NODAL MARKET EDUCATION

Retail Panel Presentation

Legal Disclaimers and Admonitions

PROTOCOL DISCLAIMER

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Course Objectives

Upon completion of this course…

…you will be able to:

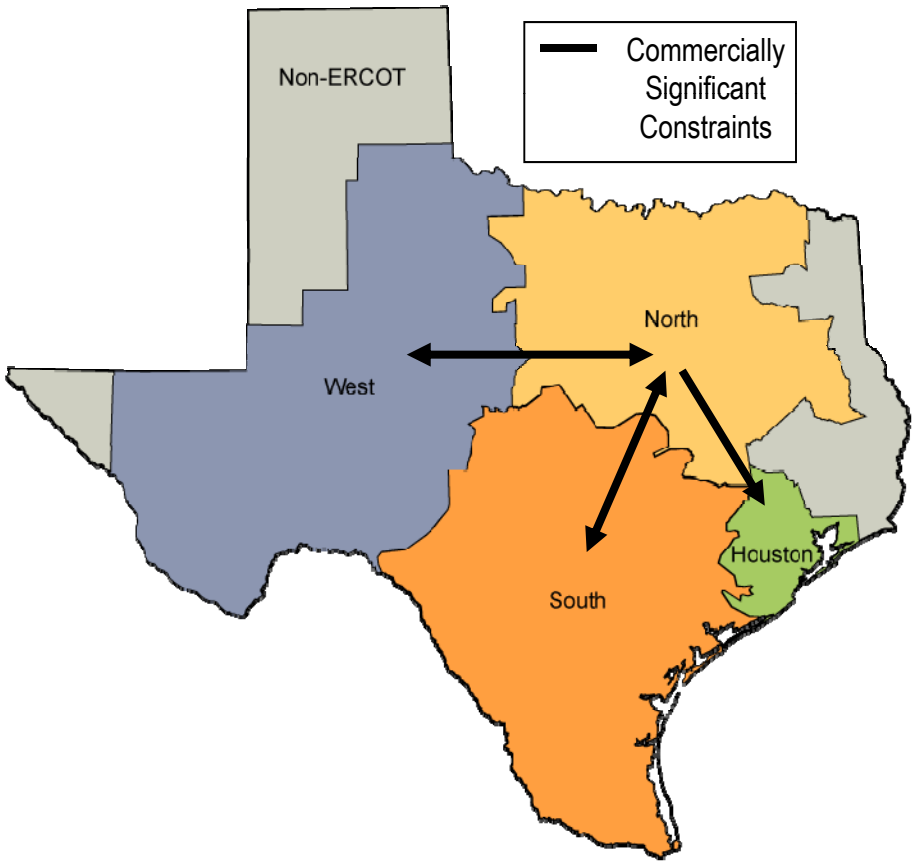
- Identify key differences between Zonal & Nodal Markets
- Describe wholesale energy transactions in the Nodal Market.
- Identify financial impacts of Nodal Market implementation

Comparing Zonal Market with Nodal Market

Zonal Market Design

Commercial Markets

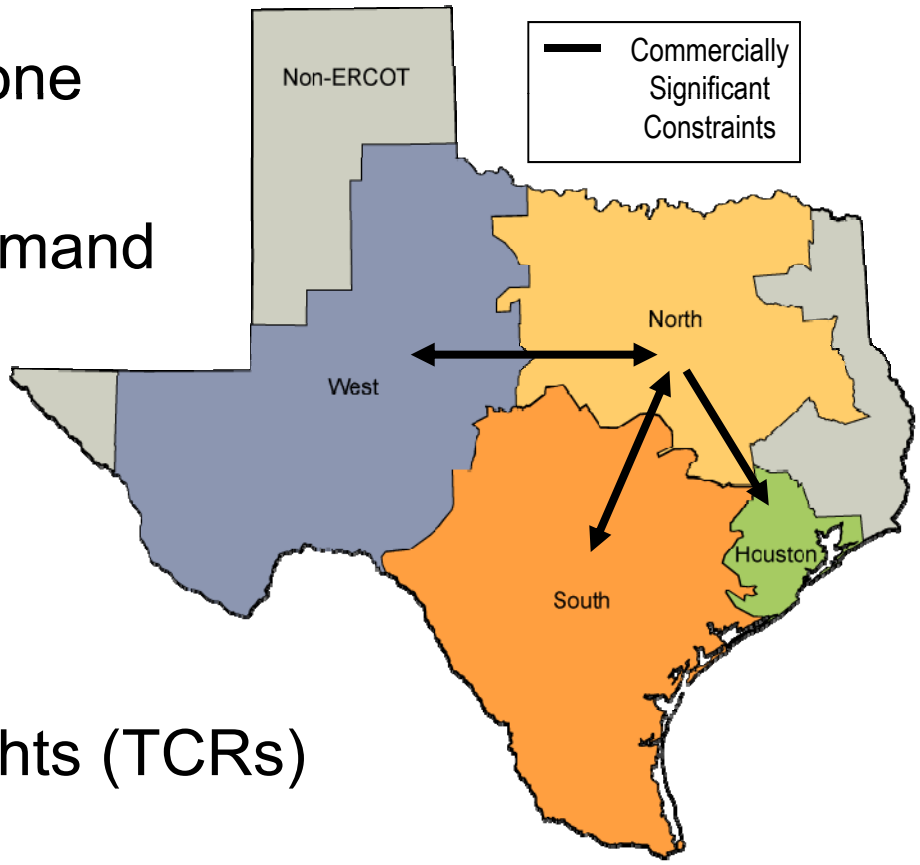
- Bilateral Market
  - Balanced Schedules
- ERCOT Facilitated Markets
  - Real-Time Balancing Energy Market
  - Day-Ahead Ancillary Services Market



Zonal Market Design

Zonal Balancing Energy

- Balancing Energy offers by zone
- Portfolio based dispatch
  - Balance generation with demand
  - Manage Zonal Congestion
  - Zonal prices for energy

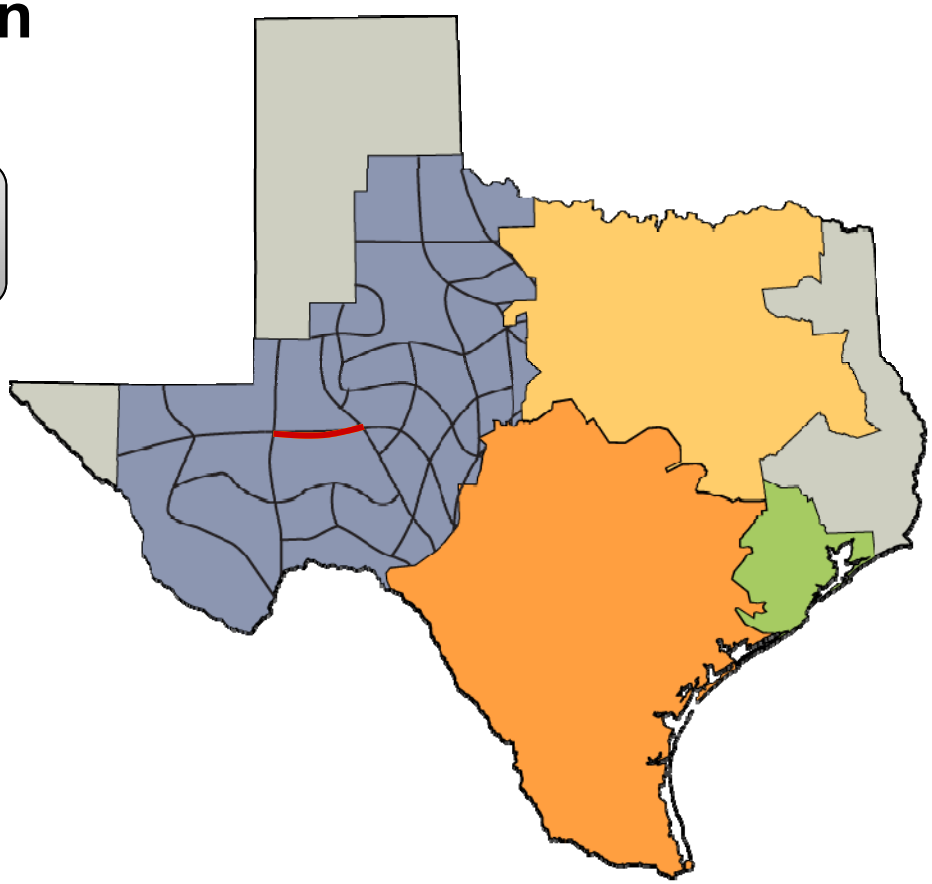


Zonal Congestion Costs

- Costs are directly assigned
- Transmission Congestion Rights (TCRs) available for hedging

Shortcomings of Zonal Design

Not all congestion is Zonal



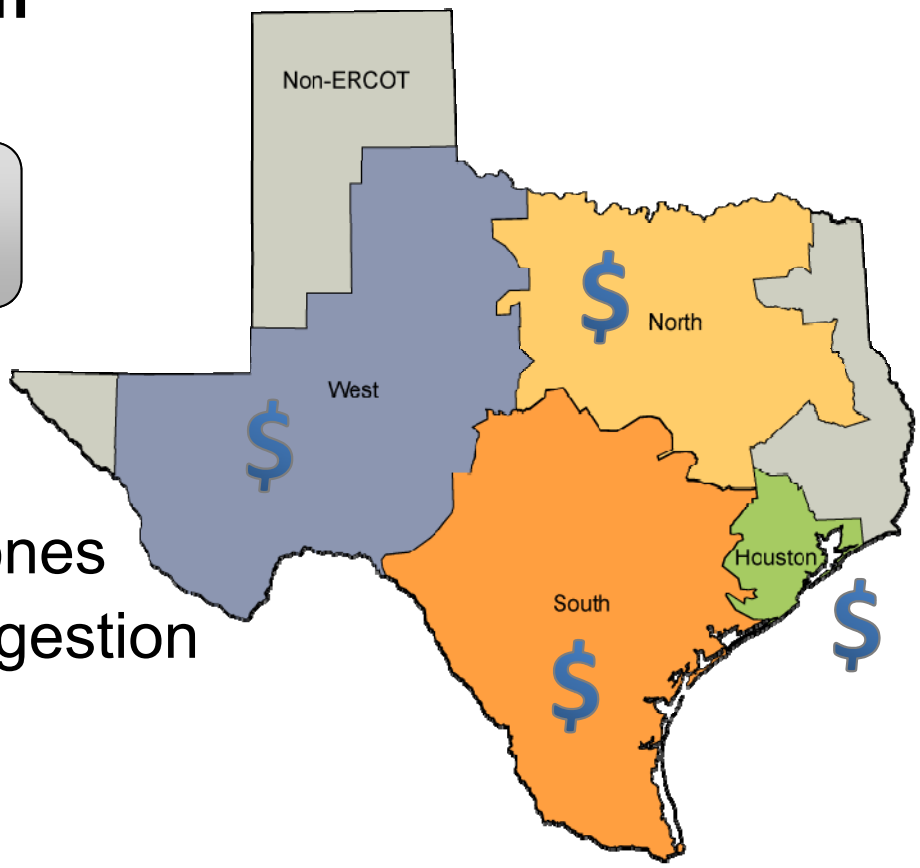
Local Congestion

- Cannot resolve with Zonal Balancing Energy
- Not market based

Zonal Market Design

Shortcomings of Zonal Design

Prices do not reflect Local Congestion



Energy Pricing

- Prices determined only for zones
- Prices only reflect Zonal Congestion

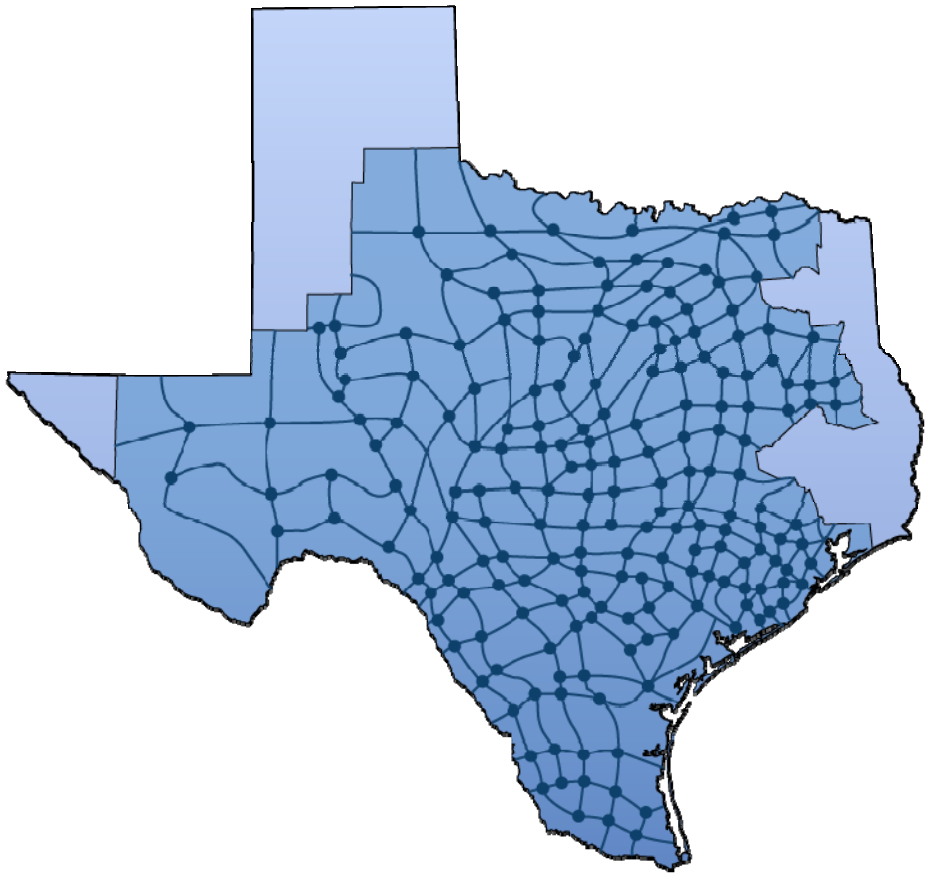
Local Congestion Costs

- Costs are uplifted to load
- No hedging mechanism

Nodal Market Design

Commercial Markets

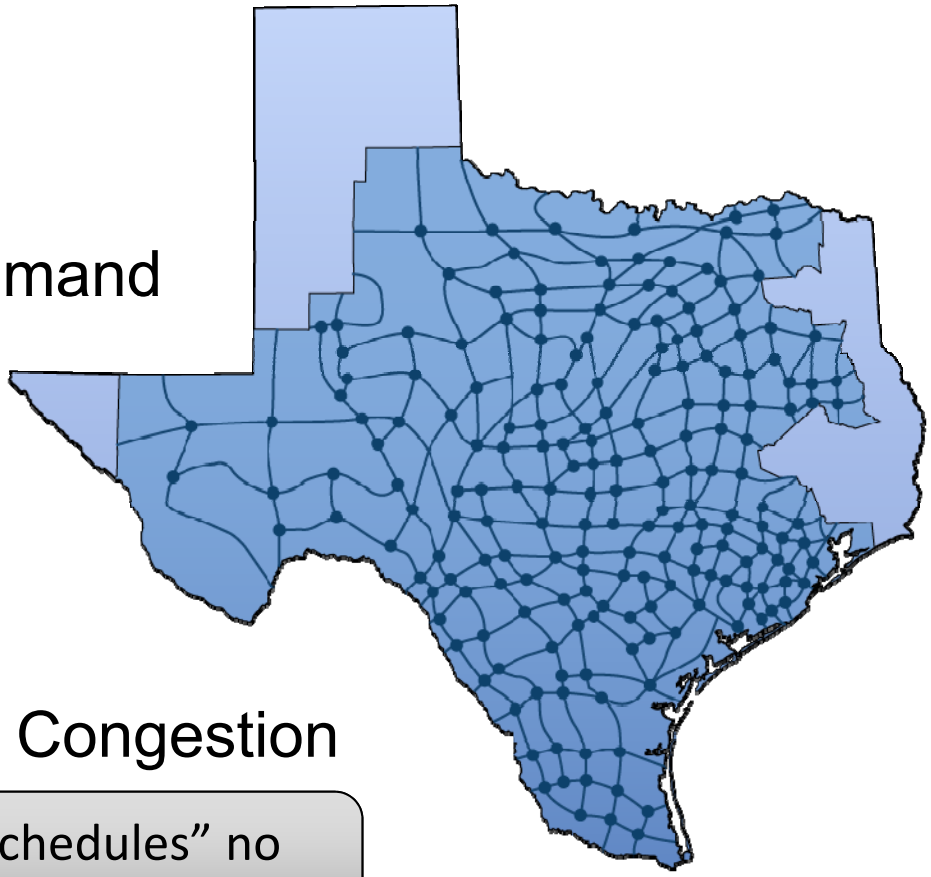
- Bilateral Market
- ERCOT Facilitated Markets
  - Real-Time Energy Market
  - Day-Ahead Ancillary Services Market
  - Day-Ahead Energy Market



Nodal Market Design

Energy Dispatch

- Resource specific offers
- Resource specific dispatch
  - Balance generation with demand
  - Manage all Congestion



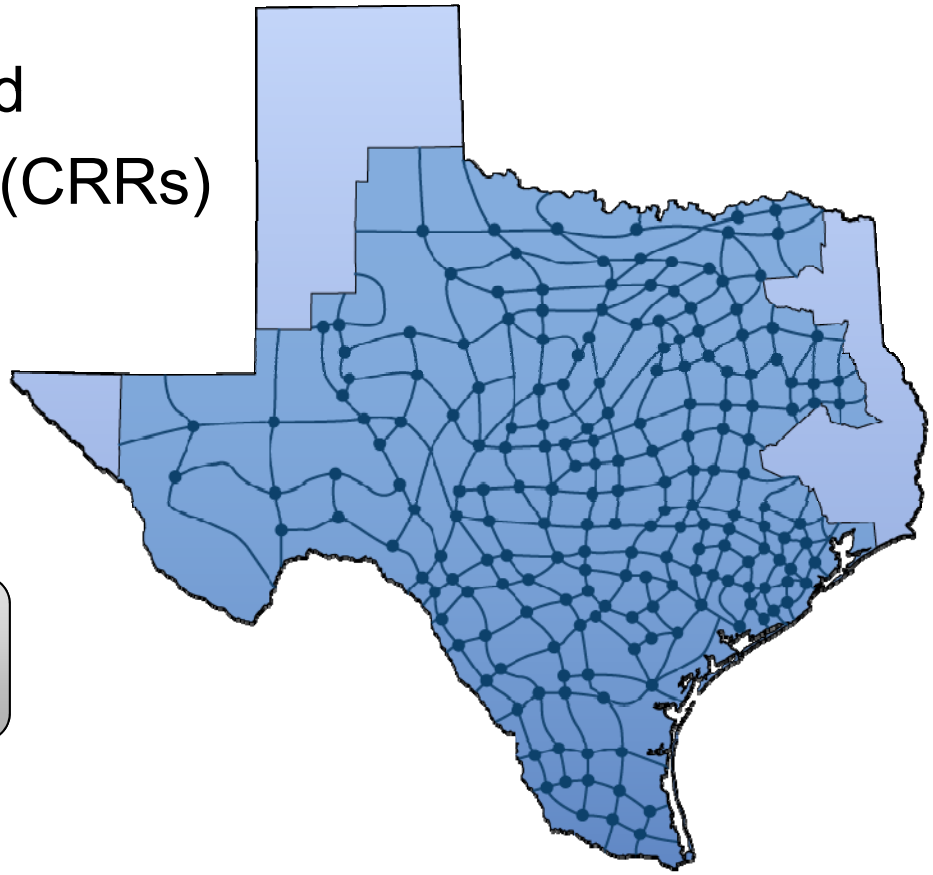
Energy Pricing

- Local prices for energy
- Prices reflect impact of any Congestion

QSE “Balanced Schedules” no longer exist.

Congestion Costs

- All costs are directly assigned
- Congestion Revenue Rights (CRRs) available for hedging



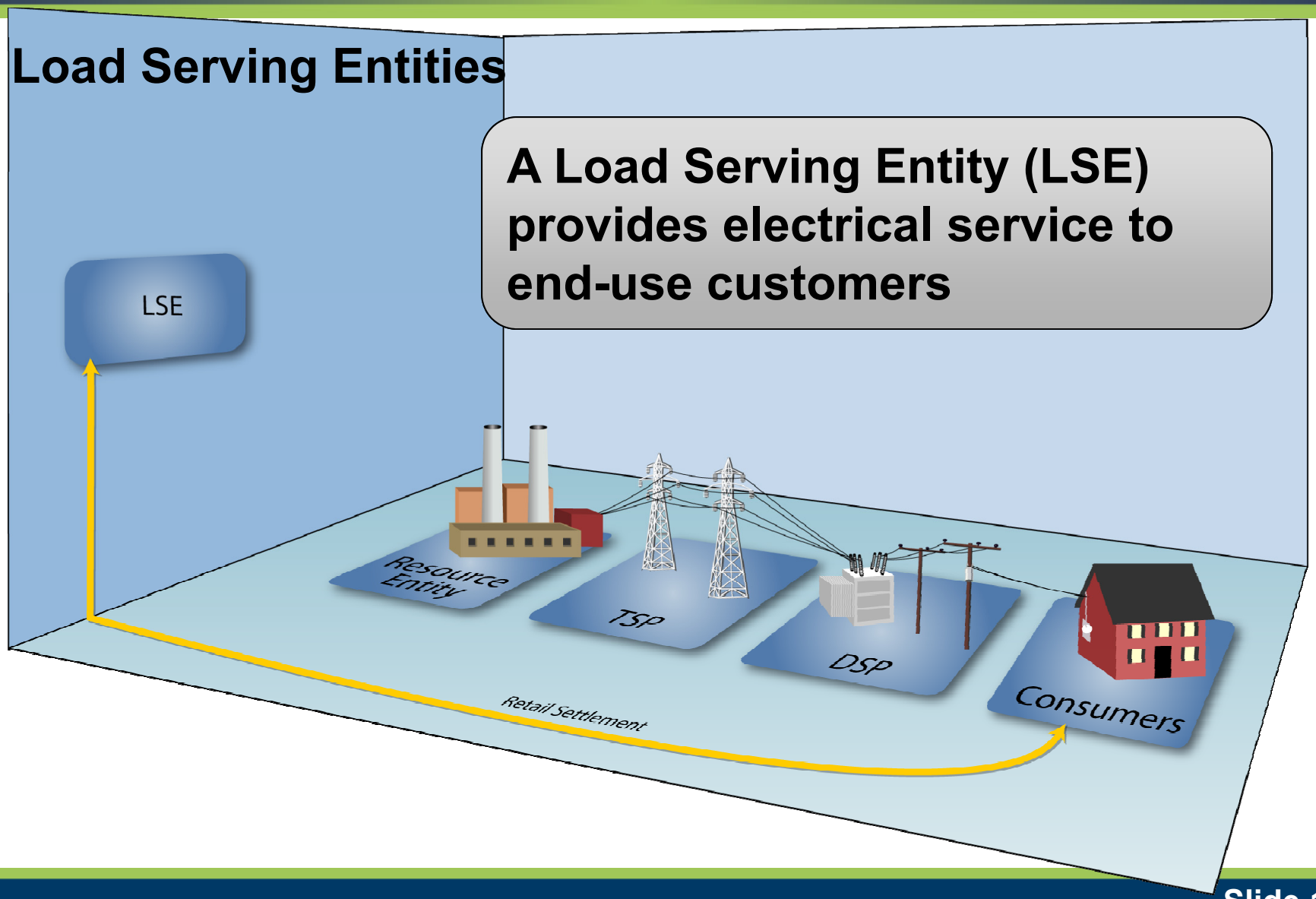
Congestion costs are built in to the energy prices.

Where do Retail Electric Providers fit?

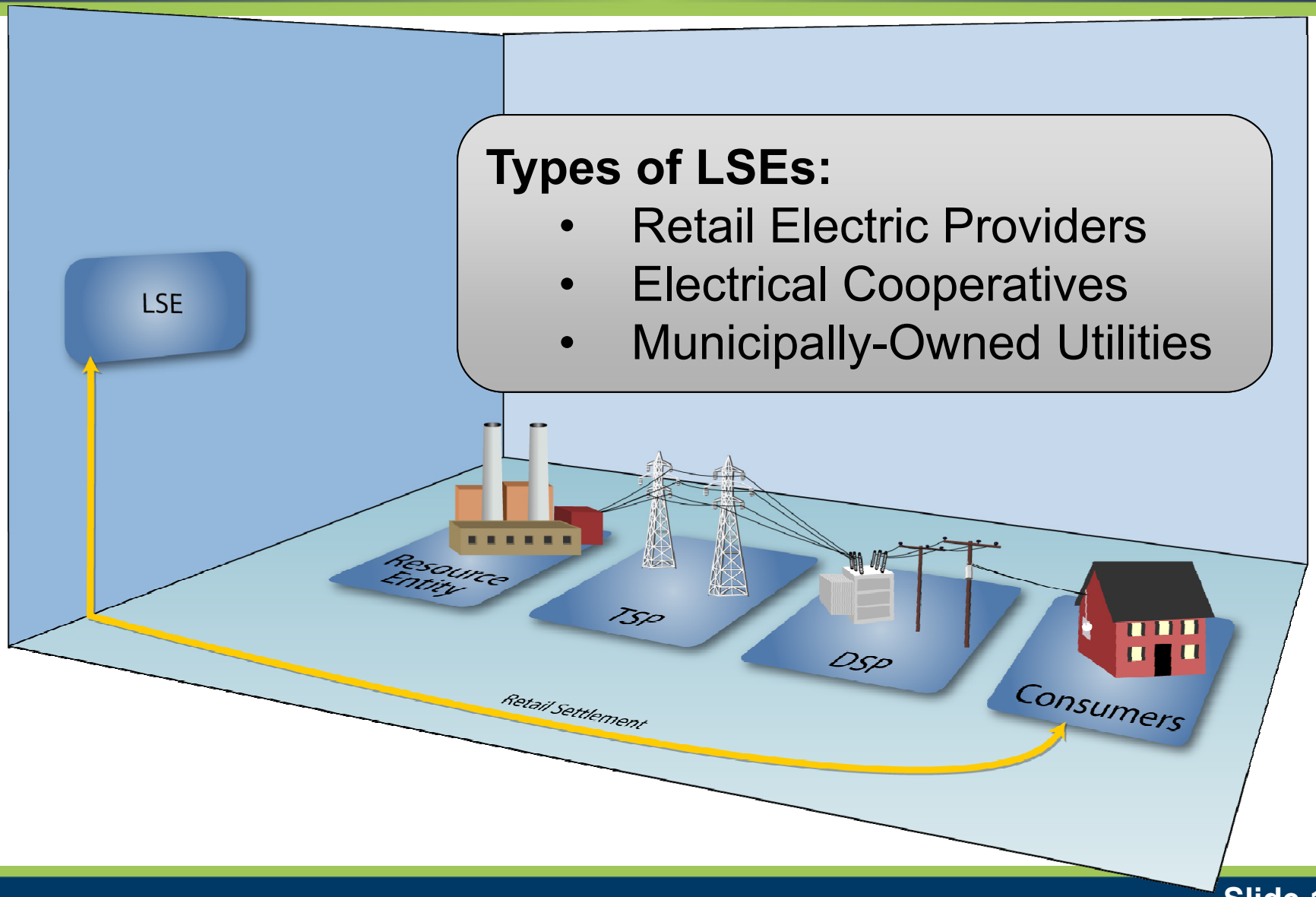
LSEs in ERCOT – Defining LSEs

Load Serving Entities

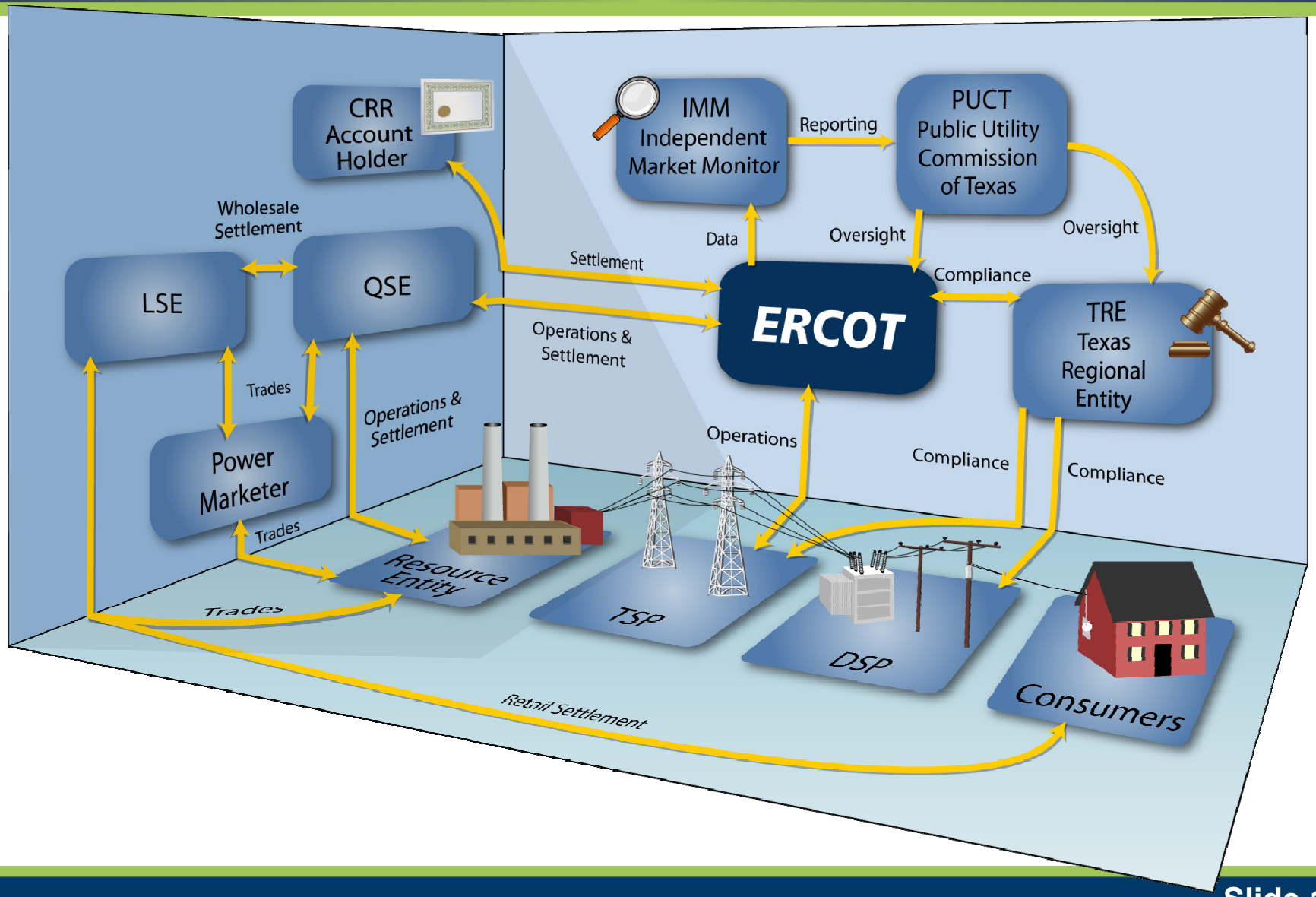
A Load Serving Entity (LSE) provides electrical service to end-use customers



LSEs in ERCOT – Defining LSEs



The LSE Business Environment



Energy Costs

Market Costs of Serving Load

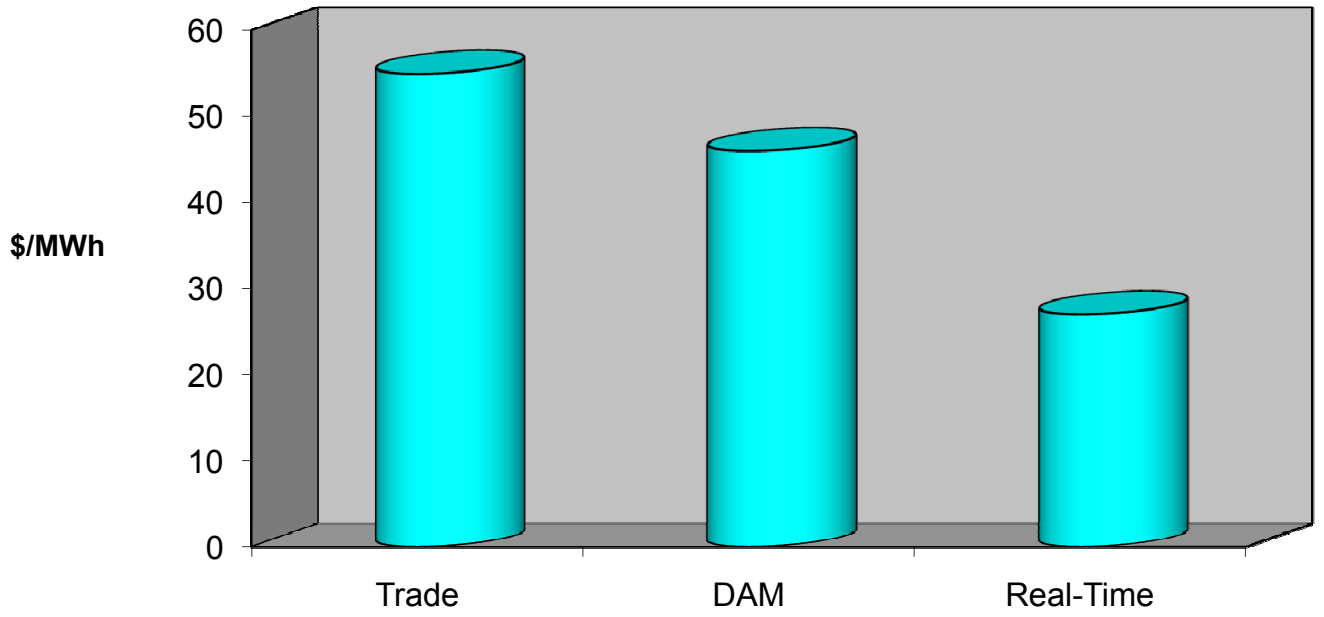
Energy Cost Exposure

- LSEs must acquire energy to serve Load

Market Costs of Serving Load

In general . . .

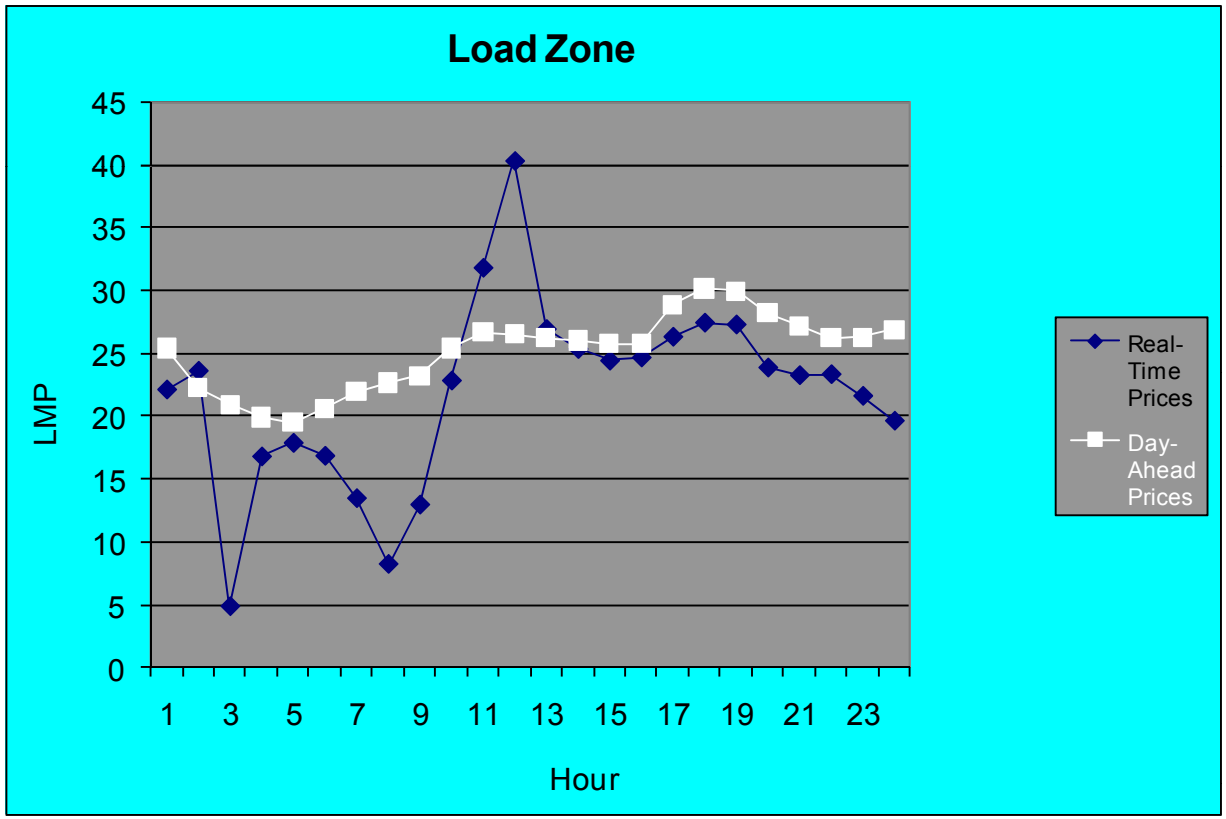
The more forward the Energy is purchased the higher the price



So, why would an LSE buy energy forward?

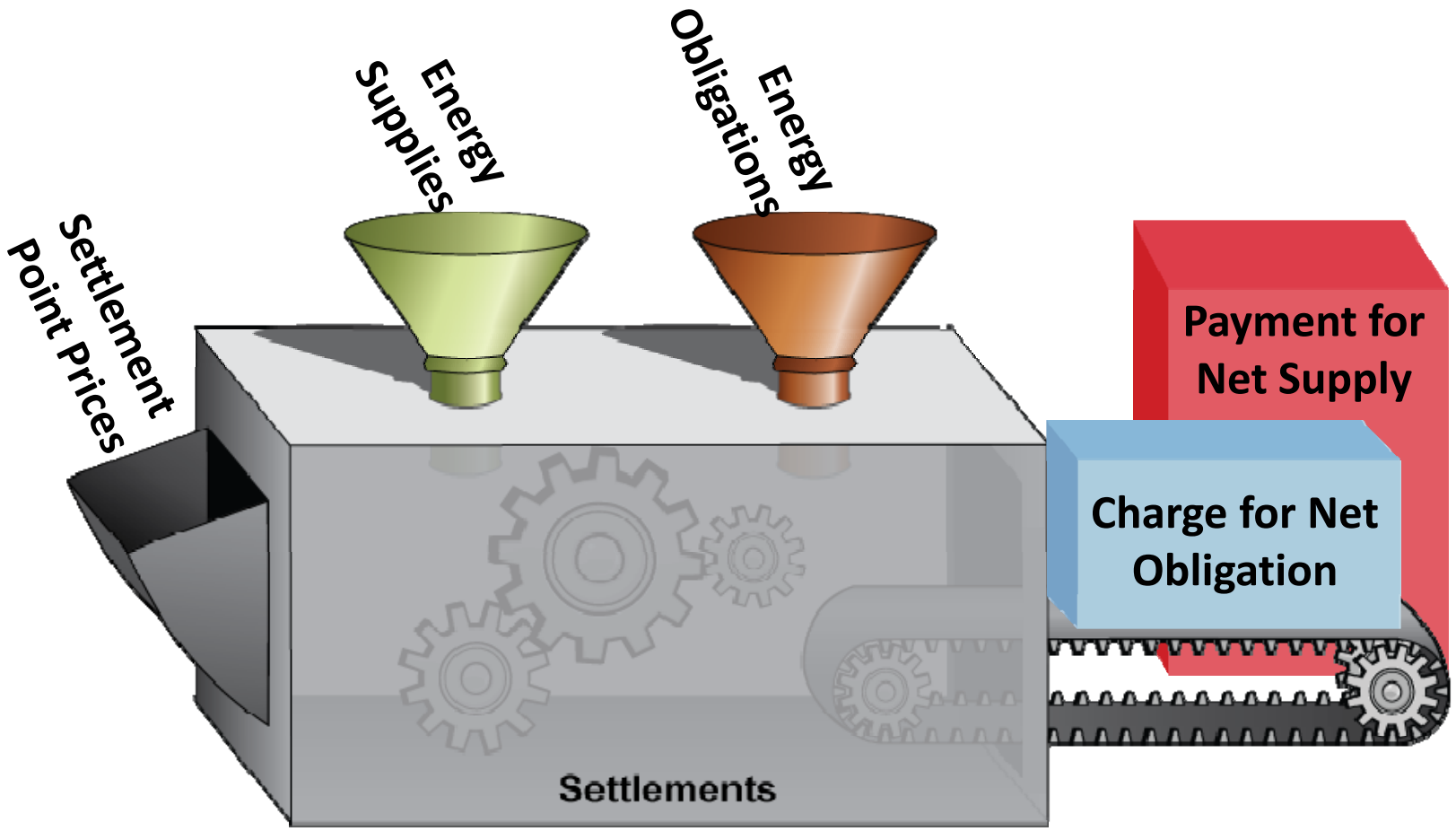
Why buy energy forward?

Real-Time Price Volatility!



Trades and DAM provide Price Certainty

Real-Time Energy Settlements



Real-Time Energy Imbalance Calculation Overview

The basic form of the Real-Time Energy Imbalance calculation at any settlement point looks like this:

(Supplies) – (Obligations) X (-1) RTSPP ($/MWh)

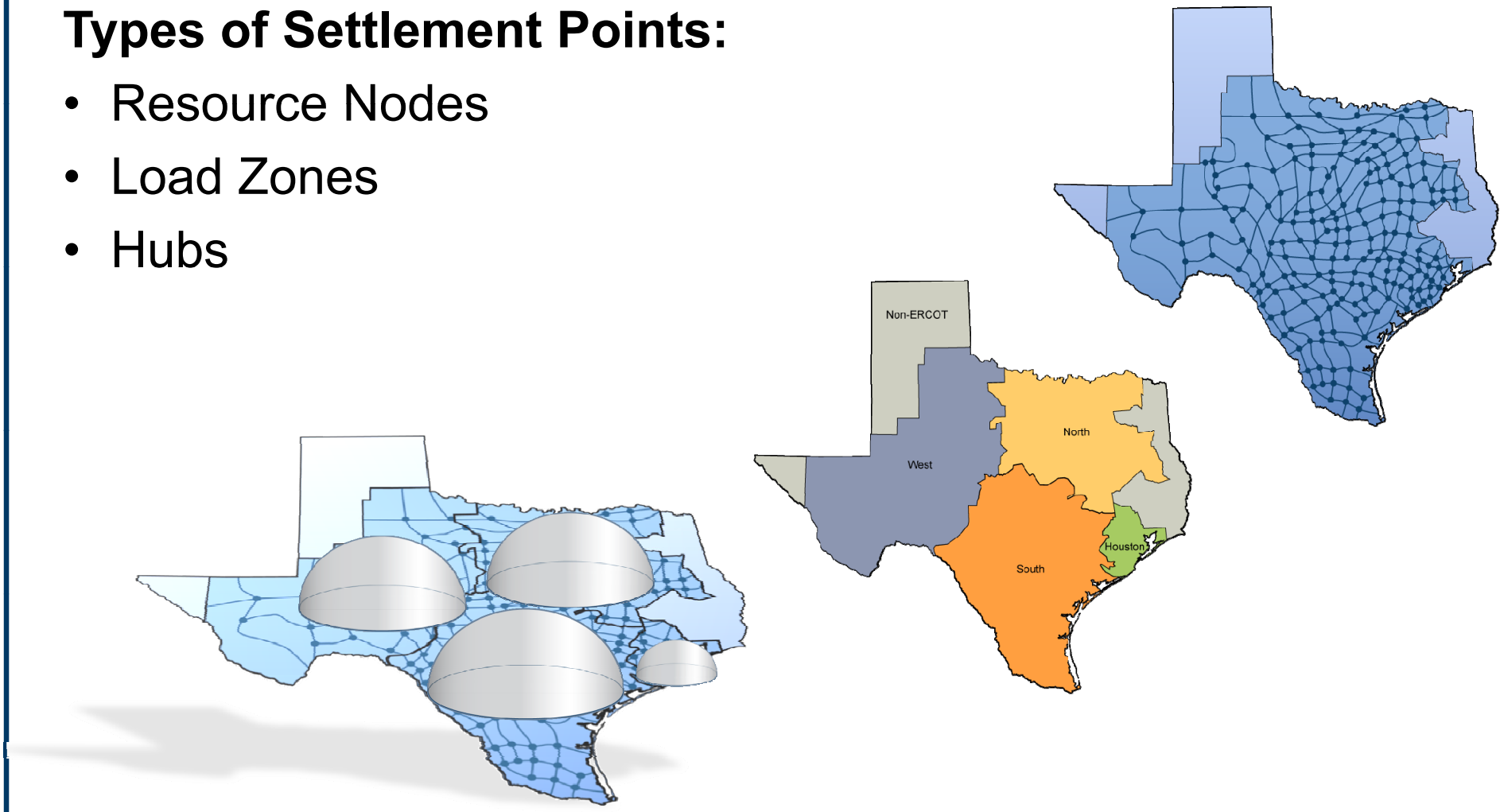
Real-Time Settlement Point Price

ERCOT will settle a QSE's Energy Imbalance at each Settlement Point

Real-Time Energy Settlements

Types of Settlement Points:

- Resource Nodes
- Load Zones
- Hubs



Real-Time Energy Settlements

SCENARIO

Real-Time Purchase:

- QSE does not participate in DAM
- No trades
- Load is 5 MWh in North Load Zone for interval 1200

(Supplies) – (Obligations) X (-1) RTSPP ($/MWh)

Real-Time Settlement Point Price

Real-Time Energy Settlements

SCENARIO

Real-Time Purchase:

- Load is exposed to Real-Time Prices
- Settlement Point Price
  - North Load Zone: $40

(0) – (5) X (-1)$40.00/MWh = $200.00

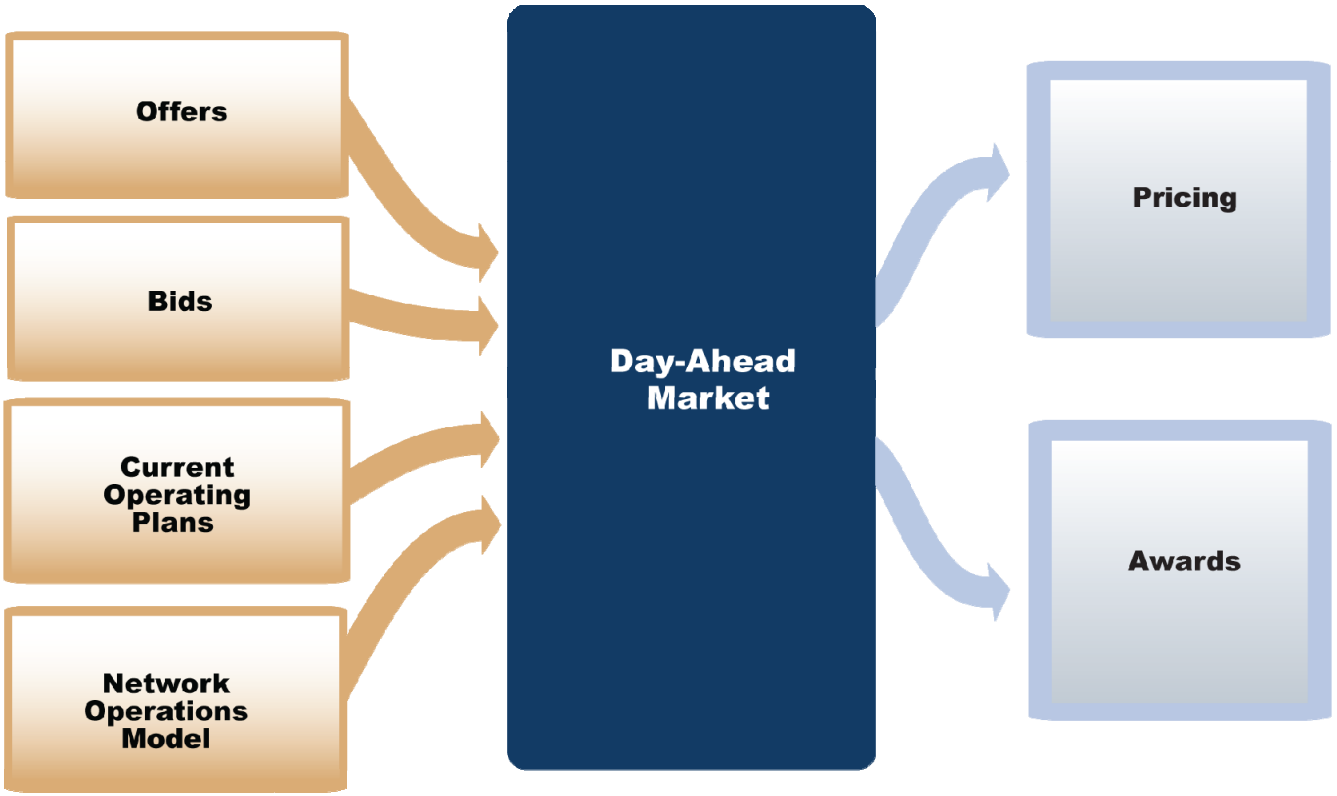
Real-Time Settlement Point Price

Day-Ahead Market

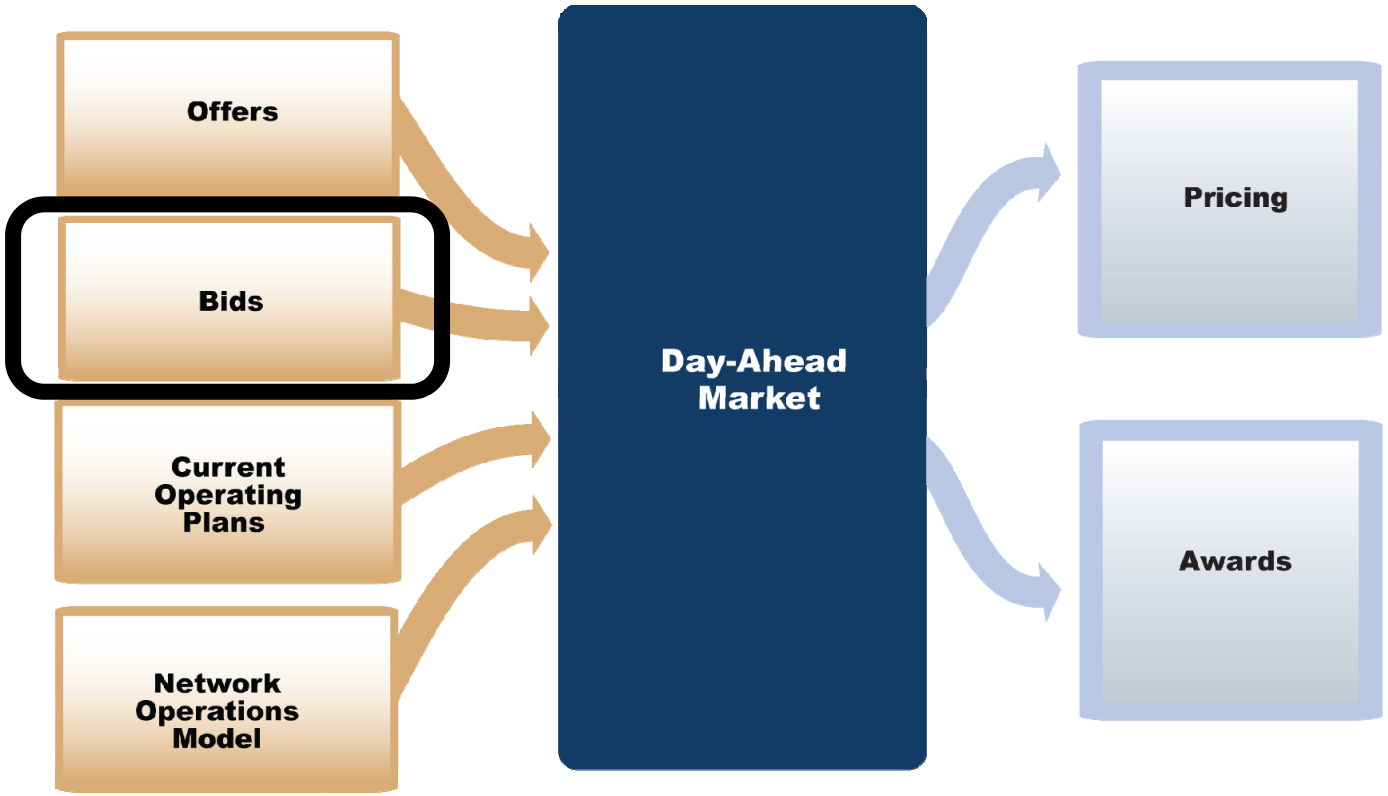
Purpose of the Day-Ahead Market

- Centralized Forward Market
- Buy and sell Energy
- Sell Ancillary Services to ERCOT
- Forward market provides price certainty

The Day-Ahead Market

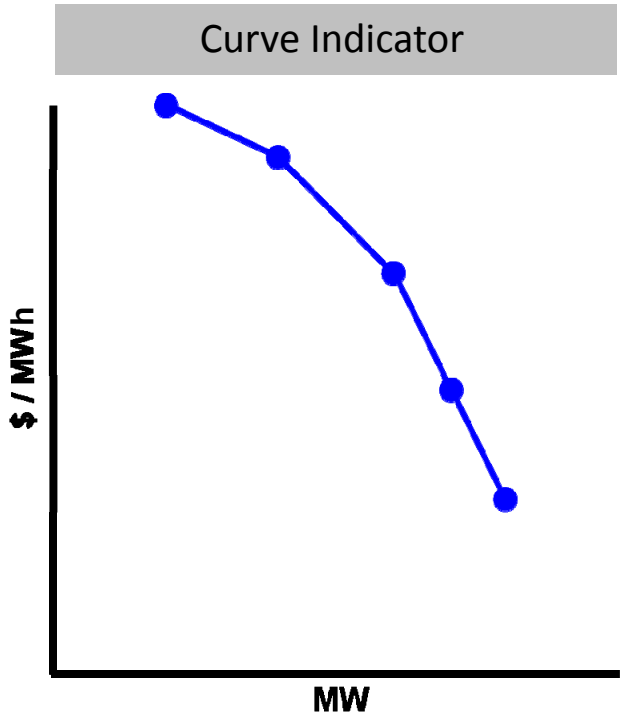


The Day-Ahead Market

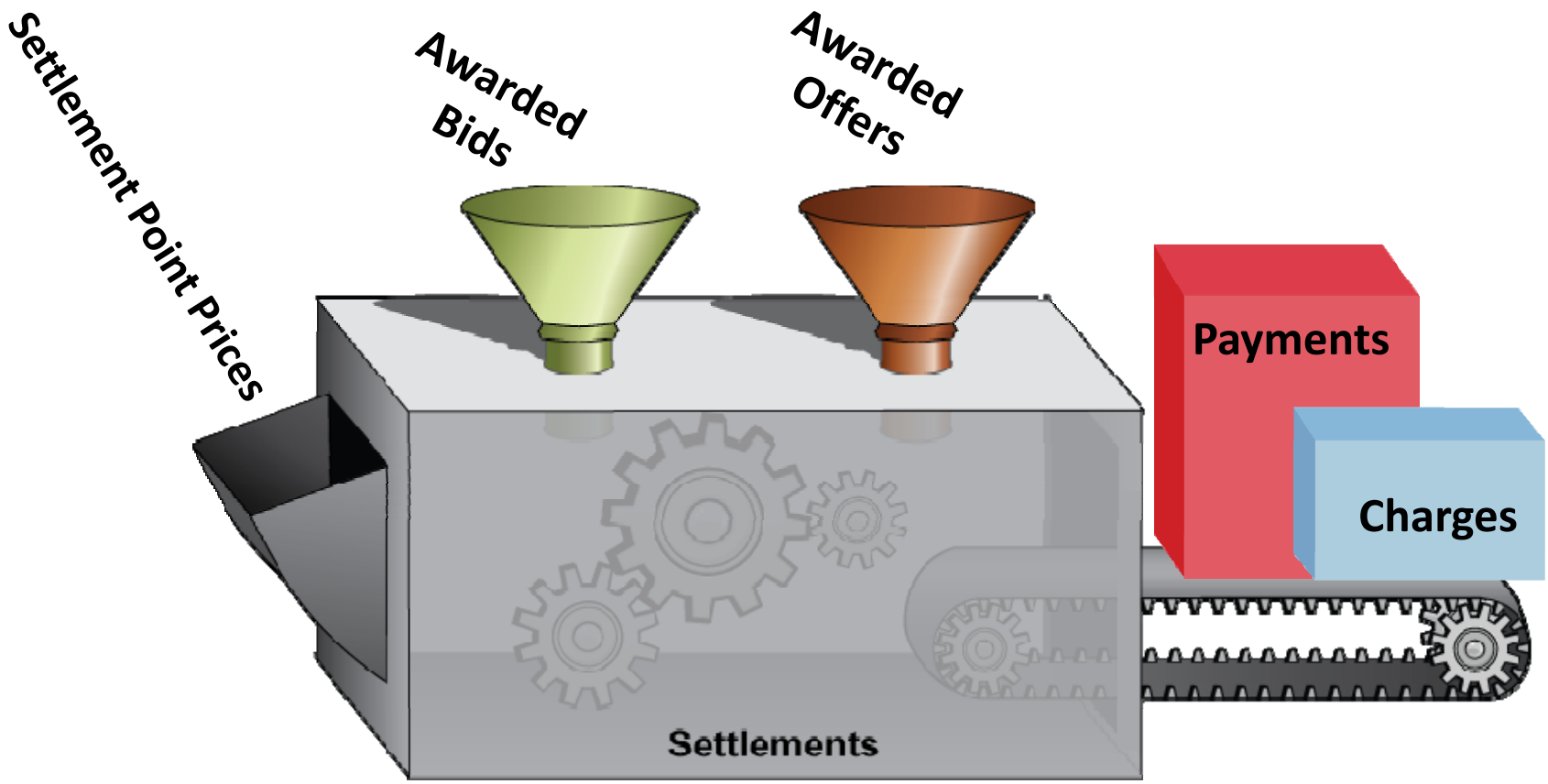


Day-Ahead Market Energy Bid

- Submitted at any Settlement Point
- Valid only in the Day-Ahead Market
- Includes:
  - Quantity
  - Price buyer is willing to pay



Day-Ahead Market Energy Settlements



Day-Ahead Market Energy Transactions

Comparing DAM & Real-time transactions

DAM transactions & Trades are conducted *hourly*

Real-Time is settled in *15 minute intervals*

For Real-Time Settlements, DAM transactions and Trades must be converted to 15 minute intervals

Day-Ahead Market Energy Transactions

SCENARIO

Day-Ahead Market Purchase:

- QSE buys 20MW in the North Load Zone for hour 1200
- Day-Ahead Settlement Point Price
  - North Load Zone: $26

20MW X (-1)$26.00/MWh = $520.00 for the hour

-- or --

5MWh X (-1)$26.00/MWh = $130.00 for each interval

Day-Ahead Market Energy Transactions

SCENARIO

Real-Time Settlement:

- QSE bought 5MWh in DAM
- No trades
- Load is 5 MWh in North Load Zone for interval 1200

(Supplies) – (Obligations) X (-1) RTSPP ($/MWh)

Real-Time Settlement Point Price

Day-Ahead Market Energy Transactions

SCENARIO

Real-Time Settlement:

- Load is *not* exposed to Real-Time Prices
- Settlement Point Price
  - North Load Zone: $40

(5) – (5) X (-1)$40.00/MWh = $0

Real-Time Settlement Point Price

Day-Ahead Market Energy Transactions

SCENARIO

Real-Time Settlement:

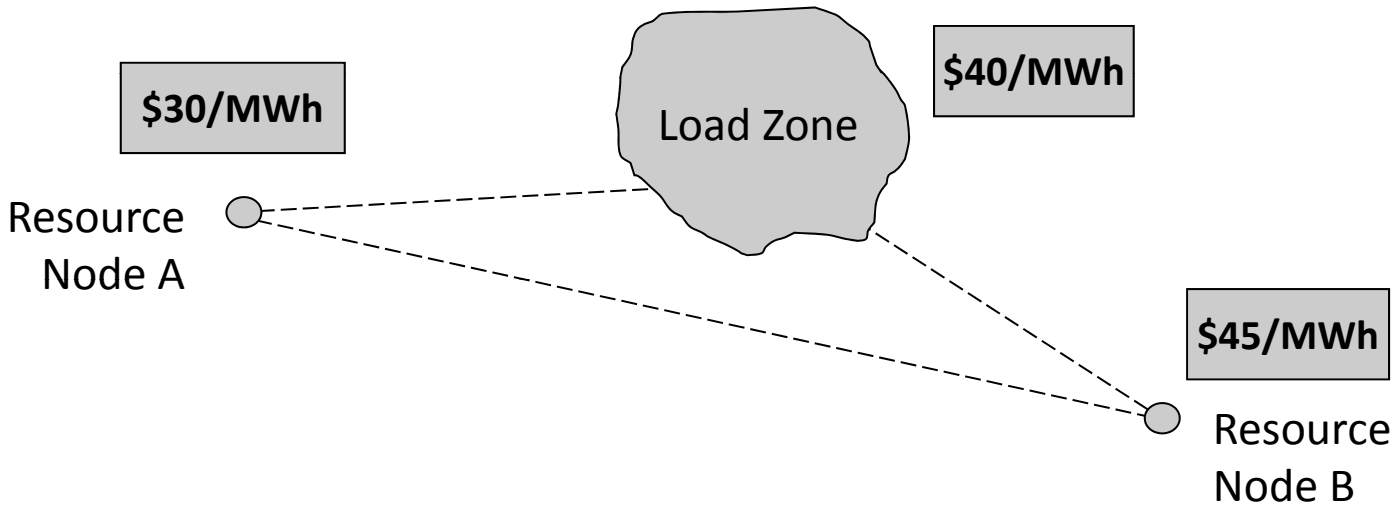
- Similar results with Trade
- 20 MW (5MWh per interval) Energy Trade at North Load Zone

(5) – (5) X (-1)$40.00/MWh = $0

Real-Time Settlement Point Price

Hedging Congestion Costs

Congestion Cost exposure

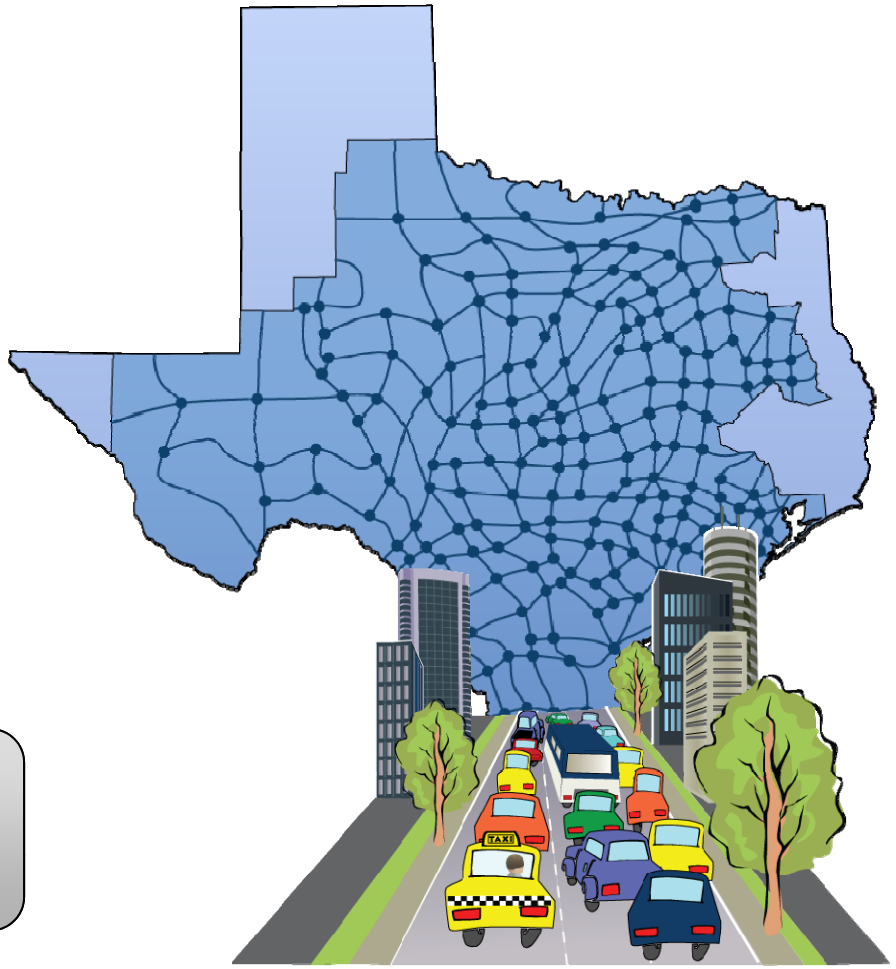


Congestion costs are built in to the energy prices.

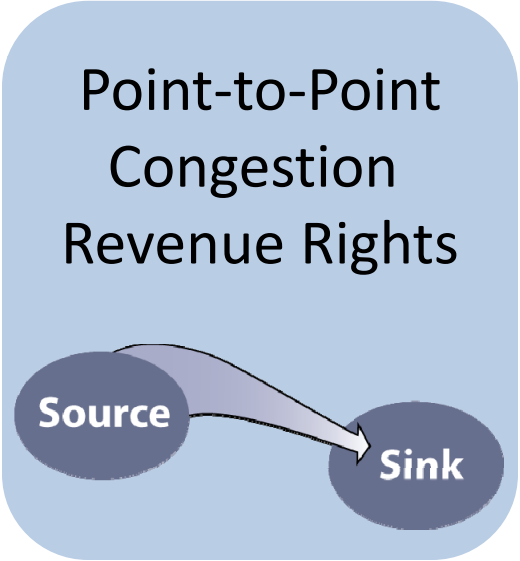
Purpose of Congestion Revenue Rights

- Financial instruments
  - Hedge against congestion costs
  - Financial Investment
- Payment or charge when Grid is congested in DAM

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



Types of Congestion Revenue Rights



Point-to-Point Options

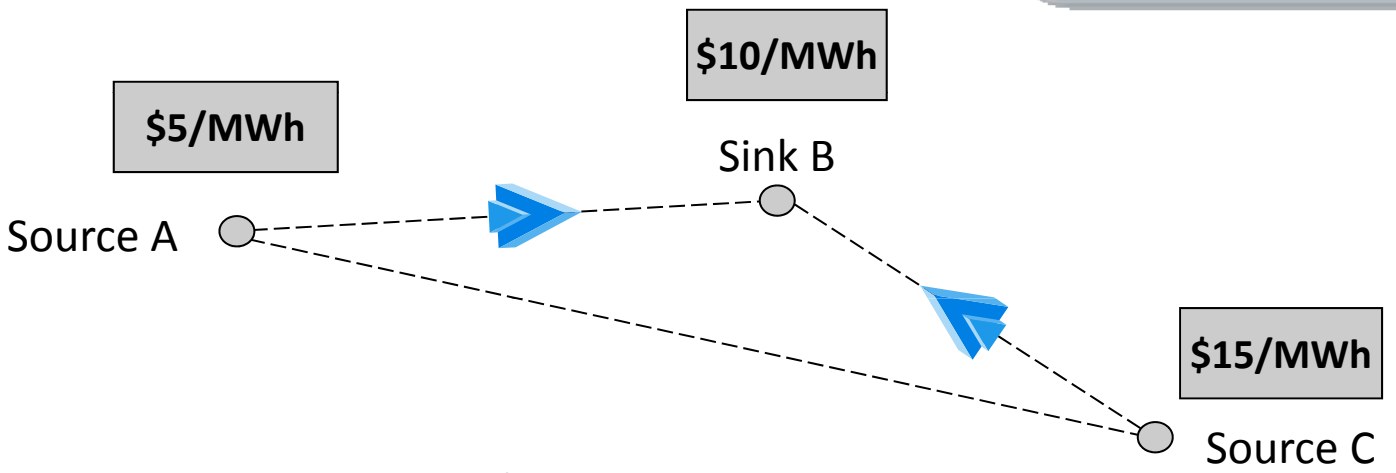
- Can only result in a payment

Point-to-Point Obligation

- Can result in a payment or charge

Point-to-Point (PTP) Options

EXAMPLE

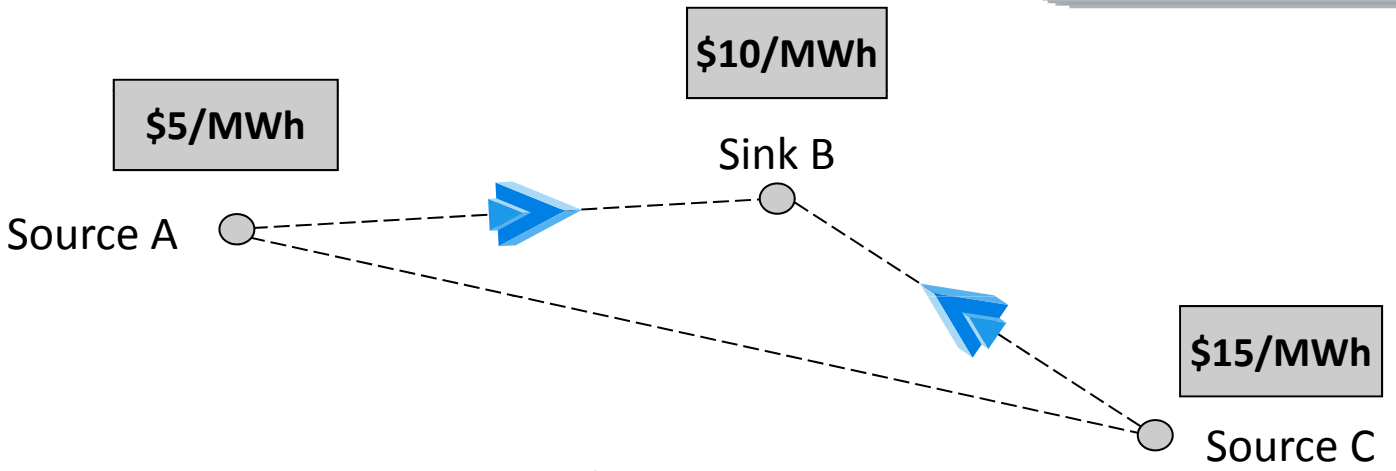


Option $_{AB}$ Payment = $5.00

Option $_{CB}$ Payment = ?

Point-to-Point (PTP) Obligations

EXAMPLE



Obligation $_{AB}$ Payment = $5.00

Obligation $_{CB}$ Payment = **?**

Hedging Congestion Costs

CRRs are acquired in:

- One month strips
- Time-of-Use Blocks

<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 (2300 – 2400)</td></tr>
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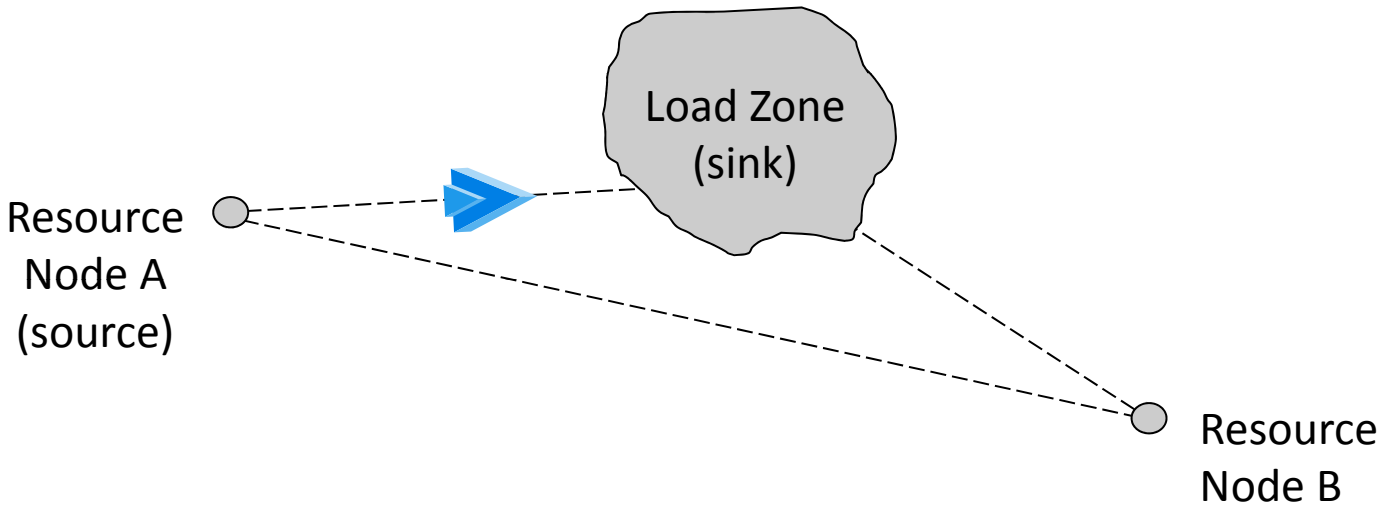
Hedging Congestion Costs

CRR Auction

- Monthly and Annual Auctions
- Single-round simultaneous auction
- Based on Network Operations Model

Day-Ahead Congestion Hedging

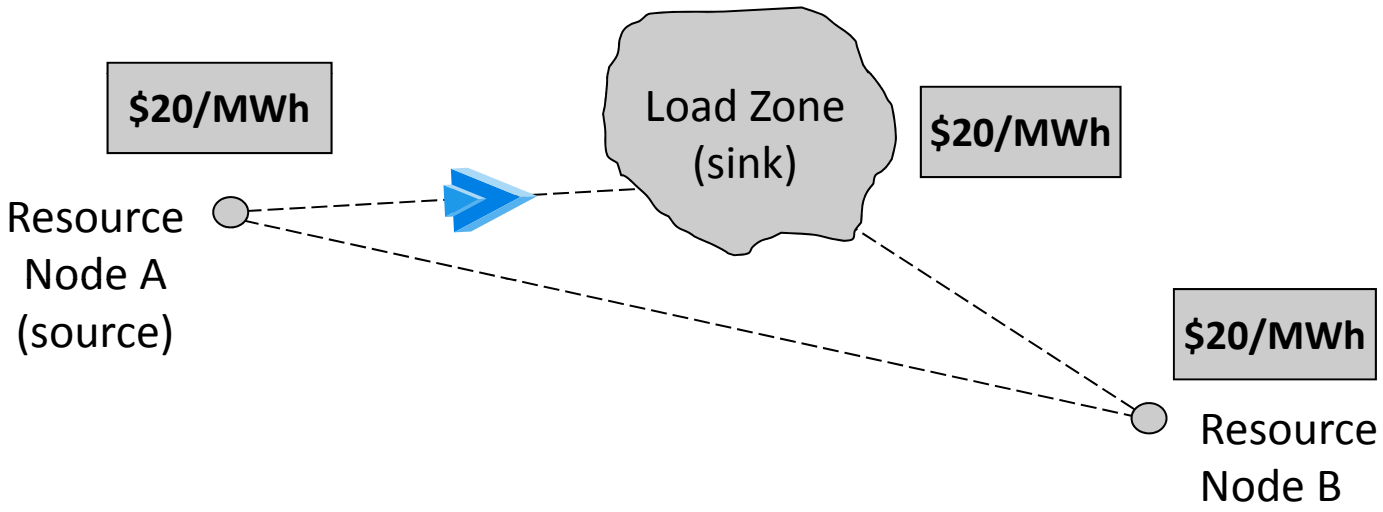
SCENARIO



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

Day-Ahead Congestion Hedging

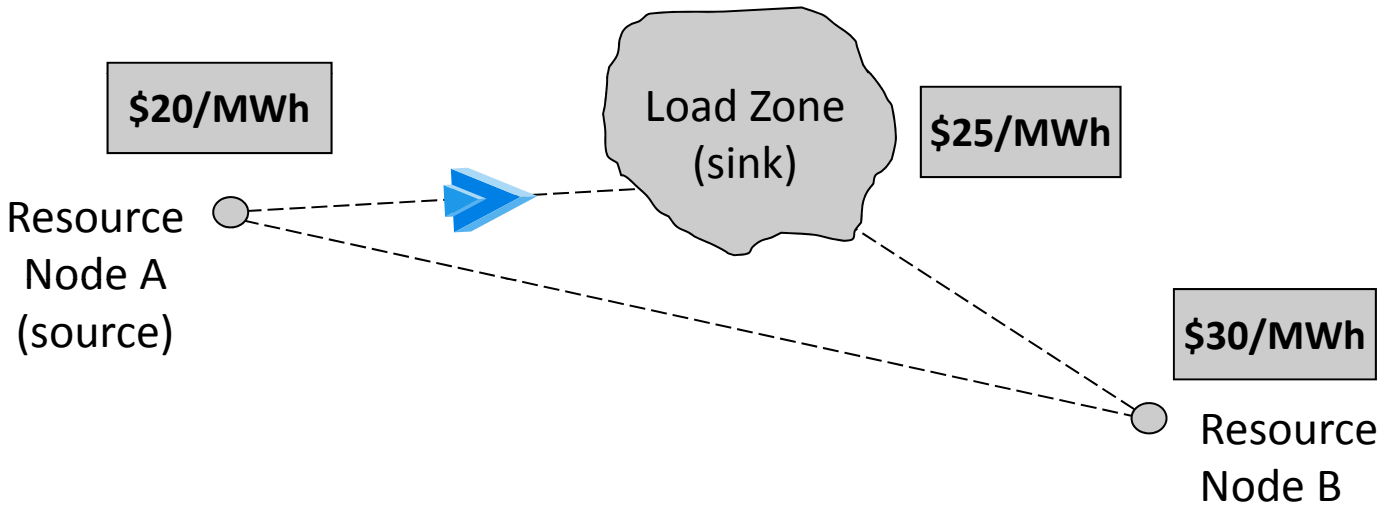
SCENARIO



Energy Purchase	PTP Option Payment	Net Day-Ahead Cost
$100	$0	$100

Day-Ahead Congestion Hedging

SCENARIO

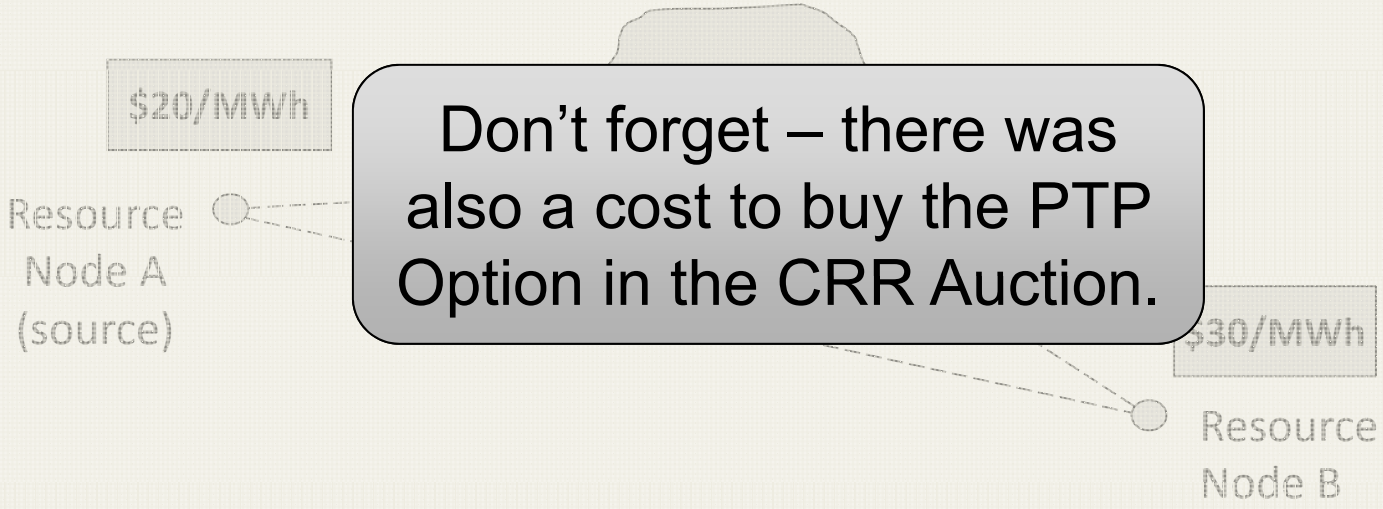


Energy Purchase	PTP Option Payment	Net Day-Ahead Cost
$125	$25	$100

Hedging Congestion Costs

Day-Ahead Congestion Hedging

SCENARIO

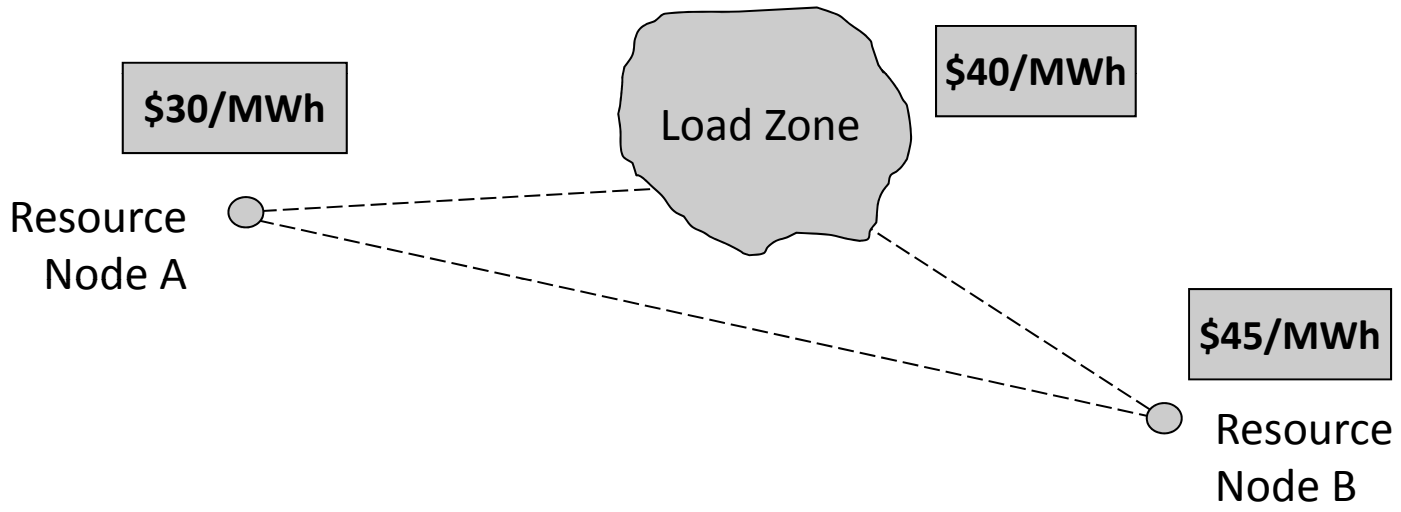


Don't forget – there was also a cost to buy the PTP Option in the CRR Auction.

Energy Purchase	PTP Option Payment	Net Day-Ahead Cost
$125	$25	$100

Real-Time Congestion Hedging

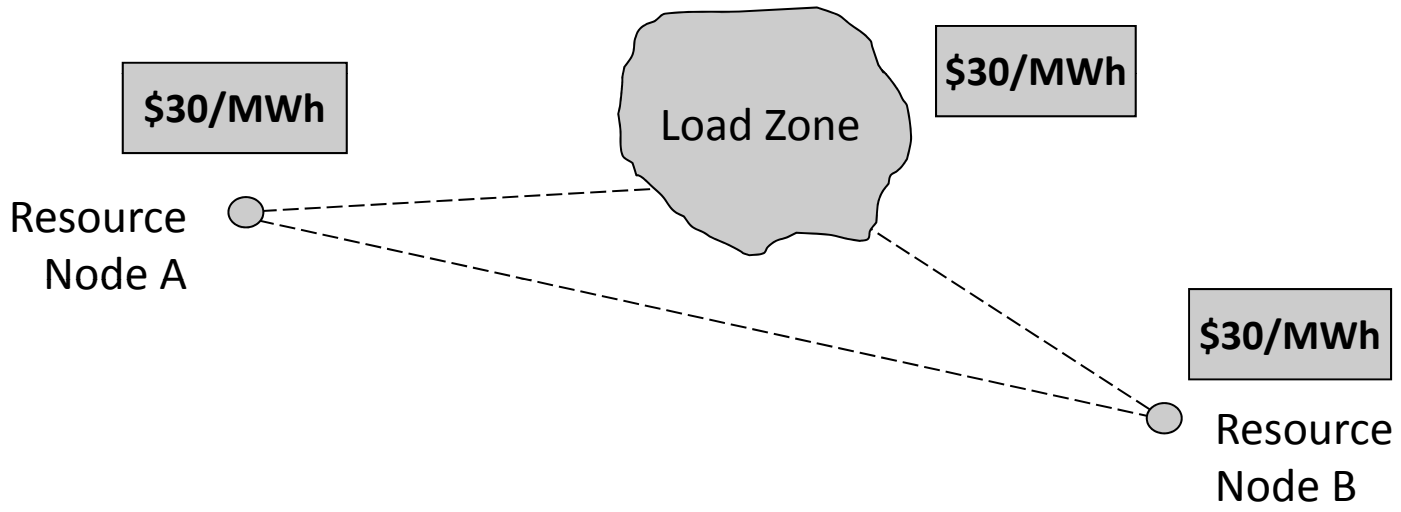
SCENARIO



- 5MWh DAM Energy Purchase at Resource Node A
- 5MWh Load at Load Zone

Real-Time Congestion Hedging

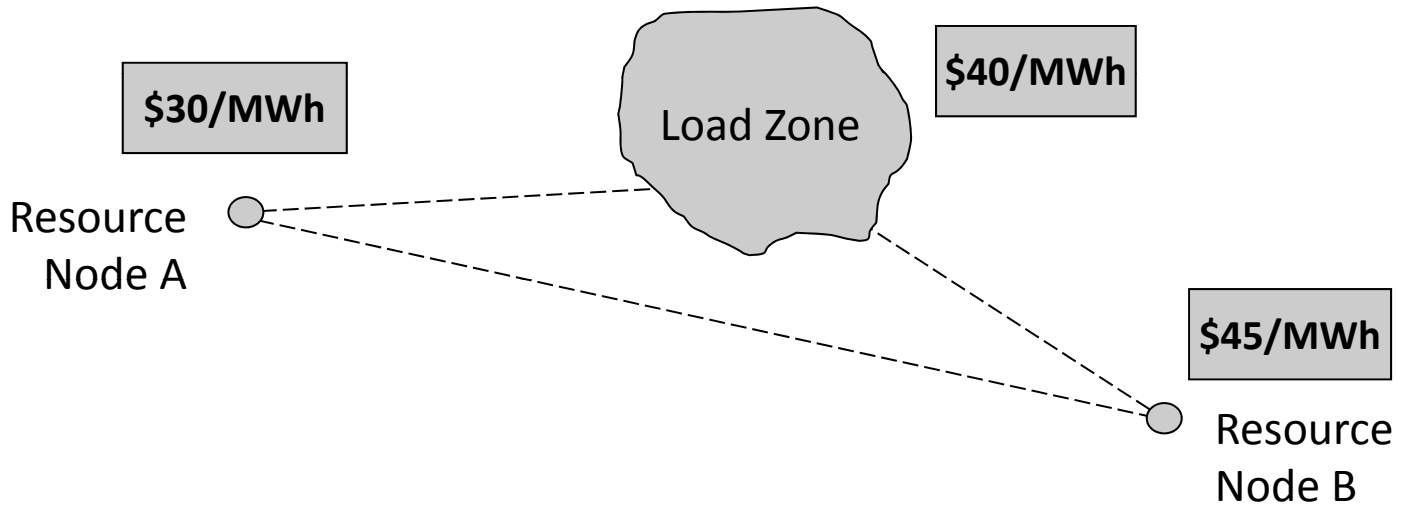
SCENARIO



Payment at Resource Node A	Charge at Resource Node B	Real-time Congestion Exposure
$150	$150	$0

Real-Time Congestion Hedging

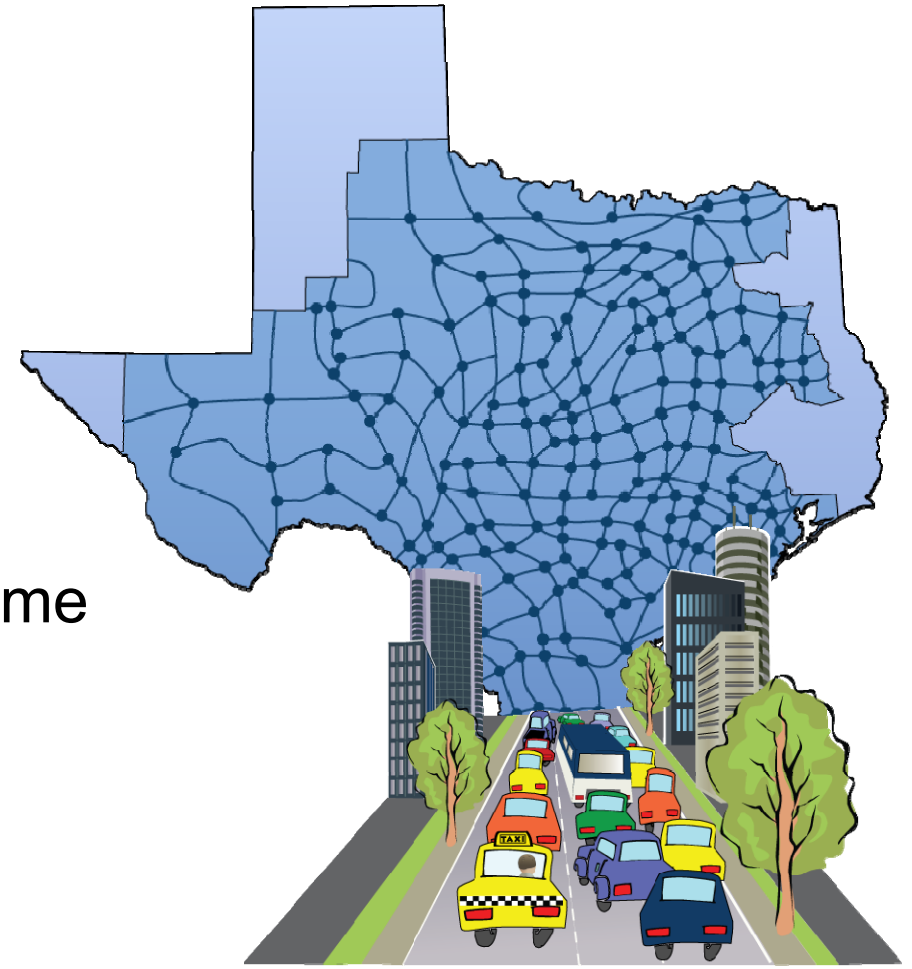
SCENARIO



Payment at Resource Node A	Charge at Resource Node B	Real-time Congestion Exposure
$150	$200	$50

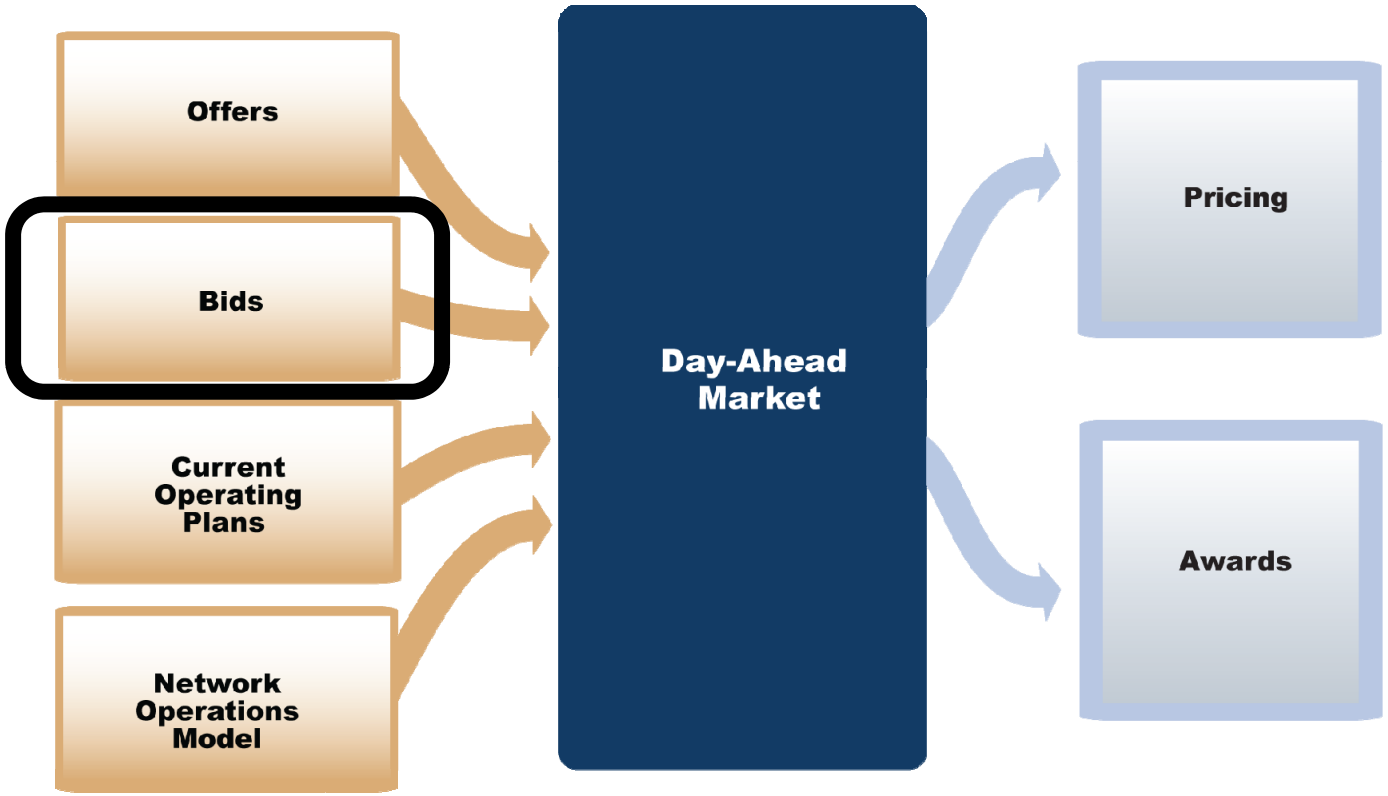
Day-Ahead Market PTP Obligations

- Financial instruments
  - Hedge against congestion costs
  - Financial Investment
- Payment or charge when Grid is congested in Real-time



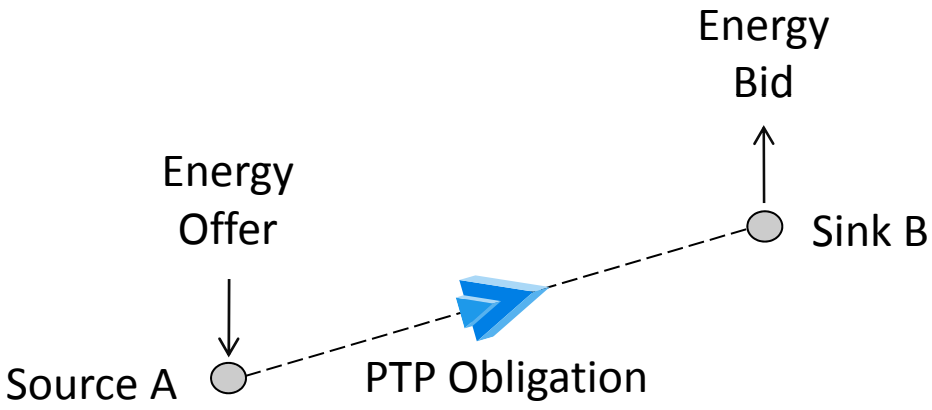
Hedging Congestion Costs

The Day-Ahead Market



Day-Ahead Market PTP Obligation Bids

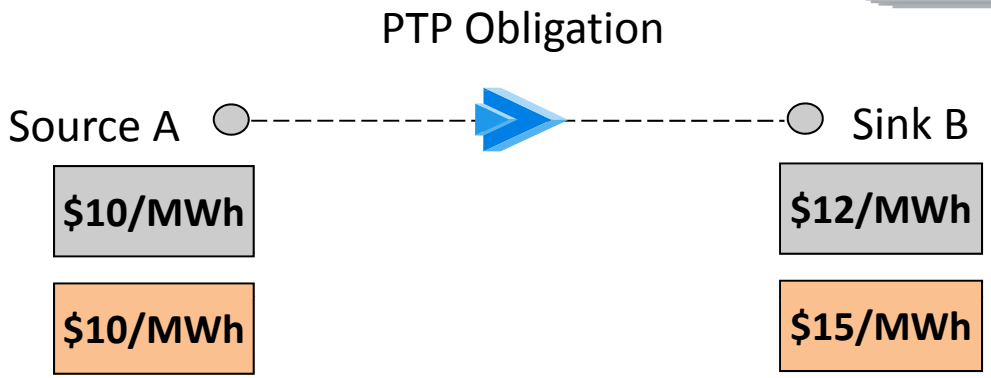
- Like coupled Energy Bid and Energy Offer
- Purchased at DAM Settlement Point Prices
- Settled at Real-Time Settlement Point Prices



DAM PTP Obligation can result in a payment or charge

Day-Ahead Market PTP Obligations

EXAMPLE



QSE charge in Day Ahead Market = ?

QSE payment in Real Time = ?

Capacity Costs

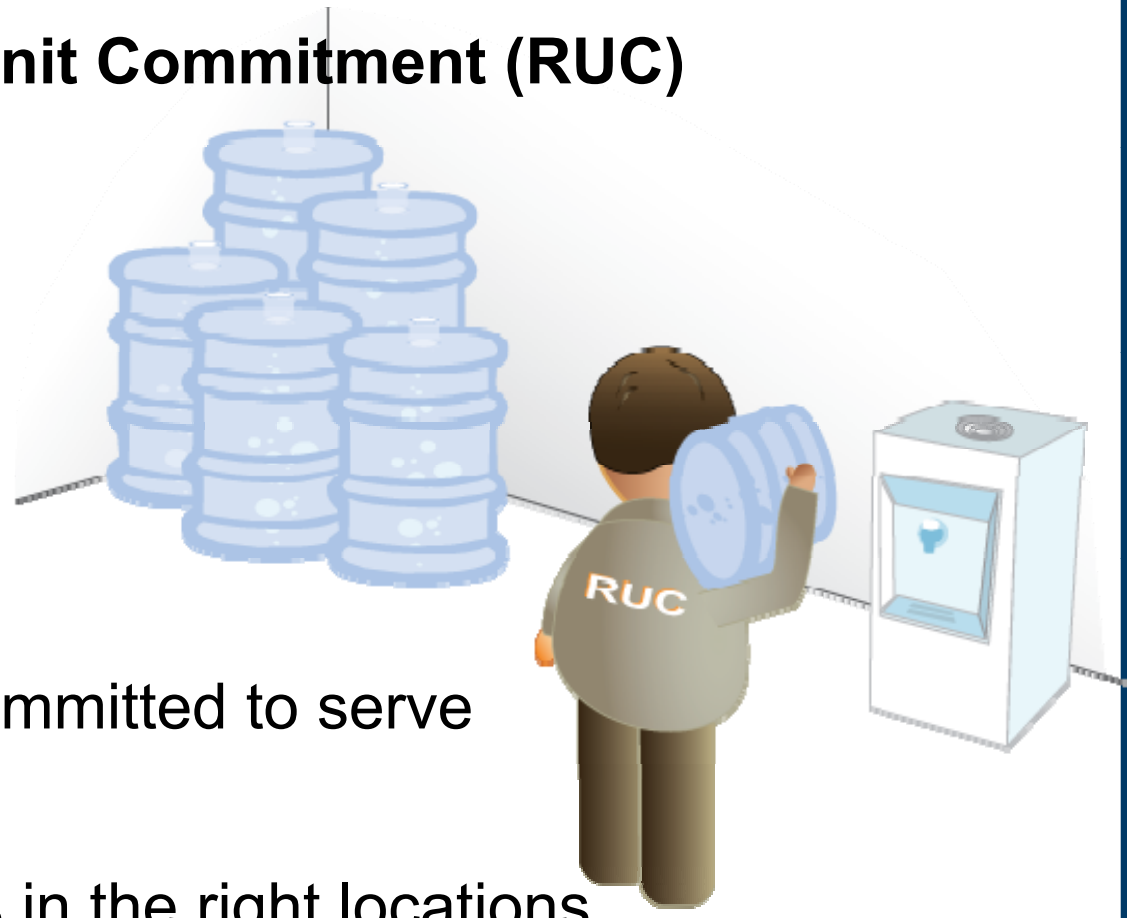
Market Costs of Serving Load

Capacity Cost Exposure

Capacity Costs?

Reliability Unit Commitment

Purpose of Reliability Unit Commitment (RUC)



It ensures:

- Enough capacity is committed to serve the forecasted load
- Committed capacity is in the right locations

Reliability Unit Commitment

If ERCOT commits a Resource through RUC

- ERCOT provides QSE with a payment guarantee
- May provide "Make-Whole Payment" to cover QSE's Start-up and Minimum Energy Costs

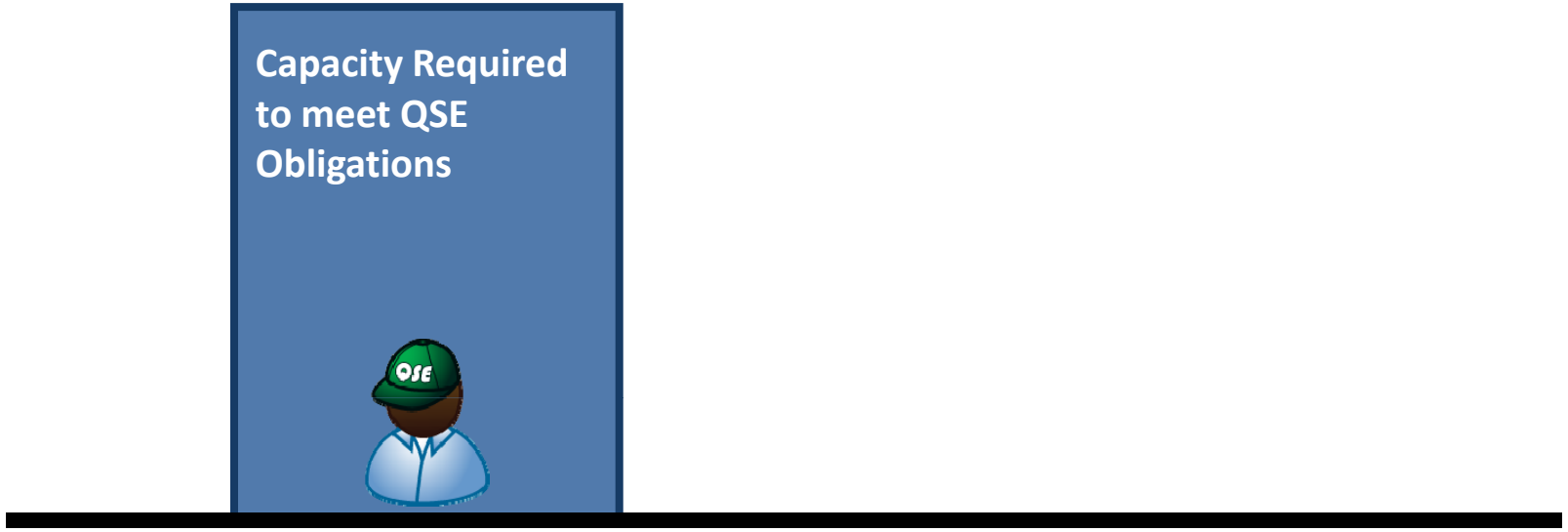
Cost recovery

- QSEs are responsible for capacity
- QSEs who are capacity short responsible for Make-Whole

Reliability Unit Commitment

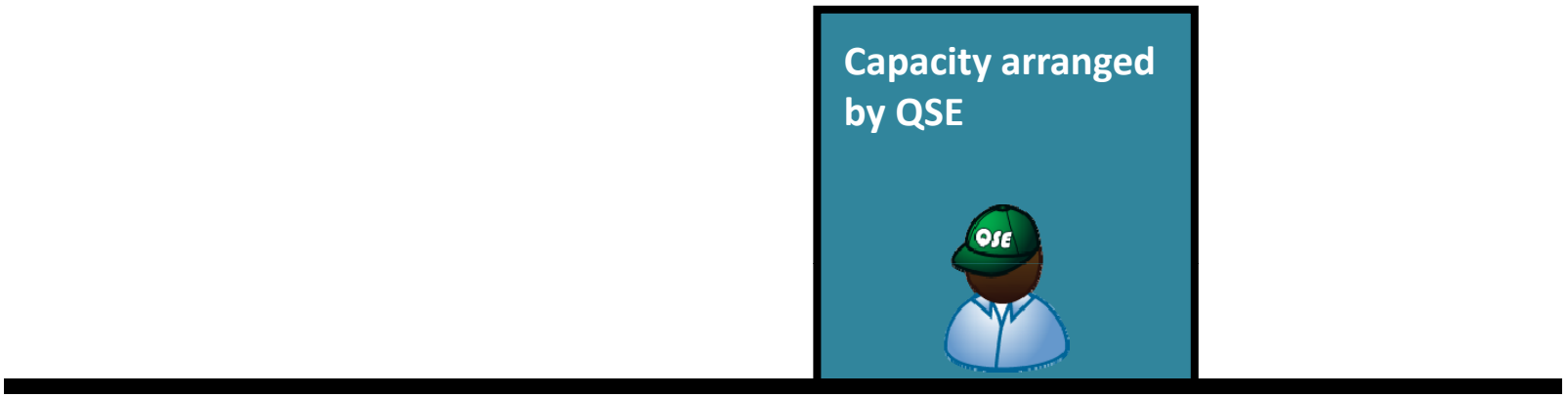
What is included in the QSE's capacity obligation?

- Load (Adjusted Metered Load)
- Capacity Trades where the QSE is a seller
- Energy Trade where the QSE is a seller
- Cleared DAM Energy Offer



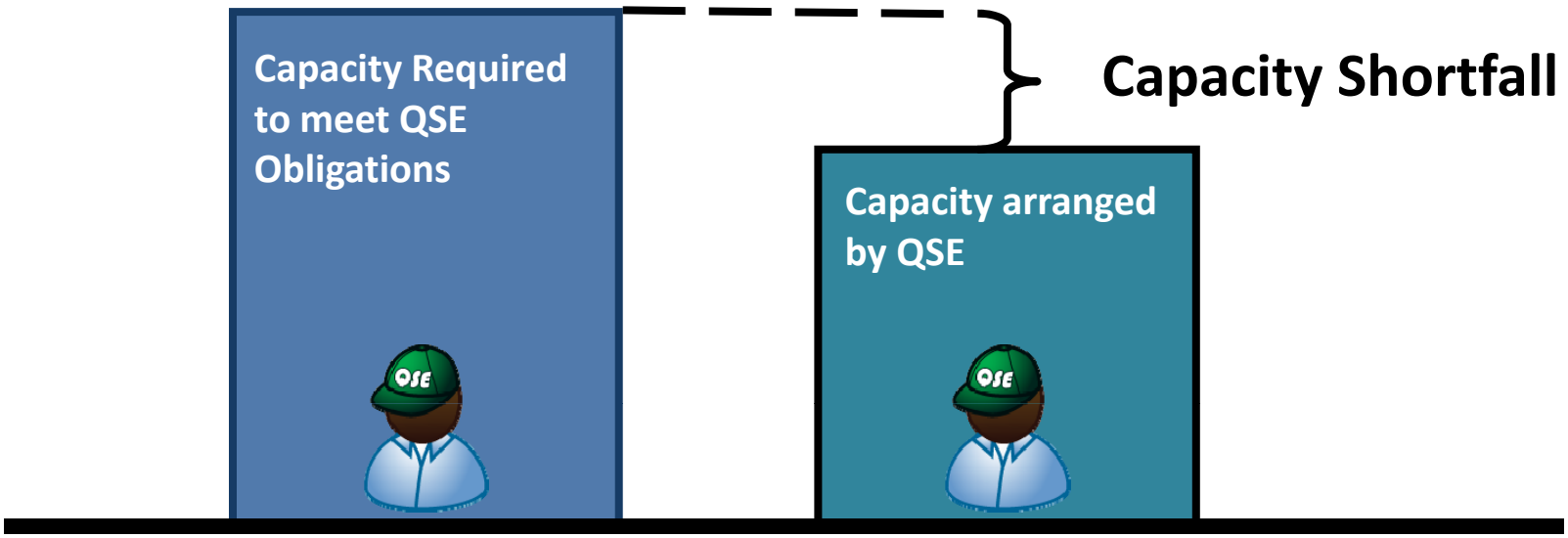
How can a QSE arrange to meet these obligations?

- Show capacity from its Resources in its COP
- Capacity Trades where the QSE is a buyer
- Energy Trades where the QSE is a buyer
- Cleared DAM Energy bids



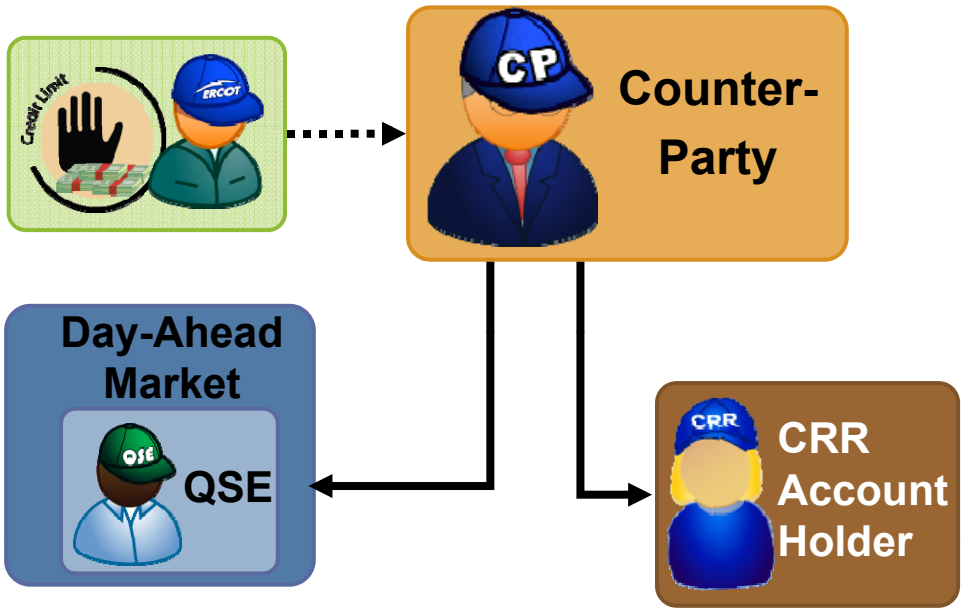
Capacity Short Charge

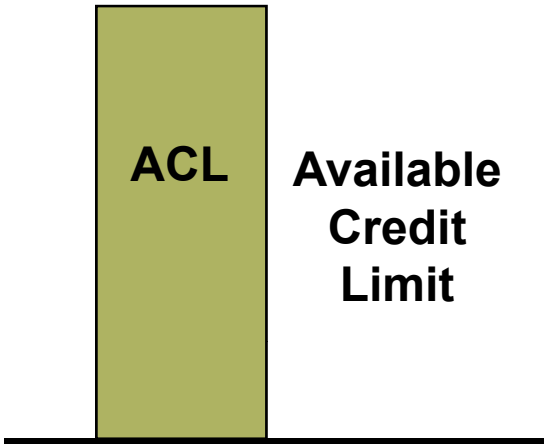
- QSEs that do not arrange enough capacity to cover obligations are responsible for the costs of RUC



Credit Considerations

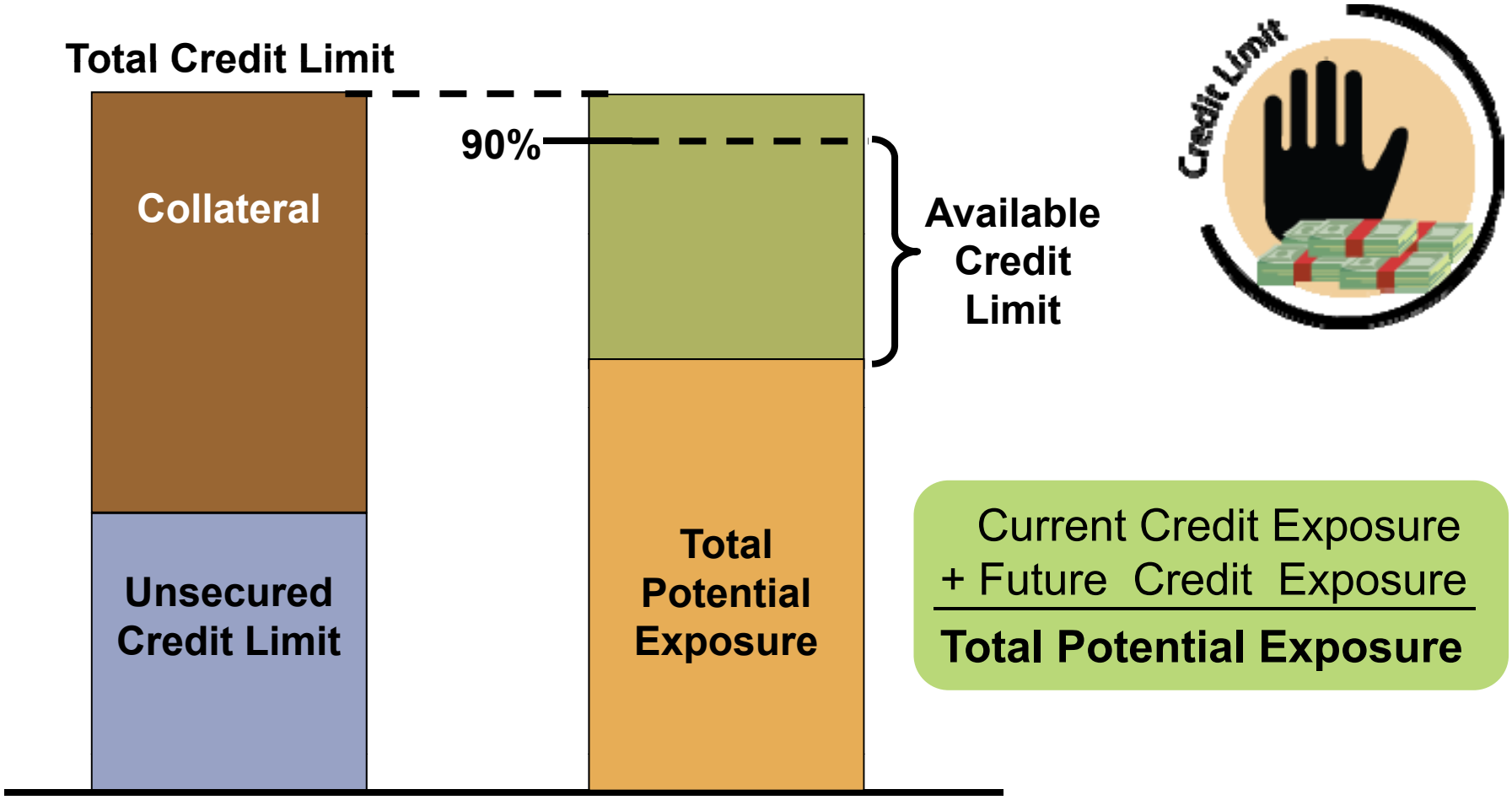
Managing Creditworthiness





- ERCOT assigns ACL to Counter-Party
- Counter-Party makes credit decisions based on activities affecting credit:
  - CRR Auctions
  - DAM

Total Potential Exposure



Current Credit Exposure
+ Future Credit Exposure

Total Potential Exposure

Total Potential Exposure

Current Credit Exposure

Counterparty's estimated liability based on market activity of its CRR Account Holders and/or QSEs

- Real-Time and Adjustment Period Activities
- Day-Ahead Market Activities
- Outstanding Unpaid Invoices
- Potential Uplifts

Total Potential Exposure

Future Credit Exposure

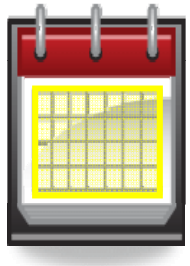
Inputs for CRRs:

- Forward value of CRRs

Auction Clearing Price

Most Recent Day's Value (Sink – Source)

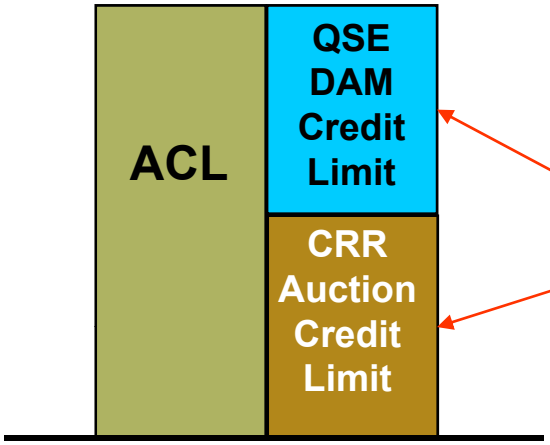
Most Recent Last 5-Day Average Value



Previous Month's Average Value

See Nodal Protocols 16.11.4

Managing Creditworthiness for CRR Auctions and DAM



- Counter-Party assigns Credit Limit for each CRR Auction
- Remaining balance of Available Credit Limit available for Day-Ahead Market activities

Day-Ahead and Real Time Market Activities

Disclaimer Statement

•This presentation provides a general overview of the Texas Nodal Market Implementation and is not intended to be a substitute for the ERCOT Nodal Protocols (available at http://nodal.ercot.com/protocols/index.html), as amended from time to time. If any conflict exists between this presentation and the ERCOT Nodal Protocols, the ERCOT Nodal Protocols shall control in all respects.

Presentation Purpose

- This presentation is intended to facilitate discussion about the use of the market tools and transactions described in the ERCOT training curriculum by Retail Electric Providers and their QSE.
- This presentation assumes participants have completed the ERCOT Nodal 101, Basic Training course or have an equivalently gained understanding of the Nodal Protocols. ERCOT makes an extensive set of training courses available to Market Participants as described at http://nodal.ercot.com/training/index.html. ERCOT encourages Market Participant participation in these courses and has established Market Participant Readiness criteria for such participation.
- Please feel free to stop me and ask questions as we proceed.

- Nothing in this presentation should be construed as advice or recommended action by any Market Participant or Entity.

Presentation Purpose

•What differences between the Nodal Market vs today's Zonal Market do you think will have a significant affect on your businesses (both good or bad)?

- My suggestions include the following as possible candidates:
  - In the Nodal Market all wholesale energy is sold to and bought from the nodal market operator - ERCOT.
  - New charges and payments will accompany the nodal market implementation.
  - The implementation of a formal Day-Ahead Market creates a new settlement and billing time line that is shorter than the Real-Time Market settlement timeline, which is unchanged from today's zonal market.
  - The price of wholesale energy now reflects, in a more granular way, differences in the cost of the delivery of electric energy on the ERCOT grid.
  - Since ERCOT controls all of the Real Time Generation Dispatch and Ancillary Services, it can observe the detailed performance of Resources in meeting Protocol Requirements.

Taken together all of these differences alter the environment in which you operate, which has risk implications.

We will look at some of these differences to increase your understanding of the operation of the nodal market, the ways in which your business may be affected and some tools that are available to help address some of the impacts of these differences.

Presentation Purpose

- Since the primary and direct impact of the nodal market implementation is at the wholesale market level, much of this discussion has a wholesale market focus.
- However, the inescapable consequence is that Load and the Load Serving Entities ultimate see the economic impacts of what happens at the wholesale supply level.
- Notwithstanding the foregoing, I believe that the LSEs and in particular, the REPs, have the ability to drive the creation of new wholesale products in the nodal market that will provide benefit to your end-use customers.

Discussion Topics

- **Topics covered in this presentation:**

I. Typical DAM Transactions

II. Risk Issues in the Day Ahead Market (DAM) and Real Time (RT) Operating Day

III. Tools to Address Basis Risk in the DAM and RT

IV. DAM Bid Submittals

V. Reliability Unit Commitment Risk Mitigation

I. Typical DAM Transactions

Typical DAM Transactions

- **All DAM transaction submittals are from a QSE**
- Depending on the transaction, there can be as many as 4 parties involved: a Resource Entity, the Resource Entity's QSE, the Buying Entity's QSE, and the Buying Entity.
- **Transactions Types Include:**
- **DAM Energy Bids**
  - Energy Bids express a willingness to buy a quantity of energy at or below a specified price. These bids are considered only in the DAM.
- **QSE-to-QSE Energy Trades**
  - Energy Trades settle at the Settlement Point price of the designated trade point. The Trade Volume is treated as capacity in the DRUC and HRUC.
- **QSE-to-QSE Capacity Trades**
  - Capacity Trades have no Settlement value. The Trade Volume is treated as capacity in the DRUC and HRUC.
- **Point-to-Point Obligation Bids**
  - P-to-P Obligations are bought in the DAM and settled in Real Time. They provide a means to hedge the delivery cost in Real Time and are essentially a linked virtual energy sale at a point of injection and a matching virtual energy buy at the point of withdrawal. Here "linked" means that the virtual energy sale and buy can only be stuck simultaneously in the DAM.

II. Risk Issues in the DAM and RT Operating Day

Risk Issues in the DAM and RT Operating Day

- **Basis Risk**
  - Basis risk is the risk that the price difference between the exchange contract and the commodity being hedged (electric energy) will widen (or narrow) unexpectedly. In our case that the price difference between the sink LMP and source LMP will widen (or narrow).
  - A CRR financial instrument is a hedge that sets the limit of financial exposure to congestion cost or basis risk that the **CRR Owner** is willing to incur or accept between two specified Settlement Points (SP).
  - In ERCOT, there are two types of CRR financial instruments: an **Option CRR** and an **Obligation CRR**.
  - The **Option CRR** strike price per megawatt is the maximum of $0.00 or the sink (withdrawal) SP Price – the source (injection) SP Price.
  - The **Obligation CRR** strike price per megawatt equals the sink (withdrawal) SP Price – the source (injection) SP Price, which can be either positive, in which case ERCOT pays the CRR Owner, or negative, in which case the CRR Owner pays ERCOT.

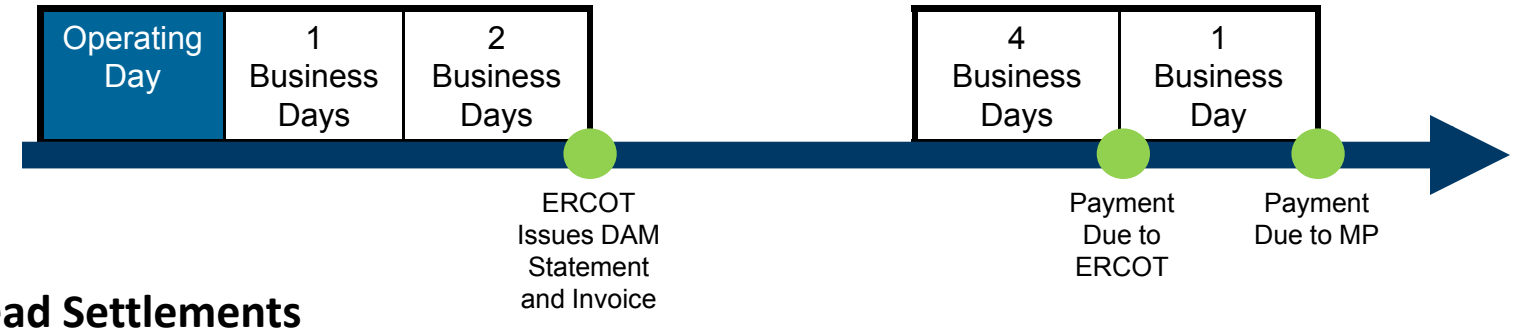
- **Basis Risk Differences Between DAM and RT**
  - CRR financial instruments not subject to Pre-assignment are settled in the Day-Ahead Market.
  - Entities whose CRR instruments are settled in the DAM face a Basis Risk between DAM and Real Time congestion cost.
  - This risk is a function of many factors including: demand amount cleared in the DAM; the difference in the generation pattern between that cleared in the DAM and the actual generation pattern in Real Time; Force Outages of Transmission facilities or Generation Resources; other changes in the network model between DAM execution and Real Time etc.

Risk Issues in the DAM and RT Operating Day

•Differences in the settlement timeline for the DAM and its associated Operating Day results in risk due to the:

- **Cost of Money**
  - Participation in the DAM accelerates the payments to ERCOT for energy bought in the DAM and consumed in RT because of the DAM settlement timeline with RT true-up following on the RT settlement timeline.
  - On the other hand, participation in the DAM is voluntary; however, a decision to not participate in the DAM places the entire metered consumption at risk of facing the RT SP spot price if not covered by a bi-lateral trade.
- **Credit Impacts**
  - These timelines also result in credit impacts on Market Participants resulting in part from the treatment of outstanding DAM and Real Time Invoices in ERCOT's credit exposure calculations for each counter party participating in the DAM and RT markets.

Day-Ahead Settlements



Day-Ahead Settlements

Executed on a separate timeline

Scope – DA Energy, A/S and most CRRs

Settlement Interval – one hour

Prices – Nodal prices (for energy) and MCPC for capacity

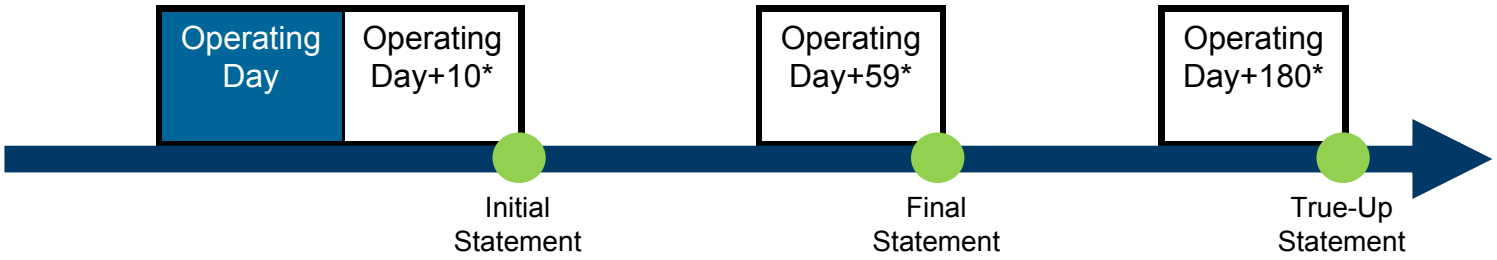
Statements & Invoices

Statement & Invoice published on *same day* (because meter data not required)

Payments due 4th business day from invoice

Paid 5th business day

Real-Time Settlements



Real-Time Settlements

- Same timeline as current Zonal market
- Scope – DRUC, Adjustment Period, and RT Operations
- Settlement Interval – one hour or 15 minutes
- Prices – nodal prices (for energy) and MCPC for capacity

Statements & Invoices

- Published separately
- Weekly invoices

Note: *Must fall on a business day (not a weekend)

III. Tools to Address Basis Risk in the DAM and RT

Tools to Address Basis Risk in the DAM and RT

•Purchase of CRR Financial Instruments for DAM Basis Risk Mitigation

- Market Participants that satisfy the registration requirements to be an ERCOT CRR Account Holder can purchase CRRs in the Annual and Monthly CRR Auctions.
- Market Participants can sell/purchase CRRs in the bilateral market (which is an OTC market in ERCOT).
- Only ERCOT CRR Account Holders can register their CRR ownership and track change of ownership resulting from bilateral CRR sales and purchases in the CRR Account Holders database maintained by ERCOT.
- ERCOT will only settle CRR financial instruments with the CRR Account Holder registered as the owner of the CRR instrument.
- **Purchase of P-to-P Obligations in the DAM for RT Basis Risk Mitigation**
- QSE's may bid to buy a P-to-P Obligation in the DAM. The P-to-P bid price represents the not-to-exceed premium the buyer of the instrument is willing to pay. The purchase premium is part of the DAM Invoice charges.
- DAM P-to-P Obligations are valued and settled only in that DAM's associated Operating Day and as such are part of the Real Time Invoice payments or charges.
- P-to-P Obligations can provide a basis hedge between the DAM and RT.

•There are other more sophisticated transaction strategies that can be used by Market Participants to create basis or energy hedges in the DAM and RT Markets. Discussion of such strategies is beyond the scope of this discussion.

IV. DAM Bid Submittals

DAM Bid Submittals

- **Bidding as a Price Taker**
- A **DAM Energy Bid** represents the QSE's willingness to buy energy at or below a certain price and at a certain quantity (which may be fixed or variable) at a specified settlement point in the DAM.
- **DAM Energy Bids** may only be made and can only be struck in a DAM.
- By Protocol requirement and system implementation, a valid DAM Bid must include an up-to price. Essentially, each Energy Bidder is a price taker up to the bid price specified in the bid submittal.
- The implication is that the higher the bid price specified the more likely the DAM optimization engine will strike the offer.
- However, as described in the following the Bidder's ability to maximize its bid price is restrained by the Bidder's ability to meet the ERCOT credit requirement checks performed prior to DAM execution.

DAM Bid Submittals

- **Day Ahead Market Credit Rules & Impacts**
- The DAM Credit Requirement for QSE is described in Nodal Protocol 4.4.10(6) and further described in the MMS – Day-Ahead Market and Supplemental Ancillary Service Market Requirements Specification, Section 3.4.1, CR1 – Credit Requirement.
- The pre-DAM credit requirement checks are preformed for each QSE. ERCOT systems assume that each transaction is struck in the DAM and calculates a running transaction-by-transaction impact on the QSE's credit exposure.
- A QSE Transaction that cause the QSE's credit exposure to exceed its posted credit limit in the DAM is rejected. This process continues until all transactions are evaluated.

IV. Reliability Unit Commitment Risk Mitigation

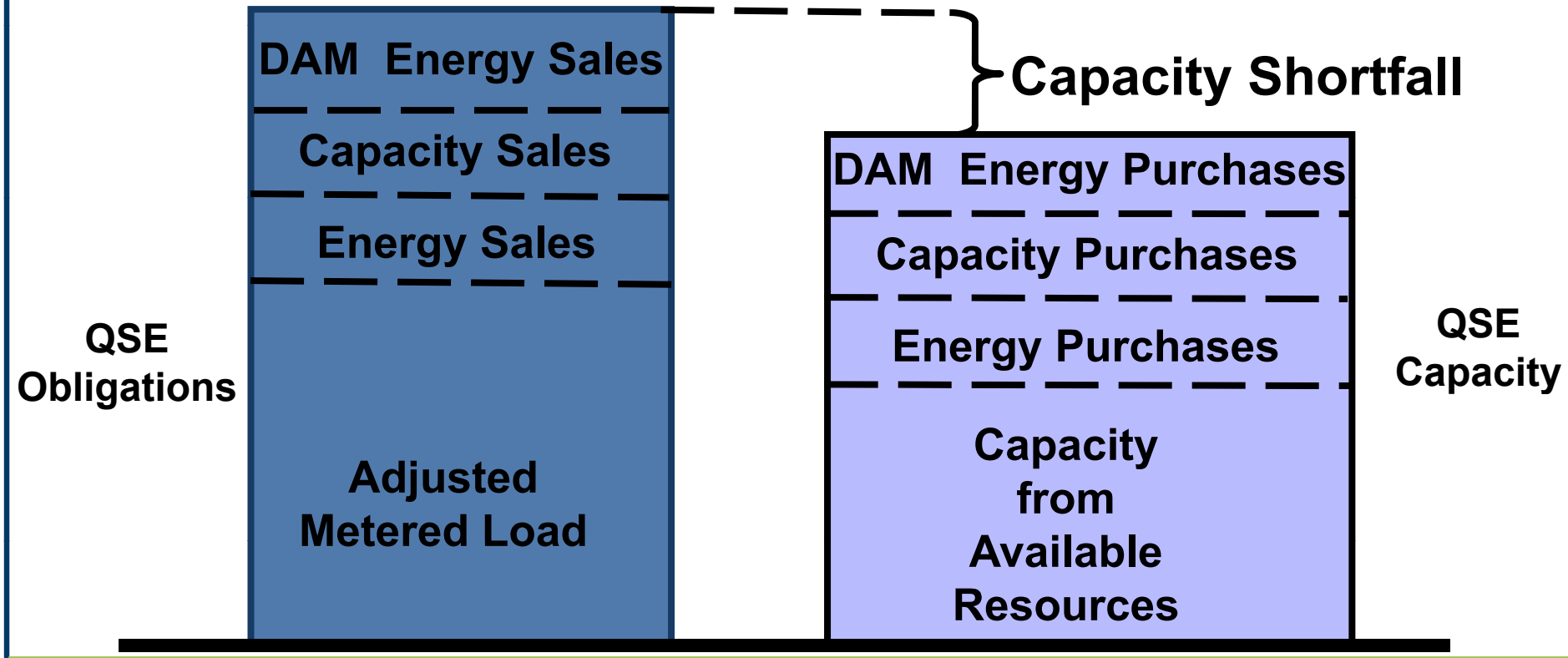
Reliability Unit Commitment Risk Mitigation

- **Nature of the Risk**
- A QSE that **fails** to cover its obligation with capacity can be subject to a RUC Capacity Short Charge.
- Each time a RUC process is executed at ERCOT a snapshot of each QSE's net capacity is recorded for settlement purposes.
- The larger QSE RUC capacity shortfall (RUC or Real-Time) is used for capacity short calculations.
- **Tools to Address RUC Risks**

Dam Energy Purchases & Sales	**QSE-to-QSE Capacity Trades**	**QSE-to-QSE Energy Trades**

RUC Capacity Short Charge

When a QSE does not provide enough capacity to meet its obligations, it may be assessed a Capacity Short Charge



Reliability Unit Commitment - Snapshot

RUC Snapshot =

Sum of HASLs in COP + Capacity Trades as buyer - Capacity Trades as seller

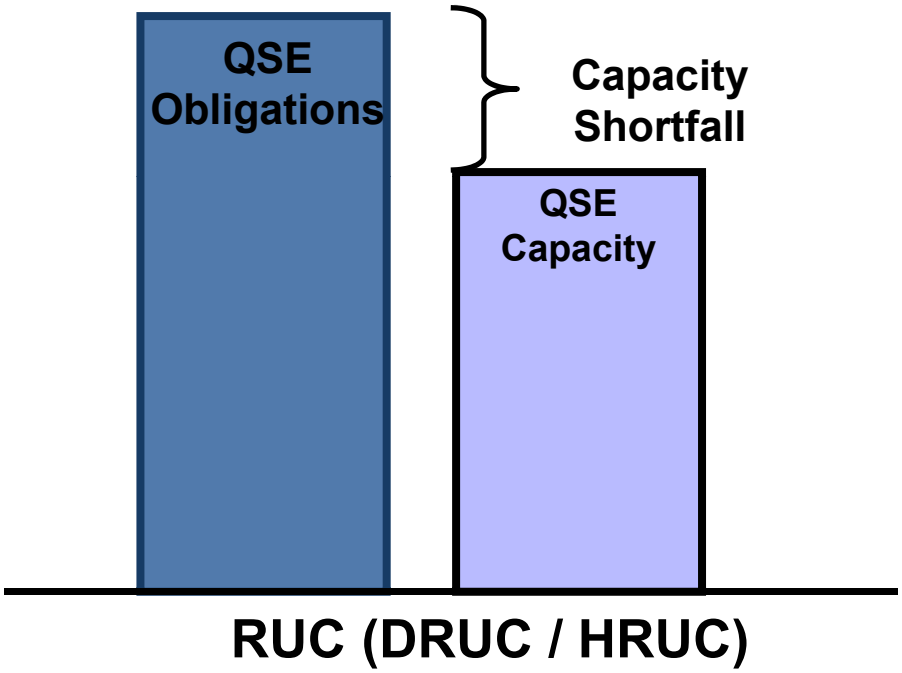
+ Energy Trades as Buyer - Energy Trades as Seller + Energy Bids awarded in DAM

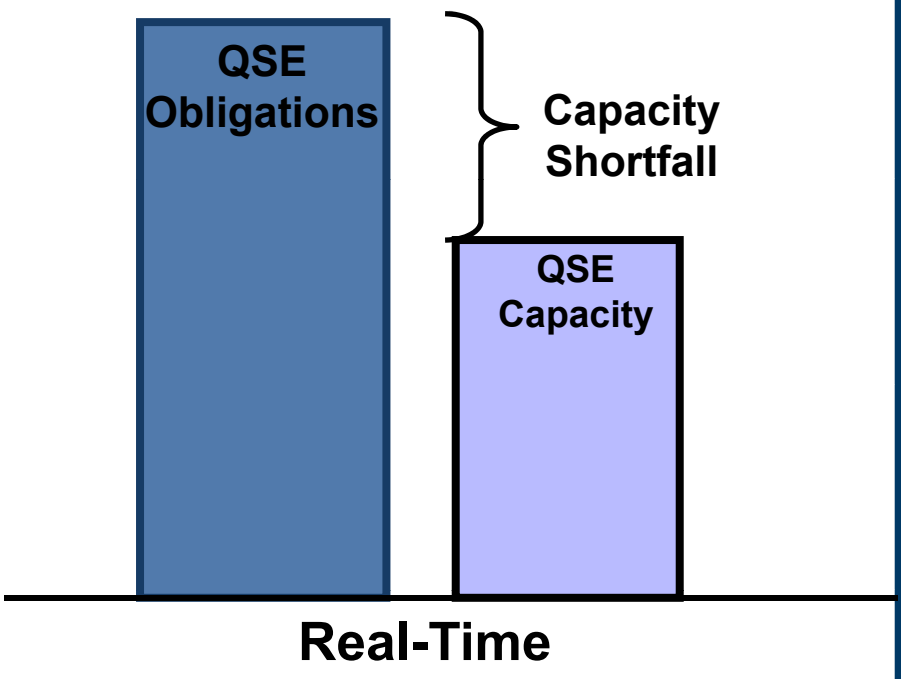
- Energy Only Offers awarded in DAM + DC Tie imports

Note that all values/trades are as of the time of the RUC Snapshot

RUC Capacity Short Charge

The larger QSE capacity shortfall (RUC or Real-Time) is used for capacity short calculations





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3. MMS Project Other Deliverables, http://nodal.ercot.com/docs/pd/mms/index.html#oth
4. Credit Exposure Study for DAM Bids & Offers, http://nodal.ercot.com/docs/pd/mms/wp/wp-damcec/credit_exposure_study_for_dam_bids_and_offers.doc

Example Contract for Differences
DAM SPP Contract Strike Price

An Example

- In all cases when energy is injected and withdrawn at different locations on the ERCOT grid, the difference in the Settlement Point Prices between the two locations is the cost of the congestion.
- ERCOT Settlement generally collects the congestion cost through charges to Load; however, either the Supplier or the Load can assume the financial responsible for this cost, depending on contractual arrangements.
- Since all energy injected into and withdrawn from the ERCOT grid is subject to ERCOT settlement payments/charges, both parties to a transaction will receive Settlement Statements and Invoices for the Settlement charges/payments from ERCOT. The "Contract for Differences" example illustrates a scenario in which the seller is responsible for the congestion cost. The purpose of this example is not to identify a benefit to Load but rather to illustrate a process that results in the Seller (Supplier) being financially responsible for the congestion costs associated with the transaction.
-
- Specifically, the "Contract for Differences" example illustrates the charges and payments that flow among ERCOT, the Load Serving Entity's QSE and the Resource Entity's QSE.
- Additionally, the example illustrates a method of exchange of cash between the Load and Resource parties to a bilateral Power Purchase Agreement (PPA). In part, the example illustrates that the suggested cash exchange between the parties to the PPA (i.e. buyer to seller or seller to buyer) under various Settlement scenarios with ERCOT results in the buyer and seller remaining whole under the terms of the PPA. For this example, the end result is that the buyer's forward position is always a 100 MWh purchase for $20.00/MWh and the seller's forward position is always a sale of 100 MWh at $20.00/MWh. Any fees or charges associated between with the Buyer or Seller and their respective QSE are neglected.
- The operation of a Contract for Differences is by no means the only possible methodology that can be used to achieve the intent of a bilateral forward sale and purchase; rather, the example illustrates one scenario and method to account for ERCOT settlement charges or payments to each of the parties in a bilateral forward contract.

A Contract for Differences Example

This example is intended to demonstrate how a contract for differences could work. Certain simplifying assumptions are made for ease of illustration.

This example does not include the effect of cost of credit required for the bilateral contract or for ERCOT.

The example demonstrates how an energy hedge, a guaranteed energy price for the purchaser and seller, and a congestion hedge utilizing a PTP Option operates under various price scenarios.

	Contract Amt	Contract Strike Price	Contract Fin Obl
Assume:	100	$20	$2,000

Entities G and L Agree to Guarantee one another 100 MWhs at $20/MWh in a contract for differences, delivered to the Load Zone.
Entity G buys a 100 Mw PTP Option strip in a Monthly CRR Auction for $5.00/MW per hour.
G's Marginal cost is $15/MWH for all MWs generated.

Case	G RT Dispatch	G's SPP	ERCOT → G	L's Contract Demand	L's LZSPP	L → ERCOT	L → G	G → L	L Net Position	Option Premium	Option Value to G	G Net Position	G Marginal Profit
No Congestion	**100**	**$15**	$1,500	**100**	**$15**	$1,500	500	0	-$2,000	-$500	$0	$1,500	$0
No Congestion	**100**	**$20**	$2,000	**100**	**$20**	$2,000	0	0	-$2,000	-$500	$0	$1,500	$0
No Congestion	**100**	**$30**	$3,000	**100**	**$30**	$3,000	0	1000	-$2,000	-$500	$0	$1,500	$0
Congestion	**100**	**$15**	$1,500	**100**	**$20**	$2,000	0	0	-$2,000	-$500	$500	$1,500	$0
Congestion	**100**	**$15**	$1,500	**100**	**$30**	$3,000	0	1000	-$2,000	-$500	$1,500	$1,500	$0
Congestion	**100**	**$15**	$1,500	**100**	**$40**	$4,000	0	2000	-$2,000	-$500	$2,500	$1,500	$0
Congestion	**100**	**$20**	$2,000	**100**	**$40**	$4,000	0	2000	-$2,000	-$500	$2,000	$1,500	$0
Congestion	**100**	**$40**	$4,000	**100**	**$20**	$2,000	0	0	-$2,000	-$500	$0	$3,500	$2,000
Congestion	**100**	**$50**	$5,000	**100**	**$30**	$3,000	0	1000	-$2,000	-$500	$0	$3,500	$2,000

Conclusions:

The Load has achieved a $2,000 hedge for 100 MW delivered to the LZ
The Generator has achieved a $1,500 hedge for 100 MWs generated and delivered to the LZ
If the delivery hedge is reversed in ownership, add -$500 to the Load position and +$500 to the Generator position

Course Conclusion

Retail Panel – Questions

- **Questions or comments?**