500

	Resource Node A	West Hub	West Load Zone
Bilateral Trade	\$45/MWh	\$50/MWh	\$60/MWh
Day-Ahead Market	\$40/MWh	\$50/MWh	\$52/MWh



# **Market Products for Hedging Wholesale Market Costs**



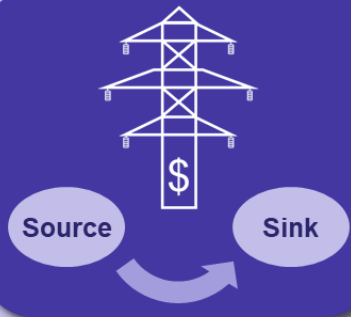
## Day Ahead Market

- Energy
- Congestion
- Capacity



## Bilateral Trades

- Energy
- Capacity
- Ancillary Service



## Congestion Revenue Rights

- Congestion

Introducing ...

# *Friendly Power, LLP*



## Business Goals

- Provide reliable electric service at a competitive rate
- Manage cost exposure



## Comparing Forward & Real-time transactions

- Day-Ahead Market & Trades transact hourly MWs
- Real-Time settles 15-minute MWhs

## For simplicity, we will

- Calculate all scenarios in hourly MWs
- Assume Real-Time prices and loads are constant for an hour

## Costs

Energy

Congestion

Capacity

Ancillary Services

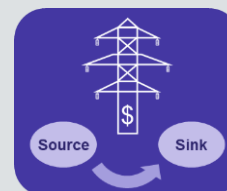
## Tools



Day-Ahead Market



Bilateral Trades



CRRs



## *Friendly Power, LLP*



### Does not hedge for Hour 1200

- 100 MW load in West Load Zone
- Buys all energy in Real-Time
- Real-Time Price = \$40

## Real-Time Energy Imbalance

$$= (-1) \left( \left( \text{SUPPLIES} \right) - \left( \text{OBLIGATIONS} \right) \right) * \text{RTSPP}$$

RTSPP = Real-Time Settlement Point Price

## Real-Time Energy Imbalance at Load Zone

$$= (-1) \left( \left( \begin{array}{c} \text{DAM Energy Purchases} \\ + \\ \text{Trade Energy Purchases} \end{array} \right) - \left( \begin{array}{c} \text{DAM Energy Sales} \\ + \\ \text{Trade Energy Sales} \\ + \\ \text{Metered Load} \end{array} \right) \right) * \text{RTSPP}$$

Each Settlement Point  
settled separately

## Real-Time Energy Imbalance at Resource Node

$$= (-1) \left( \begin{array}{c} \text{Metered Generation} \\ + \\ \text{DAM Energy Purchases} \\ + \\ \text{Trade Energy Purchases} \end{array} \right) - \left( \begin{array}{c} \text{DAM Energy Sales} \\ + \\ \text{Trade Energy Sales} \end{array} \right) * \text{RTSPP}$$

Each Settlement Point  
settled separately

## Real-Time Energy Imbalance at Hub

$$= (-1) \left( \left( \begin{array}{c} \text{DAM Energy Purchases} \\ + \\ \text{Trade Energy Purchases} \end{array} \right) - \left( \begin{array}{c} \text{DAM Energy Sales} \\ + \\ \text{Trade Energy Sales} \end{array} \right) \right) * \text{RTSPP}$$

Each Settlement Point  
settled separately



## Real-Time Energy Imbalance at West Load Zone

$$= (-1) \left( \left( \begin{array}{c} \text{DAM Energy Purchases} \\ + \\ \text{Trade Energy Purchases} \end{array} \right) - \left( \begin{array}{c} \text{DAM Energy Sales} \\ + \\ \text{Trade Energy Sales} \\ + \\ \text{Metered Load} \end{array} \right) \right) * \text{RTSPP}$$

$$= (-1) \left( \left( \quad \right) - \left( \quad \right) \right) * \$40/\text{MWh}$$

=





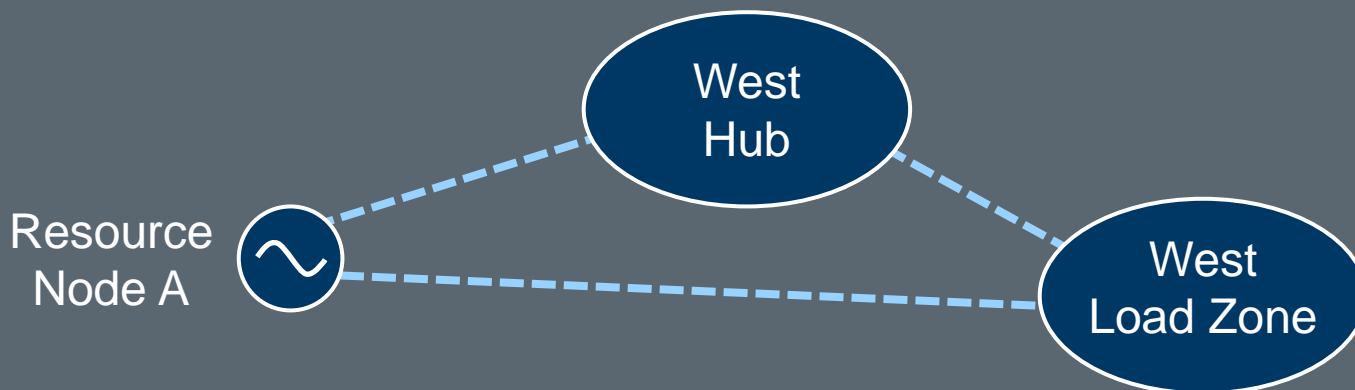
## Real-Time Energy Imbalance offers ideas

$$= (-1) \left( \left( \text{SUPPLIES?} \right) - \left( \text{Metered Load} \right) \right) * \text{RTSPP}$$

... but what are the Potential Risks?



	Resource Node A	West Hub	West Load Zone
Bilateral Trade	\$50/MWh	\$55/MWh	\$60/MWh
Day-Ahead Market	\$45/MWh	\$47/MWh	\$50/MWh
Real-Time	\$30/MWh	\$35/MWh	\$40/MWh



## Costs

Energy

Congestion

Capacity

Ancillary Services

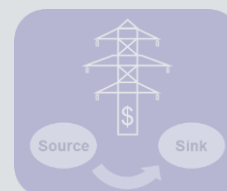
## Tools



Day-Ahead Market

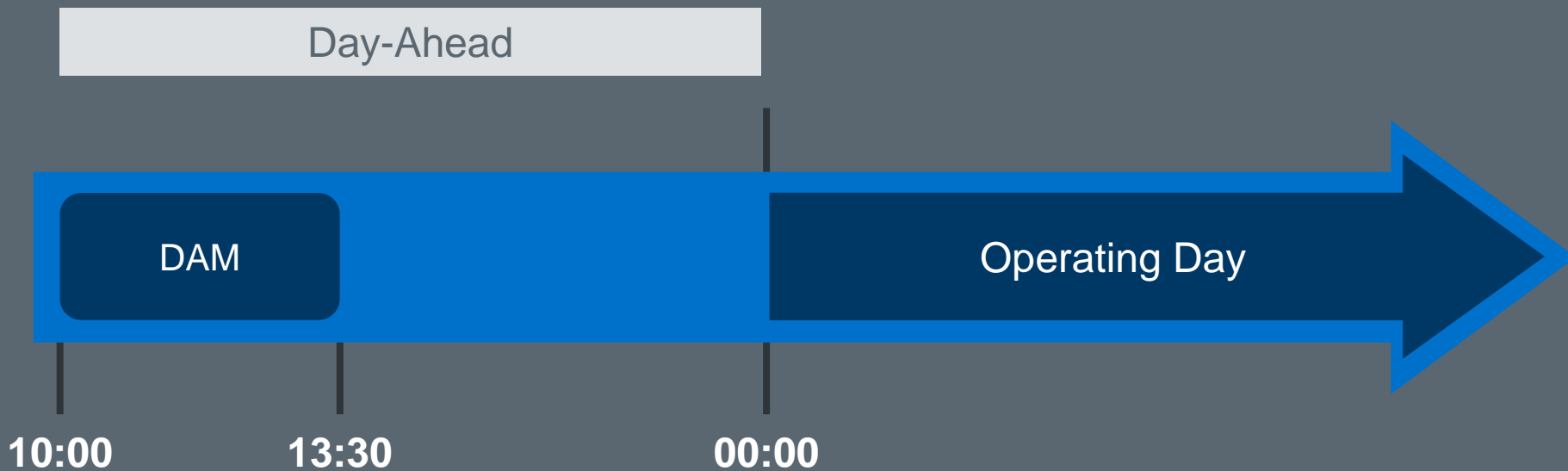


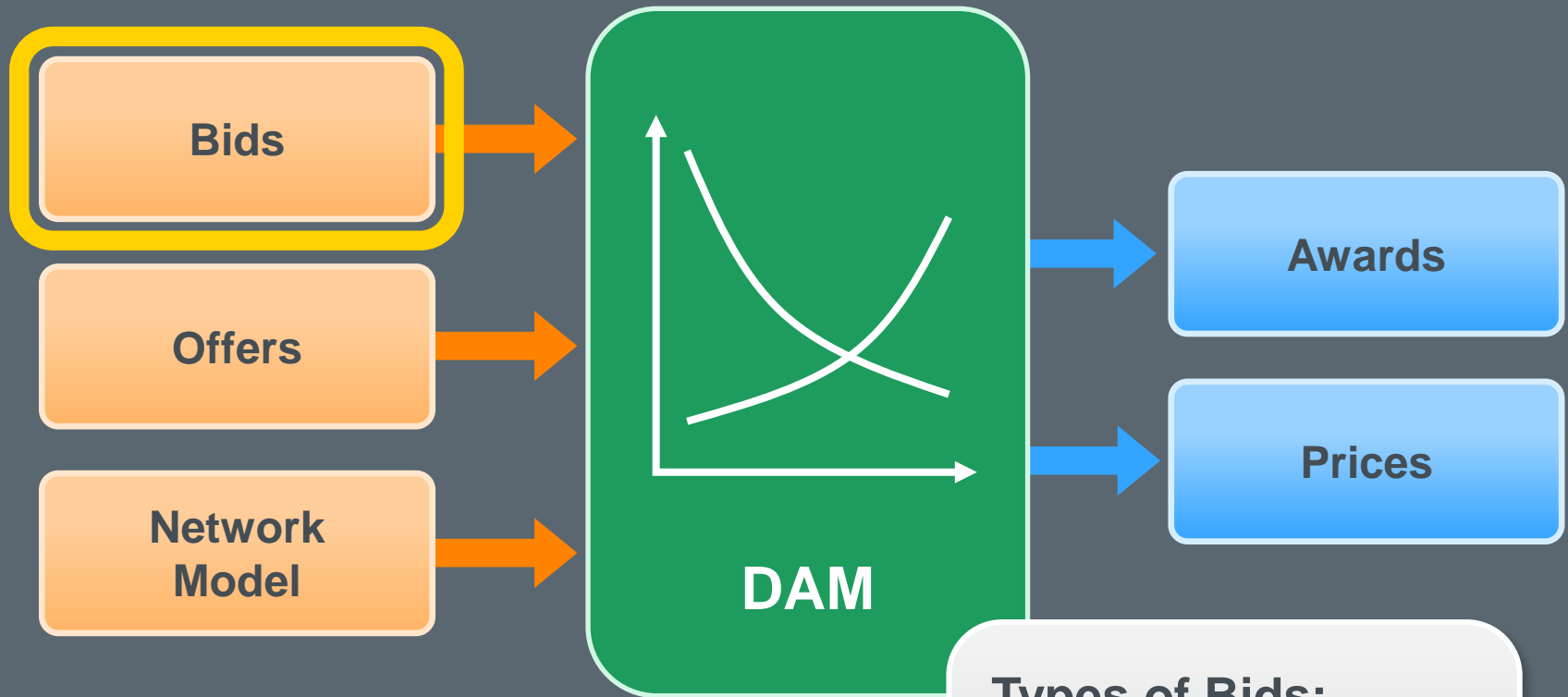
Bilateral Trades



CRRs

# Timing



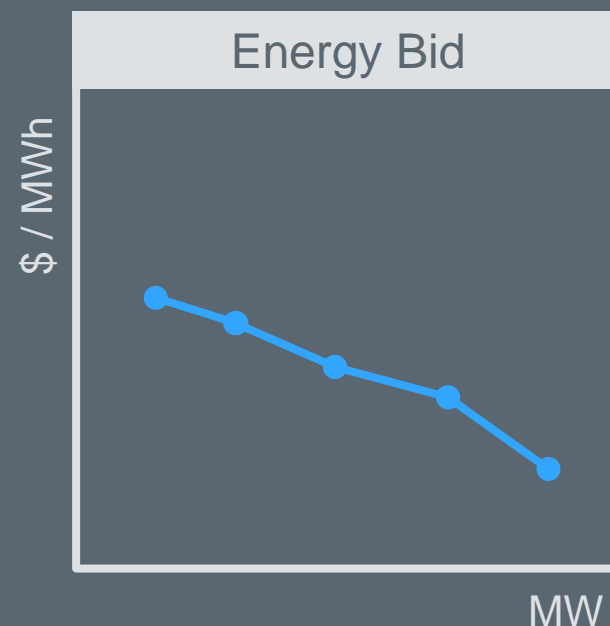


## Types of Bids:

- Energy Bid
- PTP Obligation Bid

## Day-Ahead Market Energy Bid

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



*Financial credit in Real-Time*

## Charge for awarded Energy Bid

$$= \text{Awarded MWs} * \text{DASPP}$$

## Payment for awarded Energy Offer

$$= (-1) * \text{Awarded MWs} * \text{DASPP}$$

DASPP = Day-Ahead Settlement Point Price

# *Friendly Power, LLP*



## DAM Award for Hour 1200

- 100 MW Energy Purchase
- West Load Zone

$$\begin{aligned}\text{Charge} &= 100 \text{ MW} * \$50/\text{MWh} \\ &= \$5000 \text{ per hour}\end{aligned}$$



## Real-Time Energy Imbalance at West Load Zone

$$= (-1) \left( \left( \begin{array}{c} \text{DAM Energy Purchases} \\ + \\ \text{Trade Energy Purchases} \end{array} \right) - \left( \begin{array}{c} \text{DAM Energy Sales} \\ + \\ \text{Trade Energy Sales} \\ + \\ \text{Metered Load} \end{array} \right) \right) * \text{RTSPP}$$

$$= (-1) \left( \left( \quad \right) - \left( \quad \right) \right) * \$40/\text{MWh}$$

=



	Type of Settlement	Result
<b>Day-Ahead Market</b>	DAM Energy Purchase	\$5000.00
<b>Real-Time</b>	Real-Time Energy Imbalance	\$0
	<b>NET Cost</b>	<b>\$5000.00</b>

## Costs

Energy

Congestion

Capacity

Ancillary Services

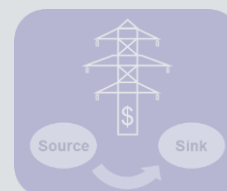
## Tools



Day-Ahead Market



Bilateral Trades

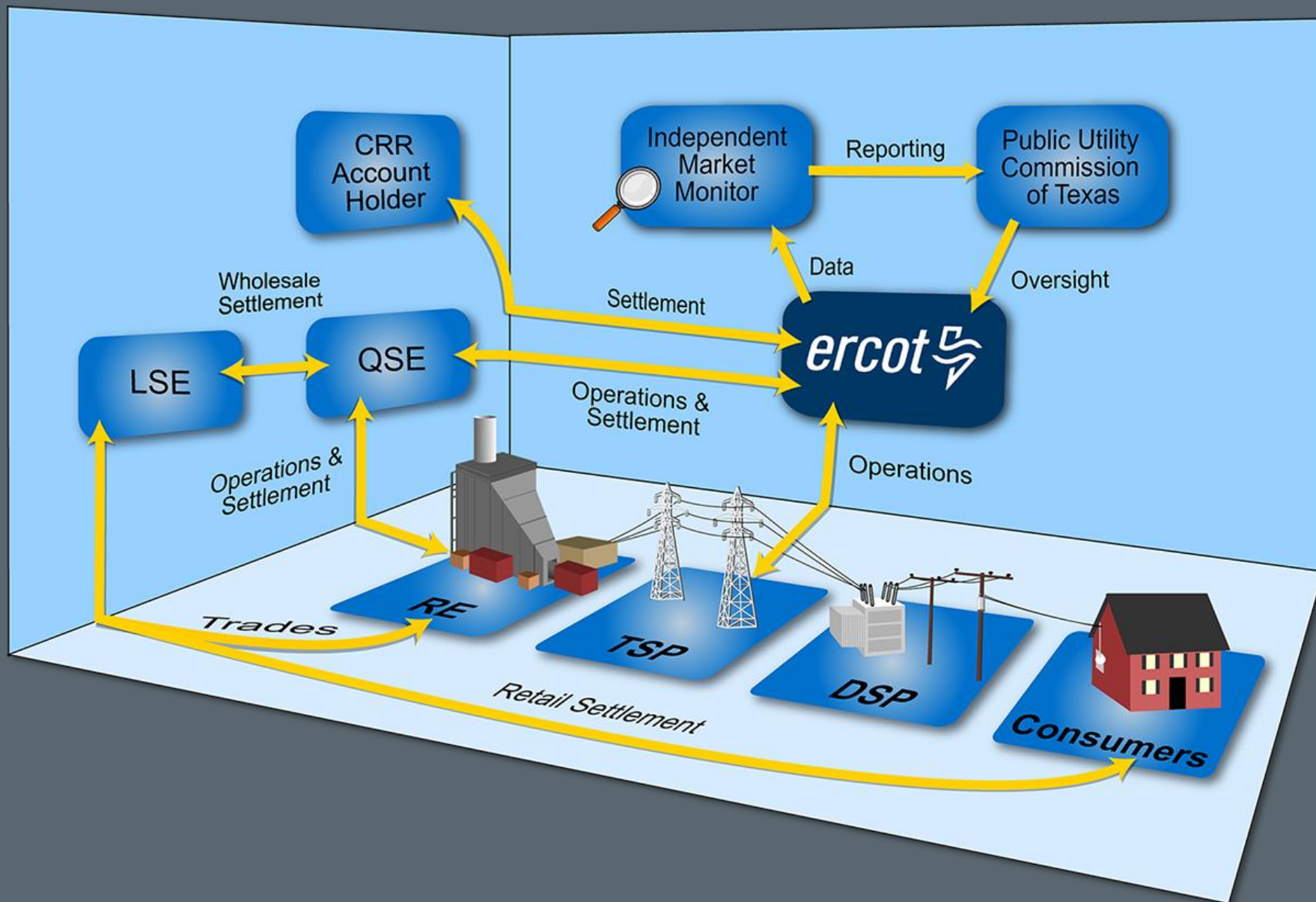


CRRs

## Decentralized Forward Market

- QSE-to-QSE transactions
- Transfers settlement responsibility
- Buyer and seller must confirm





# Friendly Power, LLP



## Energy Trade for Hour 1200

- 100 MW Energy Purchase
- For delivery to West Hub

$$\begin{aligned} \text{Cost} &= 100 \text{ MW} * \$55/\text{MWh} \\ &= \$5500 \text{ per hour} \end{aligned}$$

## Real-Time Energy Imbalance at West Hub

$$= (-1) \left( \left( \begin{array}{c} \text{DAM Energy Purchases} \\ + \\ \text{Trade Energy Purchases} \end{array} \right) - \left( \begin{array}{c} \text{DAM Energy Sales} \\ + \\ \text{Trade Energy Sales} \end{array} \right) \right) * \text{RTSPP}$$

$$= (-1) \left( \left( \quad \right) - \left( \quad \right) \right) * \$35/\text{MWh}$$

=

## Real-Time Energy Imbalance at West Load Zone

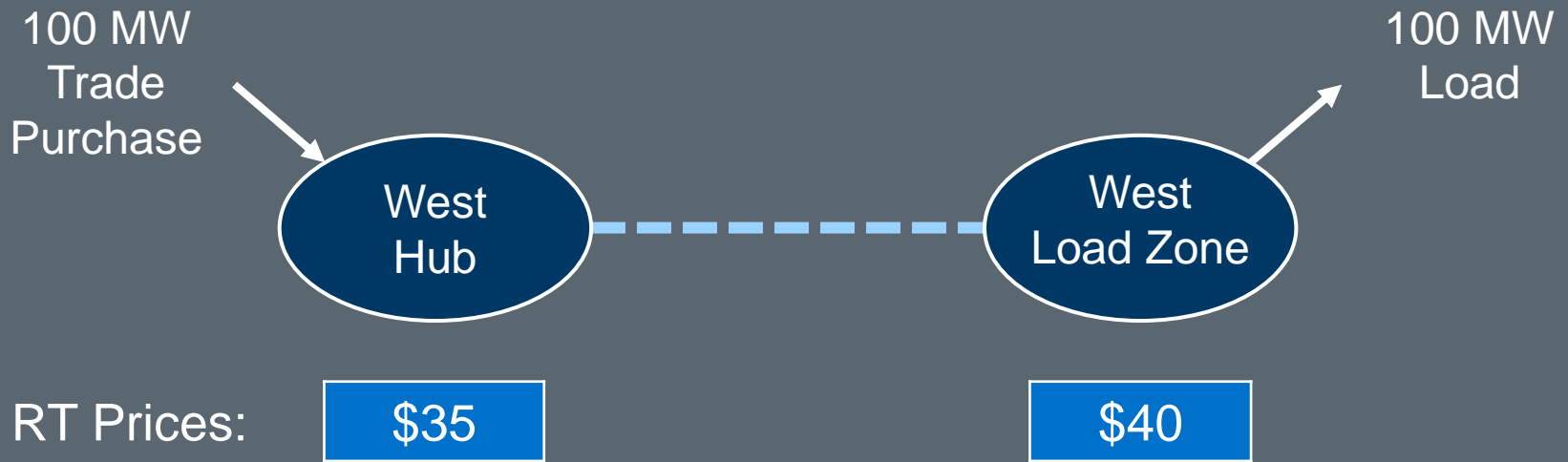
$$= (-1) \left( \left( \begin{array}{c} \text{DAM Energy Purchases} \\ + \\ \text{Trade Energy Purchases} \end{array} \right) - \left( \begin{array}{c} \text{DAM Energy Sales} \\ + \\ \text{Trade Energy Sales} \\ + \\ \text{Metered Load} \end{array} \right) \right) * \text{RTSPP}$$

$$= (-1) \left( \left( \quad \right) - \left( \quad \right) \right) * \$40/\text{MWh}$$

=



## Net Real-Time Energy Imbalance



Payment at Hub	Charge at Load Zone	Net Amount



Type of Settlement		Result
Day-Ahead Market	DAM Energy Purchase	N/A
Real-Time	Real-Time Energy Imbalance	\$500.00
<b><i>Net ERCOT Settlement</i></b>		\$500.00
Energy Trade	Cost to LSE for Energy Traded	\$5500.00
<b>NET Cost</b>		<b>\$6000.00</b>

## Costs

Energy

Congestion

Capacity

Ancillary Services

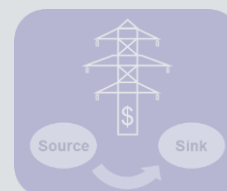
## Tools



Day-Ahead Market

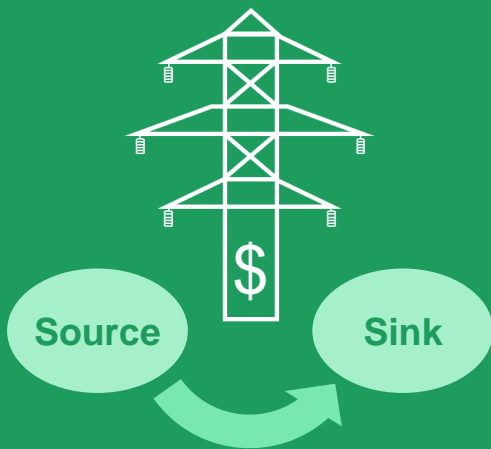


Bilateral Trades



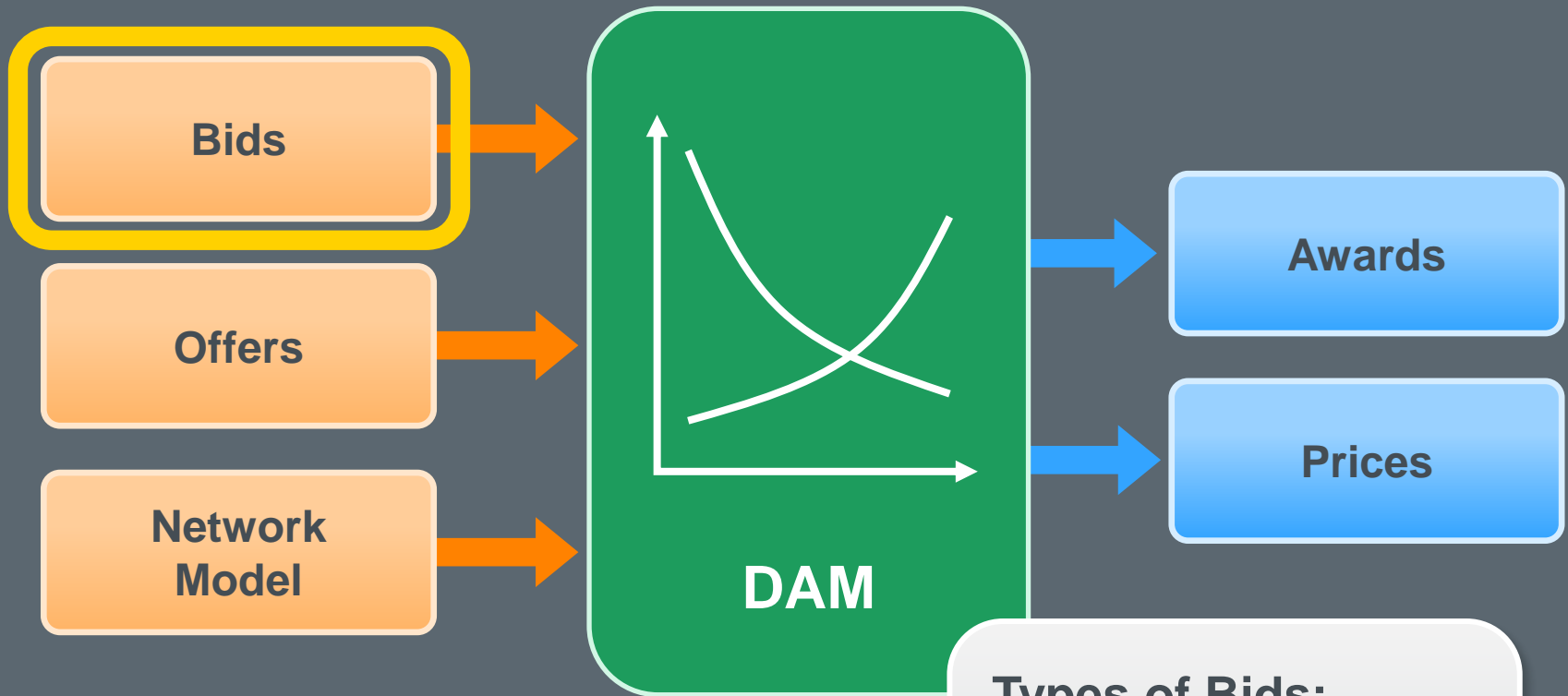
CRRs

## Point-to-Point Obligations



## Hourly Financial instruments

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



## Types of Bids:

- Energy Bid
- PTP Obligation Bid

## Submitted between any two Settlement Points

Source	Sink	Bid	
West Hub	West Load Zone	MW	\$ / MW
Resource Node A	West Load Zone	MW	\$ / MW
Resource Node A	West Hub	MW	\$ / MW
West Hub	Resource Node A	MW	\$ / MW



*Payment or charge in Real-Time!*



## *Friendly Power, LLP*

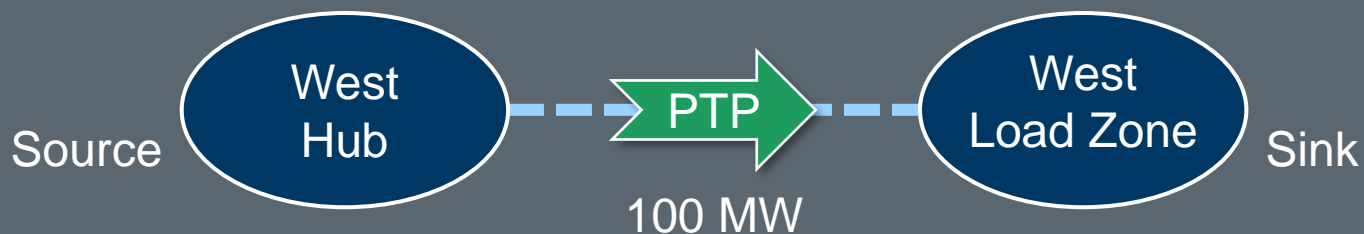


### 100 MW Transactions for Hour 1200

- DAM PTP Obligations  
West Hub to West Load Zone
- Trade Energy Purchase at West Hub



## Day-Ahead Market Point-to-Point Obligations



DAM Prices: **\$47**

**\$50**

RT Prices: **\$35**

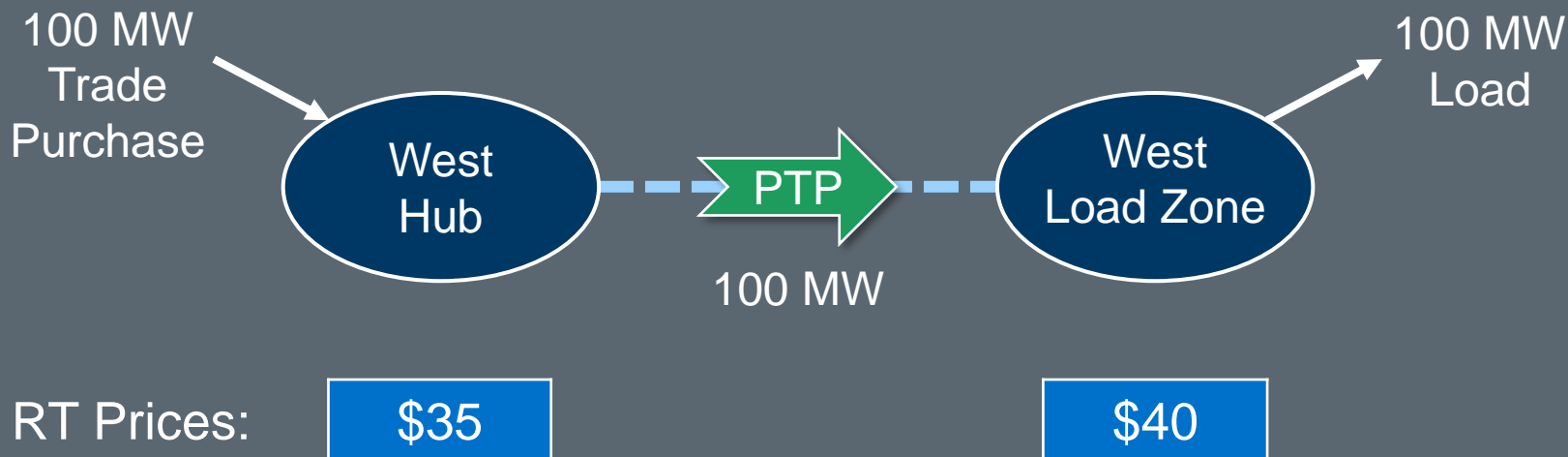
**\$40**

Settlement	Sink minus Source Price	PTP Obligation Amount
DAM		
RT		





## Real-Time Settlement



Payment at Hub	Charge at Load Zone	Payment for PTP Obligation	Net Amount



Type of Settlement		Result
Day-Ahead Market	DAM Energy Purchase	N/A
	Charge for DAM PTP Obligations	\$300.00
Real-Time	Real-Time Energy Imbalance	\$500.00
	Payment for DAM PTP Obligation	-\$500.00
<b><i>Net ERCOT Settlement</i></b>		\$300.00
Energy Trade	Cost to LSE for Energy Traded	\$5500.00
<b>NET Cost</b>		<b>\$5800.00</b>

## Costs

Energy

Congestion

Capacity

Ancillary Services

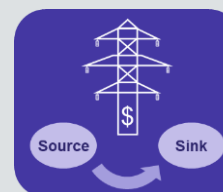
## Tools



Day-Ahead Market

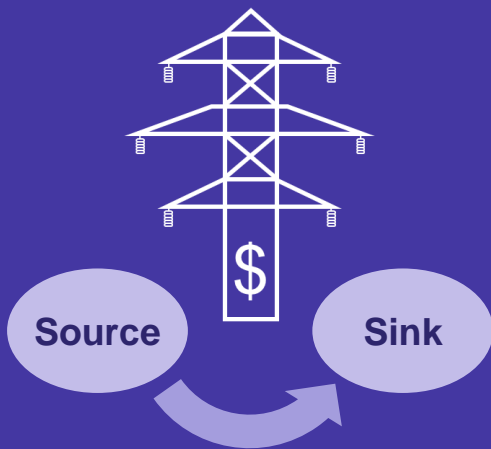


Bilateral Trades



CRRs

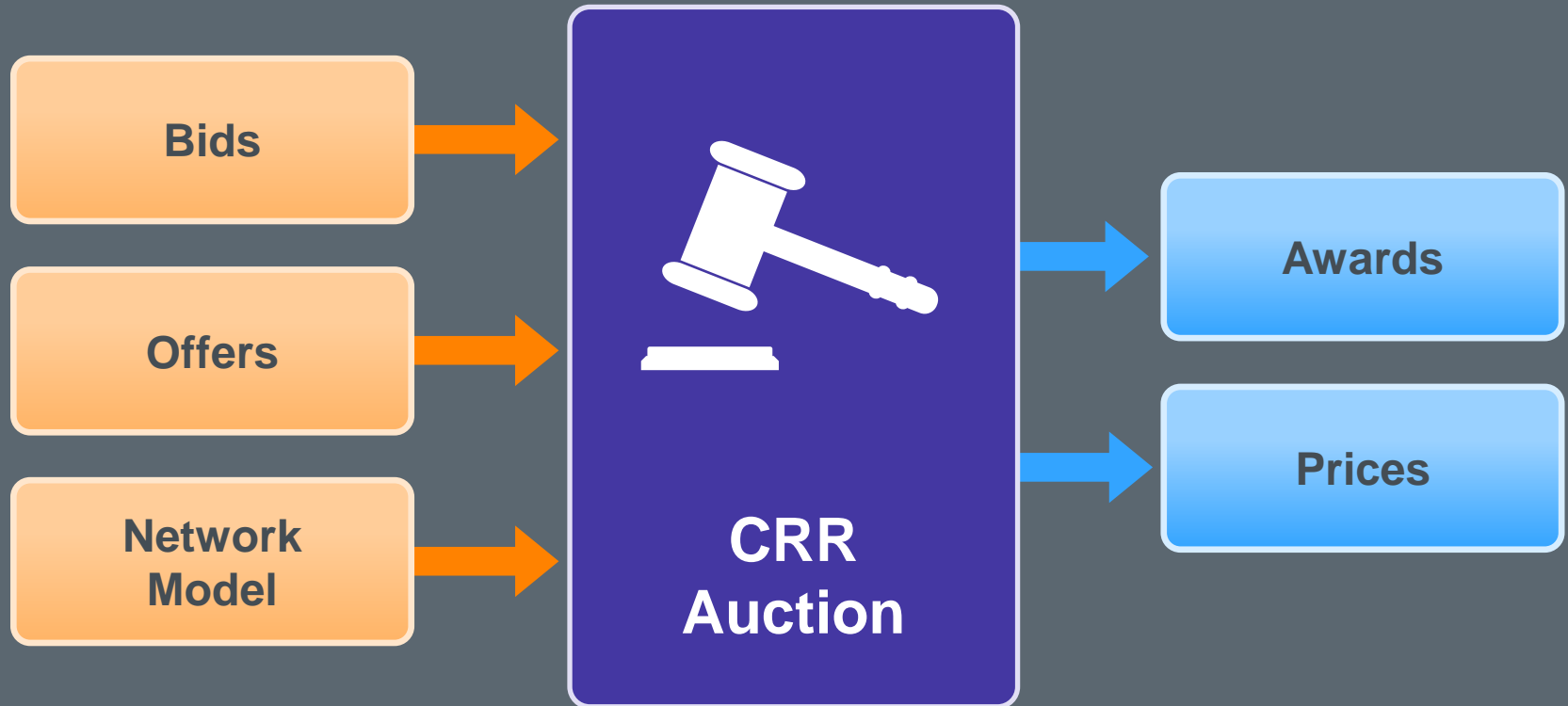
## Congestion Revenue Rights



## Monthly Financial instruments

- Purchased at Auction Price
- Settled at DAM price spread
- Two Types
  - Point-to-Point Options
  - Point-to-Point Obligations

## CRR Auction Transactions

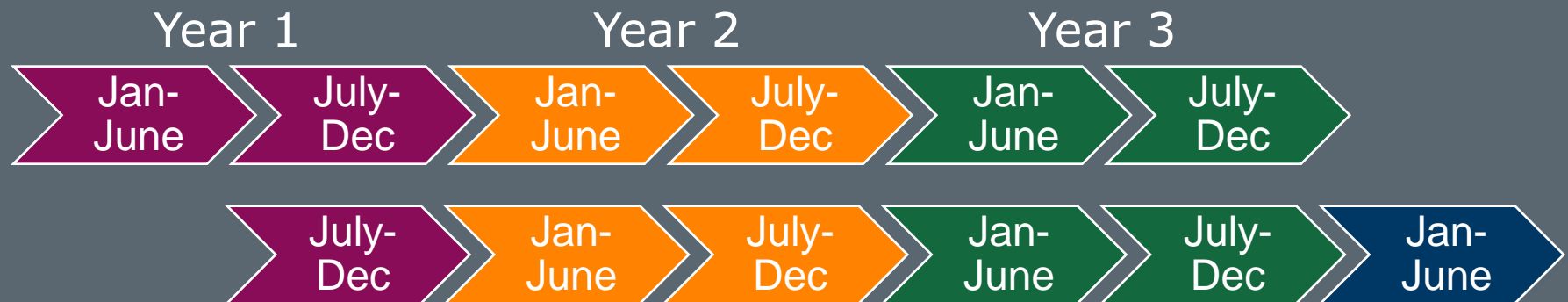


## CRR Auctions occur twice per month

Monthly Auction

Long-Term Auction Sequence

- Six successive auctions
- Six-month windows
- One window each month





## Friendly Power bids to buy CRRs in Monthly Auction



### Which Time of Use Block?

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



## Example 5: Price Matrix for Hour 1200

	Resource Node A	West Hub	West Load Zone
Bilateral Trade	\$50/MWh	\$55/MWh	\$60/MWh
Day-Ahead Market	\$45/MWh	\$47/MWh	\$50/MWh
Real-Time	\$30/MWh	\$35/MWh	\$40/MWh

Peak Weekday PTP Option	Auction Price
West Hub to West Load Zone	\$2/MWh
Resource Node A to West Load Zone	\$3/MWh





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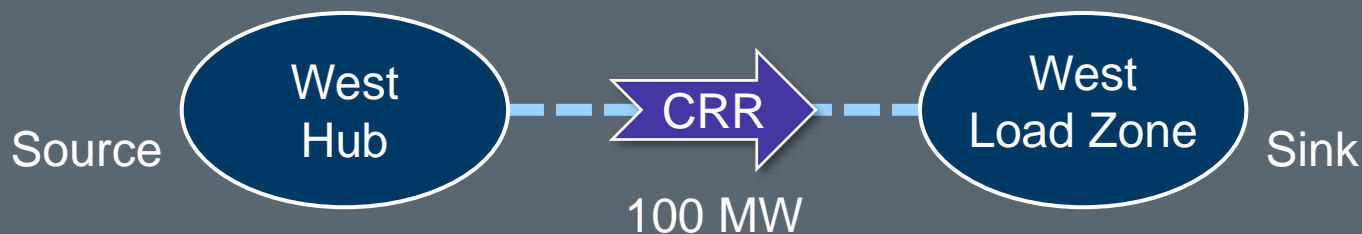


### 100 MW Transactions for Hour 1200

- Peak Weekday PTP Options  
West Hub to West Load Zone
- Trade Energy Purchase at West Hub



## CRR Auction Settlement

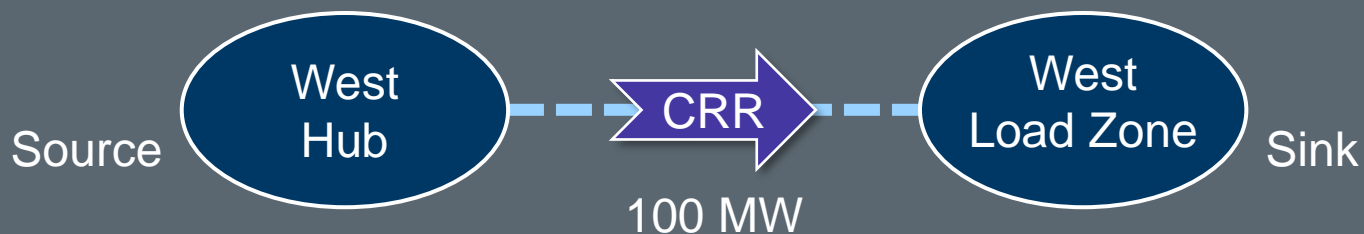


$$\begin{aligned} \text{Cost} &= 100 \text{ MW} * \$2/\text{MWh} \\ &= \$200 \text{ for Hour 1200} \end{aligned}$$

**Note:** ERCOT will charge CRR buyer for all hours in Time-Of-Use block



## Day-Ahead Market Settlement



DAM Prices:

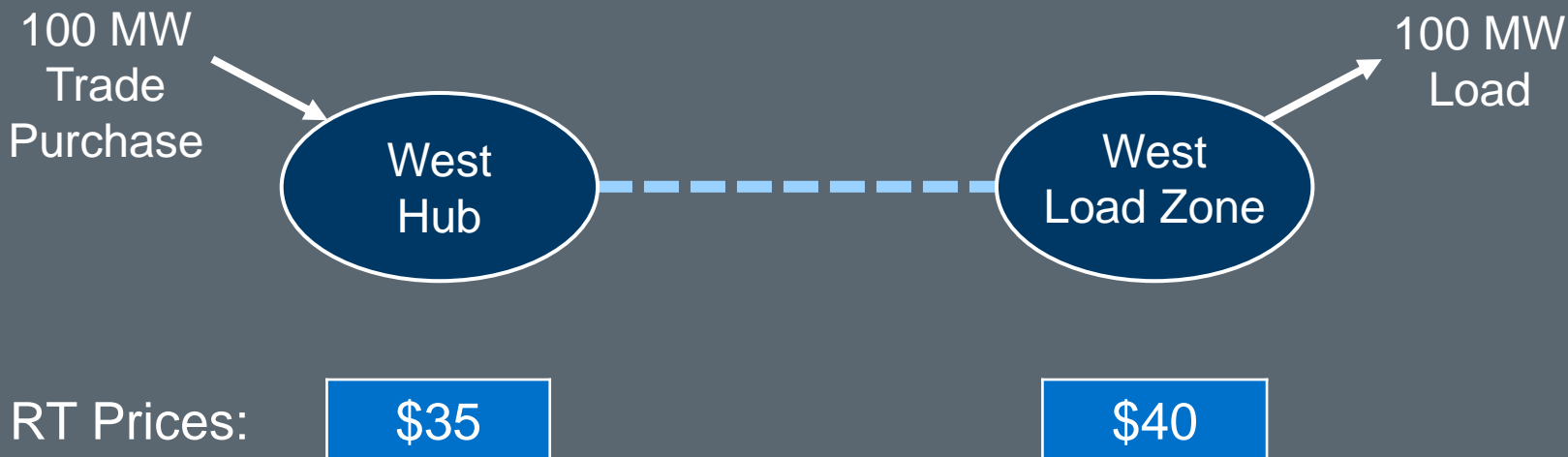
\$47

\$50

Sink minus Source Price	Payment for CRR



## Real-Time Settlement



Payment at Hub	Charge at Load Zone	Net Amount

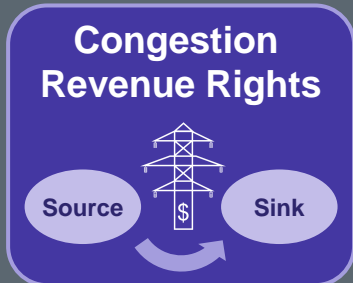


# Example 5: Scorecard

	Type of Settlement	Result
<b>CRR Auction</b>	Charge for Awarded PTP Option	\$200
<b>Day-Ahead Market</b>	DAM Energy Purchase	N/A
	Payment for PTP Option	-\$300
	Charge for DAM PTP Obligations	N/A
<b>Real-Time</b>	Real-Time Energy Imbalance	\$500
	Payment for DAM PTP Obligation	N/A
<b>Net ERCOT Settlement</b>		\$400
<b>Energy Trade</b>	Cost to LSE for Energy Traded	\$5500
<b>NET Cost</b>		<b>\$5900</b>



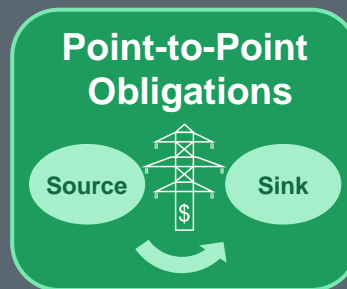
CRR Auction



CRR Auction

Day-Ahead Market

Real-Time



QSE

## Costs

Energy

Congestion

Capacity

Ancillary Services

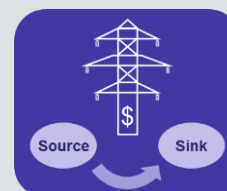
## Tools



Day-Ahead Market



Bilateral Trades



CRRs



## *Friendly Power, LLP*



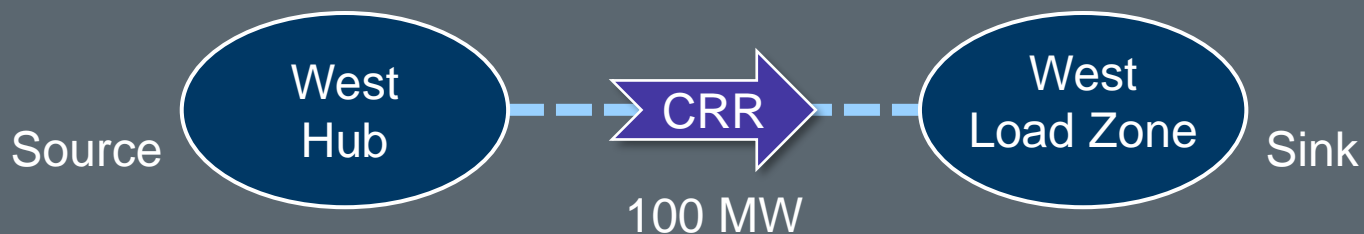
### 100 MW Transactions for Hour 1200

- Peak Weekday PTP Options  
West Hub to West Load Zone
- DAM PTP Obligations  
West Hub to West Load Zone
- Trade Energy Purchase at West Hub





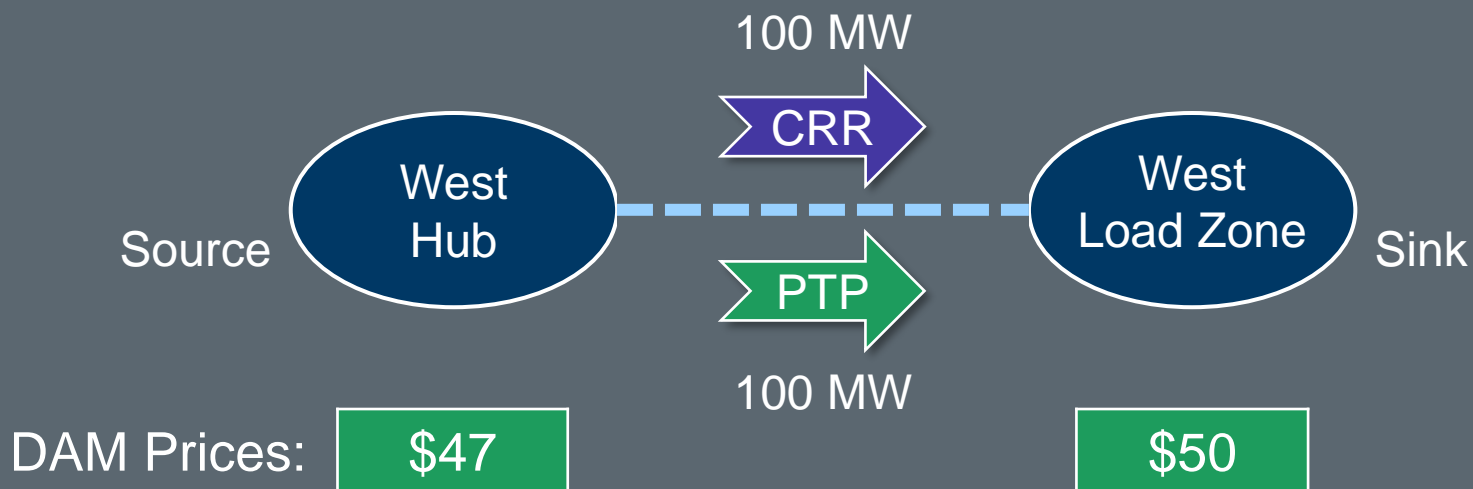
## CRR Auction Settlement



$$\begin{aligned} \text{Cost} &= 100 \text{ MW} * \$2/\text{MWh} \\ &= \$200 \text{ for Hour 1200} \end{aligned}$$



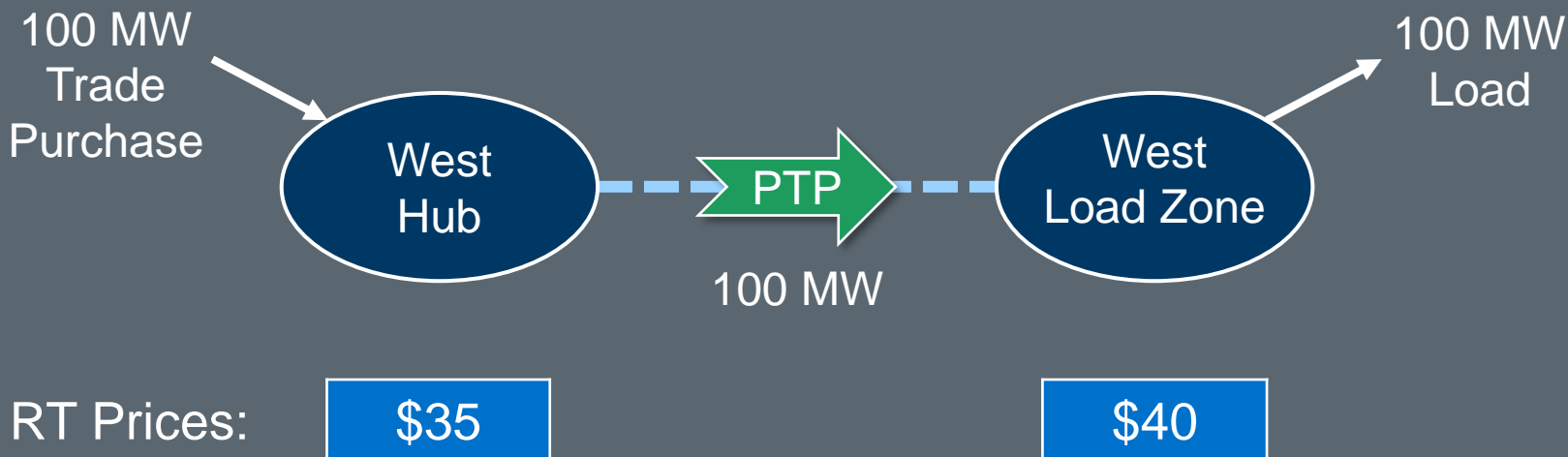
## Day-Ahead Settlement



Payment for CRR	Charge for PTP Obligation	Net Amount



## Real-Time Settlement



Payment at Hub	Charge at Load Zone	Payment for PTP Obligation	Net Amount



# Example 6: Scorecard

Type of Settlement		Result
<b>CRR Auction</b>	Charge for Awarded PTP Option	\$200
<b>Day-Ahead Market</b>	DAM Energy Purchase	N/A
	Payment for PTP Option	-\$300
	Charge for DAM PTP Obligations	\$300
<b>Real-Time</b>	Real-Time Energy Imbalance	\$500
	Payment for DAM PTP Obligation	-\$500
<b><i>Net ERCOT Settlement</i></b>		\$200
<b>Energy Trade</b>	Cost to LSE for Energy Traded	\$5500
<b>NET Cost</b>		<b>\$5700</b>

## Costs

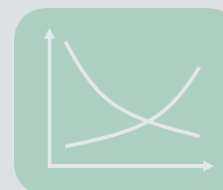
Energy

Congestion

Capacity

Ancillary Services

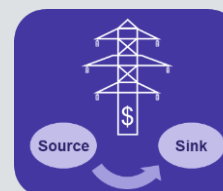
## Tools



Day-Ahead Market



Bilateral Trades



CRRs



## *Friendly Power, LLP*

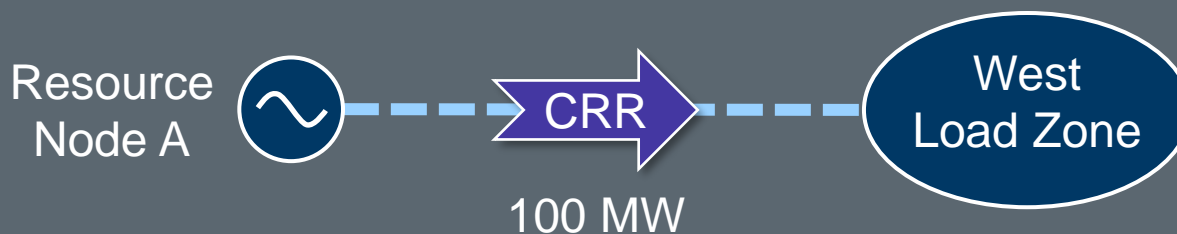


### 100 MW Transactions for Hour 1200

- Peak Weekday PTP Options  
Resource Node to West Load Zone
- DAM Energy Purchase at West Load Zone



## CRR Auction Settlement

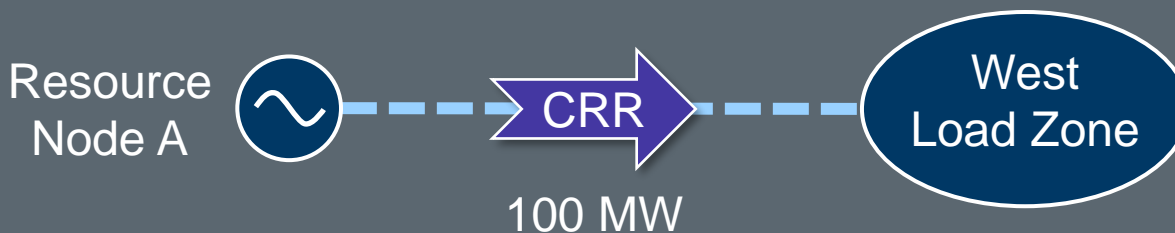


$$\begin{aligned} \text{Cost} &= 100 \text{ MW} * \$3/\text{MWh} \\ &= \$300 \text{ for Hour 1200} \end{aligned}$$

**Don't forget:** ERCOT will charge CRR buyer for all hours in Time-Of-Use block



## Day-Ahead Settlement



DAM Prices:

\$45

\$50

Energy Charge at Load Zone	Payment for PTP Option	Net Amount





## Real-Time Energy Imbalance at West Load Zone

$$= (-1) \left( \left( \begin{array}{c} \text{DAM Energy Purchases} \\ + \\ \text{Trade Energy Purchases} \end{array} \right) - \left( \begin{array}{c} \text{DAM Energy Sales} \\ + \\ \text{Trade Energy Sales} \\ + \\ \text{Metered Load} \end{array} \right) \right) * \text{RTSPP}$$

$$= (-1) \left( \left( \quad \right) - \left( \quad \right) \right) * \$40/\text{MWh}$$

=



	Type of Settlement	Result
<b>CRR Auction</b>	Charge for Awarded PTP Option	\$300
<b>Day-Ahead Market</b>	DAM Energy Purchase	\$5000
	Payment for PTP Option	-\$500
	Charge for DAM PTP Obligations	N/A
<b>Real-Time</b>	Real-Time Energy Imbalance	\$0
	Payment for DAM PTP Obligation	N/A
<b>Net ERCOT Settlement</b>		<b>\$4800</b>
<b>Energy Trade</b>	Cost to LSE for Energy Traded	N/A
<b>NET Cost</b>		<b>\$4800</b>

## Costs

Energy

Congestion

Capacity

Ancillary Services

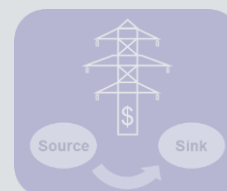
## Tools



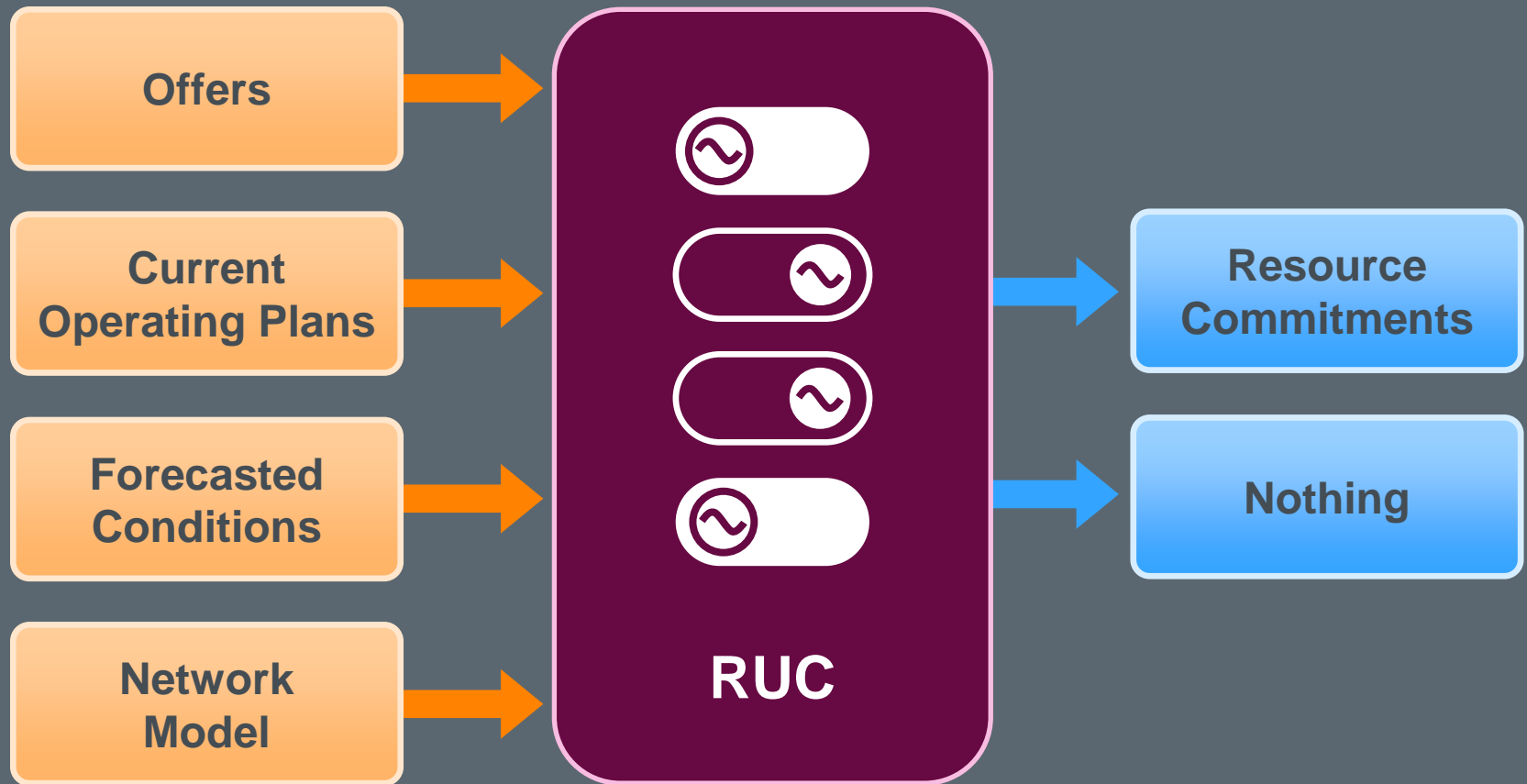
Day-Ahead Market



Bilateral Trades



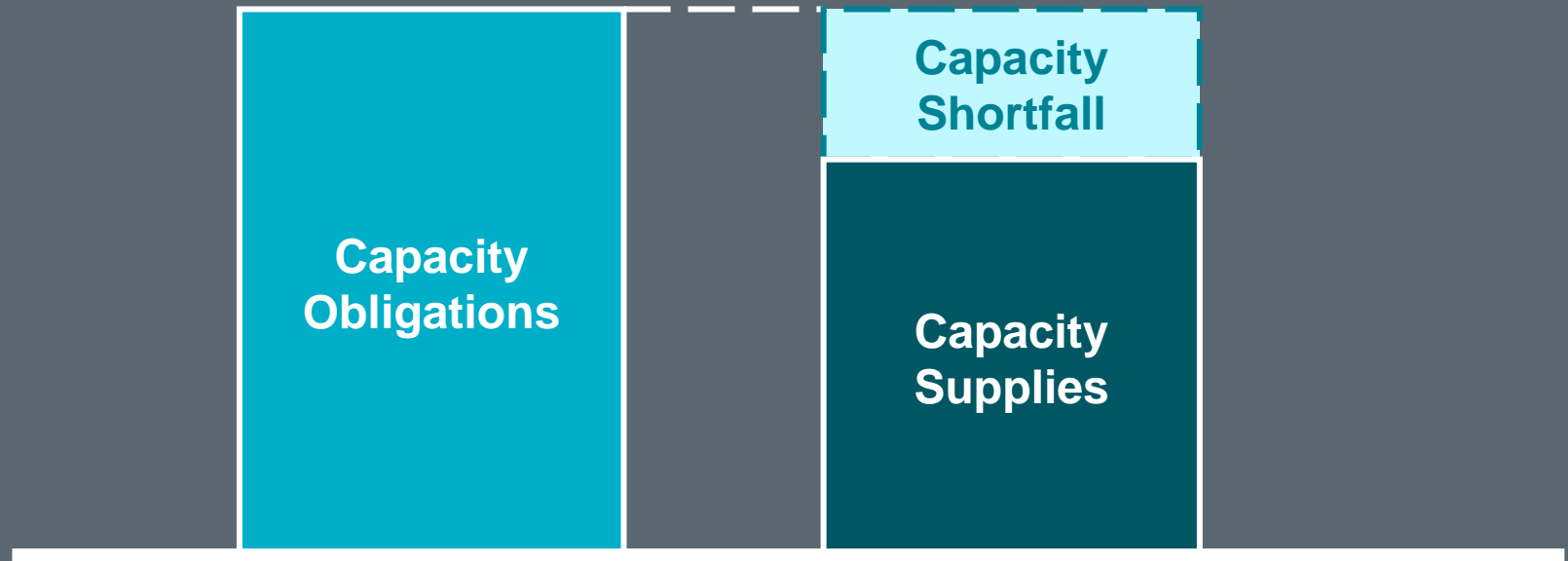
CRRs



# QSE is guaranteed to recover operating costs of Resource



## Assessed to QSEs with Capacity Shortfall



## Potential Capacity Obligations for Friendly Power, LLC



Capacity  
Obligations

Load

Energy Trade Sales

Capacity Trade Sales

DAM Energy Sales

## Capacity Supplies available to Friendly Power, LLC



**DAM Energy Purchases**

**Energy Trade Purchases**

**Capacity Trade Purchases**

**Capacity  
Supplies**



## Costs

Energy

Congestion

Capacity

Ancillary Services

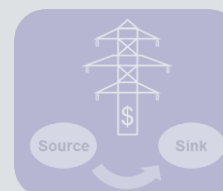
## Tools



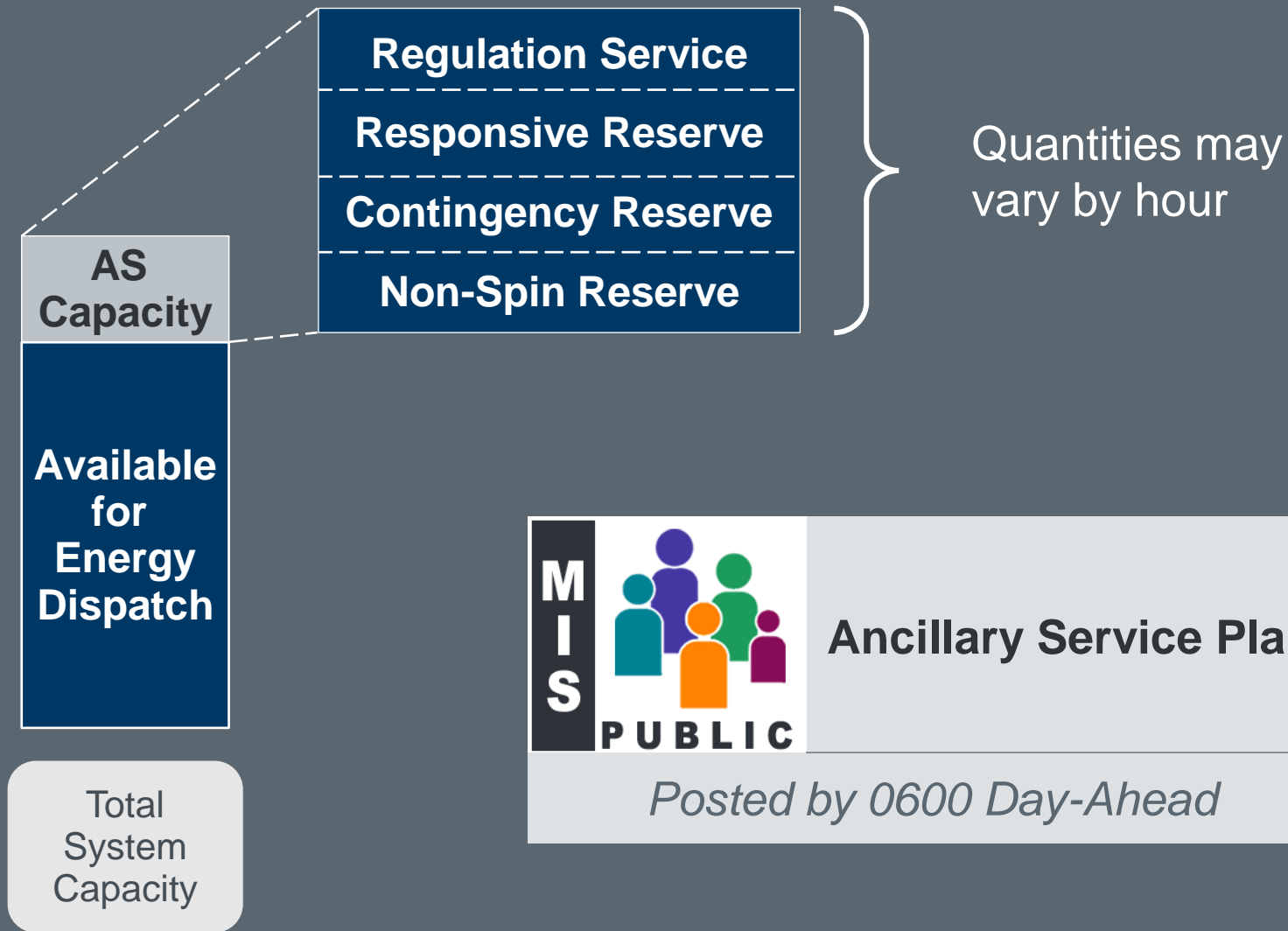
Day-Ahead Market



Bilateral Trades



CRRs

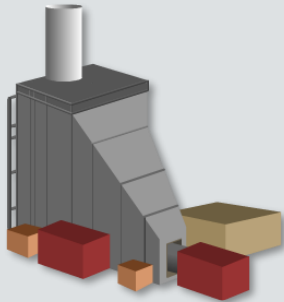


# ERCOT allocates Ancillary Service Plan

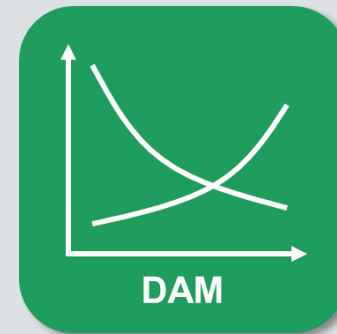


## QSE chooses how to fulfill

Self-Arrange



Allow ERCOT to procure



... but must choose before DAM

## Each QSE pays a share of the total cost for each Ancillary Service by hour

- Initially in Day-Ahead Market
- Trued-up in Real-Time



$$\text{Charge} = \text{AS Price} * \left( \left( \text{QSE Obligation} \right) - \left( \text{Self-Arranged Qty} \right) \right)$$

Where ...

$$\text{AS Price} = \left( \frac{\text{ERCOT Total AS Cost}}{\text{MW procured by ERCOT}} \right)$$



## *Friendly Power, LLP*



### **Self-arranges 30 MW of Responsive Reserve for Hour 1200**

- Responsive Reserve Obligation was 36 MW
- ERCOT procures 1200 MW Responsive Reserve
- Total Responsive Reserve Cost = \$14,400



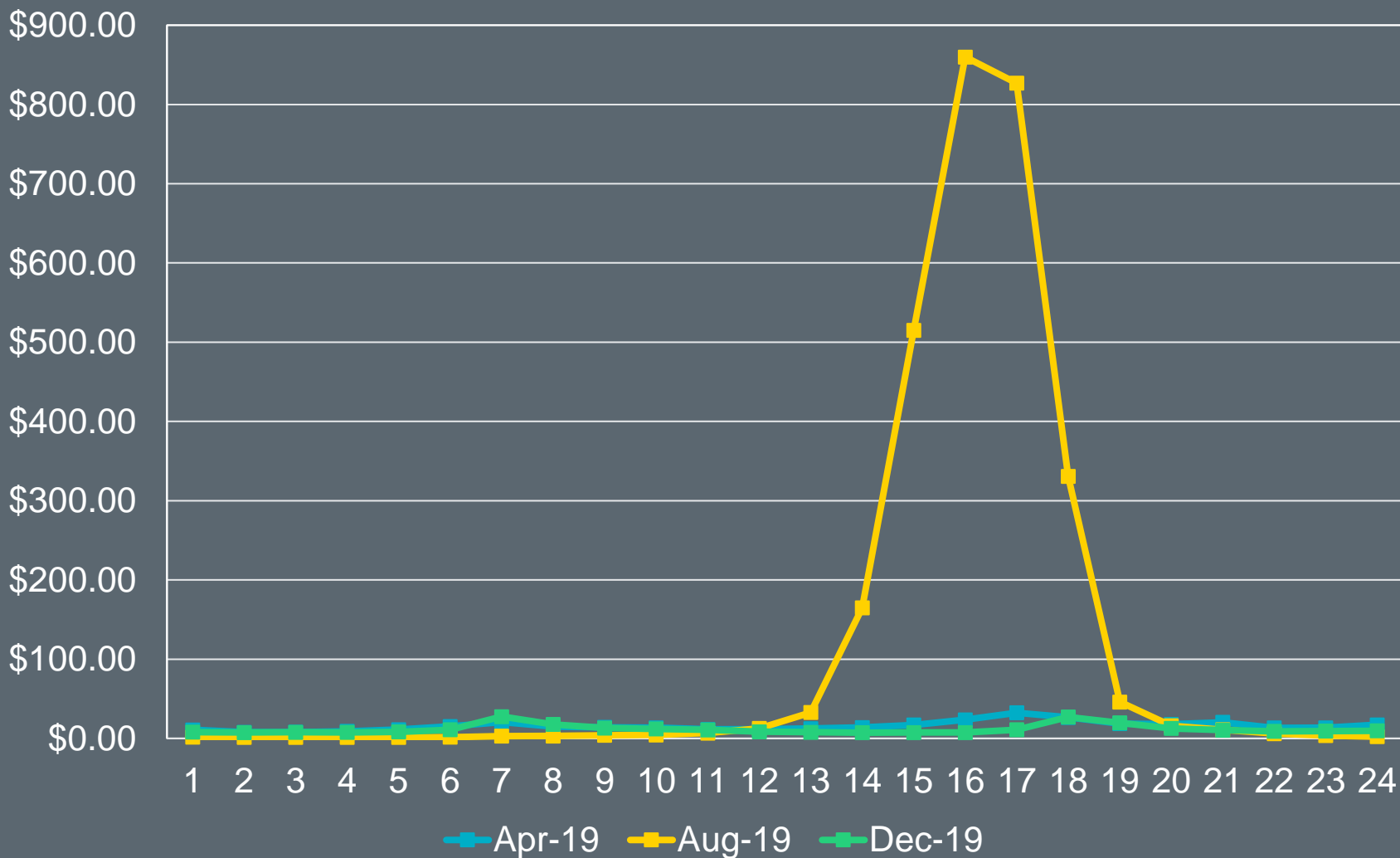
## Friendly Power's Ancillary Service Settlement

$$\text{Responsive Reserve Price} = \left( \frac{\quad}{\quad} \right) =$$

$$\begin{aligned} \text{Charge} &= \text{Responsive Reserve Price} * \left( \left( 36 \text{ MW} \right) - \left( 30 \text{ MW} \right) \right) \\ &= \end{aligned}$$



## Monthly RRS Average (by hour)





# Credit Overview



Posted  
Financial  
Security




Total  
Market  
Charges



Total  
Market  
Payments

## Sources

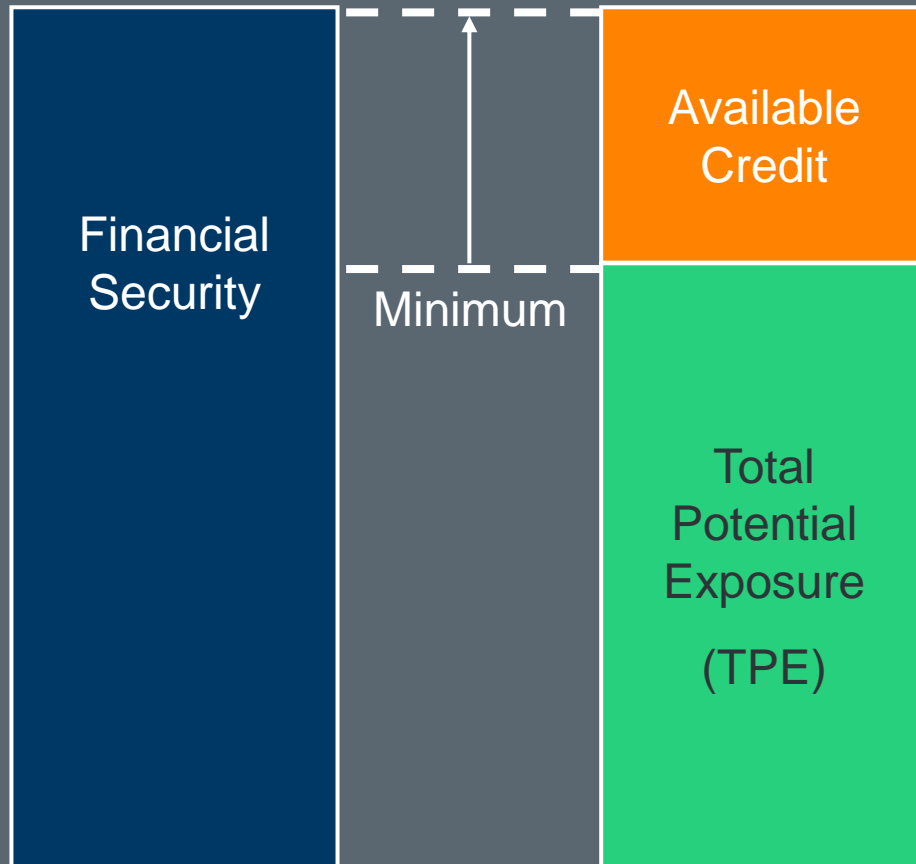
- Settlement Charges from ERCOT
- Future Exposure from CRRs



Total  
Potential  
Exposure  
(TPE)

## Minimum Requirement for Participation





Financial Security beyond minimum makes credit available for market activities



Posts Financial Security with ERCOT



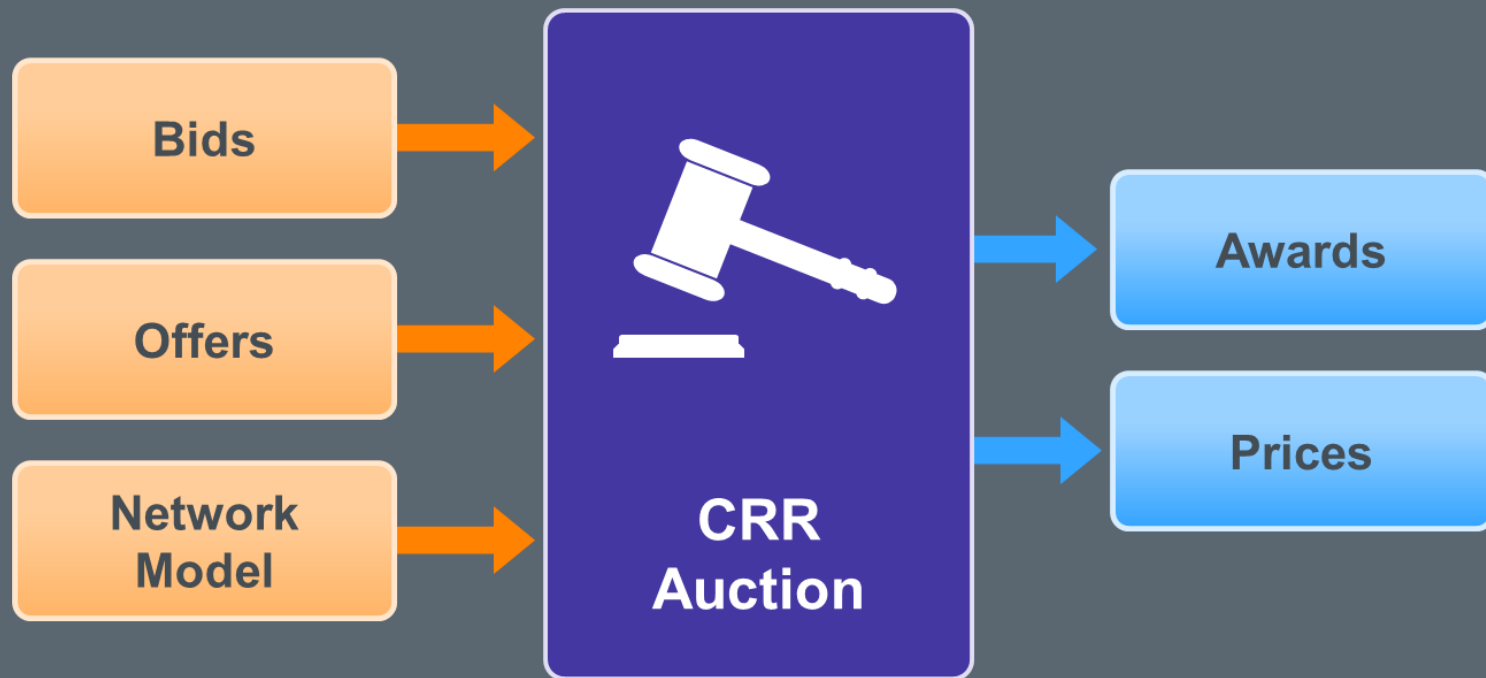
CRR  
Auction  
Credit Limit



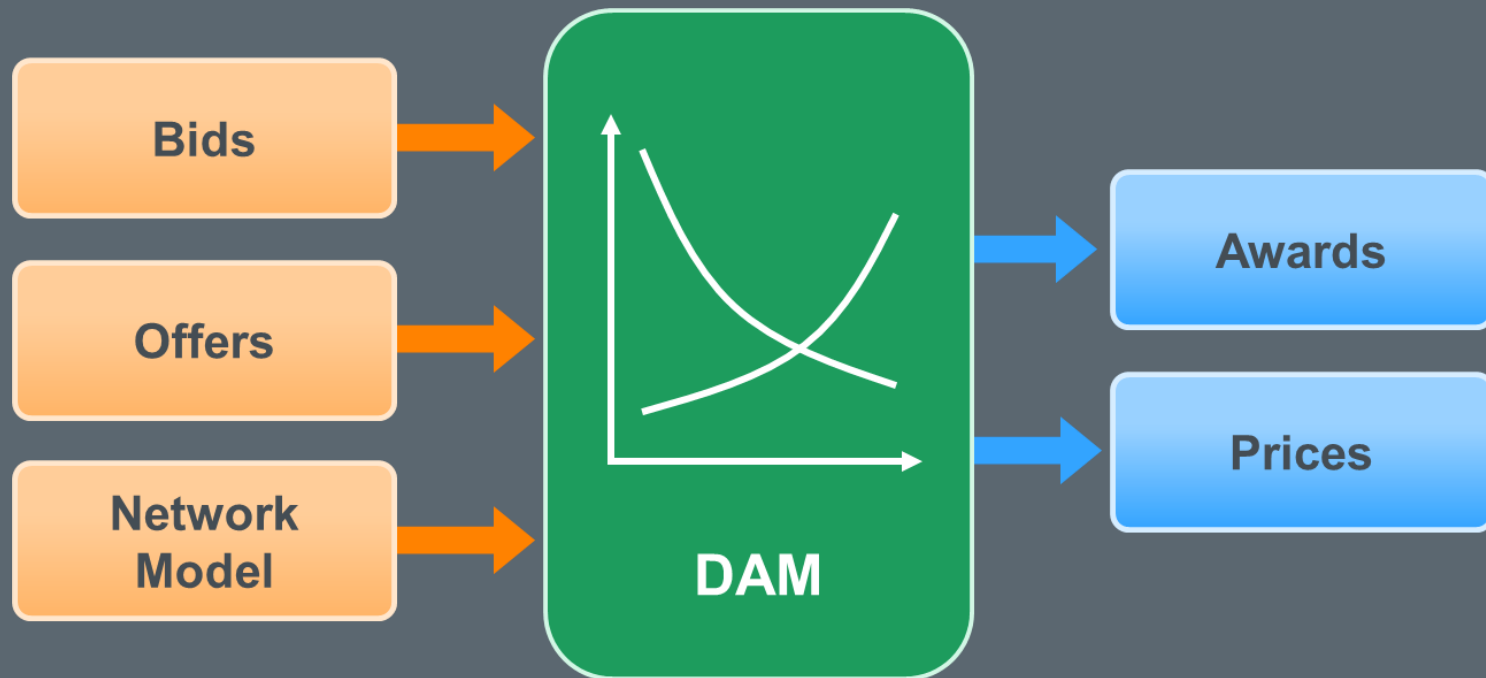
Day-Ahead  
Market  
Credit Limit



Transaction	Credit Requirement
PTP Option Bid	Volume * Bid Price
PTP Obligation Bid	Volume * (Bid Price + Path-Specific Adders)

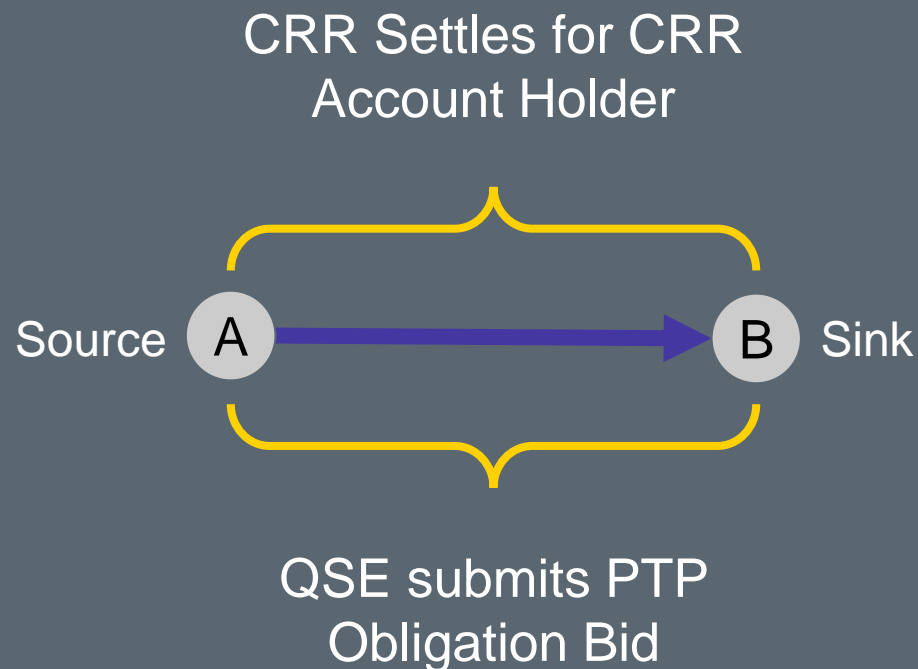
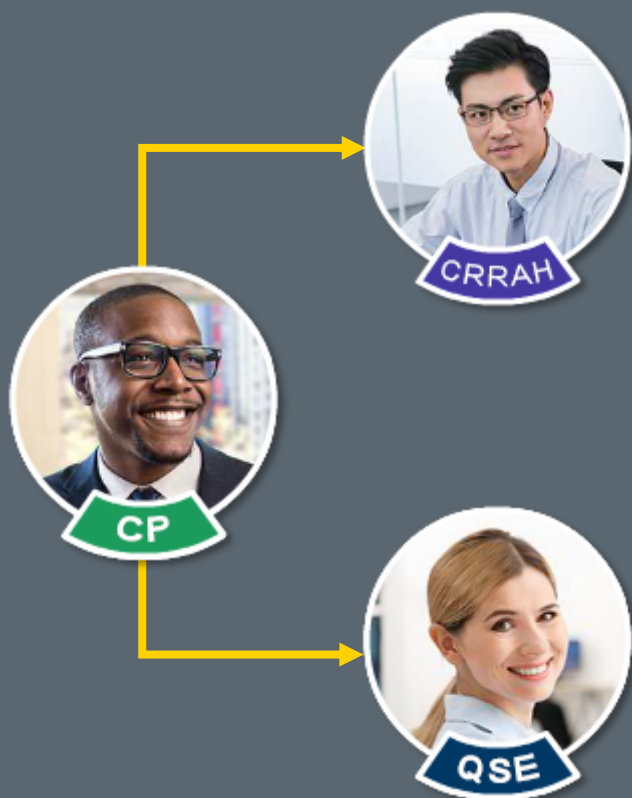


Transaction	Credit Requirement
Energy Bid	Volume * Bid Price
PTP Obligation Bid	Volume * (Bid Price + Historical RT exposure)





## For a given hour in DAM . . .



$$\text{Credit Requirement} = (\text{Min}[\text{Bid MW}, \text{CRR MW}]) * 10\% \text{ of Bid Price}$$

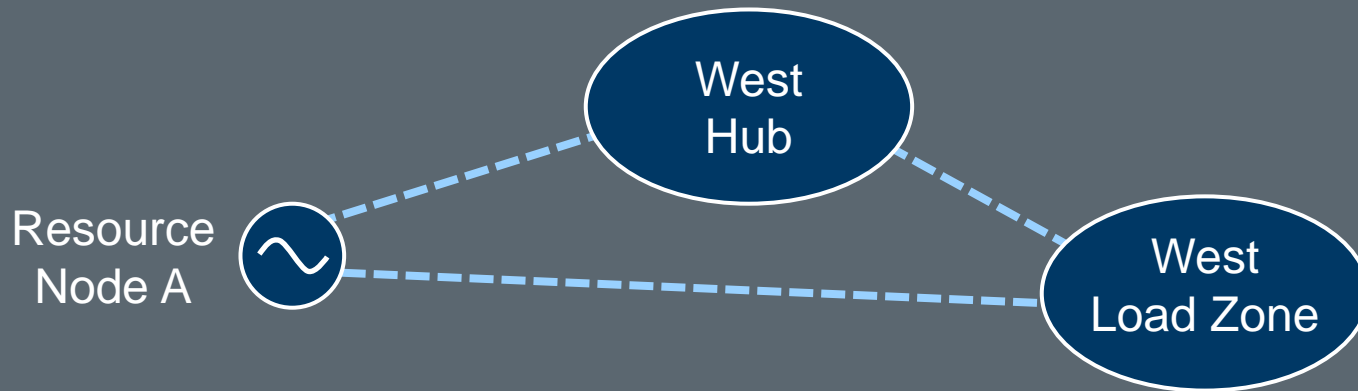
# Using Market Products for Hedging Costs



## 1. Break into teams

## 2. Devise strategy

- Study recent average pricing information for Hour 1300
- Minimize cost to serve 100 MW Load at West Load Zone





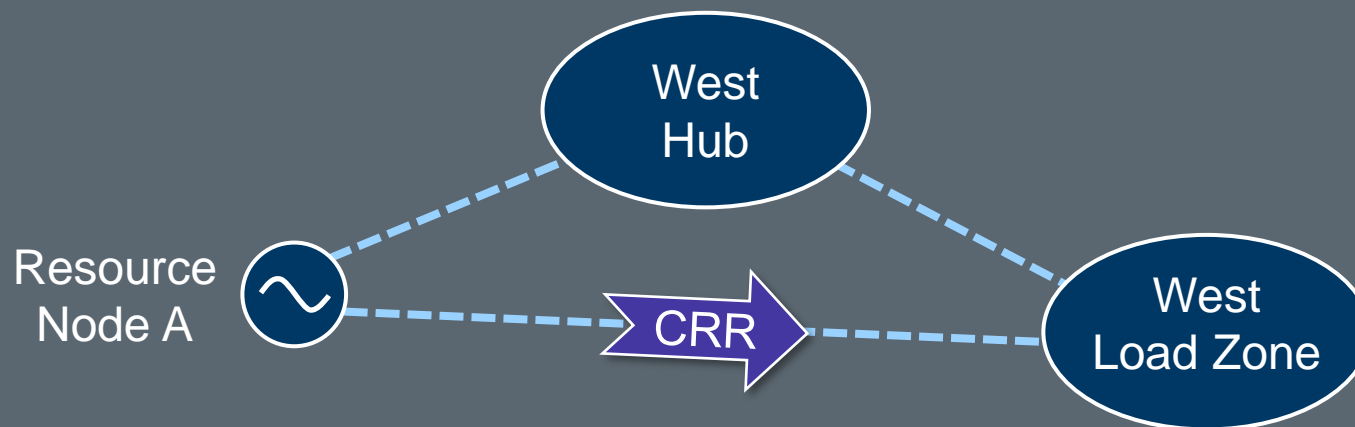
	Resource Node A	West Hub	West Load Zone
Bilateral Trade	\$50/MWh	\$55/MWh	\$60/MWh
Day-Ahead Market	\$35/MWh	\$43/MWh	\$50/MWh
Real-Time	\$25/MWh	\$35/MWh	\$40/MWh

Peak Weekday PTP Option	Auction Price
West Hub to West Load Zone	\$2/MWh
Resource Node A to West Load Zone	\$3/MWh

# **A Few Other Risks and Rewards**

## CRR payments may be derated if:

- CRR MWs exceed transmission limits
- Payment expected
- Sink is Resource Node





Distribution occurs once each month



Hourly



Congestion  
Rent

Payments



CRRAH

Excess



CRR  
Balancing  
Account





Hourly

Congestion  
Rent



Payments

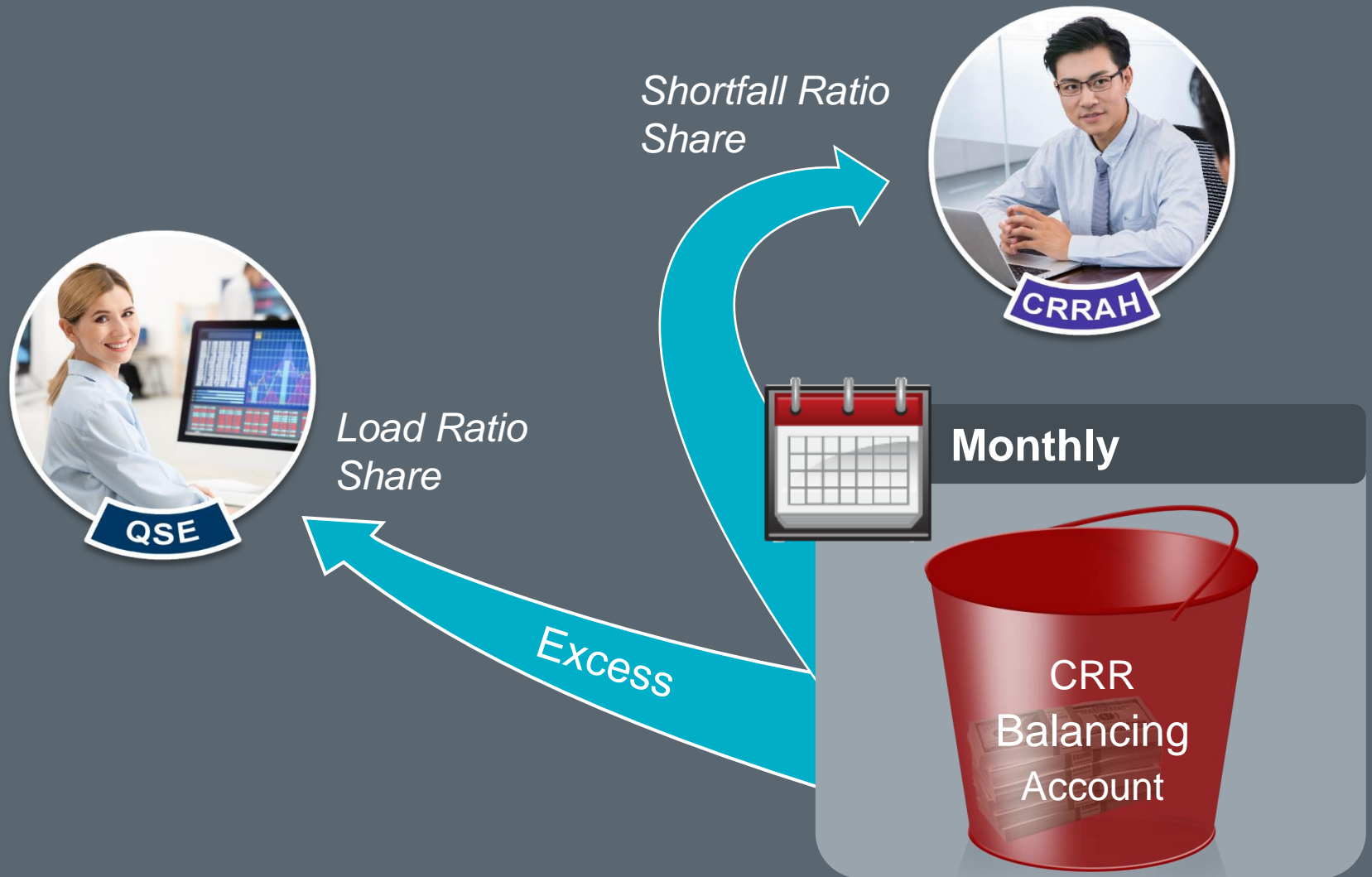
Short-Paid for  
Some Hours



CRRAH



CRR  
Balancing  
Account



# Course Wrap-Up

Home > Services > Training > Course Recommendations

## Course Recommendations

### + Foundational Market Courses

### - Wholesale Market Courses

	QSE	QSE-L	QSE-R	RE	CR	NOIE	CRR	TDSP
Load Serving Entities 201   <a href="#">ILT</a>   <a href="#">WBT</a>		<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		
Wholesale Markets 201   <a href="#">WBT</a>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>					
Wholesale Market Operations: Day-Ahead   <a href="#">ILT</a>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>					
Wholesale Market Operations: Real-Time   <a href="#">ILT</a>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>					
Congestion Revenue Rights   <a href="#">ILT</a>   <a href="#">WBT</a>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>				<input checked="" type="checkbox"/>	

### + Retail Market Courses

### + Resource Courses

### + Settlement and Financial Courses

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**<http://www.ercot.com/services/training/>**

**Market Education Contact**  
**[Training@ercot.com](mailto:Training@ercot.com)**

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<https://www.surveymonkey.com/r/ERCOTILT>

