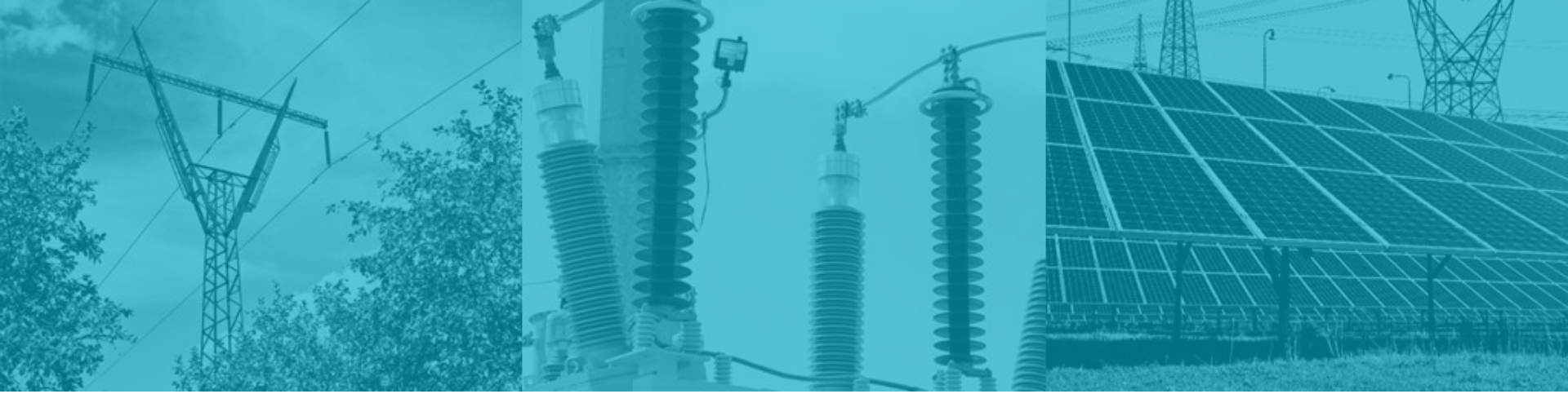


ERCOT MARKET EDUCATION

Congestion Revenue Rights

2020_05 CRR

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/

WebEx Training Tips

- Windows
- Buttons

Attendance

Questions / Chat

Please enable video & audio capabilities

Upon completion of this course, you will be able to:

- Identify the requirements to participate in the CRR market
- Explain various CRR market processes
- Describe possible financial outcomes of CRRs in the ERCOT markets

Modules in this course include:

1. Fundamentals of Congestion Revenue Rights
2. CRR Auction & Allocation Processes
3. Trading of CRRs
4. Day-Ahead Market Point-to-Point Obligations
5. Credit Limits
6. CRR Settlements

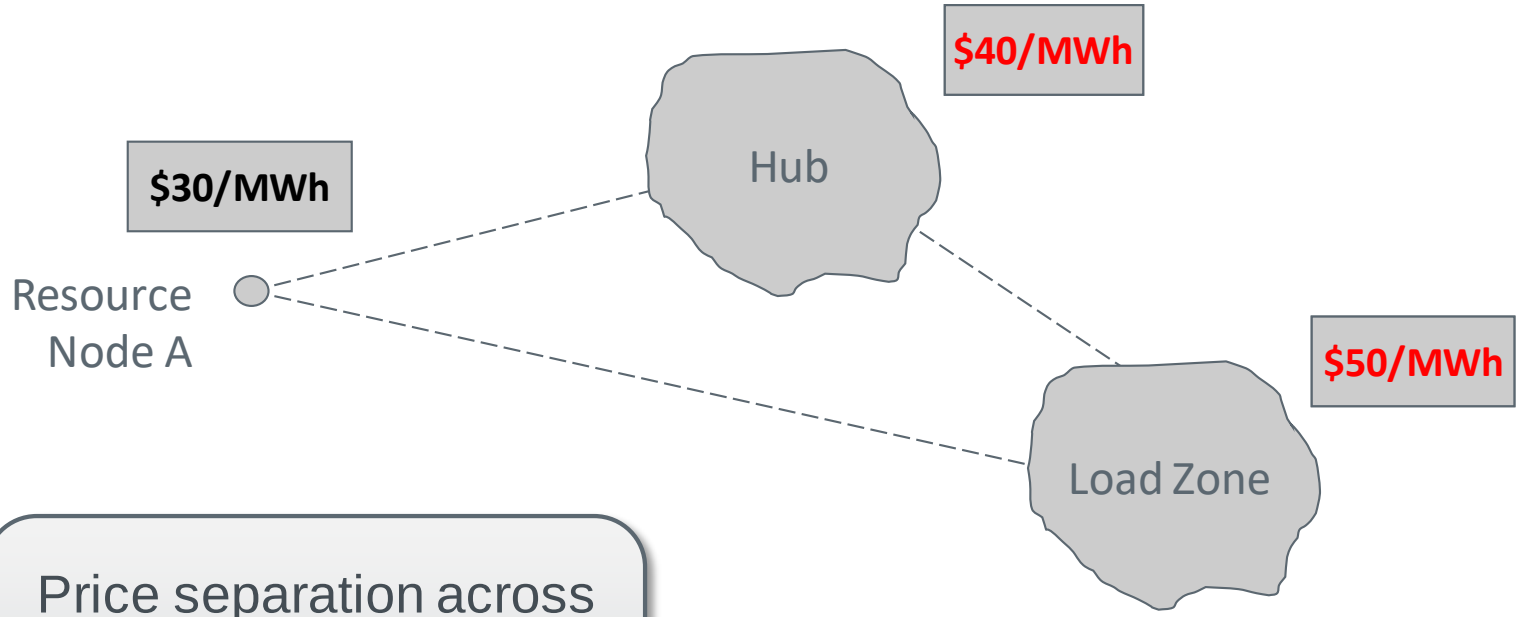
Module 1

Fundamentals of Congestion Revenue Rights

Upon completion of this module, learners will be able to:

- Explain the nature of congestion cost exposure
- Describe the products available for hedging Day-Ahead Market congestion
- Describe the product available for hedging Real-time Market congestion

Congestion Cost exposure

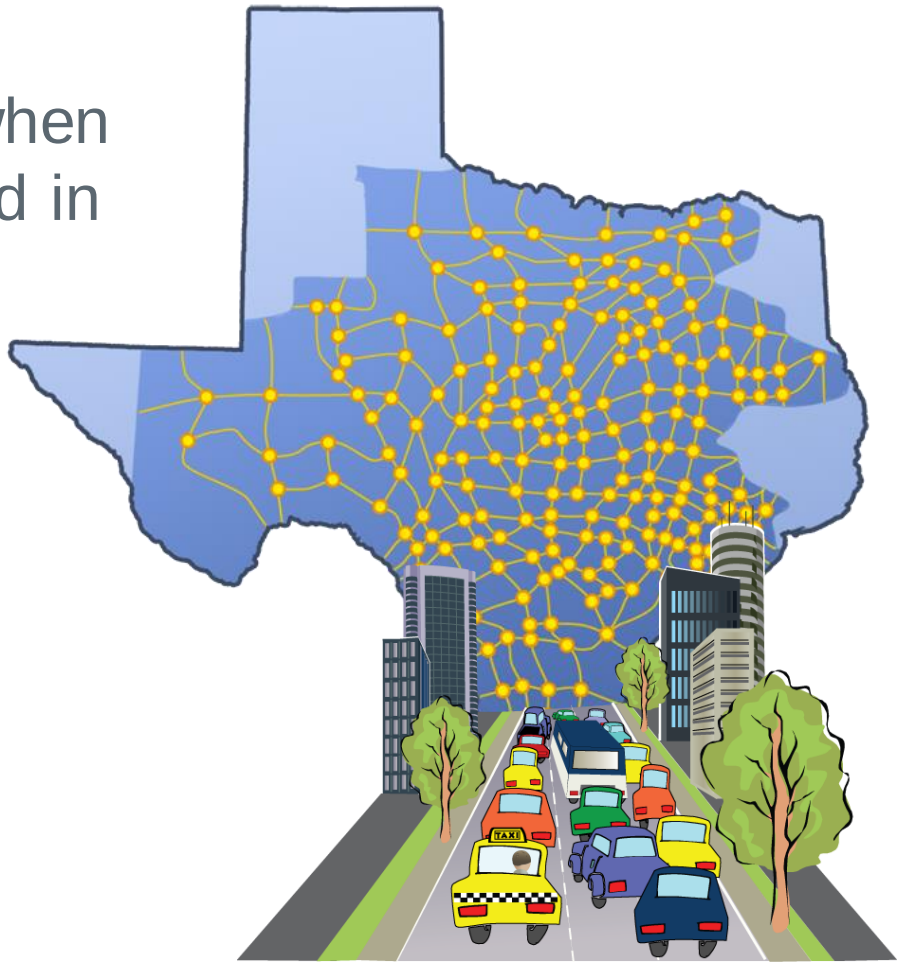


Price separation across the grid exposes buyers and sellers of energy to **Congestion Costs**

Congestion Revenue Rights (CRRs):

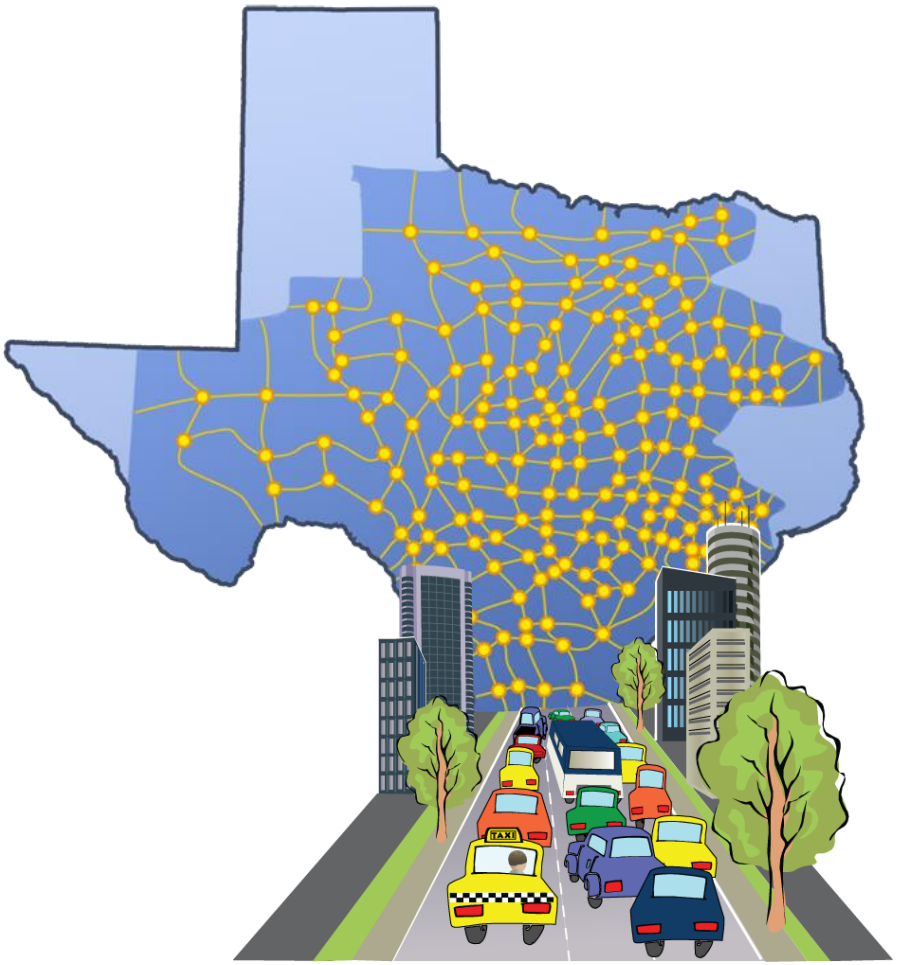
- Financial instruments
- Payment or charge to owner when Transmission Grid is congested in Day-Ahead Market

A CRR is *not* a right to deliver physical energy



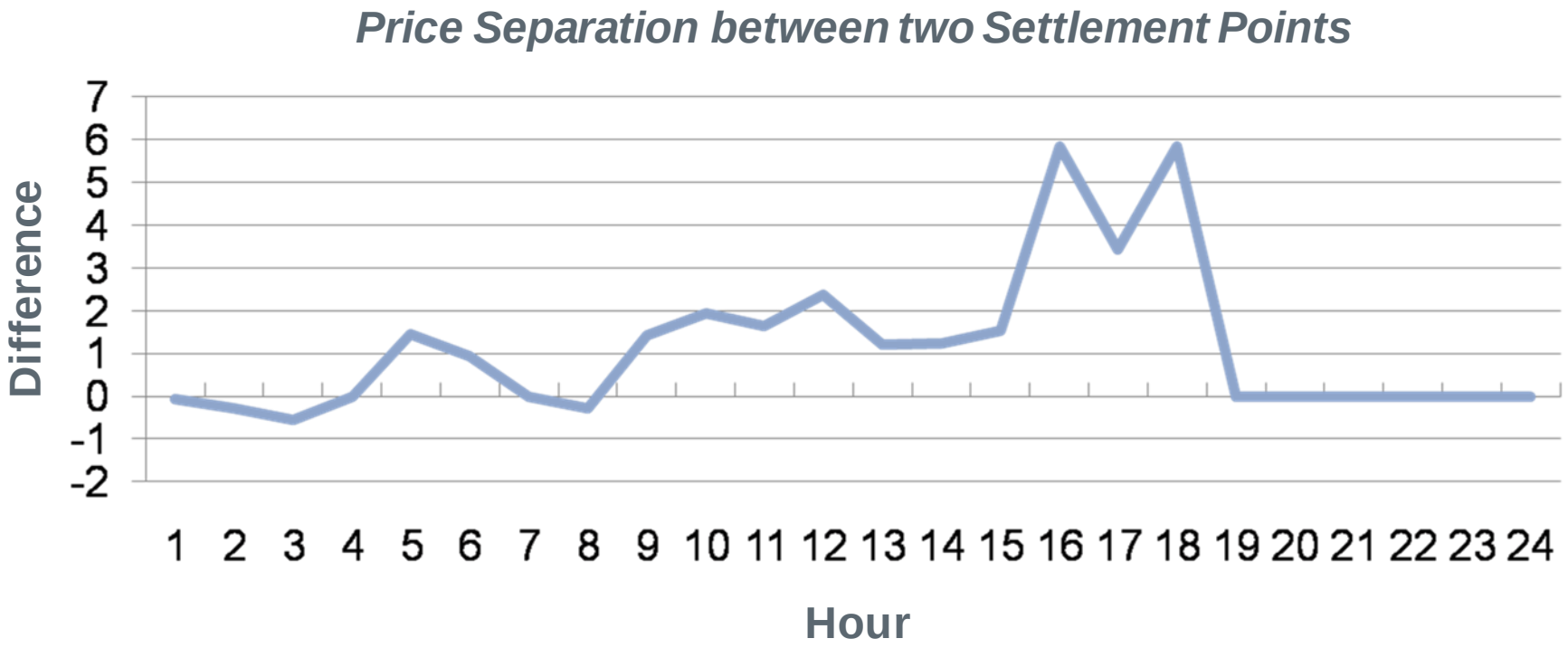
CRRs may be used as:

- Financial Hedge
- Financial Investment



As a Financial Hedge for …

- Price certainty - Locking in the cost of congestion at the cost of purchasing the CRR

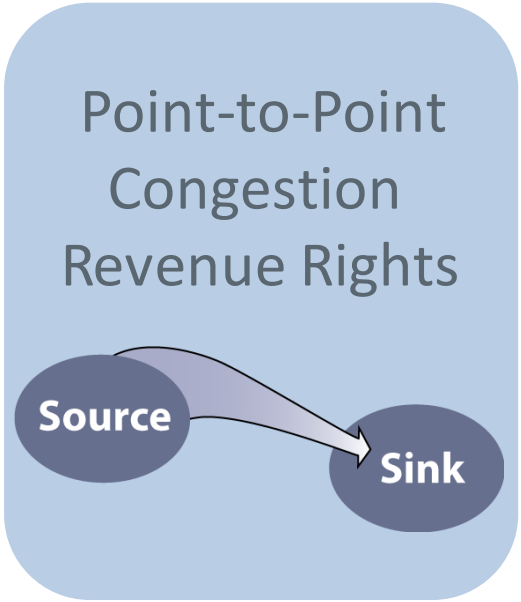


As a Financial Investment …

CRR may be purchased on a speculative basis:

Congestion Rent > Purchase Price

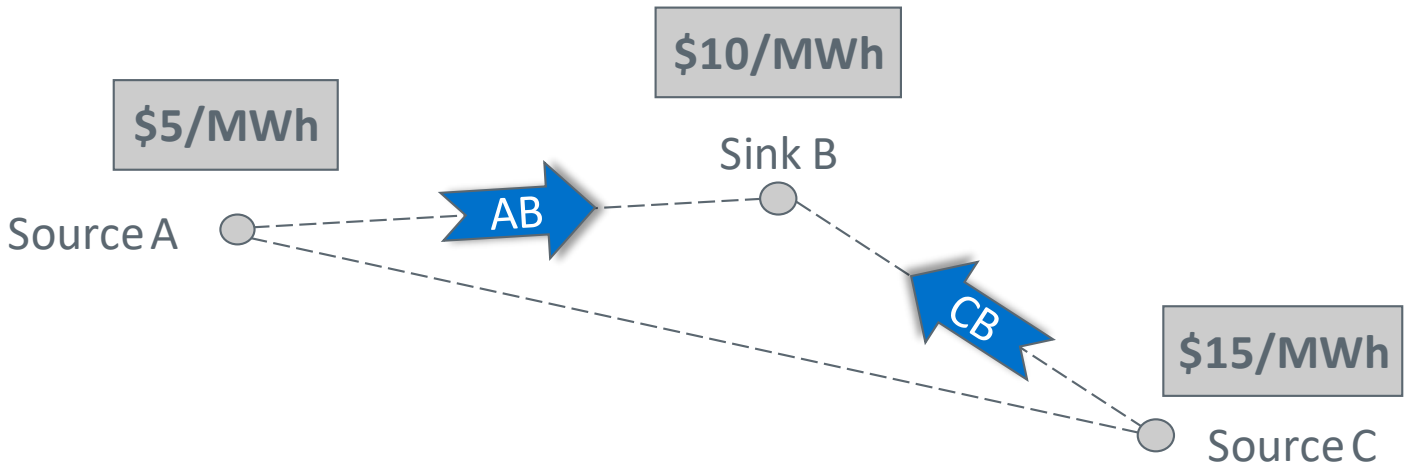
Types of Congestion Revenue Rights



- Designated point of injection (source) and point of withdrawal (sink)
- Settlement based on difference between sink and source Settlement Point Prices
- Two Instruments:
  - Point-to-Point Options
  - Point-to-Point Obligations

Point-to-Point Options

Provide a hedge that can only result in a payment

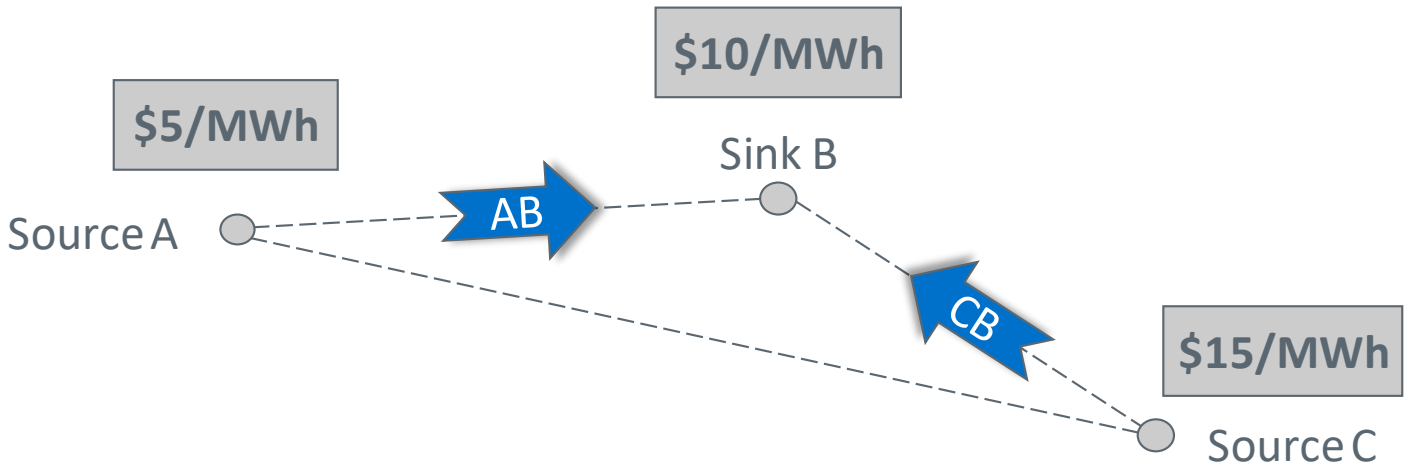


Option $_{AB}$ Payment = ?

Option $_{CB}$ Payment = ?

Point-to-Point Obligations

Provide a hedge that may result in a payment or a charge

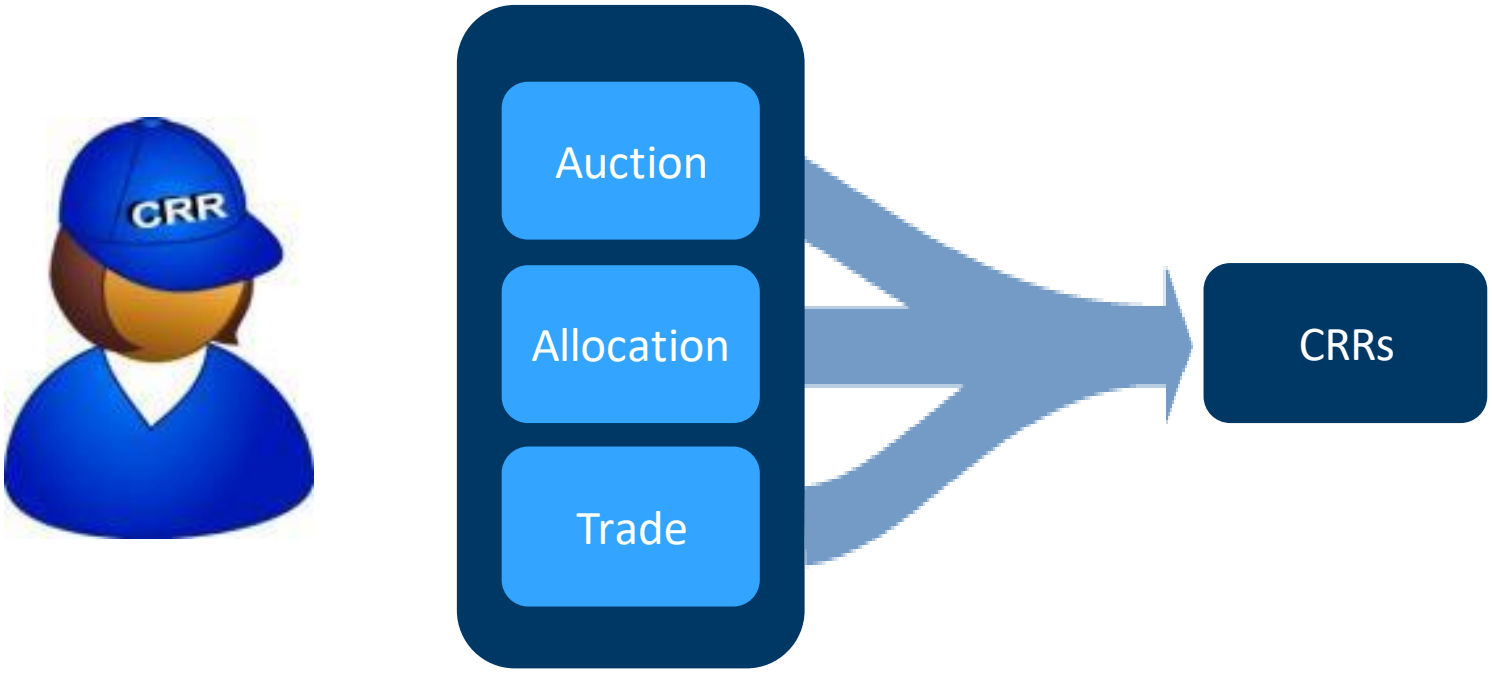


Obligation $_{AB}$ Payment = ?

Obligation $_{CB}$ Charge = ?

Three ways of acquiring CRRs:

- CRR Auction
- Allocation (Special Cases)
- Bilateral Trades



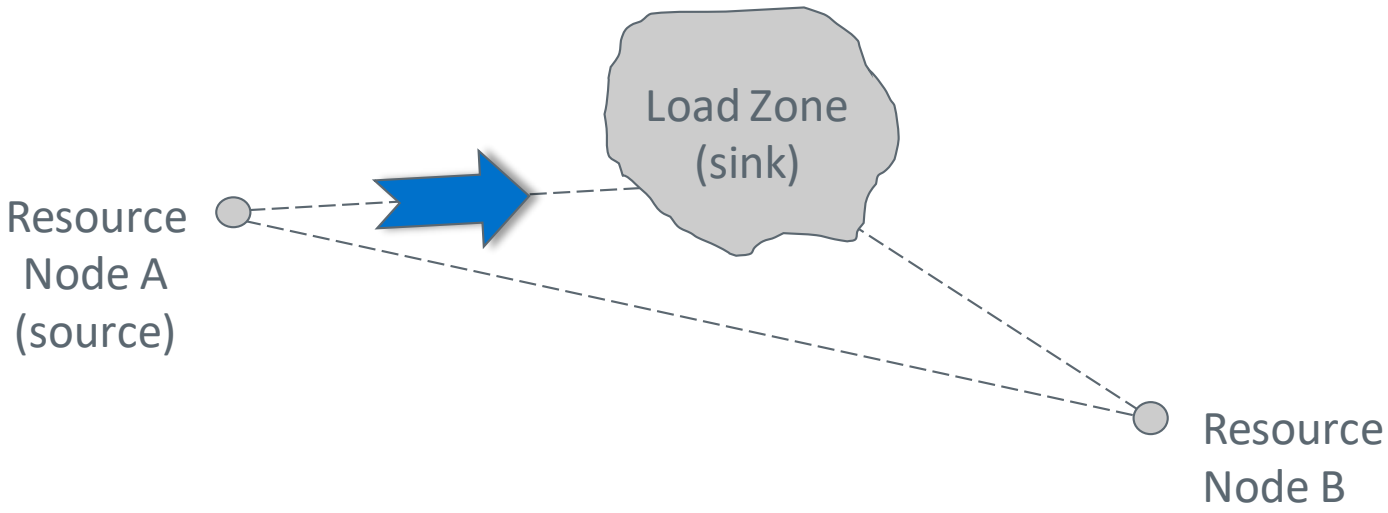
CRR Account Holder

Registration and qualification:

- CRR Account Holder Application and Standard Form Agreement
- Provide bank account information
- Demonstrate the capability to perform the functions of an Account Holder
- Satisfy ERCOT's creditworthiness requirements

Example

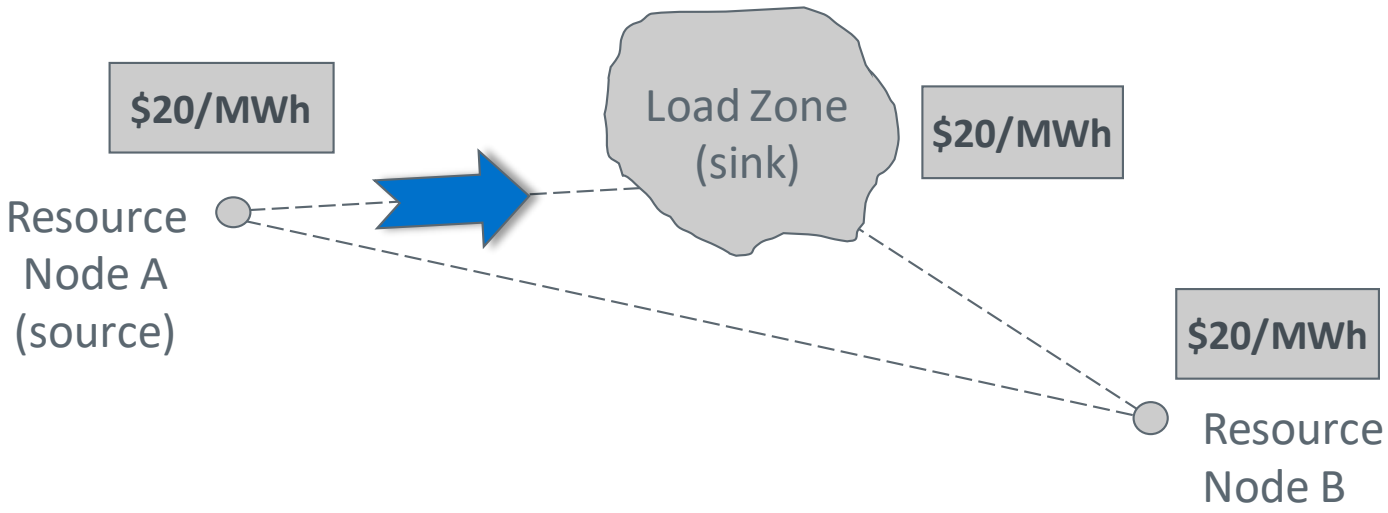
Day-Ahead Congestion Hedging



- 5MW DAM Energy Purchase at Load Zone
- 5MW PTP Option from Resource Node A to Load Zone

Example

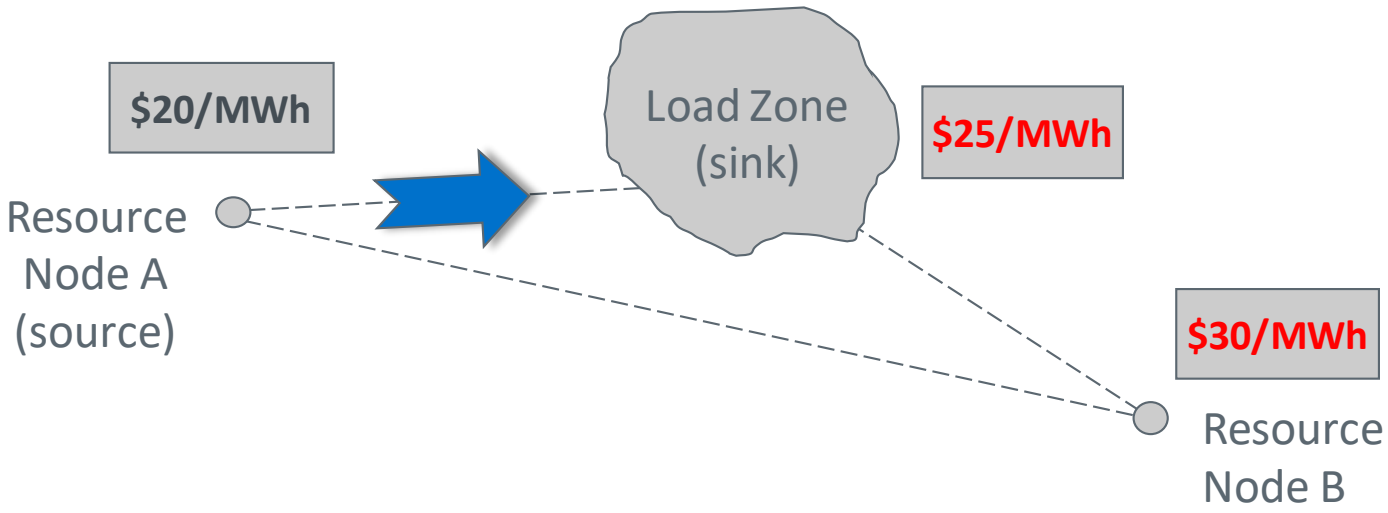
Day-Ahead Congestion Hedging



Energy Purchase	PTP Option Payment	Net Day-Ahead Cost

Example

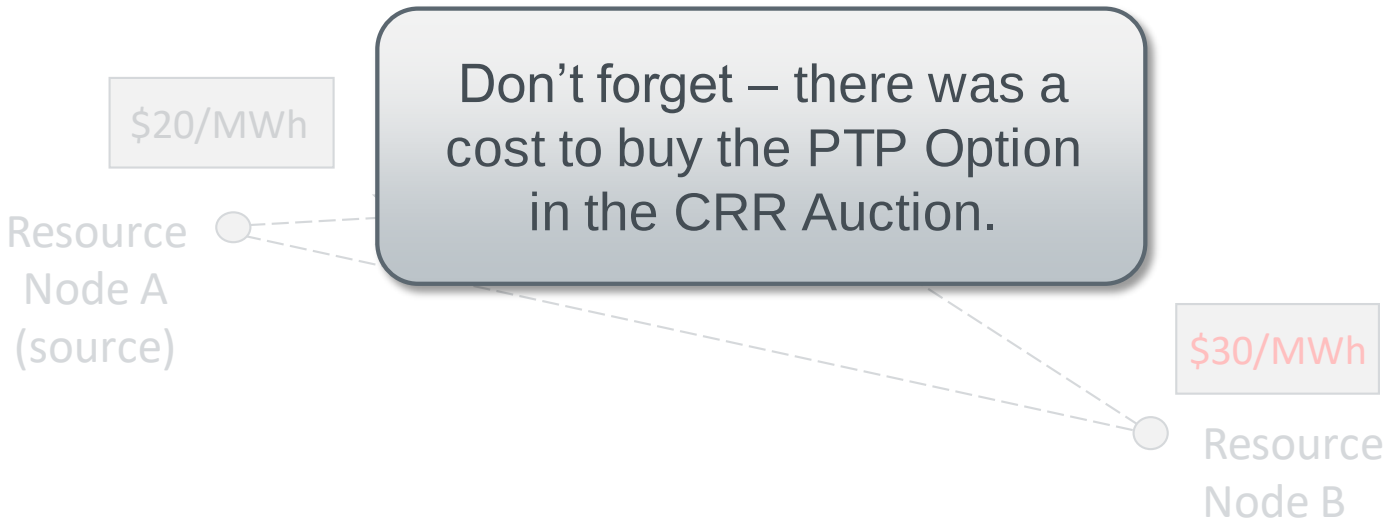
Day-Ahead Congestion Hedging



Energy Purchase	PTP Option Payment	Net Day-Ahead Cost

Example

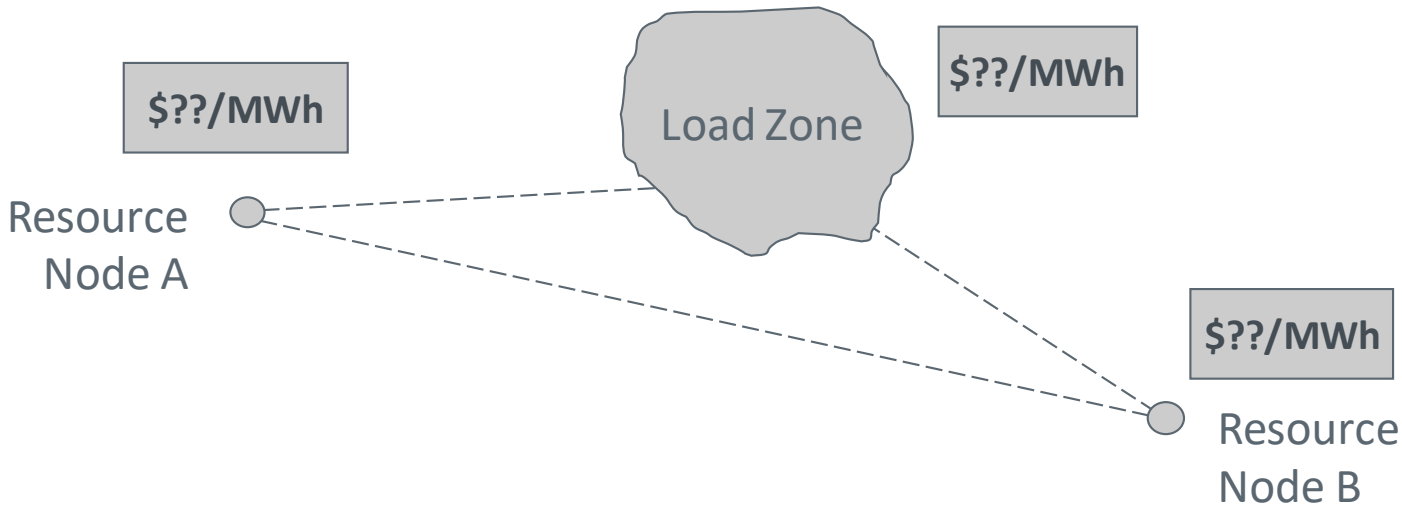
Day-Ahead Congestion Hedging



Energy Purchase	PTP Option Payment	Net Day-Ahead Cost

Example

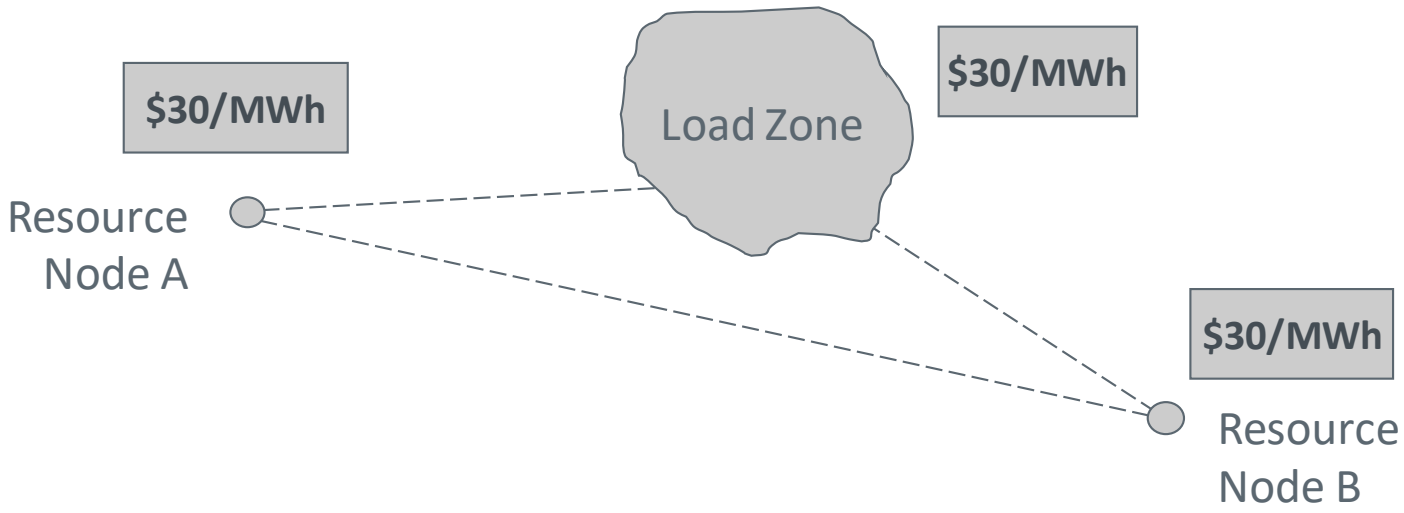
Real-Time Congestion Hedging



- 5MW Trade Energy Purchase at Resource Node A
- 5MW Load at Load Zone

Example

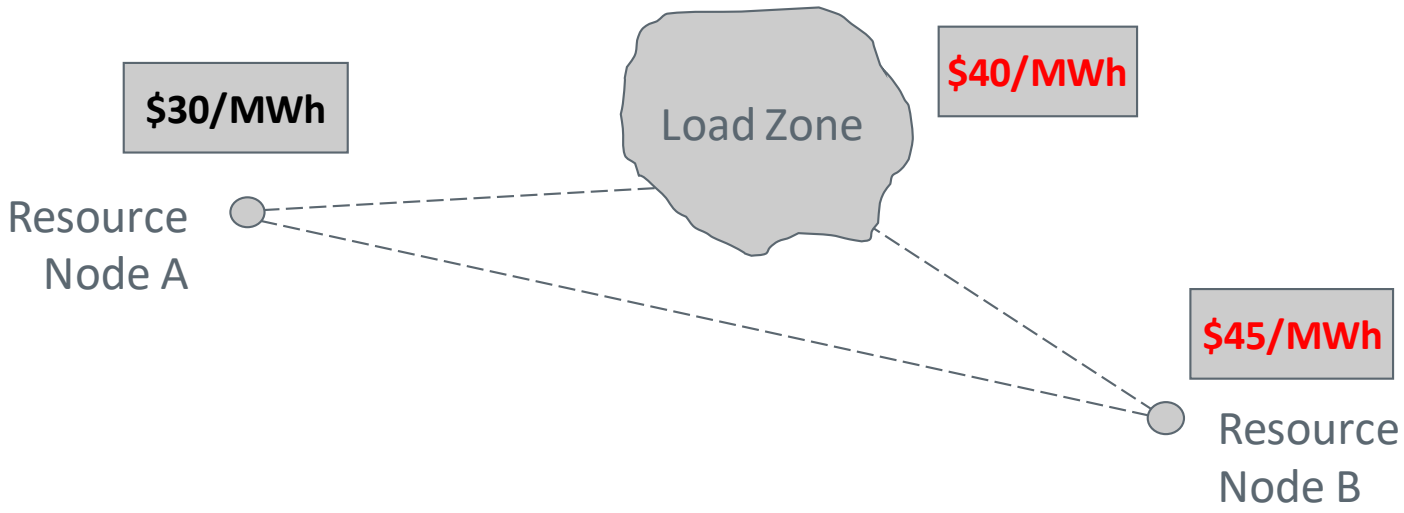
Real-Time Congestion Hedging



Payment at Resource Node A	Charge at Load Zone	Real-time Congestion Exposure

Example

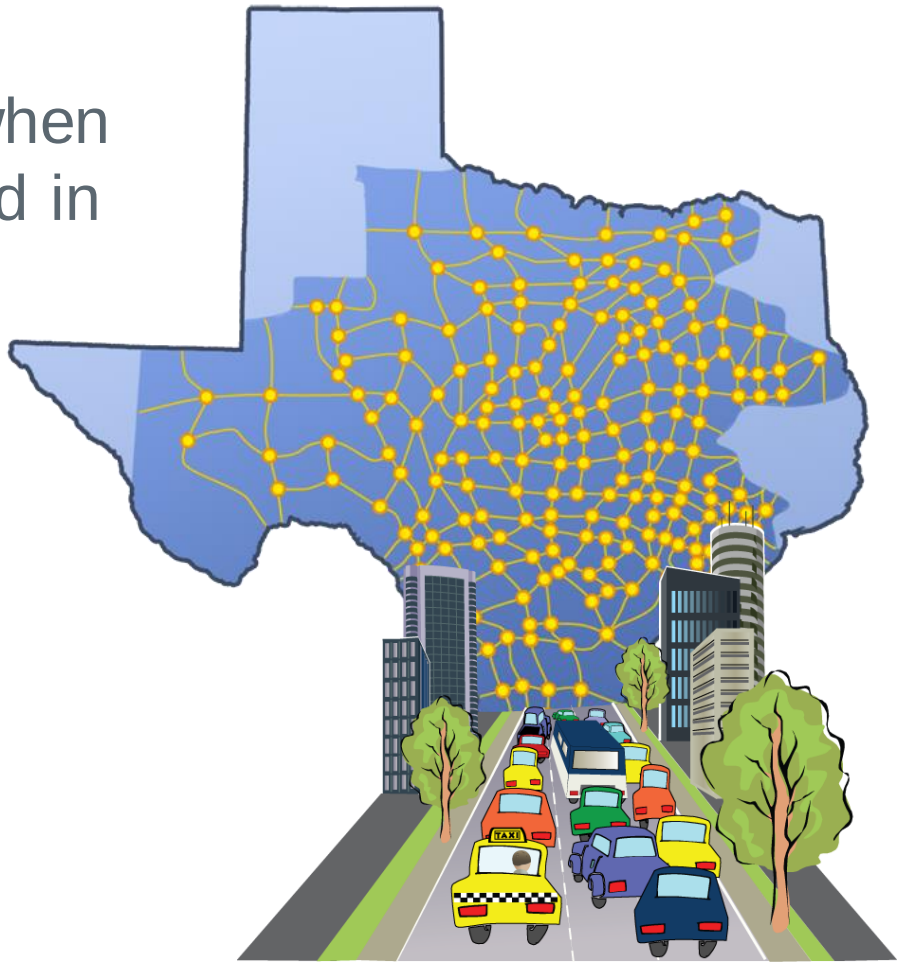
Real-Time Congestion Hedging



Payment at Resource Node A	Charge at Load Zone	Real-time Congestion Exposure

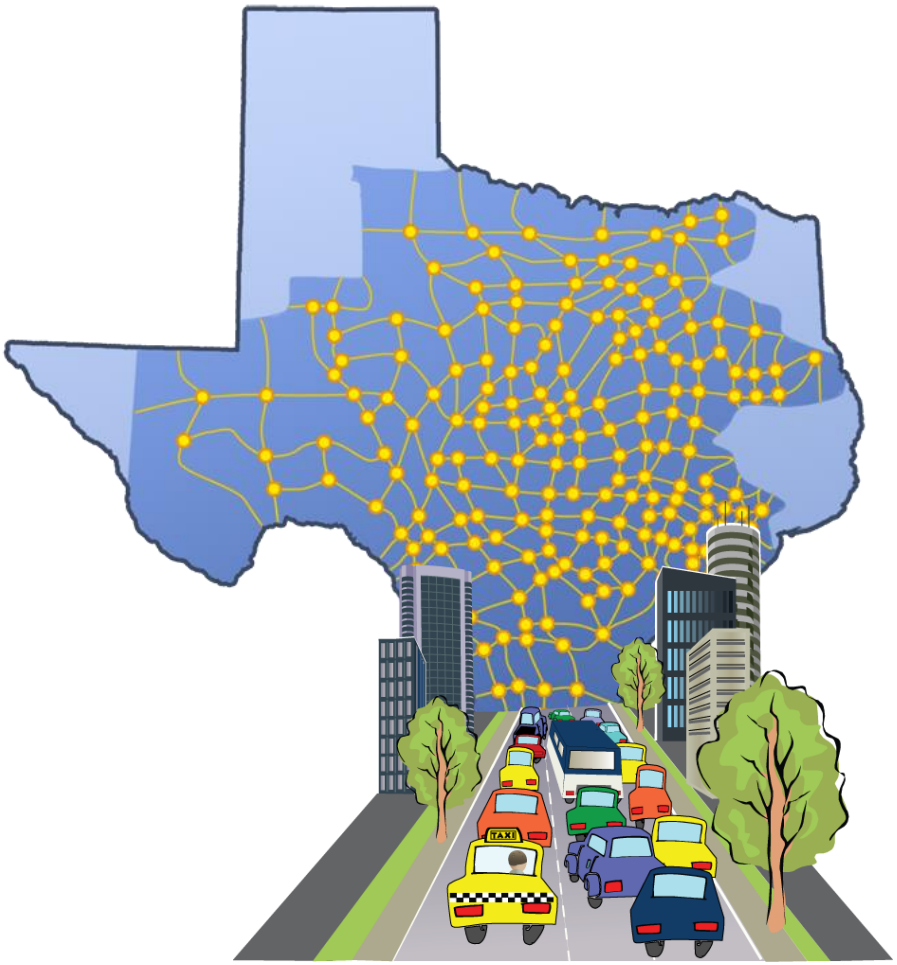
Day Ahead Market PTP Obligations:

- Financial instruments
- Payment or charge to owner when Transmission Grid is congested in Real-Time



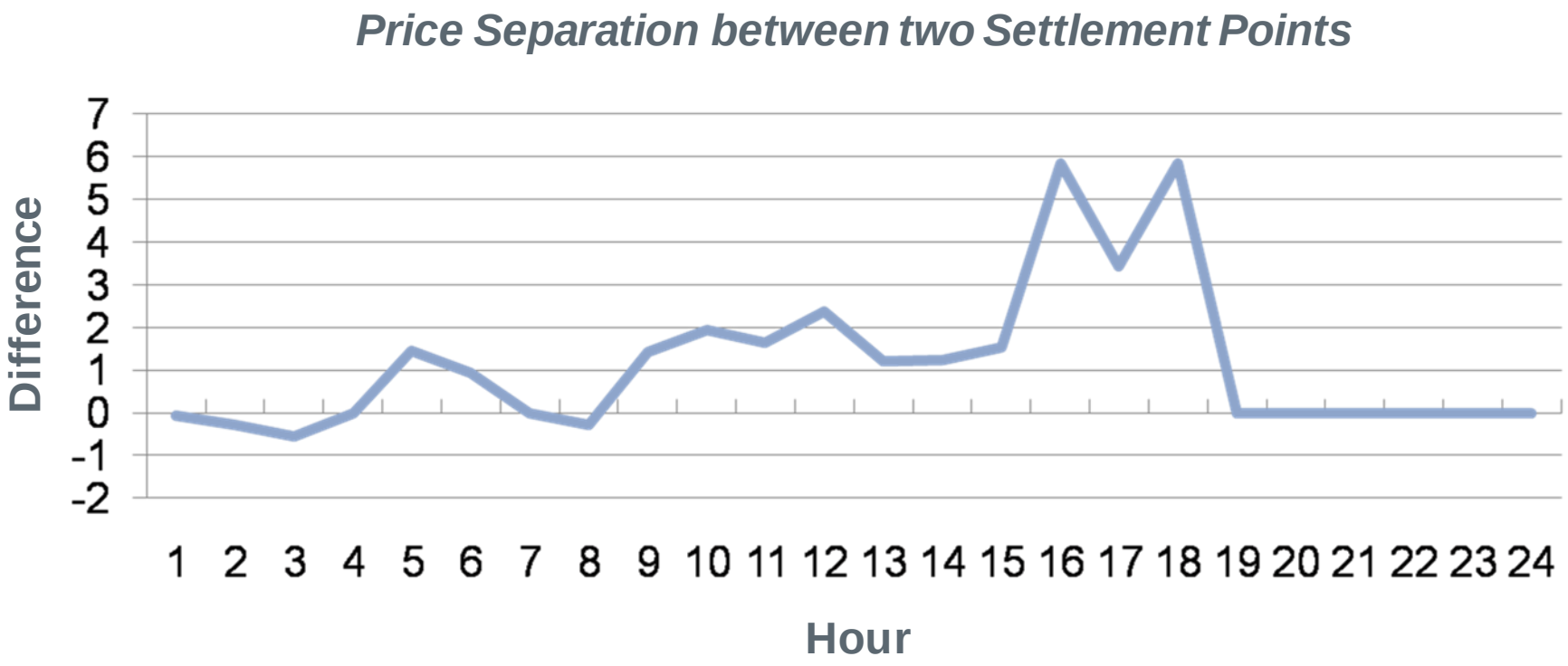
DAM PTP Obligations may be used as:

- Financial Hedge
- Financial Investment



As a Financial Hedge for…

- Price certainty - Locking in the costs of Real-time congestion at Day-Ahead Market prices



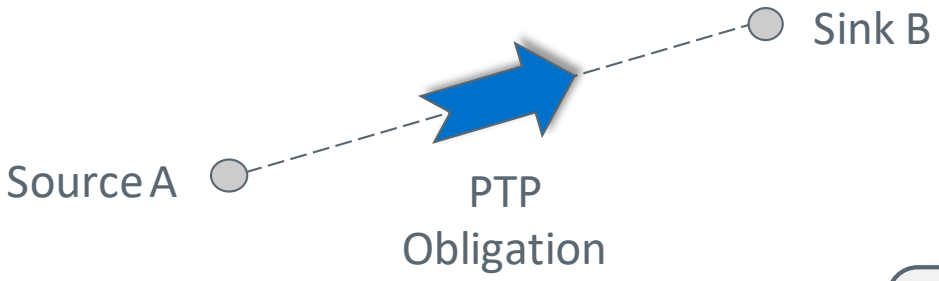
As a Financial Investment …

DAM PTP Obligations may also be purchased on a speculative basis:

Real-time value > Purchase Price

Day-Ahead Market PTP Obligations

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



Only QSEs may participate in the Day-Ahead Market

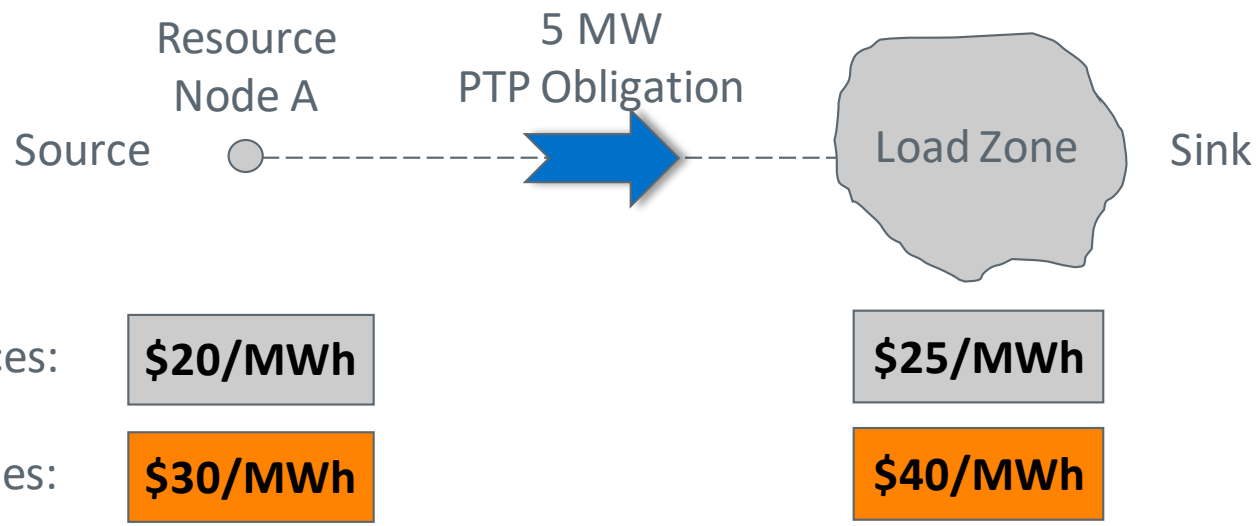
Qualified Scheduling Entity

Registration and qualification:

- QSE Application and Standard Form Agreement
- Provide bank account information
- Demonstrate the capability to perform the functions of a QSE
- Meet communications requirements
- Satisfy ERCOT's creditworthiness requirements

Example

Day Ahead Market PTP Obligations

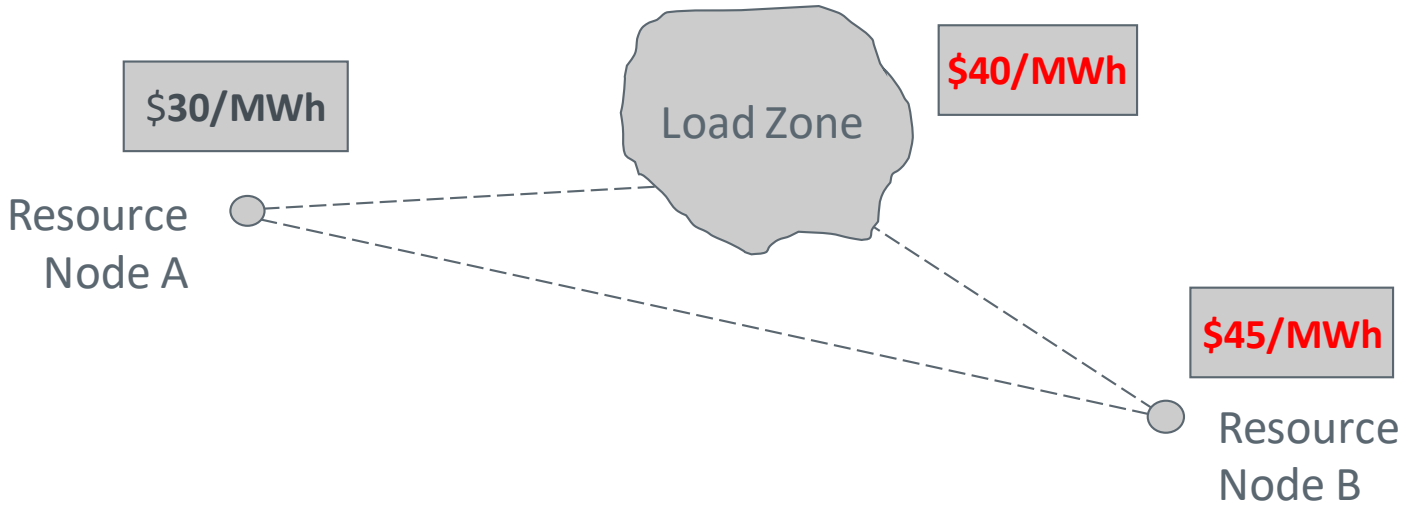


QSE charge in Day Ahead Market = ?

QSE payment in Real Time = ?

Example

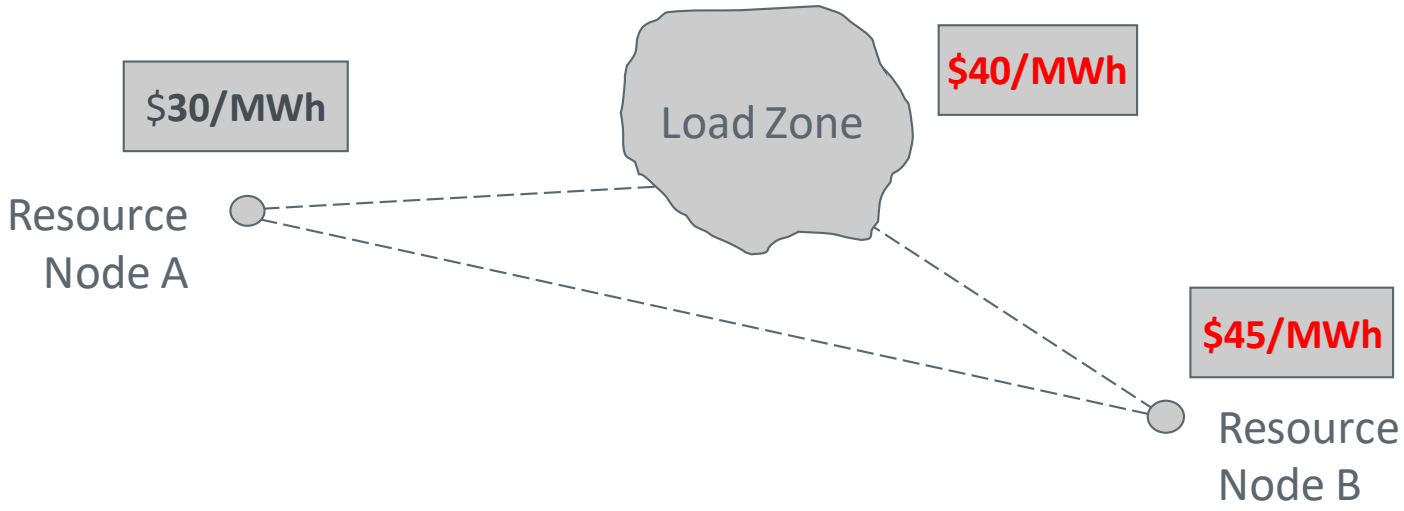
Real-Time Congestion Hedging



- 5MW Trade Energy Purchase at Resource Node A
- 5MW Load at Load Zone
- 5MW DAM PTP Obligation Resource Node A to Load Zone

Example

Real-Time Congestion Hedging



Payment at Resource Node A	Charge at Load Zone	Payment for PTP Obligation	Real-time Net Cost
$150	$200		

In this module, you've learned about:

- Congestion cost exposure in the ERCOT markets
- Financial instruments available for hedging congestion costs in the ERCOT markets

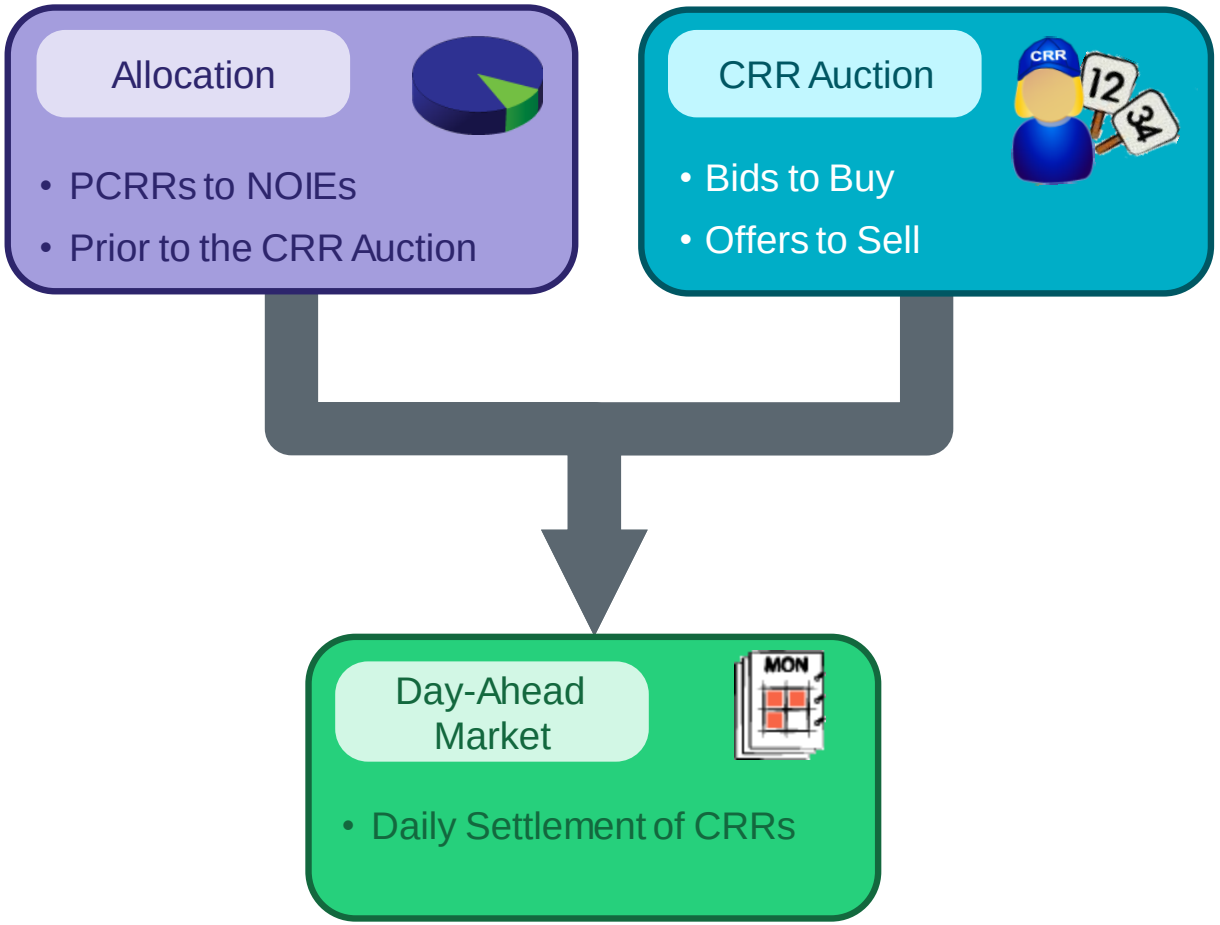
Module 2

CRR Auction & Allocation Process

Upon completion of this module, learners will be able to:

- Describe the role of the CRR Network Model in the CRR Auction
- Explain the impact of Pre-Assigned CRRs (PCRRs) on the CRR Auction
- Identify the inputs of the CRR Auction Process
- Describe the CRR Auction Process
- Identify the outputs of the CRR Auction

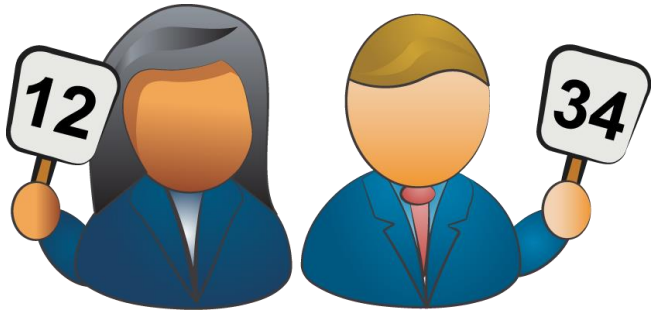
Congestion Revenue Rights Life Cycle

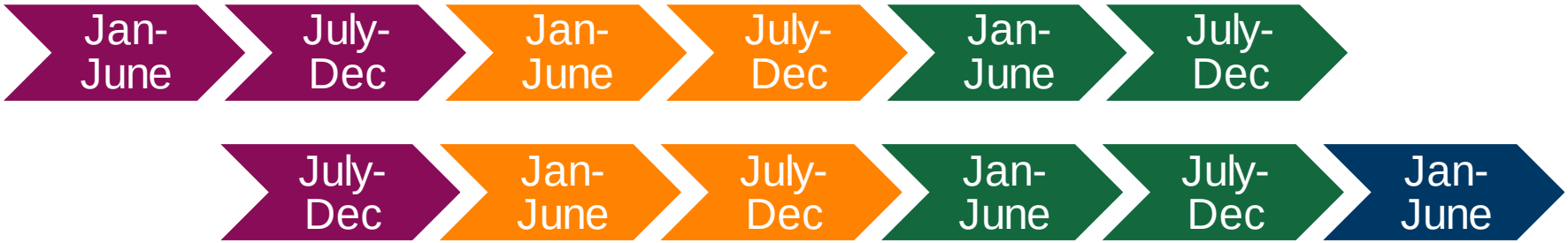


Auctions are held monthly and semi-annually.

Auctions take place twice per month:

- Monthly Auction
- Long-Term Auction Sequence
  - Six successive auctions
  - Six-month periods
  - One auction each month

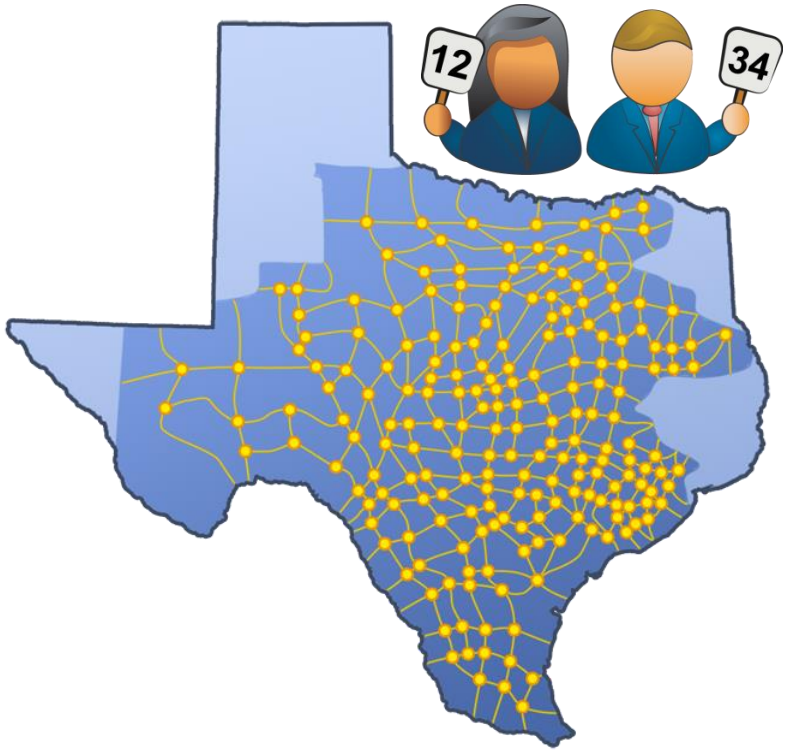




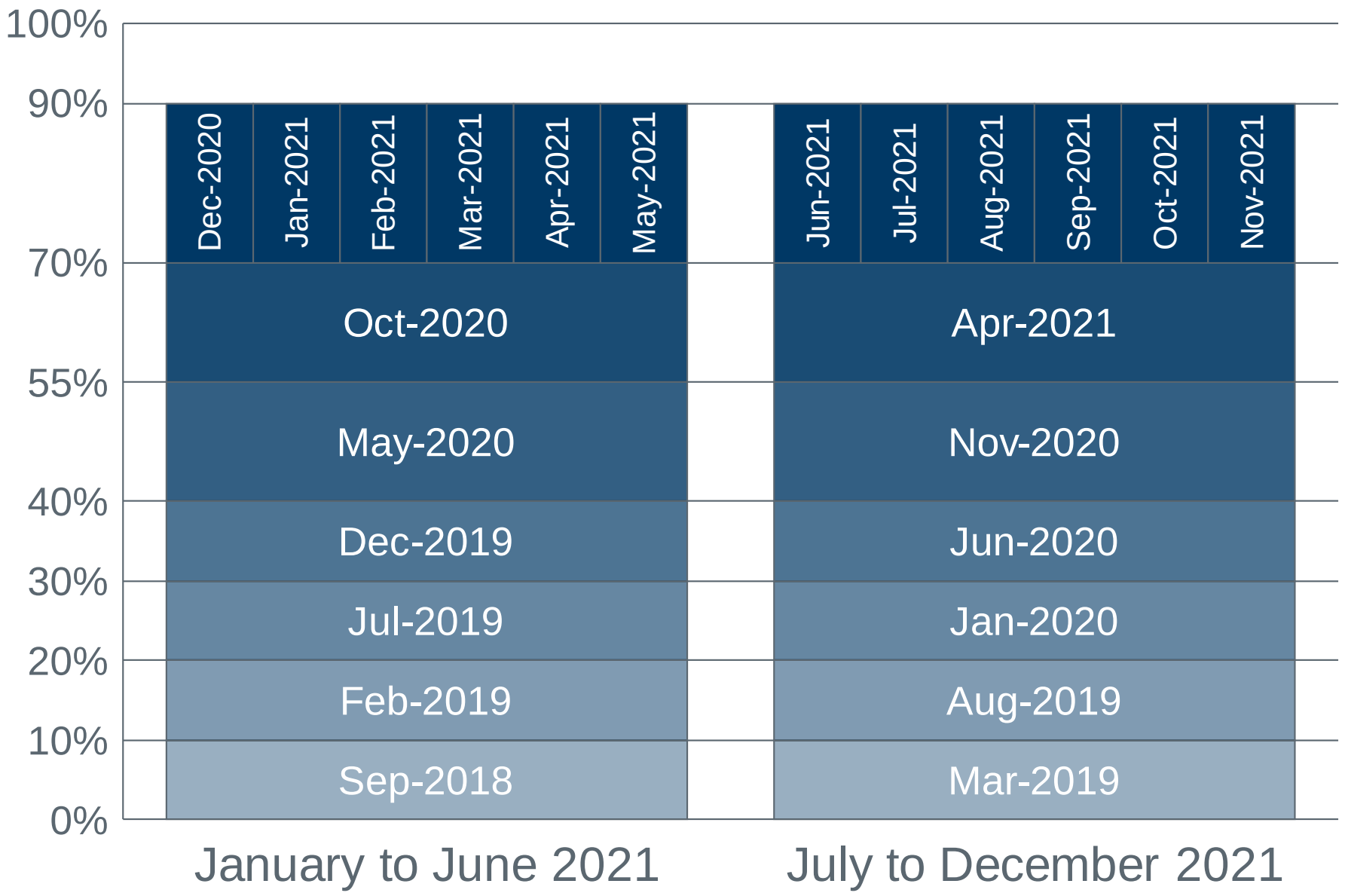
*Exact dates on CRR Activity Calendar - http://www.ercot.com/mktinfo/crr

Available Capacity

- 90% in Monthly Auction
- Less in Long-Term Auctions
  - 70% for Sequence 1
  - 55% for Sequence 2
  - 40% for Sequence 3
  - 30% for Sequence 4
  - 20% for Sequence 5
  - 10% for Sequence 6



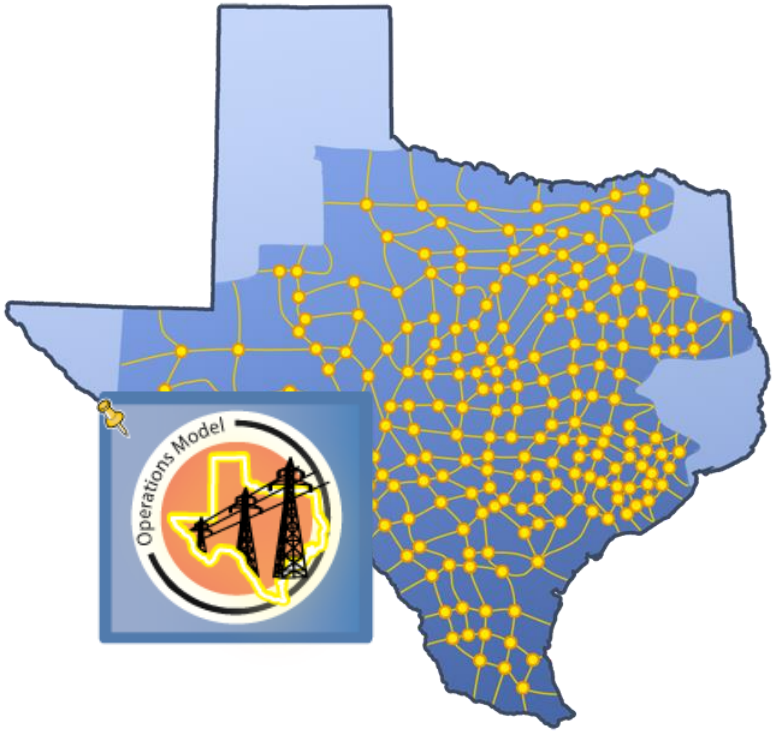
Availability of 2021 Congestion Revenue Rights



ERCOT's System Capacity is determined from the Network Operations Model

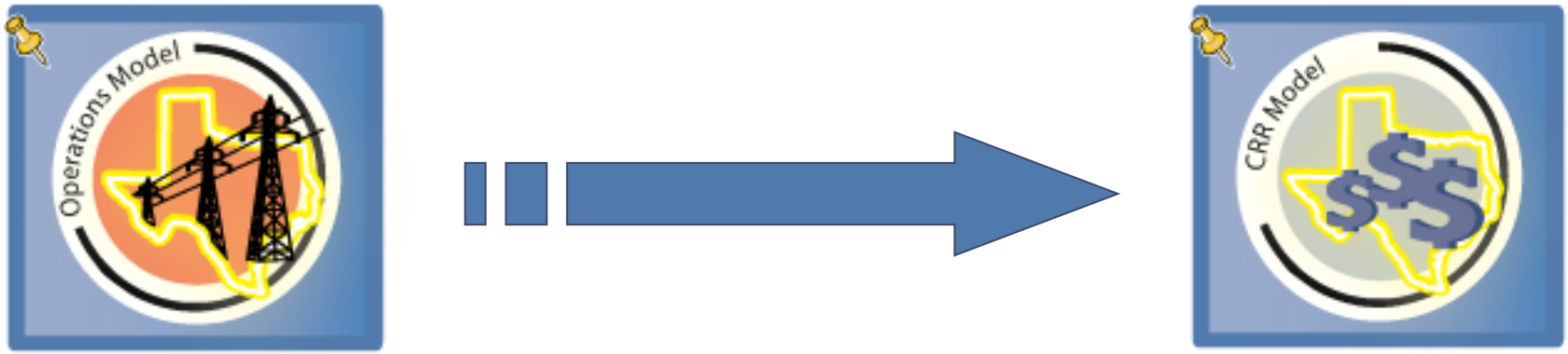
Reflects characteristics of ERCOT Transmission System

- Topology
- Equipment Ratings
- Other Operational Limits



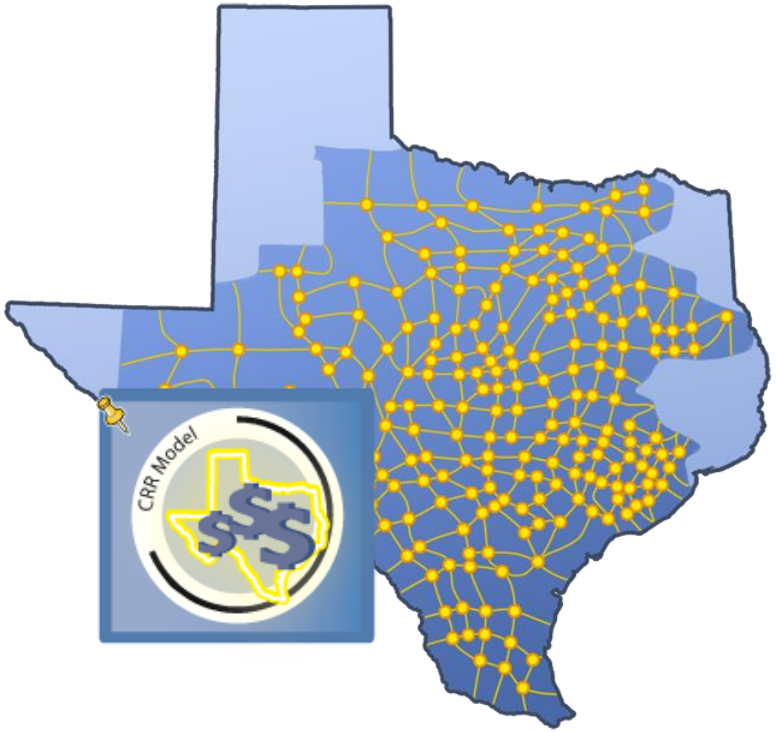
CRR Network Model

- Derived from Network Operations Model
- Represents the transmission capacity for each month



CRR Network Model will reflect:

- Transmission facilities expected to be in-service for the specified month
- Significant outages
- Dynamic Ratings
- Monitored Elements
- Contingencies
- Settlement Points

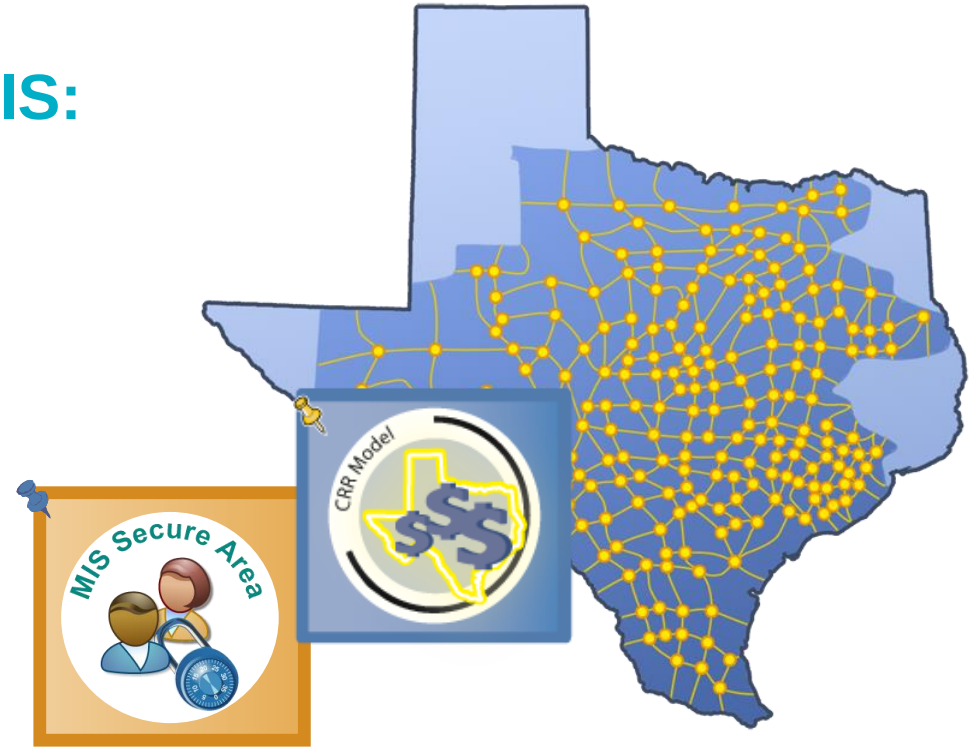


ERCOT uses the CRR Network Model in:

- CRR Auction Process
- PCRR Allocation to NOIEs

ERCOT posts Models on MIS:

- 10 business days before Monthly Auction
- 20 business days before Long-Term Auction Sequence



Pre-Assigned CRRs (PCRRs)

- Allocated to Non-Opt-In Entities (NOIEs) based on their annual nominations
- Based on the long-term supply contracts of NOIEs
- Cost is a percentage of the CRR Auction clearing price

Simultaneous Feasibility Test

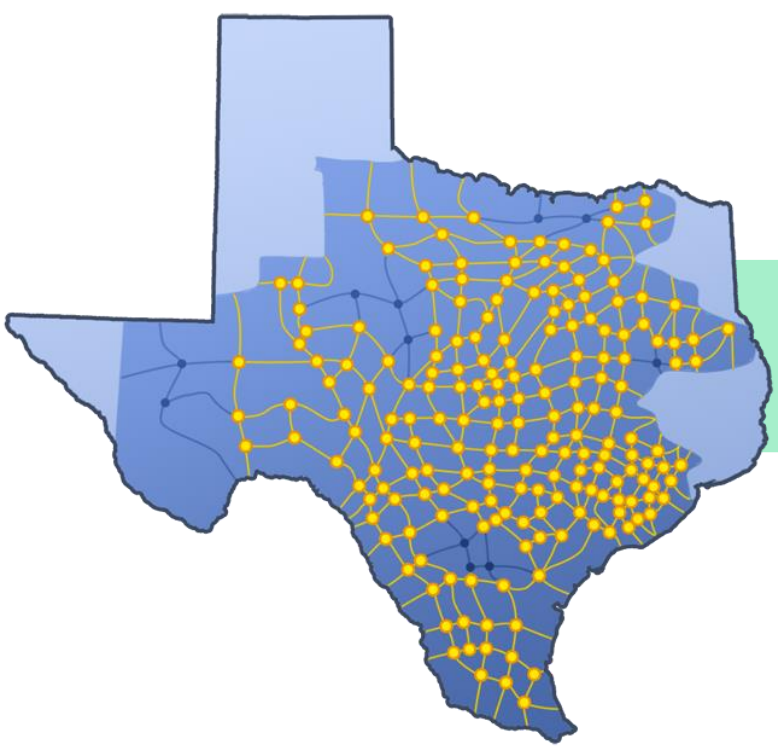
Goal:

- Confirms that the transmission system can support an awarded set of CRRs during normal system conditions

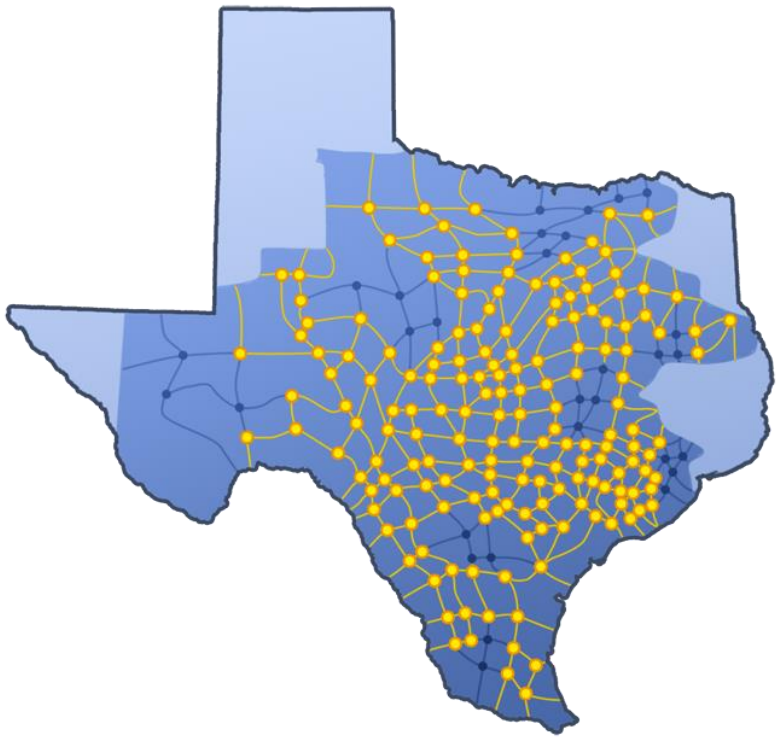
Process

- DC power-flow model
- Used during Allocation
- Used during the Day-Ahead Market

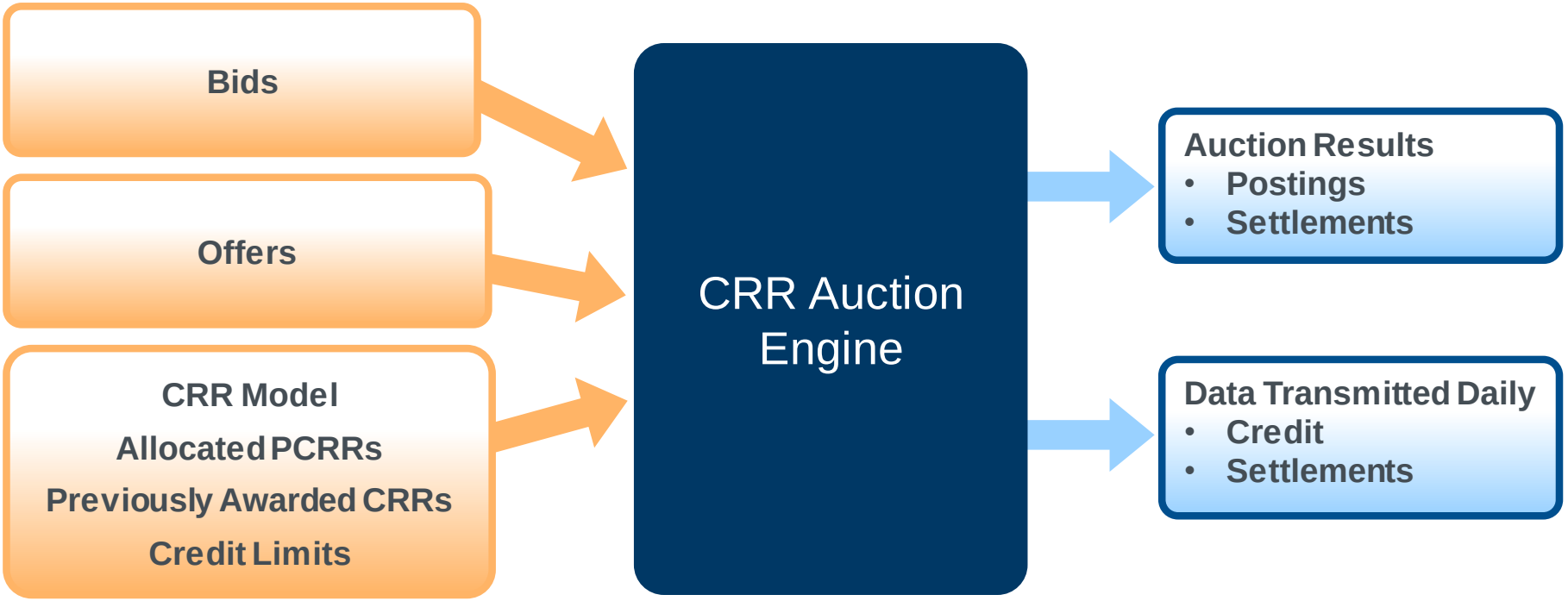
Possible Transmission Capacity Available for *Allocation*



Possible Transmission Capacity Available *Prior to the Auction*



CRR Auction Process



Inputs

Bids

Bids – willingness to buy CRRs

Indicate:

- Not-to-Exceed Price
- Maximum MWs of CRR

Bids

Account Holder	Source	Sink	MW	Price	Time Of Use	Buy or Sell	Hedge Type	Start Date	End Date
CRRAH1	RN1	LZ4	10	10	Peak WD	Buy	OBL	07/01/2014	07/31/2014
CRRAH1	RN2	LZ4	10	10	Peak WD	Buy	OBL	07/01/2014	07/31/2014
CRRAH1	LZ5	RN3	10	10	Peak WD	Buy	OBL	07/01/2014	07/31/2014
CRRAH1	Hub1	LZ2	10	10	Peak WD	Buy	OBL	07/01/2014	07/31/2014

CRRs are auctioned or allocated in:

- Time-of-Use Blocks
- One month strips

<table>
<tr><th>Mon</th><th>Tues</th><th>Wed</th><th>Thurs</th><th>Fri</th><th>Sat</th><th>Sun</th></tr>
<tr><td colspan="7">Off-Peak (0100 – 0600)</td></tr>
<tr><td colspan="5">Peak Weekday (0700 – 2200)</td><td colspan="2">Peak Weekend (0700 – 2200)</td></tr>
<tr><td colspan="7">Off-Peak (2200 – 0000)</td></tr>
</table>

7x24 Block Bids in *Monthly* Auctions

Treated as single bid across all three Time-of-Use blocks

If…		Then…
Bid Price ≥	Weighted average (by hour) of all three time-of-use clearing prices	7x24 Block Bid ***awarded***
Bid Price <	Weighted average (by hour) of all three time-of-use clearing prices	7x24 Block Bid ***not awarded***

Example

CRR Account Holder enters 7X24 bid for CRR from Source A to Sink B

- Bid Price = $6
- Month of February has total of 672 hours, including
  - 224 Off Peak hours
  - 128 Peak Weekend hours
  - 320 Peak Weekday hours

Example

The three time-of-use Clearing Prices for CRR A-B are:

- $2 Off Peak
- $3 Peak Weekend
- $8 Peak Weekday

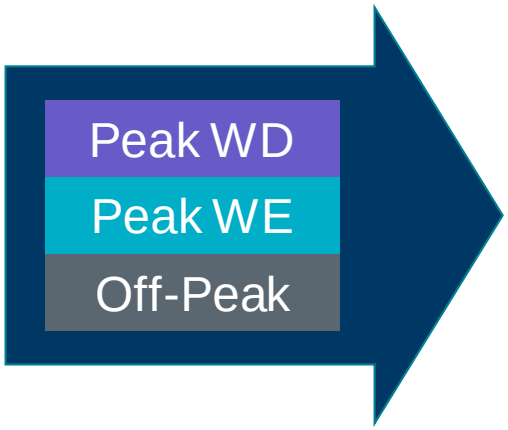
Weighted average price for the three time-of-use periods is

(224x$2 + 128x$3 + 320x$8) / 672 = $5.048

Bid price was $6, so 7x24 Bid is awarded

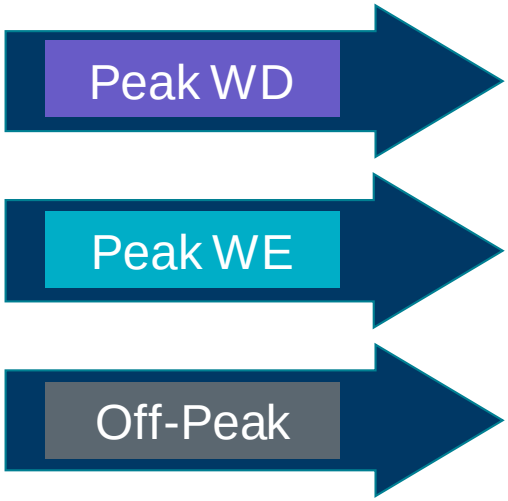
No 7x24 Block Bids in Long Term Auction Sequences

Monthly Auction



TOU blocks Optimized Simultaneously

Long-Term Auction



TOU blocks Optimized Independently

Minimum Bid Price and Auction Fees

- Minimum Bid Price for PTP Options
  - Currently $0.01/MW/hour
  - Reviewed by TAC annually
- Auction Fee for PTP Options that clear below Minimum Bid Price
  - Difference between clearing price and minimum price
  - Works out to total price of $0.01/MW/hour

Inputs

- Bids
- Offers

Offers - willingness to sell CRRs

Indicate:

- Minimum Reservation Price
- Available quantity in MW

Only the Owner of Record can offer a CRR

Offers

CRR ID	Account Holder	Source	Sink	MW	Price	Time Of Use	Buy or Sell	Hedge Type	Start Date	End Date
12345	CRRAH1	RN1	LZ4	10	10	Peak WD	Sell	OBL	07/01/2014	07/31/2014
67890	CRRAH1	RN2	LZ4	20	50	Peak WD	Sell	OPT	07/01/2014	07/31/2014
23456	CRRAH1	LZ5	RN3	50	25	Peak WD	Sell	OBL	07/01/2014	07/31/2014
78901	CRRAH1	Hub1	LZ2	15	10	Peak WD	Sell	OBL	07/01/2014	07/31/2014

CRR Auction Process

Bids

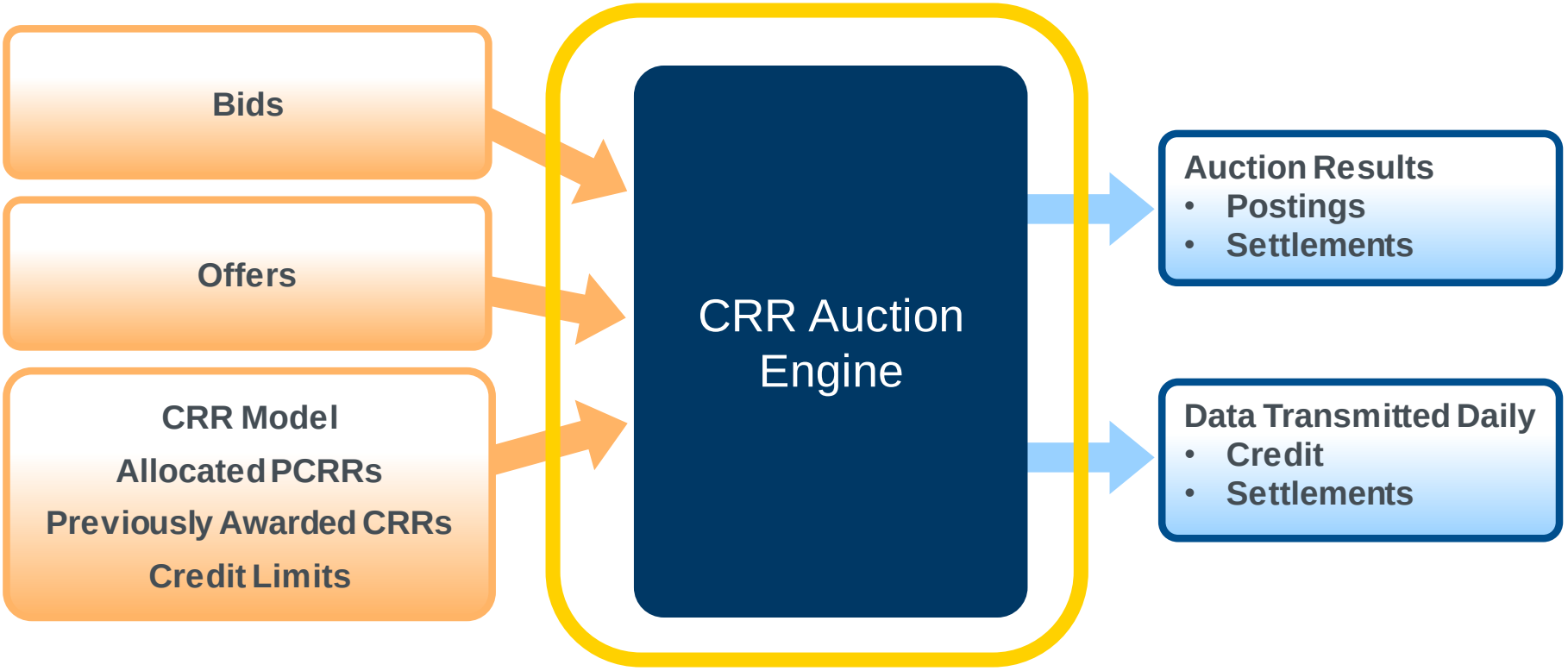
Offers

CRR Model
Allocated PCRRs
Previously Awarded CRRs
Credit Limits

Constraints managed by ERCOT

- Total Transmission Capacity
- Transmission Capacity already "owned"
- Credit limit acts as budget constraint

Clearing Process



Clearing Process

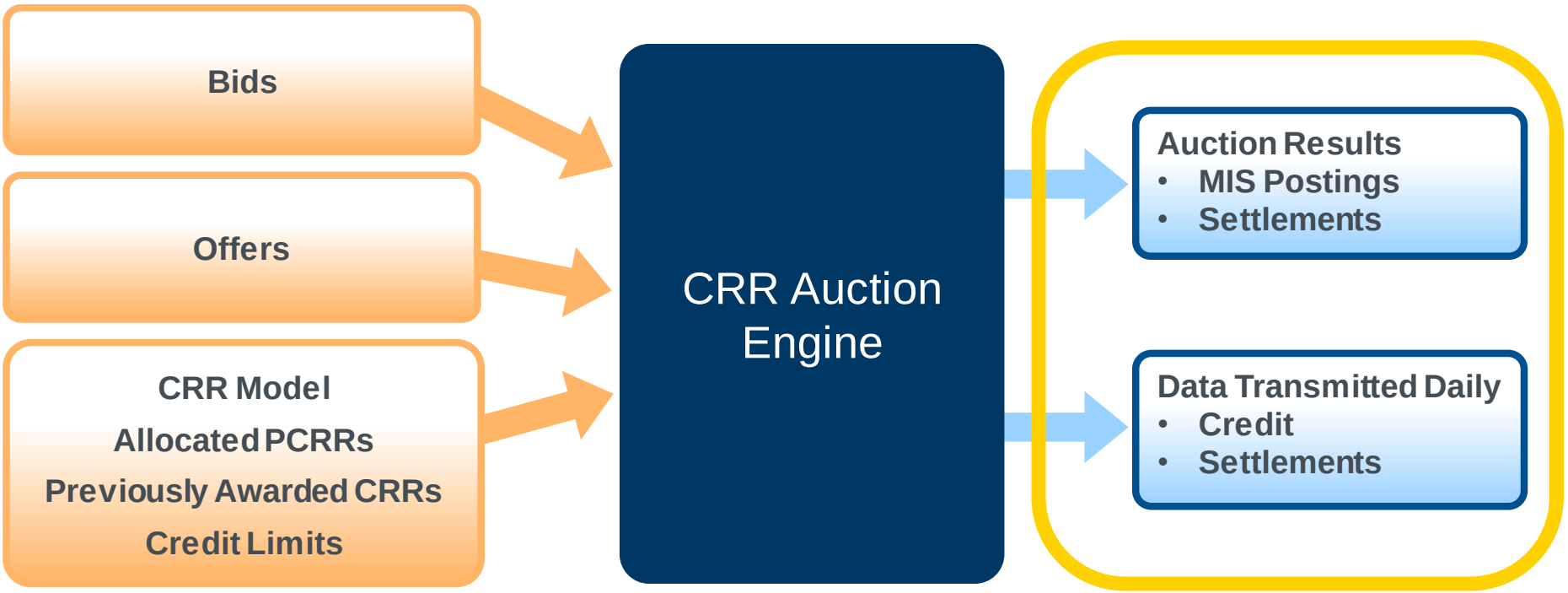
- Single-round, simultaneous auction
- Objective
  - Maximize net auction revenue
    - Bid-Based Value
    - Offer-Based Cost
  - Subject to applicable constraints
    - Transmission System limits
    - Credit limits

Scenario

Break into 8 CRR Account Holder Teams (AH1 to AH8)

- **Participate in a Long-Term Auction Sequence**
  - Sequence 3: 40% of Available Capacity
  - Net Available Capacity: 10%
- **Purchase Peak Weekday Options** (April 2022)
  - RN1 to LZ1: 30 MW Net Available Capacity (AH1 to AH3)
  - RN2 to LZ1: 30 MW Net Available Capacity (AH4 to AH5)
  - RN3 to LZ1: 30 MW Net Available Capacity (AH6 to AH8)
- **Determine Option Bid MW and Price**
  - Price Limit: Bid Price ≥ $0.01
  - Bid Limit: 2 Bids per CRRAH
  - Credit Limit: 20 MW Total
  - Historical auction data will be provided
  - Instructor will clear the auction

Outputs


Bids
Offers
CRR Model
Allocated PCRRs
Previously Awarded CRRs
Credit Limits
CRR Auction Engine
Auction Results
• MIS Postings
• Settlements
Data Transmitted Daily
• Credit
• Settlements

MIS Postings

General Auction Results

- Identities of Awarded CRR Account Holders
- Awarded CRRs by Source-Sink, TOU, MWs, Clearing Prices, Effective Dates
- Binding Constraints

All auction bids and offers

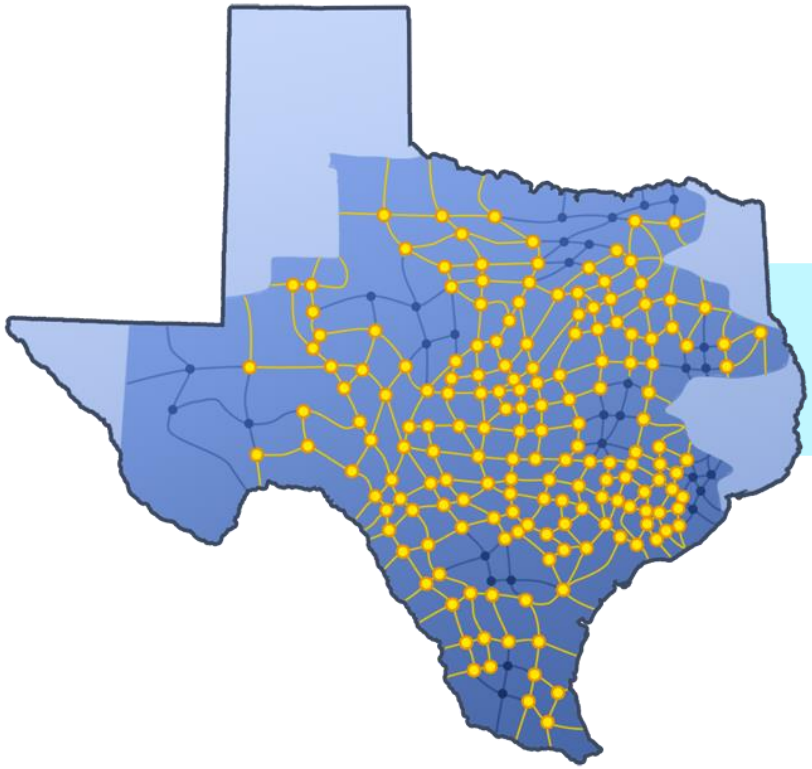
- Without identifying CRR Account Holders

Specific CRR Account Holder Information

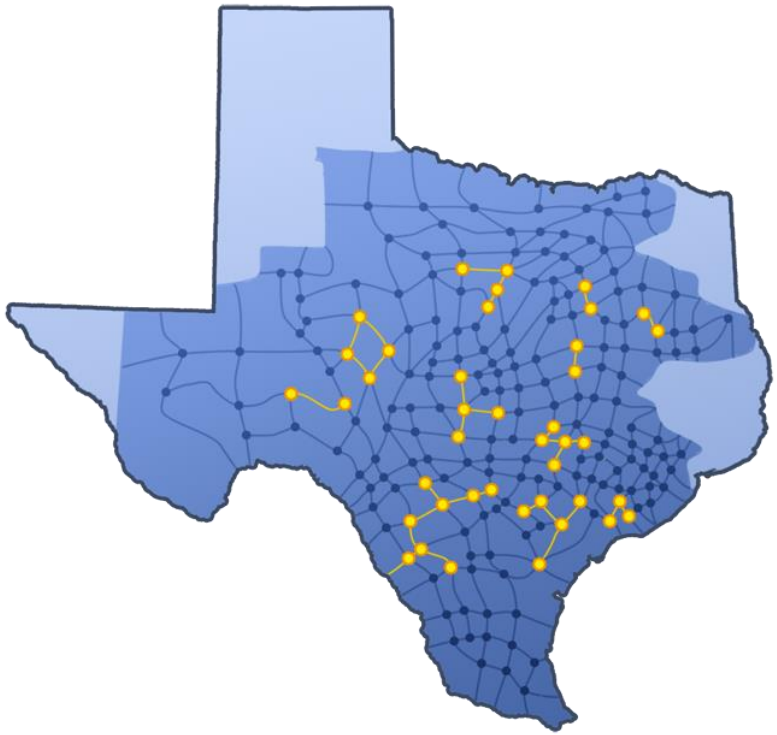
- Awarded Bids and Offers
- Unique IDs for awarded CRRs

CRR Auction – Transmission Capacity

Possible Transmission Capacity Available Prior to Auction



Possible Transmission Capacity Available After the Auction



In this module, you've learned about:

- The role of the Network Model in CRR Auctions
- Impacts of Pre-Assigned CRRs on CRR Auctions
- Inputs and outputs of the CRR Auction Process
- The CRR Auction Process

Module 3

Trading of Congestion Revenue Rights

Upon completion of this module, learners will be able to:

- Identify which CRRs are tradable
- Describe the process of registering CRR trades with ERCOT
- Describe the ERCOT requirements to trade CRRs

Congestion Revenue Rights Life Cycle

Allocation

- PCRRs to NOIEs
- Prior to the CRR Auction

CRR Auction

- Bids to Buy
- Offers to Sell

CRR Trades

- Bilateral Transaction
- CRR Account Holders

Day-Ahead Market

- Daily Settlement of CRRs

Tradable Congestion Revenue Rights

Type of CRR	Tradable
PTP Options	☑
PTP Obligations	☑
PTP Options w/ Refund	
PTP Obligations w/ Refund	

Example

CRR Account Holder Jane wants to trade a CRR:

CRR ID	Account Holder	Source	Sink	MW	Start Date	End Date	Time Of Use	Hedge Type
54321	Jane	RN1	LZ4	10	07/01/2020	07/31/2020	Peak WD	OBL

Example

What fields may be modified?

CRR ID	Account Holder	Source	Sink	MW	Start Date	End Date	Time Of Use	Hedge Type
54321	Jane	RN1	LZ4	10	07/01/2020	07/31/2020	Peak WD	OBL

CRR Account Holder Jane cannot modify:

- Source
- Sink
- Time-of-Use Block
- Hedge Type

CRR Account Holder Jane can modify:

- MWs of CRRs
- Effective Days of CRR

Example

Jane may offer the CRR for trade in two different ways:

1

CRR ID	Account Holder	Source	Sink	MW	Start Date	End Date	Time Of Use	Hedge Type
54321	Jane	RN1	LZ4	3	07/13/2020	07/17/2020	Peak WD	OBL

2

CRR ID	Account Holder	Source	Sink	MW	Start Date	End Date	Time Of Use	Hedge Type
54321	Jane	RN1	LZ4	2	07/01/2020	07/31/2020	Peak WD	OBL

CRR Account Holders may indicate willingness to:

- Sell a CRR in a trade
- Buy a CRR in a trade

CRRs for Sale

CRR ID	Initiating Account Holder	Source	Sink	MW	Start Date	End Date	Time Of Use	Hedge Type	Contact Info…	Status
54321	Jane	RN1	LZ4	10	07/01/2020	07/31/2020	Peak WD	OBL	Seller	Open

Want to Buy

Initiating Account Holder	Source	Sink	MW	Start Date	End Date	Time Of Use	Hedge Type	Contact Info…	Status
Jill	RN1	LZ4	15	08/01/2020	08/31/2020	Peak WD	OBL	Buyer	
Jill	Hub1	LZ4	12	09/01/2020	09/30/2020	Peak WD	OPT	Buyer	Ope

Example

CRR Account Holder Jill

- Sees Jane's offers
- Contacts Jane to trade for Offer #1

1

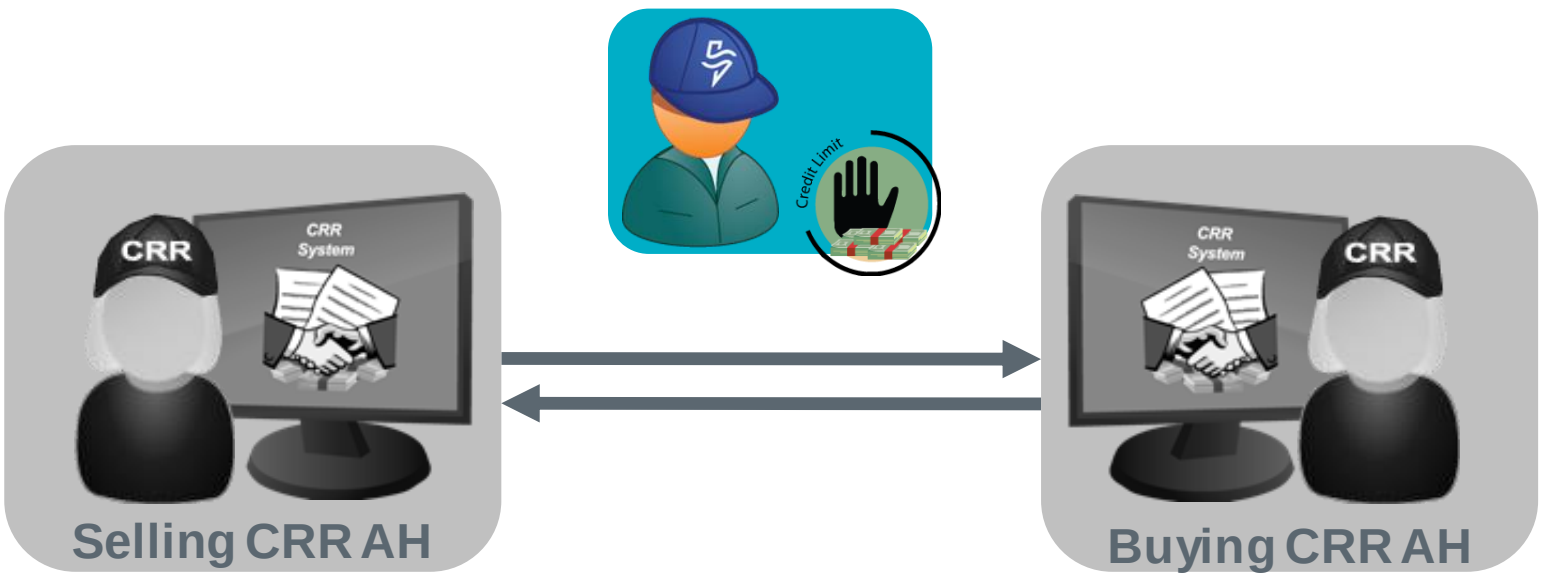
CRR ID	Account Holder	Source	Sink	MW	Start Date	End Date	Time Of Use	Hedge Type
54321	Jane	RN1	LZ4	3	07/13/2020	07/17/2020	Peak WD	OBL

CRR Account Holders:

- Selling party reports the trade to ERCOT
- Buying party confirms the trade through ERCOT

ERCOT

- Checks Account Holders' Available Credit Limits
- Financially settles with new CRR owner



Example

Traded CRR reflects:

- New Account Holder
- New CRR ID

CRR ID	Account Holder	Source	Sink	MW	Start Date	End Date	Time Of Use	Hedge Type
56789	Jill	RN1	LZ4	3	07/13/2020	07/17/2020	Peak WD	OBL

In this module, you've learned about:

- Which CRRs are tradable
- The process of registering CRR trades with ERCOT
- The ERCOT requirements to trade CRRs

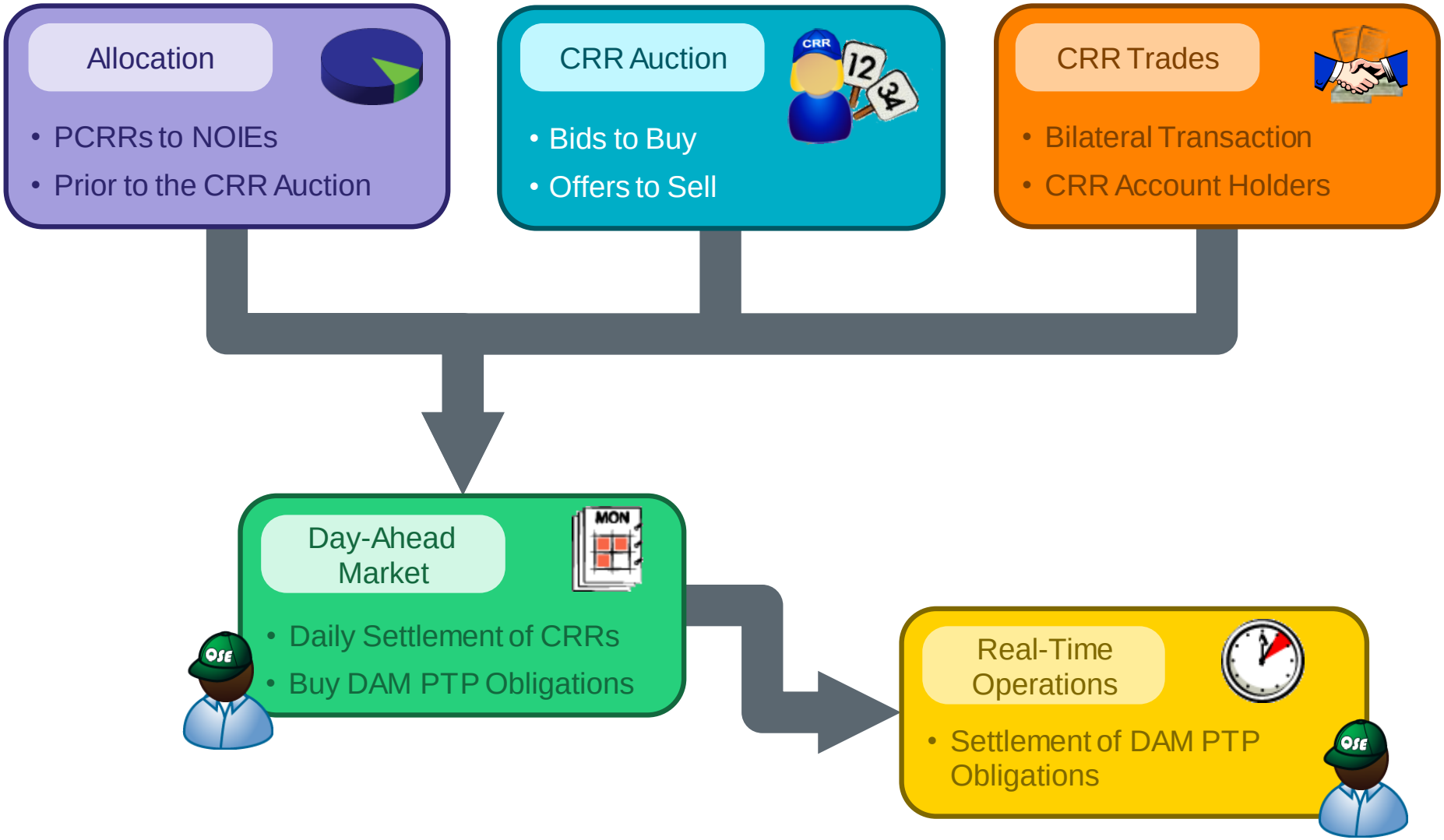
Module 4

Day-Ahead Market Point-to-Point Obligations

Upon completion of this module, learners will be able to:

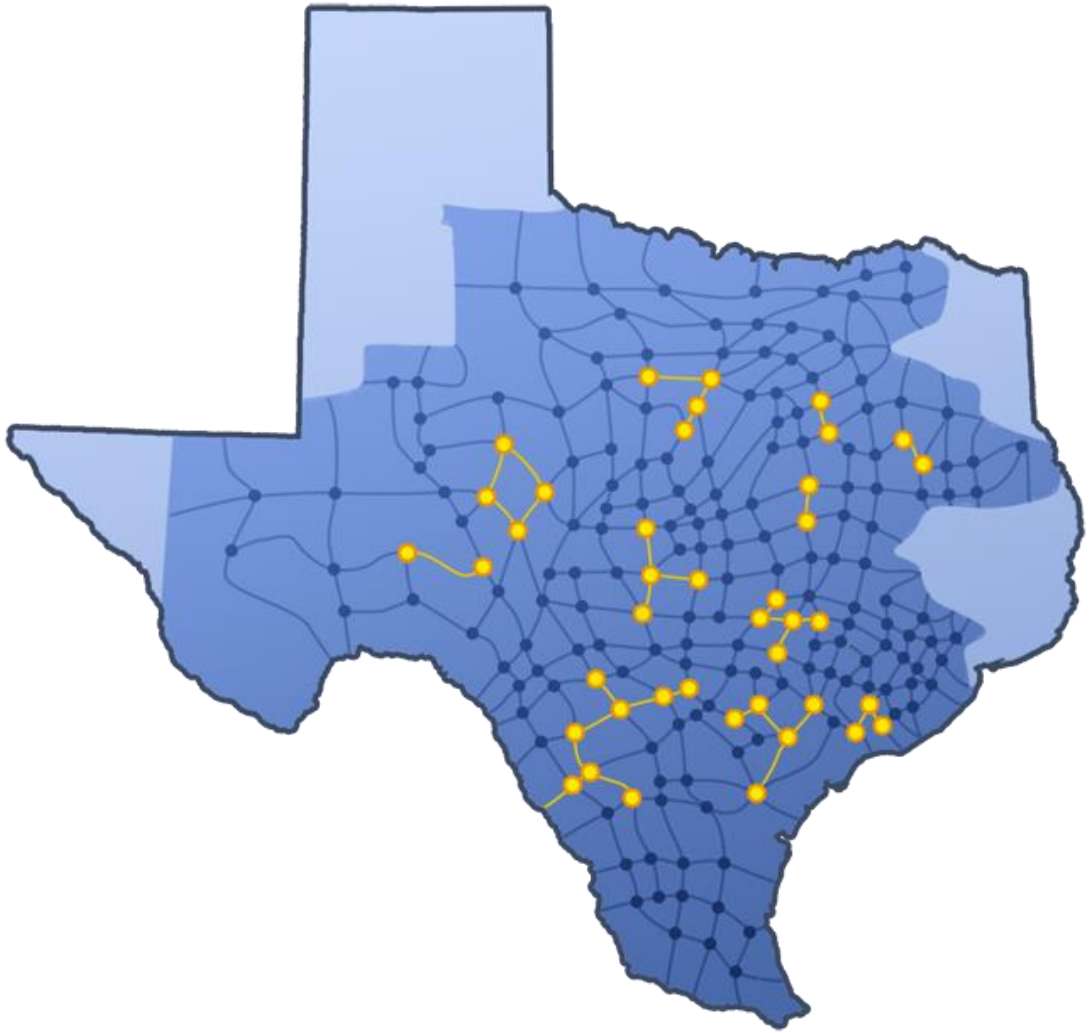
- Identify how to acquire PTP Obligations in the DAM
- Explain the differences between DAM PTP Obligations and CRRs acquired in the Auction

Congestion Revenue Rights Life Cycle



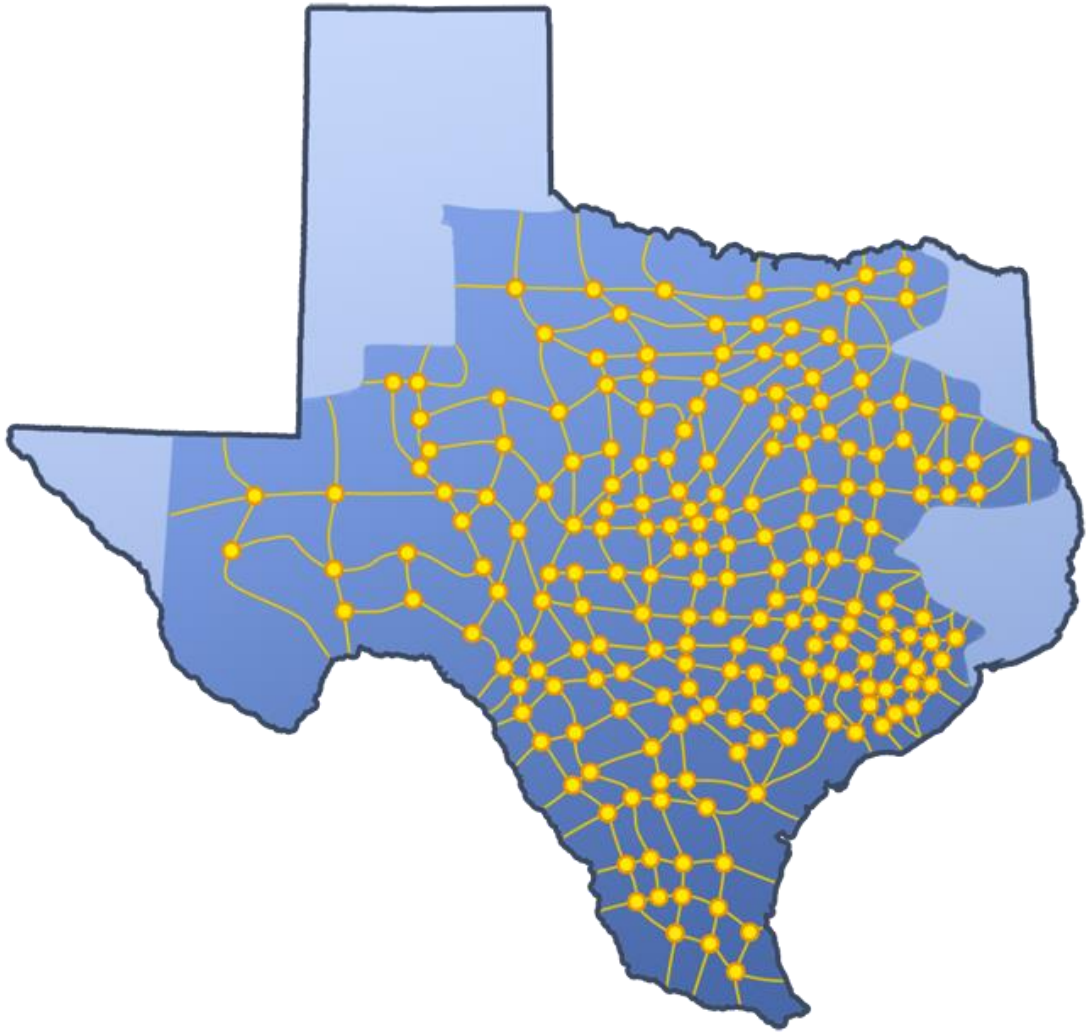
Transmission Capacity in Day-Ahead Market

Possible Transmission Capacity Available After the Auction



Transmission Capacity in Day-Ahead Market

Possible Transmission Capacity Available for Day-Ahead Market



Day-Ahead Market:

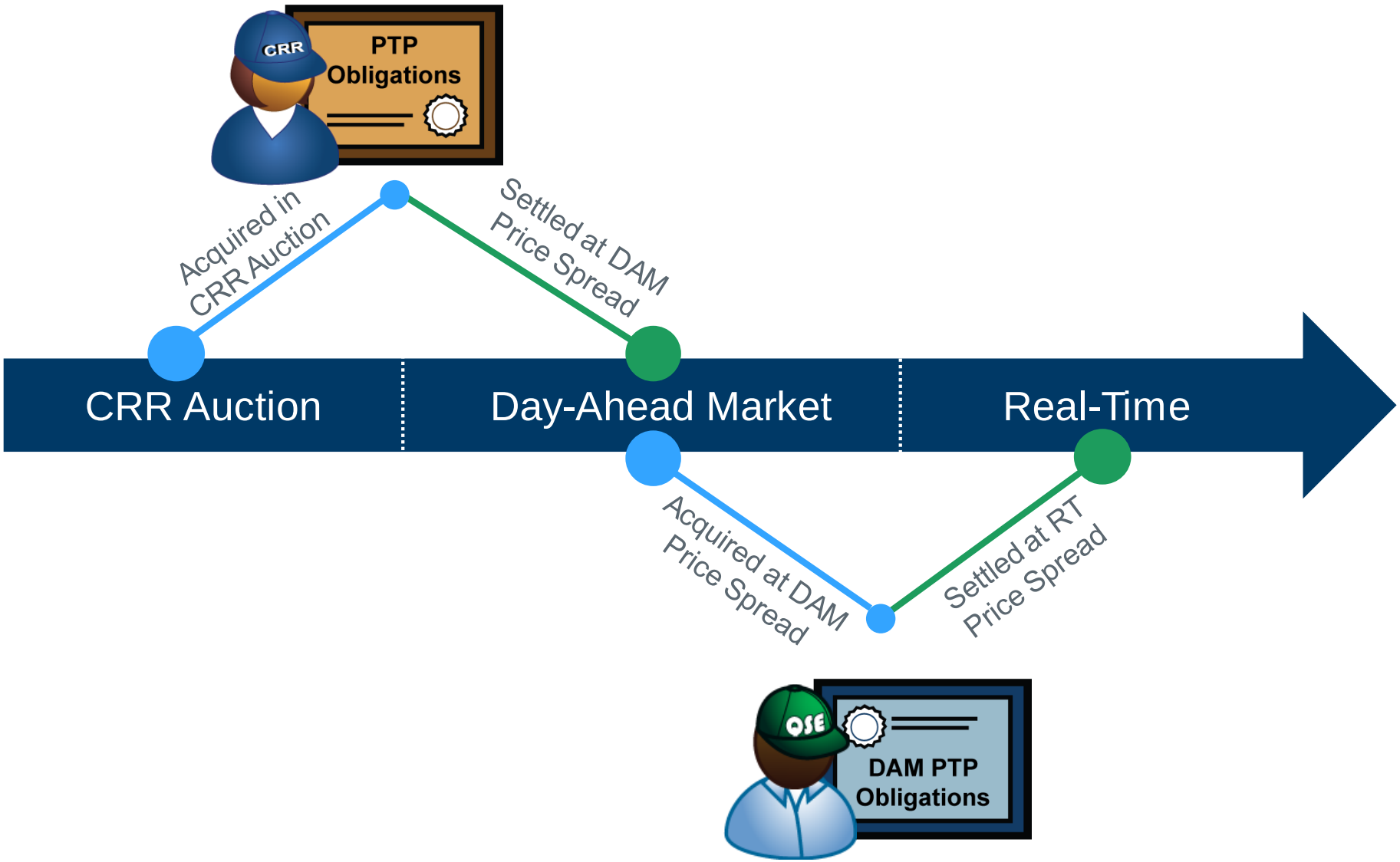
- CRRs purchased in Auction are settled in DAM
- Settlement of CRRs "frees up" available network capacity for the DAM

Point-to-Point Obligations – The bigger picture

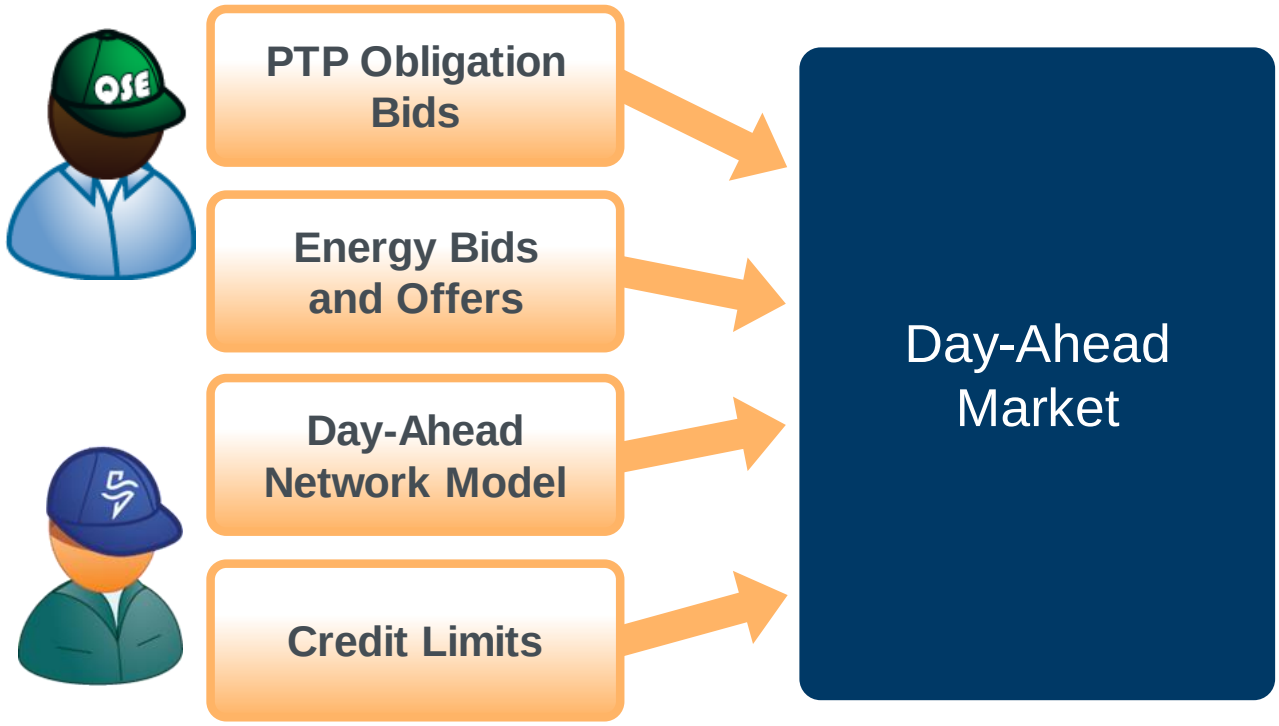
	PTP Obligation (CRR)	DAM PTP Obligation
How acquired:	Auction / Allocation	DAM
Who Purchases:	CRR Account Holder	QSE
Tradable:	Yes	No
How Purchased:	TOU Blocks	Hourly
Initial Investment:	Auction clearing price	Day-Ahead SPPs (Sink – Source)*
Target Payout:	Day-Ahead SPPs (Sink – Source)	Real-Time SPPs (Sink – Source)

** Other DAM charges may apply*

Point-to-Point Obligations – The bigger picture

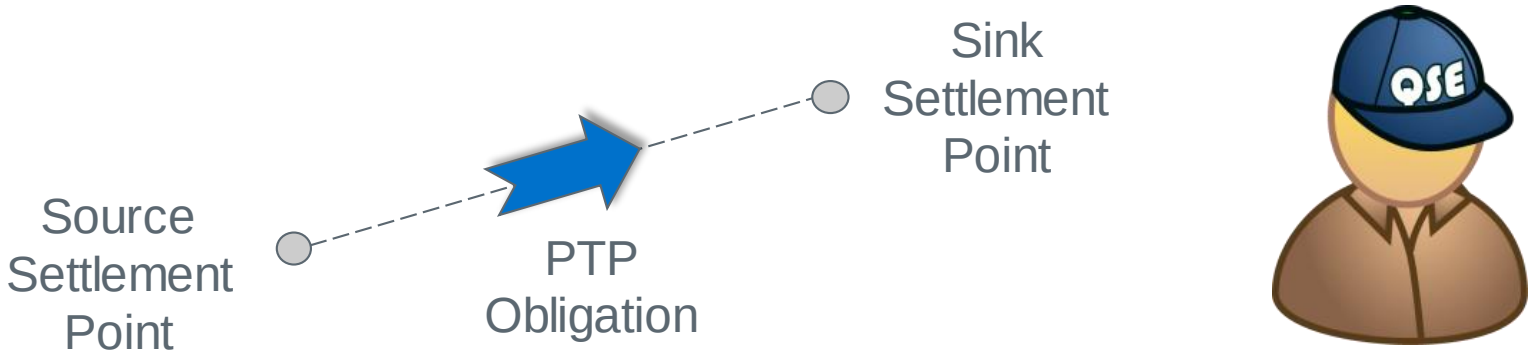


Inputs for Award of PTP Obligations

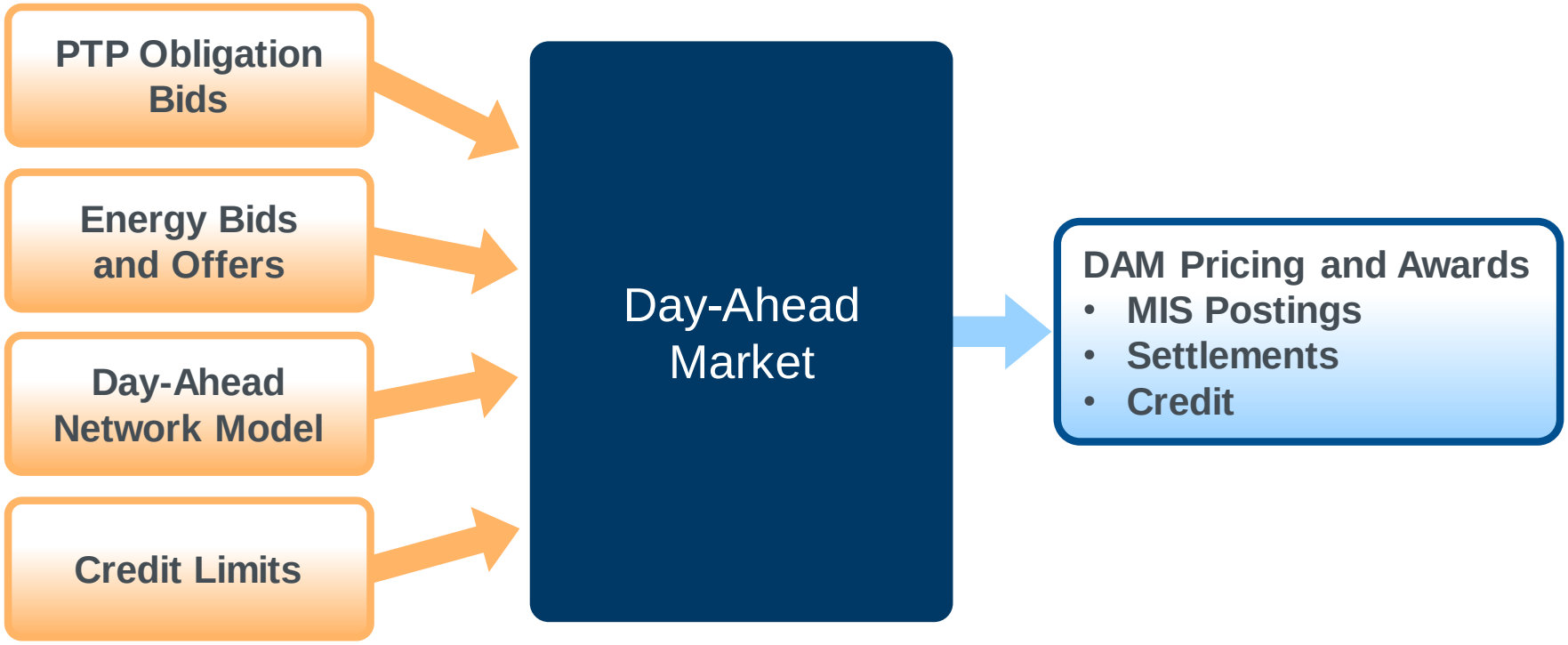


DAM PTP Obligation Bid

- Submitted for any two Settlement Points
- Includes:
  - MW Quantity
  - (Sink – Source) price buyer is willing to pay



Day-Ahead Market Results



In this module, you've learned about:

- How to acquire PTP Obligations in the Day-Ahead Market
- How PTP Obligations in the Day-Ahead are different from and similar to CRRs acquired in the Auction

Module 5

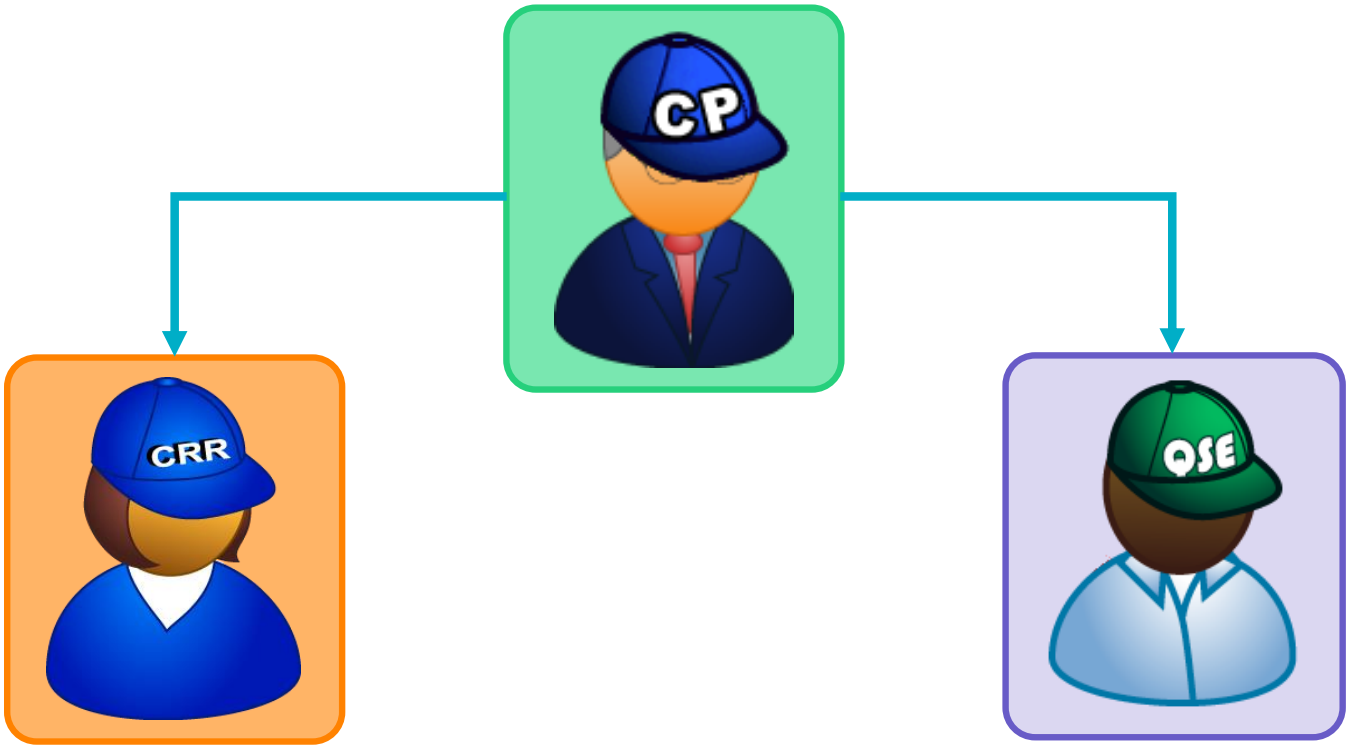
Credit Limits

Upon completion of this module, learners will be able to:

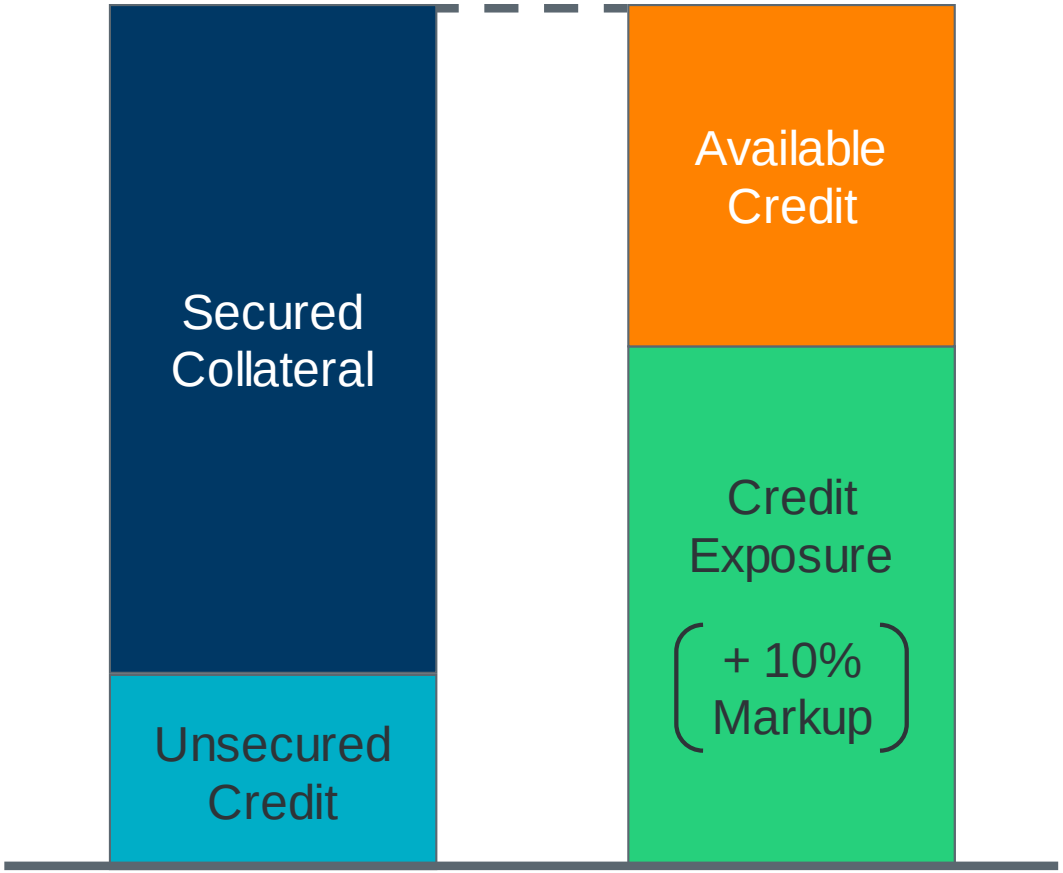
- Recognize how a company establishes available credit
- Explain the process of allocating credit for a CRR Auction
- Describe how credit is utilized in the CRR Auction
- Recognize how credit is shared between QSEs and CRR Account Holders

Introducing ... The Counter-Party

- Entity that is also a QSE and/or a CRR Account Holder
- Responsible for managing Available Credit

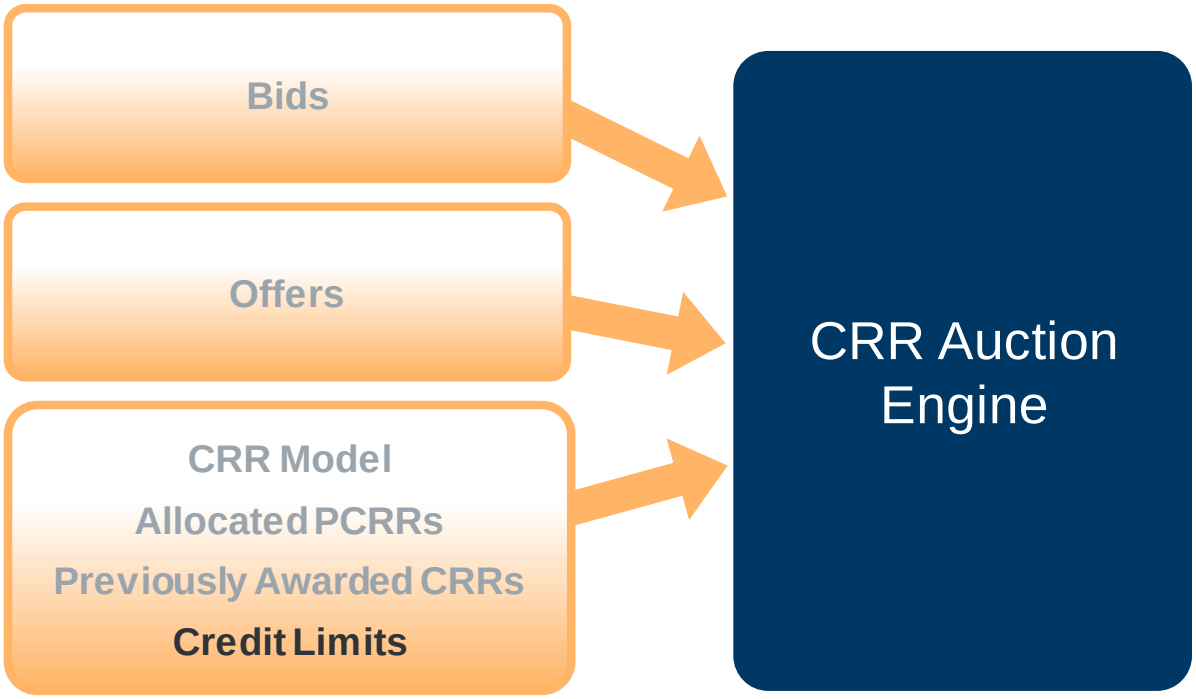


Available Credit



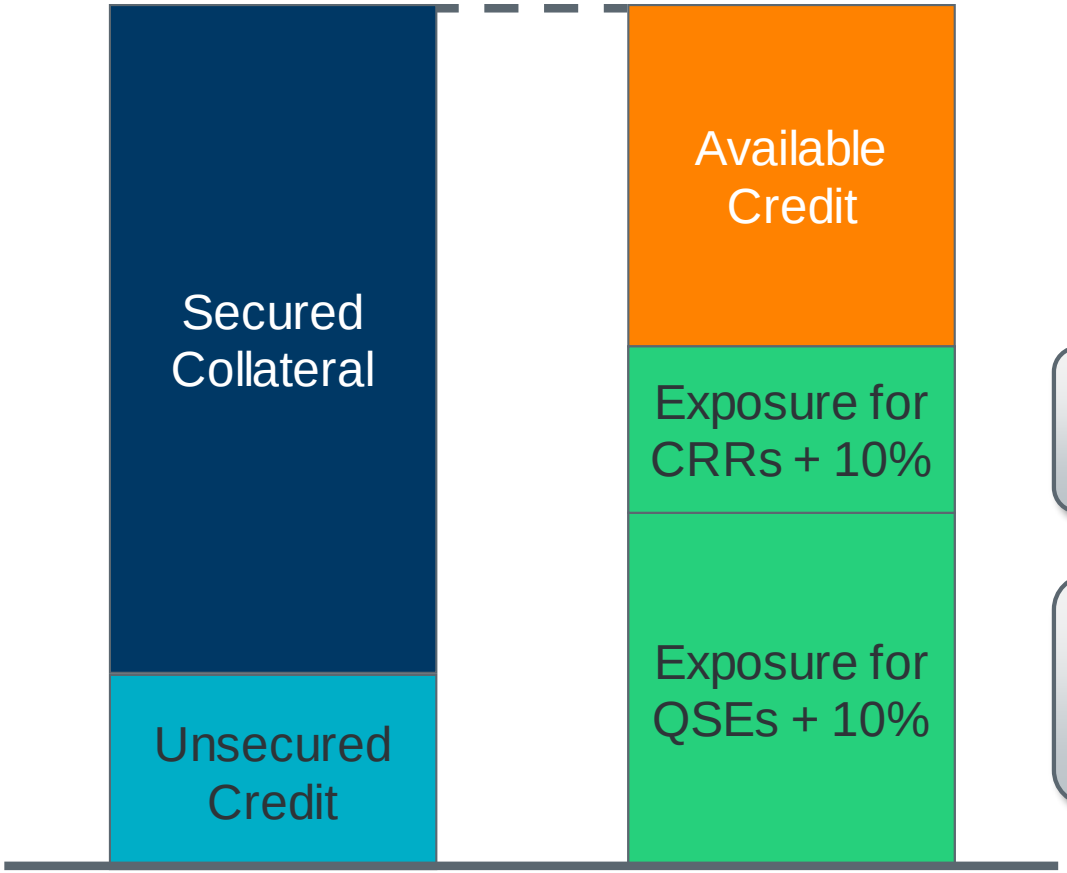
Counter-Party posts Secured Collateral to make credit available to its QSEs and CRR Account Holders

CRR Auction Inputs



Credit limit acts as budget constraint

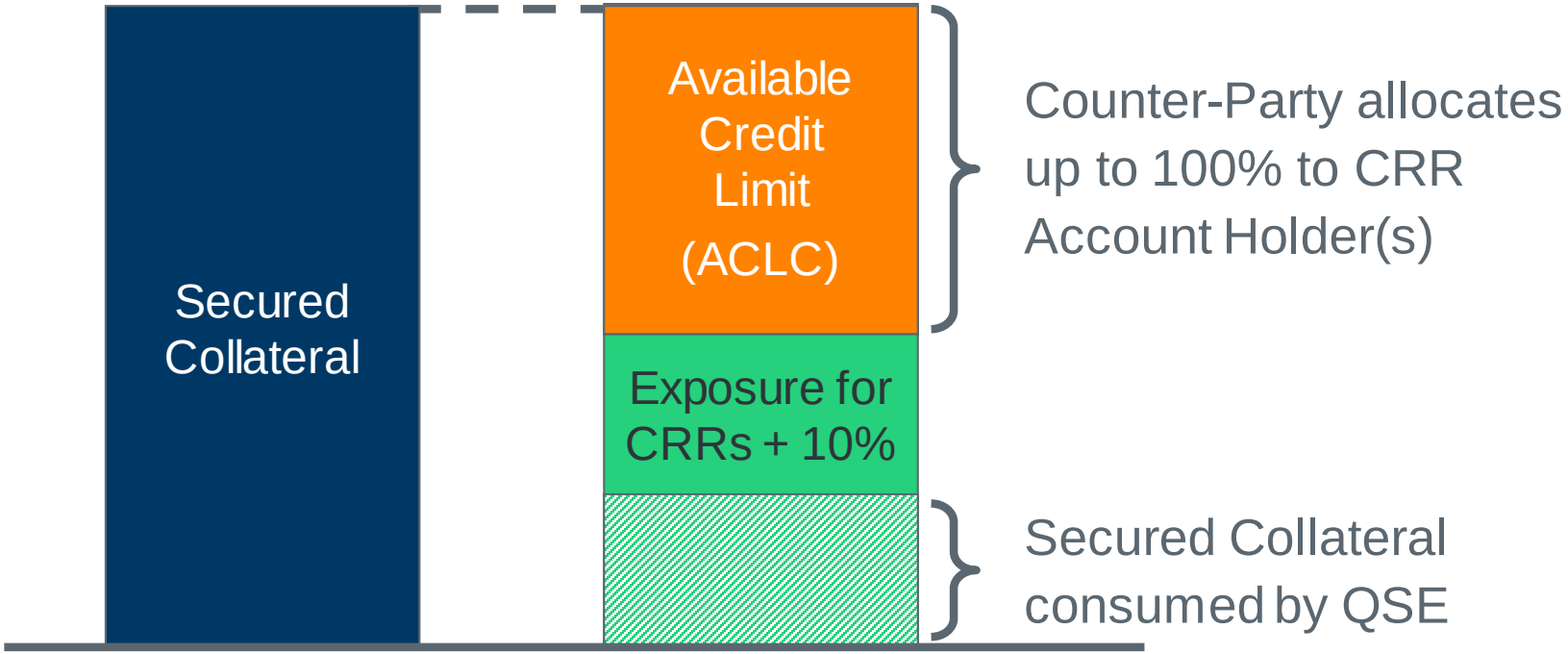
Available Credit



Satisfied only by Secured Collateral

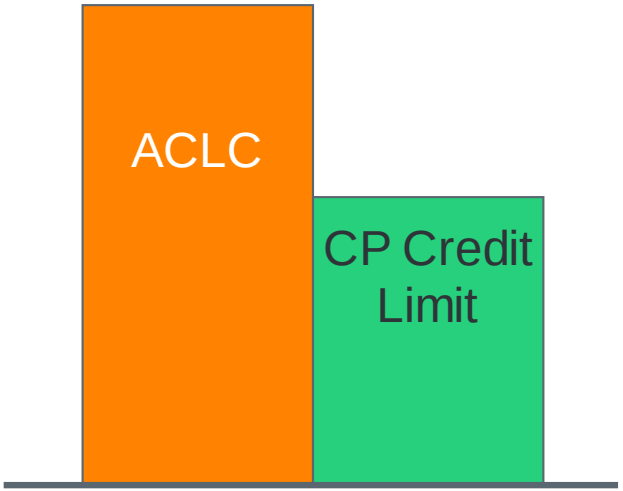
Satisfied by Secured Collateral and Unsecured Credit

ERCOT Calculates Counter-Party's Available Credit Limit for CRR Auction (ACLC)



Budget Constraint in CRR Auction

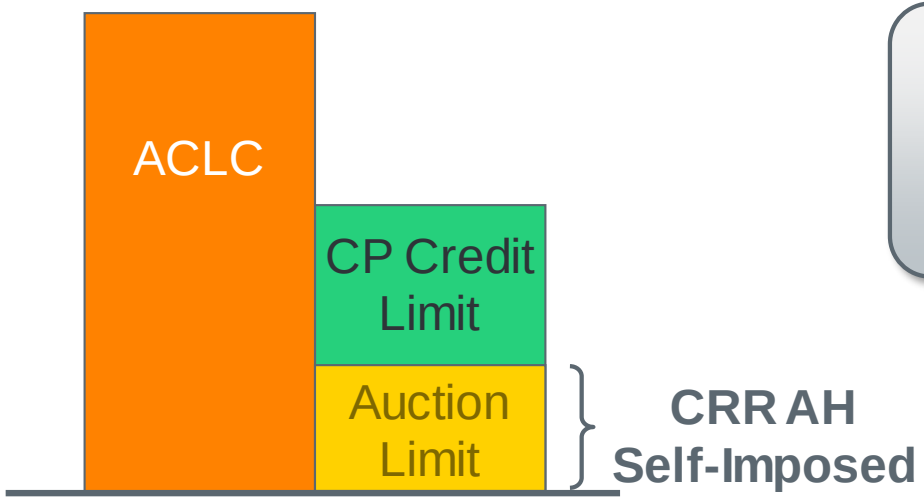
- ERCOT calculates ACLC for Counter-Party
- Counter-Party must set a Credit Limit for the Auction for their CRR Account Holder to participate



Counter-Party must lock credit by close of the Bid Window for the CRR Auction

Budget Constraint in CRR Auction

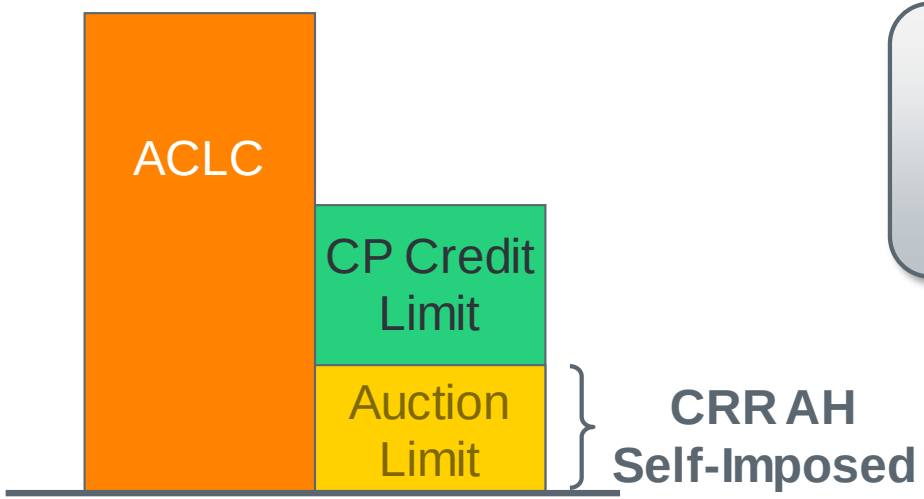
- Counter-Party must set a Credit Limit for the Auction for their CRR Account Holder to participate
- CRR Account Holder may assign a self-imposed Credit Limit



The Counter-Party credit limit determines how much credit is locked for the auction.

Special Rules for Long-Term Auction Sequence

- Counter-Party must lock credit separately for each Auction in the sequence
- Counter-Party must lock credit separately for each Time-of-Use (TOU)

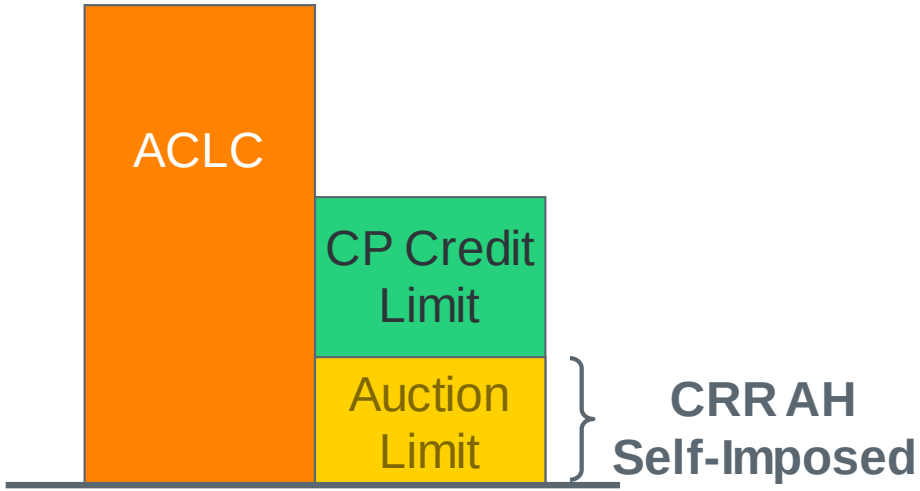


For credit-lock deadlines, refer to CRR Activity Calendar on ercot.com

Credit Consumption in CRR Auction

Credit is consumed as follows:

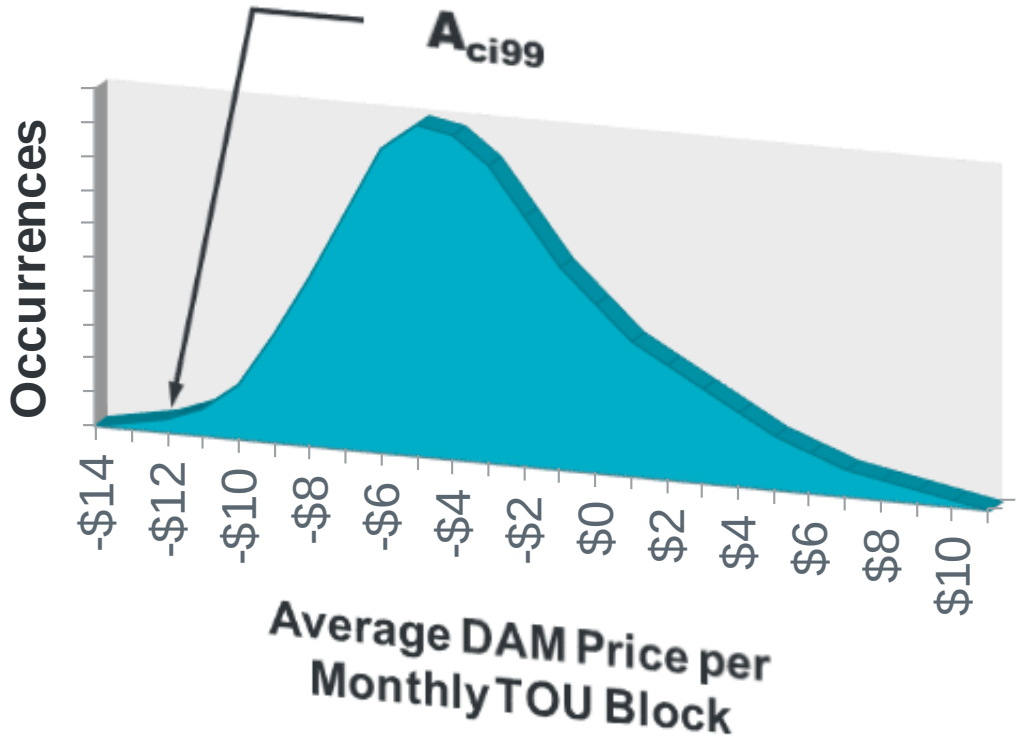
- PTP Options Bids: Volume * Bid price
- PTP Obligation Offers: Volume * Min (0, Offer price)
- PTP Obligation Bids: Volume * (Bid price + **Path-Specific Adders**)



Path-Specific DAM-Based Adder for PTP Obligation Bids

- Calculated for each source/sink pair
- Three year look-back

ci99 = 99th percentile Confidence Interval



Auction PTP Obligation Credit Requirement (AOBLCR)

$$AOBLCR = BOBLMW * (Max(0, BPOBL) - Min(0, Aci_{99}, EACP))$$

Where

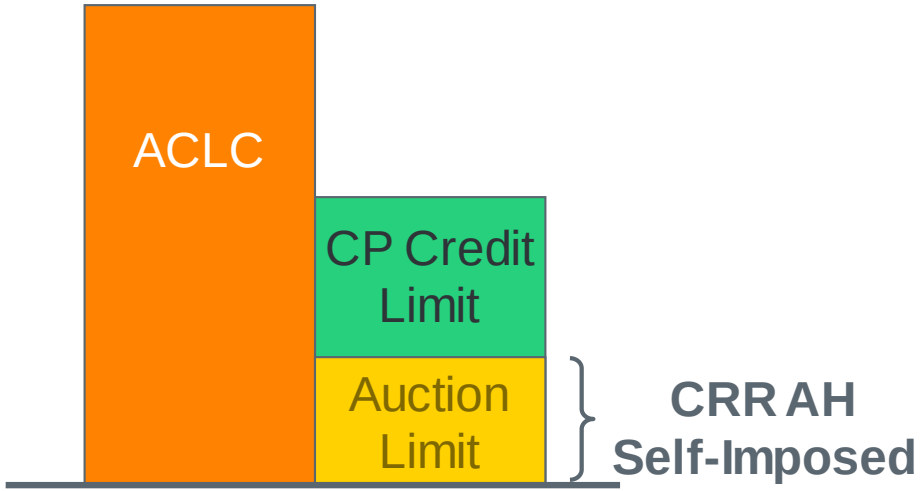
BOBLMW = (Potentially) Awarded PTP Obligation

BPOBL = Bid Price for PTP Obligation

EACP = Effective Auction Clearing Price (most recent)

Credit Pre-Screening for CRR Auction

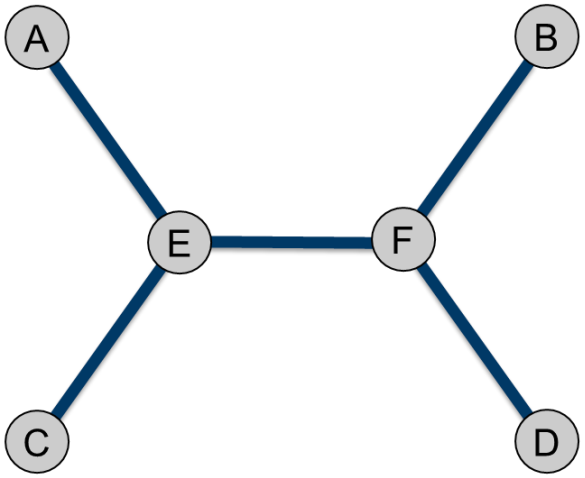
- Like credit constraint except calculated with Bid Volumes rather than Awarded Volumes
- If exposure < CP Credit Limit, then Limit is ignored
- If exposure < Self-Imposed Credit Limit, then Limit is ignored



Scenario 1

CRR Account Holder sets a self-imposed credit limit of $50,000 and submits bids for a Monthly CRR Auction

- 100 MW PTP Options from A to B
- $1000 Bid Price



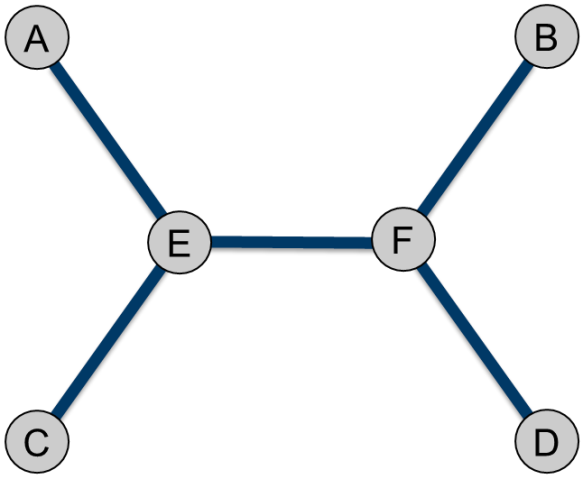
Auction awards them 50MW @ $20

What happened?

Scenario 2

CRR Account Holder sets a self-imposed credit limit of $18,000 and submits bids for a Monthly CRR Auction

- 100 MW PTP Obligations from D to C
- $180 Bid Price

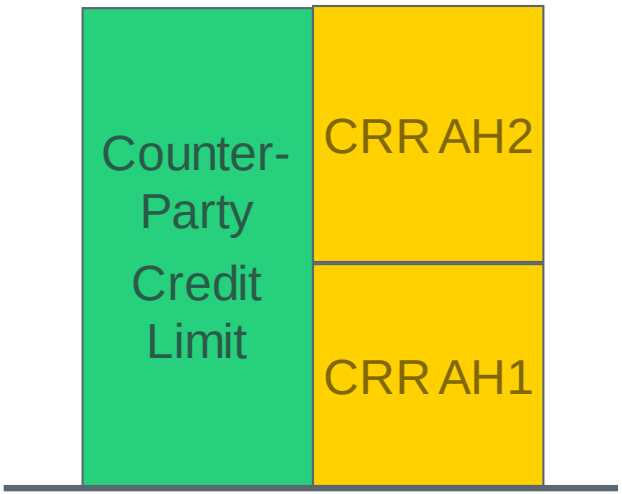


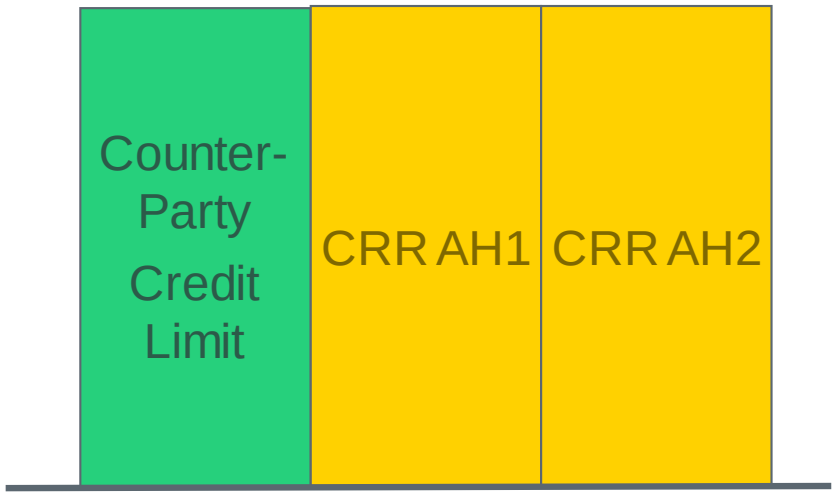
Auction awards them 90MW @ -$20

What happened?

Bonus Scenario

CRR Account Holder 1 & CRR Account Holder 2 are part of the same Counter-Party. What would happen if they both self-imposed a credit limit for a CRR Auction?





The Rest of the Credit Picture

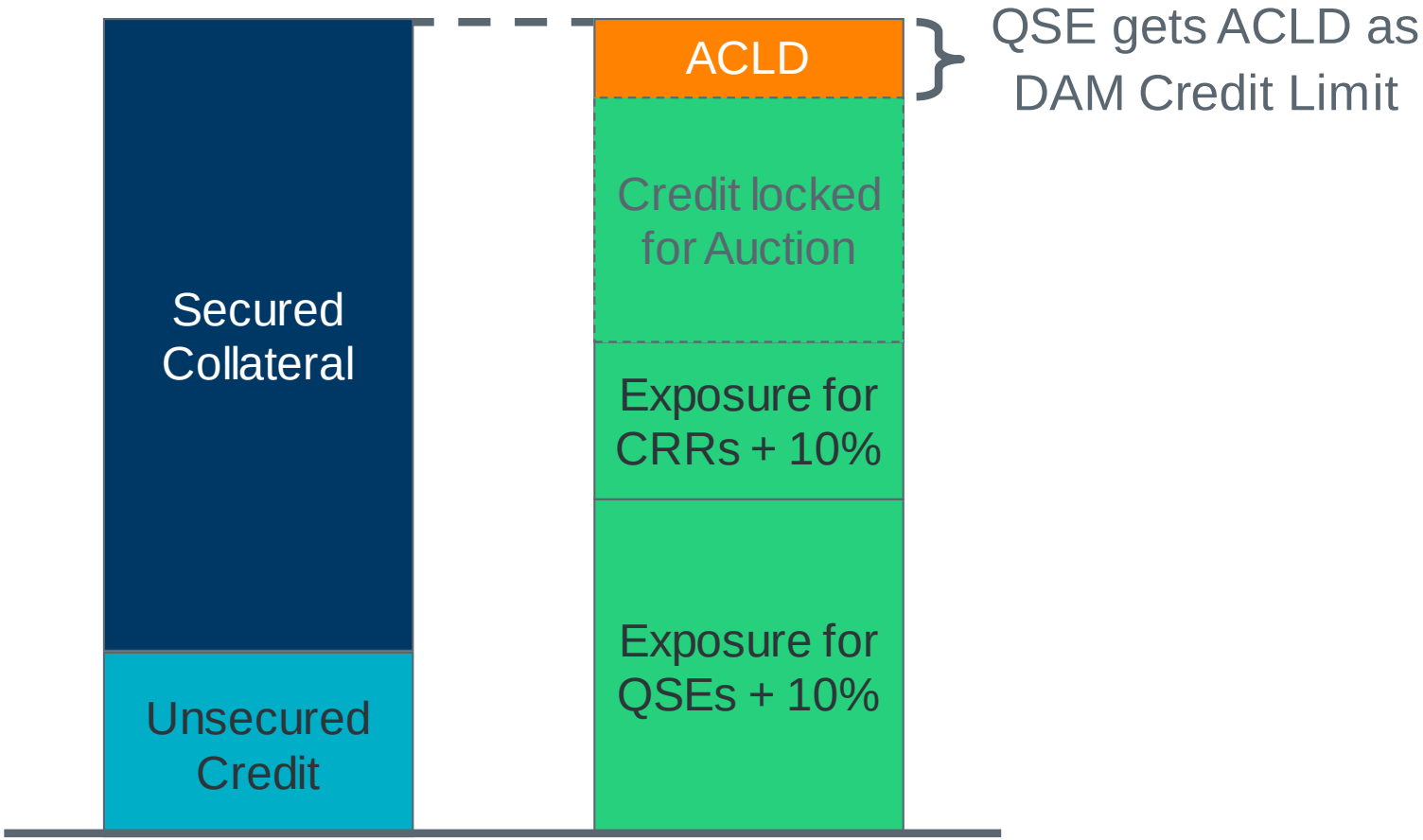
Maintains Secured Collateral with ERCOT

Available credit is shared

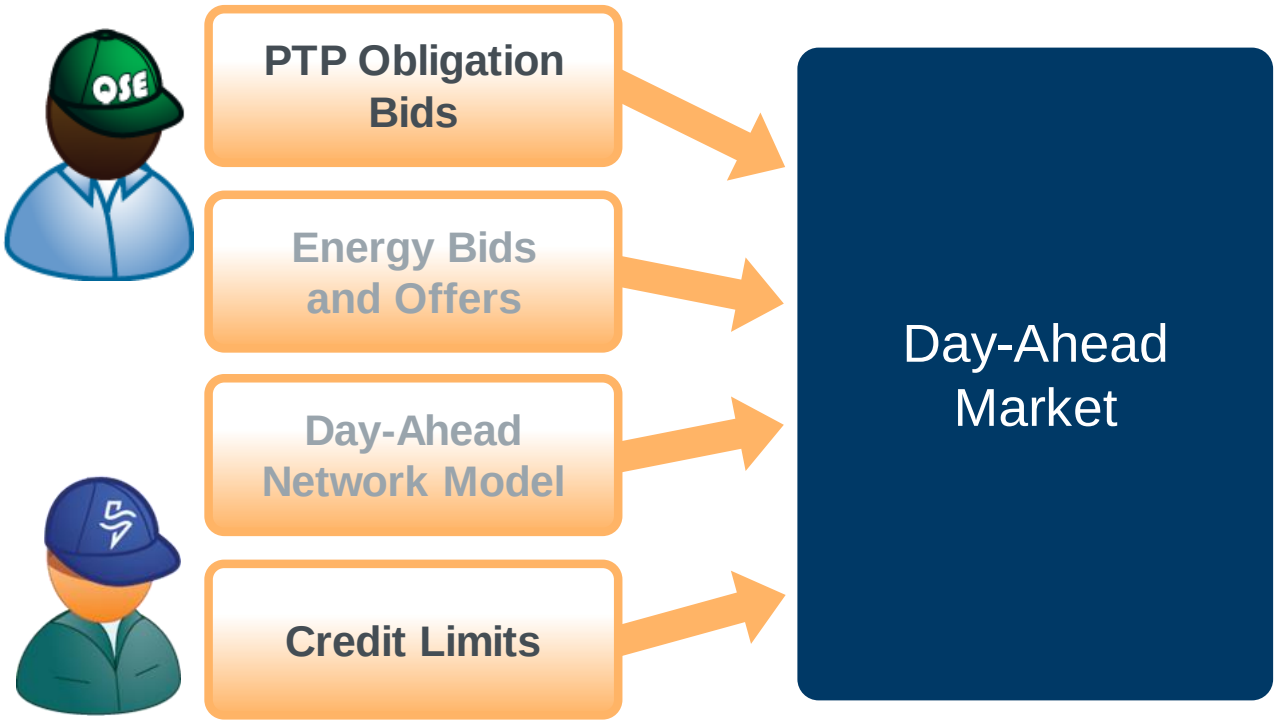
CRR Auction Credit Limit

Day-Ahead Market Credit Limit

ERCOT Calculates Counter-Party's Available Credit Limit for DAM (ACLD)



Buying PTP Obligations in DAM?



Credit limit acts as budget constraint

In this module, you've learned about:

- How a company establishes available credit
- The process of allocating credit for a CRR Auction
- How credit is utilized in the CRR Auction
- How credit is shared between QSEs and CRR Account Holders

Module 6

CRR Settlements

Upon completion of this module, learners will be able to:

- Identify the settlements associated with buying, owning and selling CRRs
- Describe the flow of money in the CRR Auction and for settlements of CRRs in the Day-Ahead Market
- Explain how ERCOT uses the CRR Balancing Account
- Identify the settlements associated with buying PTP Obligations in DAM
- Describe the flow of money for DAM PTP Obligations

CRR Settlements

Three Settlement Processes

- CRR Auction Settlement
- Day-Ahead Market
  - Settlement of CRRs
  - Shortfall Charges
- CRR Balancing Account

CRR Auction Settlement Timeline

* ERCOT Business Day
** Bank Business Day
*** ERCOT Business Day and Bank Business Day

Charges and Payments for CRR Auction

Charge for awarded CRR Bid

= (Price) * (CRRs) * (TOU Hours)

Payment for awarded CRR Offer

= (-1) * (Price) * (CRRs) * (TOU Hours)

CRRAH1 is awarded on a PTP Option bid:

- 20 MWs
- Peak WD (5x16)
- Price of $5/MW
- 320 hr in February

- For one hour:

$$\frac{\text{(Price) * (CRRs)}}{\text{(\$5/MW) * (20 MW) = \$100}}$$

- For entire TOU block:

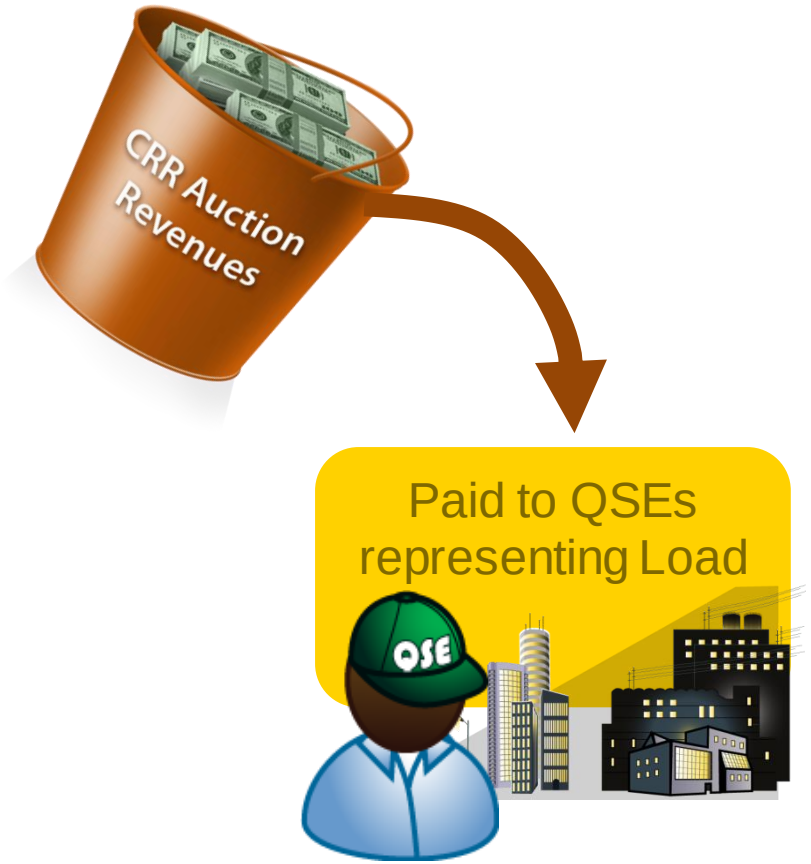
$100 * 320 = $32,000

Collection of Auction Revenues

- PCRR Revenues
- Charges for Awarded CRR Bids

- Payments for Awarded CRR Offers
- Payments for Awarded CRR Bids

Distribution of Auction Revenues



- Revenues from Intra-Zonal* CRRs are distributed by Zonal Load Ratio Share
- Revenues from Inter-Zonal* CRRs are distributed by ERCOT-wide Load Ratio Share

Distribution occurs once a month.

*Based on 2003 Congestion Management Zones

CRRs Settled in the Day-Ahead

Calculated hourly

- Charges for Cleared DAM Energy Bids
- Charges for Cleared DAM PTP Obligation Bids

- Payments for Cleared DAM Energy Offers
- Payments for Cleared DAM PTP Obligation Bids

Payment due to CRR Account Holders
(Target Payment)

Payment for CRRs Settled in Day-Ahead

Target Payment

$$\left(\text{Price}\right) * \left(\text{Quantity}\right) \text{ Per hour}$$

Price: $DASPP_{sink} - DASPP_{source}$

Quantity: MW of CRRs owned on path

Target Payment

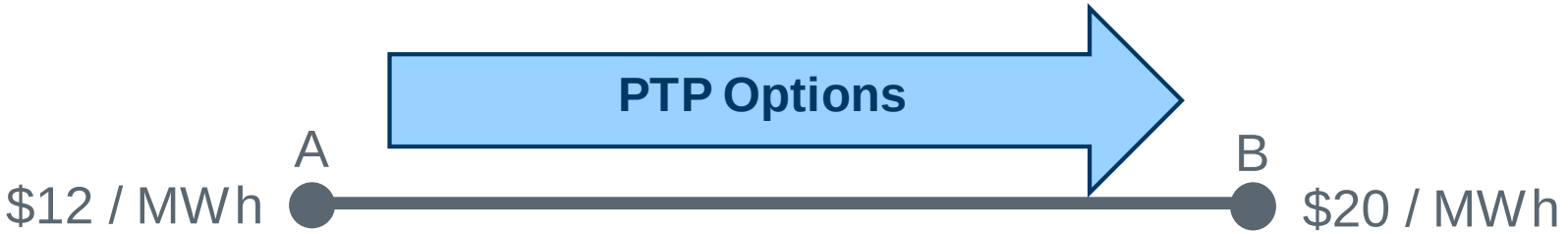
$$(\text{Price}) * (\text{Quantity}) \text{ Per hour}$$

PTP Options

- Only results in a payment
- If price is negative, there is no charge

Target Payment

(Price) * (Quantity) Per hour = ?



CRR Account Holder owns 2 MWs of PTP Options between Source A and Sink B.

Payment for CRRs Settled in Day-Ahead

Target Payment

$$\left(\text{Price}\right) * \left(\text{Quantity}\right) \text{ Per hour}$$

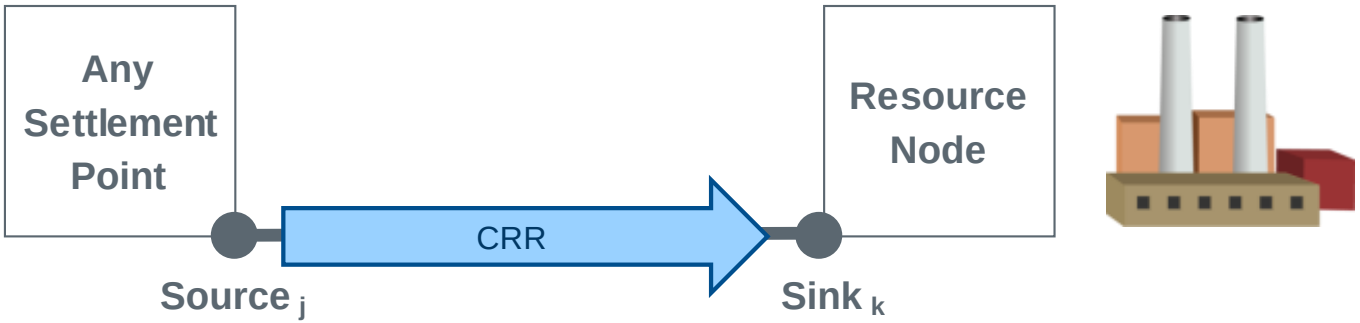
PTP Obligations

- Results in a payment or charge

Reduced CRR Payments

CRR payments may be derated if:

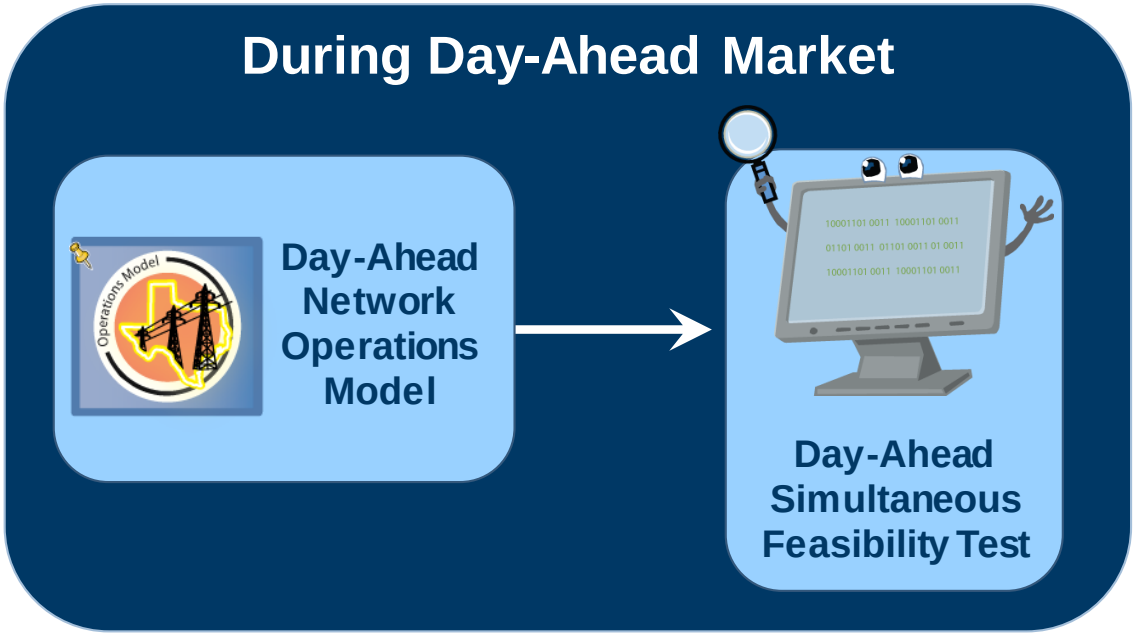
- Transmission elements are oversold
- The Target Payment is a positive value
- CRR sink is a Resource Node



Deration of CRRs

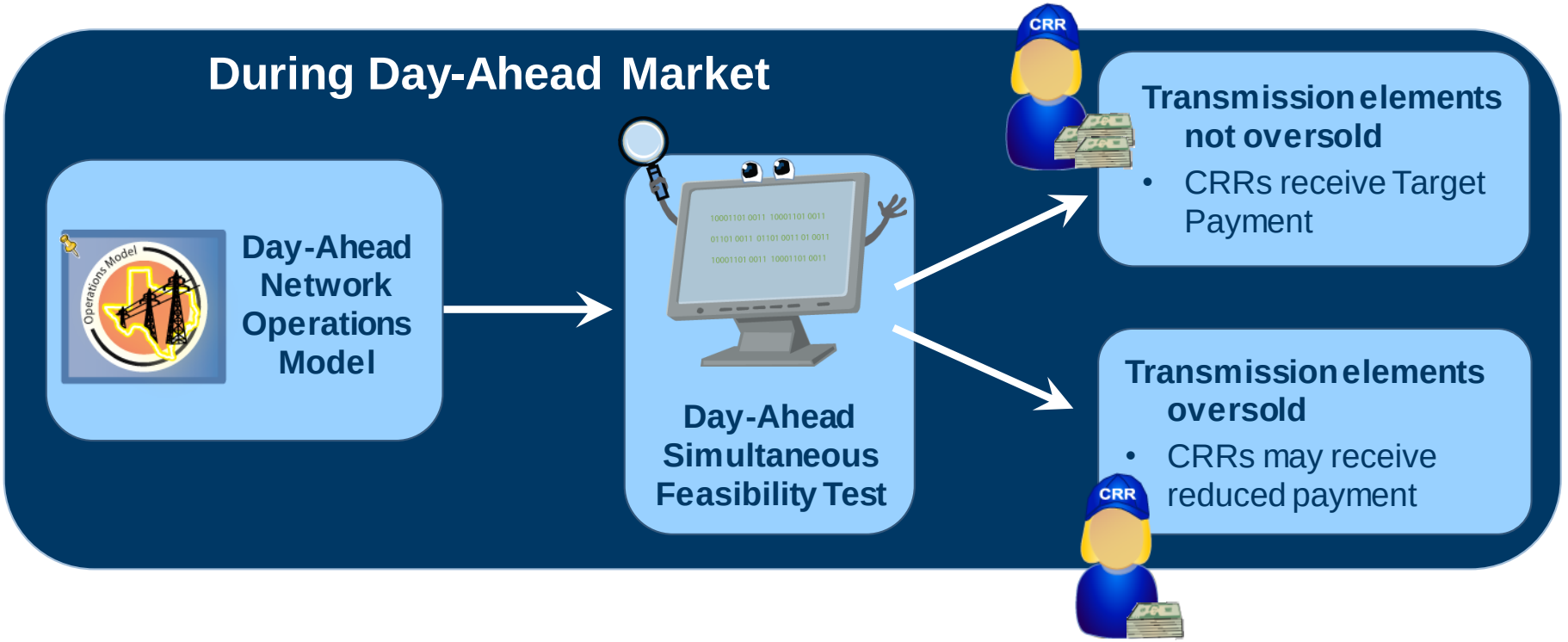
- Developed daily
- Reflects forecasted transmission system for the next day
- Updated with scheduled outages and forecasted system conditions

Deration of CRRs

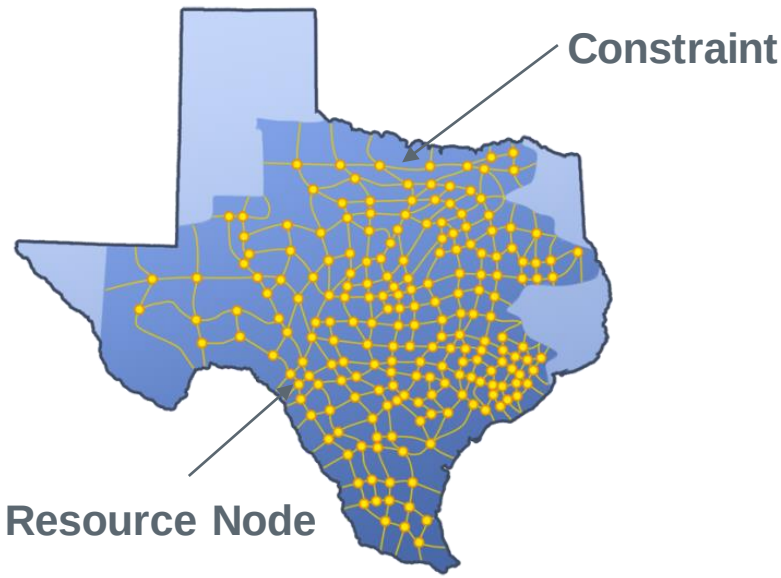


- Executed daily
- Verifies feasibility of CRRs sold in Auction

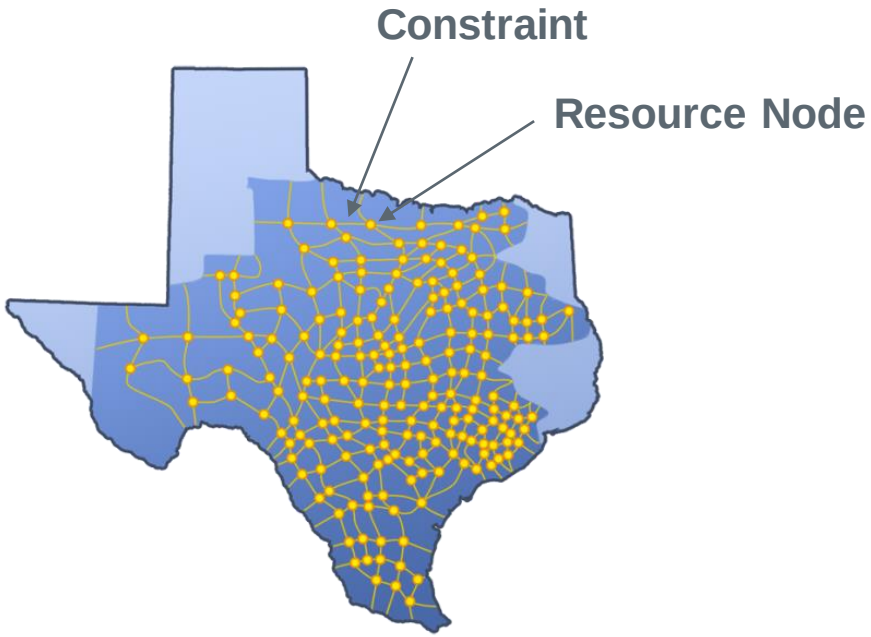
Deration of CRRs



Deration of CRRs is based on impact of Resource Node on constraints



Minimal impact
Minimal deration



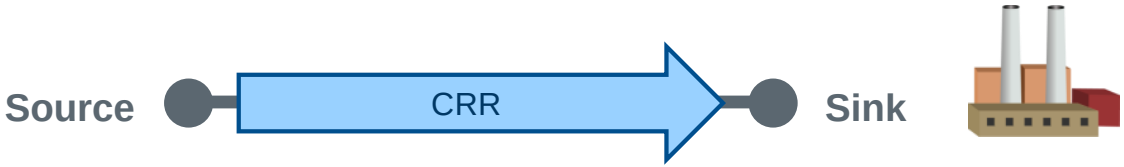
Significant impact
Significant deration

Derated Amount and Hedge Value

- **Derated Amount limits pricing games for CRR at Resource Node**
- **Hedge Value maintains value of CRR as Hedge**
  - Maximum Resource Price at sink
  - Minimum Resource Price at source

RESOURCE TYPE	MAXRESPR $_k$	MINRESPR $_j$
Nuclear	$15/MWh	-$20/MWh
Simple Cycle > 90MW	FIP*14	FIP*10
Combined Cycle > 90MW	FIP*9	FIP*5
Wind	$0	-$35/MWh
PhotoVoltaic (Solar)	$0	-$10/MWh

Hedge Value Price



HV PRICE = Max (0, MAXRESPR $_{sink}$ – DASPP $_{source}$)

HV PRICE = Max (0, MAXRESPR $_{sink}$ – MINRESPR $_{source}$)

Payment for CRRs Settled in Day-Ahead

Target Payment < Hedge Value

CRR Owner receives Target Payment

Hedge Value < Target Payment

CRR Owner receives Hedge Value or Derated Amount, whichever is greater

Day-Ahead Market Congestion Rent

- Charges for Cleared DAM Energy Bids
- Charges for Cleared DAM PTP Obligation Bids

- Payments for Cleared DAM Energy Offers
- Payments for Cleared DAM PTP Obligation Bids

Payment due to CRR Account Holders
(Target Payment)

Day-Ahead Market Congestion Rent

- Charges for Cleared DAM Energy Bids
- Charges for Cleared DAM PTP Obligation Bids

- Payments for Cleared DAM Energy Offers
- Payments for Cleared DAM PTP Obligation Bids

Payment due to CRR Account Holders
(Target Payment)

Some hours there is more Congestion Rent collected than needed to pay CRR Owners

Day-Ahead Market Congestion Rent

Occurs hourly

- Charges for Cleared DAM Energy Bids
- Charges for Cleared DAM PTP Obligation Bids

- Payments for Cleared DAM Energy Offers
- Payments for Cleared DAM PTP Obligation Bids

Payment due to CRR Account Holders
(Target Payment)

Day-Ahead Market Congestion Rent

- Charges for Cleared DAM Energy Bids
- Charges for Cleared DAM PTP Obligation Bids

- Payments for Cleared DAM Energy Offers
- Payments for Cleared DAM PTP Obligation Bids

Payment due to CRR Account Holders
(Target Payment)

Some hours there is not enough Congestion Rent to pay CRR Owners

Shortfall Charge for CRRs Settled in Day-Ahead - Activity

$$\text{Shortfall Charge} = \left(\text{Total CRR Shortfall}\right) * \left(\text{CRR Owner Target Payment} \Big/ \text{Total CRR Target Payments for hour}\right)$$

Hour Ending 1300	
Total CRR Target Payment	$20 Million
Congestion Rent Collected	$19 Million
CRR Shortfall for the hour	
CRR Owner's Target Payment	$2 Million
CRR Owner's Share of Total Payment	
CRR Owner's Shortfall Charge	

CRR Balancing Account Fund

Payment due to CRR Account Holders

Monthly

Pay to QSEs representing Load

CRR Rolling Balancing Account

Payment due to CRR Account Holders

Monthly

CRR Rolling Balancing Account

may remain short paid

Payment due to CRR Account Holders

Monthly

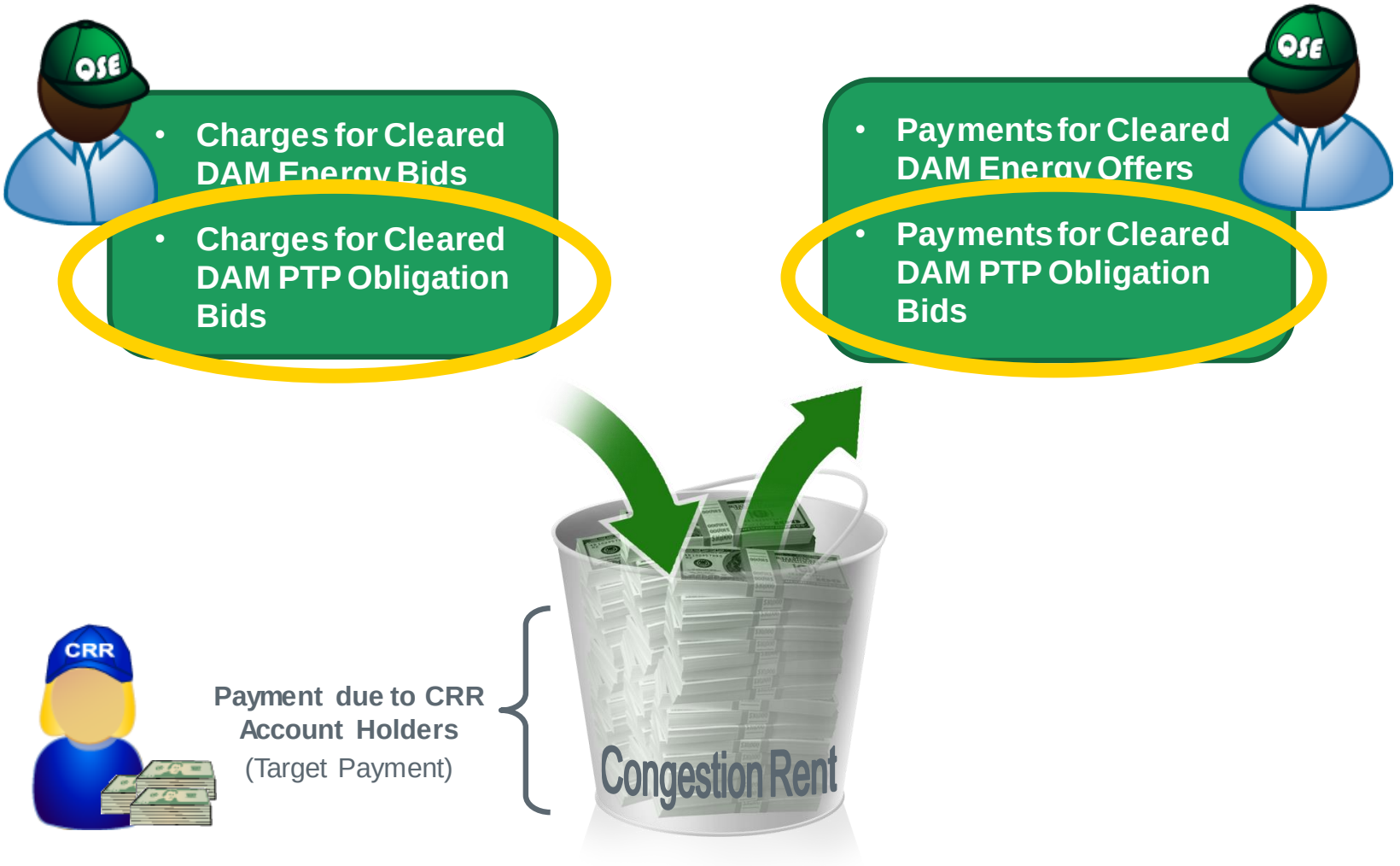
Charge for DAM PTP Obligation Bids

$$\left(\text{Price}\right) * \left(\text{Quantity}\right) \text{ Per hour}$$

Price: $DASPP_{sink} - DASPP_{source}$

Quantity: MW of PTP Obligations awarded on path

PTP Obligations Settled in the Day-Ahead Market



Payment for DAM PTP Obligations

$$\left(\text{Price}\right) * \left(\text{Quantity}\right) \text{ Per hour}$$

$$\text{Price: } \sum_{i=1}^{4} \left(\text{RTSPP}_{\text{sink}} - \text{RTSPP}_{\text{source}}\right) / 4$$

Quantity: MW of DAM PTP Obligations owned on path

In this module, you've learned about:

- Settlements associated with CRRs
- The flow of money related to CRRs in the ERCOT Markets
- The CRR Balancing Account
- Settlements associated with DAM PTP Obligations
- The flow of money related to DAM PTP Obligations

Course Conclusion

In this course, you've learned about:

- Requirements to participate in the CRR market
- CRR Market processes
- Possible financial outcomes of CRRs in the ERCOT markets

Scan this QR code to take the course survey!

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Additional Resources

ERCOT Protocols
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