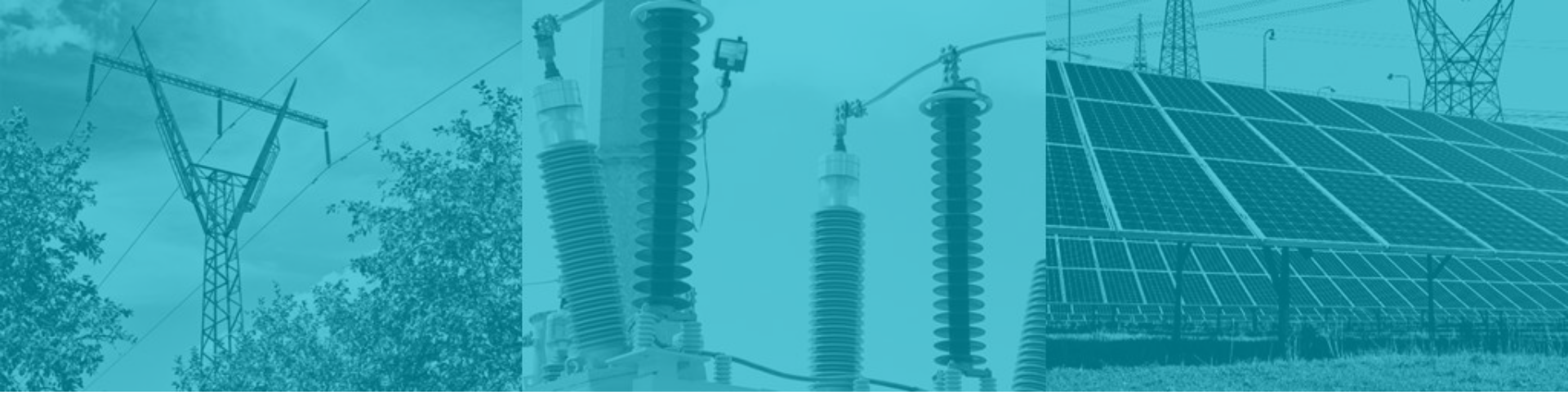
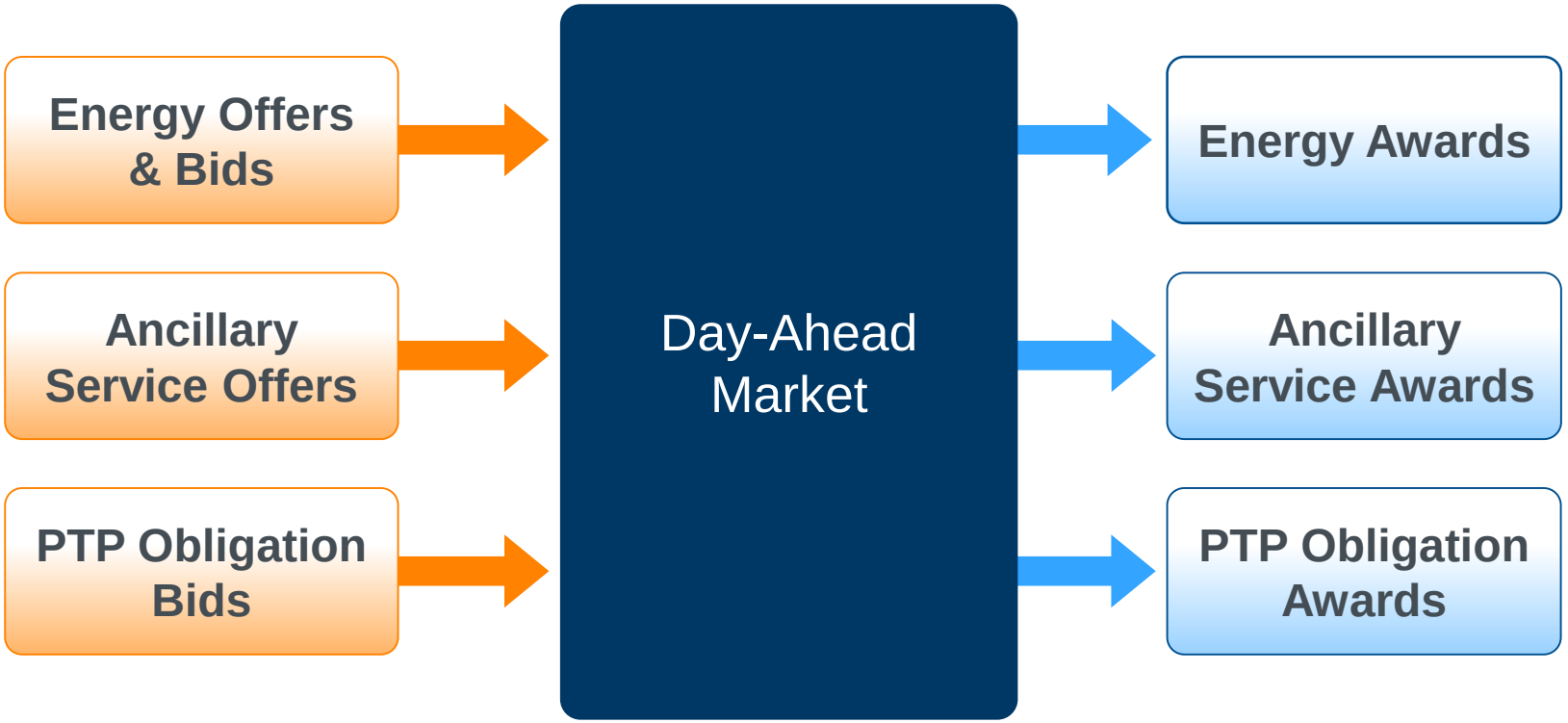


ERCOT Market Education

Settlements 301

Module 3: Day-Ahead Market

Products bought and sold in the DAM:



Day-Ahead Market Settlements

DAM

Participation in DAM

- **Energy**
- **Ancillary Services**
- **PTP Obligations**

DAM Commitment

- **Make-Whole**

Settlement of CRRs in the DAM

Energy Offers & Bids

DAM

Participation in DAM

- Energy
- AS
- PTP Obligations

Outcome #1

Charge to QSE for Awarded Energy Bid in DAM

Outcome #2

Payment to QSE for Awarded Energy Offer in DAM

DAM Settlements: Charge for an Awarded Energy Bid

QSE5 submits an Energy Bid in the Day-Ahead Market

DAM Energy Bid is a QSE's willingness to buy energy:

- Maximum **price**
- Up to a certain **quantity**
- At a specific Settlement Point in the DAM

DAM Settlements: Charge for an Awarded Energy Bid

- QSE5 submits an Energy Bid in the Day-Ahead Market
  - Bid Price = $45/MWh
  - Quantity = 68MW for one hour
  - At Load Zone 2
- ERCOT executes the DAM Clearing Process
- **DAM prices Load Zone 2 at $40 / MWh**

DAM Settlements: Charge for an Awarded Energy Bid

Trigger #1

- QSE5 purchased:
  - 68 MW of Energy for one hour
  - At Load Zone 2
  - Price of $40/MWh

Outcome #1

- Settled hourly
- Settlement calculation is:

(Day-Ahead Settlement Point Price) * (Quantity)

($40/MWh) * (68 MW) = $2720

DAM Settlements: Charge for an Awarded Energy Bid

Day-Ahead Energy Purchase Amount

$$DAEPAMT_{q,p} = DASPP_{p} * DAEP_{q,p}$$

Day-Ahead Energy Purchase Amount QSE Total

$$DAEPAMTQSETOT_{q} = \sum_{P} DAEPAMT_{q,p}$$

p = A Settlement Point

q = QSE

Determinants
Day-Ahead Energy Purchase Amount
Day-Ahead Settlement Point Price
Day-Ahead Energy Purchase
Day-Ahead Energy Purchase Amount QSE Total

Energy Offers & Bids

DAM

Participation in DAM

- Energy
- AS
- PTP Obligations

Outcome #1

Charge to QSE for Awarded Energy Bid in DAM

Outcome #2

Payment to QSE for Awarded Energy Offer in DAM

DAM Settlements: Payment of an Awarded Energy Offer

- QSE1 submits an Energy Offer in the Day-Ahead Market

- Three-Part Supply Offer
  - Startup Offer
  - Minimum Energy Offer
  - Energy Offer Curve
- DAM Energy-Only Offer

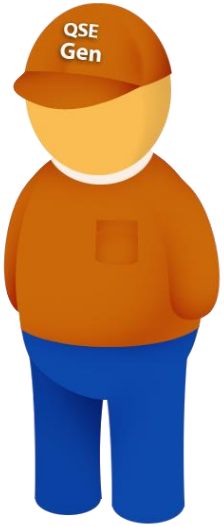
Two types of Energy Offers in Nodal Market

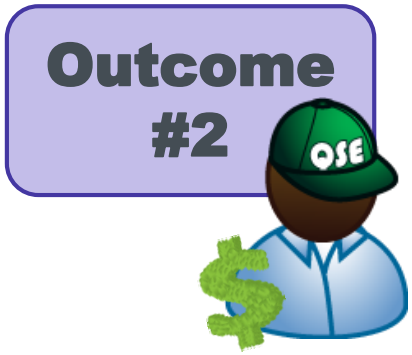
DAM Settlements: Payment of an Awarded Energy Offer

- QSE1 submits an DAM Energy-Only Offer in the Day-Ahead Market
  - Offer Price = $16/MWh
  - Quantity = 40 MW for one hour
  - At Resource Node 4
- ERCOT executes the DAM Clearing Process
- **DAM prices Resource Node 4 at $16/MWh**

DAM Settlements: Payment of an Awarded Energy Offer

- QSE1 sold:
  - 40 MW of Energy for one hour
  - At Resource Node 4
  - Price of $16/MWh





- Settled hourly
- Settlement calculation is:

(-1) * (Day-Ahead Settlement Point Price) * (Quantity)

(-1) * ($16/MWh) * (40 MW) = -$640

Day-Ahead Energy Settlements - Payments

Day-Ahead Energy Sale Amount

$$DAESAMT_{q,p} = (-1) * DASPP_{p} * DAES_{q,p}$$

Day-Ahead Energy Sale Amount QSE Total

$$DAESAMTQSETOT_{q} = \sum_{p} DAESAMT_{q,p}$$

p = A Settlement Point

q = QSE

Determinants
Day-Ahead Energy Sale Amount
Day-Ahead Settlement Point Price
Day-Ahead Energy Sale
Day-Ahead Energy Sale Amount QSE Total

Combined Cycle Train (CCT)

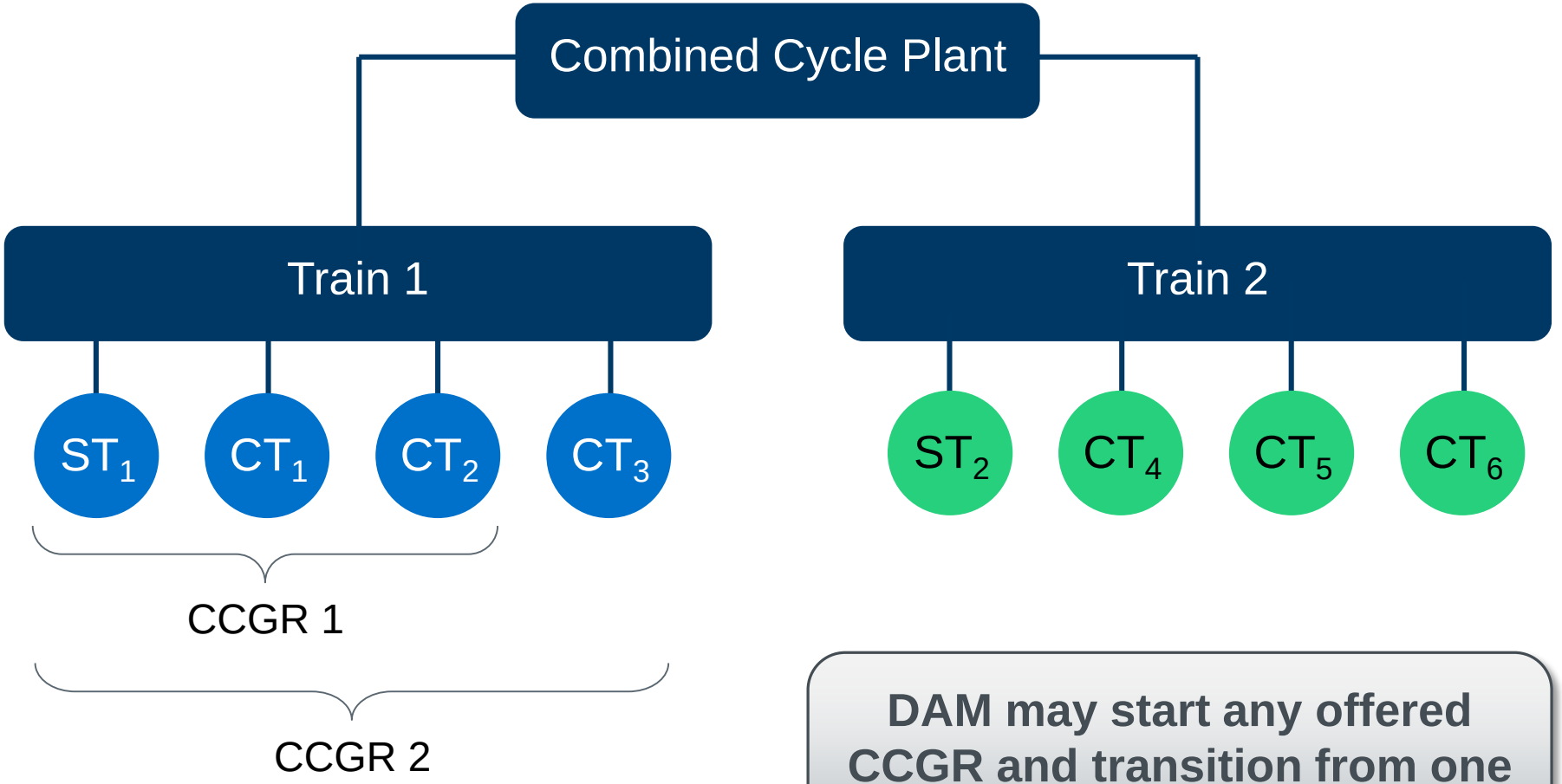
- A group of Combustion Turbines (CT) and Steam Turbines (ST)
- Operate in one or more configurations

Combined Cycle Generation Resource (CCGR)

- A registered configuration of a Combined Cycle Train
- Offered as a single Resource

Any or all CCGRs from a Combined Cycle Train may be offered in the Day-Ahead Market.

Day-Ahead Energy Settlements - Combined Cycle Resources



DAM may start any offered CCGR and transition from one offered CCGR to another

Settlement Point Locations in DAM

Settlement Point	Transaction					
	3PSO	CCGR 3PSO	DAM Energy Only Offer	DAM Energy Bid	PTP Obligation Bids	QSE to QSE Trades
Resource Node	X		X	X	X	X
CCP Logical Resource Node		X				
CCU Resource Node			X	X	X	X
Load Zone			X	X	X	X
Hub			X	X	X	X

Notes:

1. CCP = Combined Cycle Plant
2. CCU = Combined Cycle Unit
3. 3PSO = Three Part Supply Offer
4. CCGR = Combined Cycle Generation Resource

Day-Ahead Market Settlements

DAM

Participation in DAM

- Energy
- Ancillary Services
- PTP Obligations

DAM Commitment

- Make-Whole

Settlement of CRRs in the DAM

Ancillary Service (AS) Plan

The required quantity in MW of each Ancillary Service for each hour of the Operating Day ERCOT-wide

- Developed by ERCOT
- Posted to MIS Public Area by 0600

Types of Ancillary Services

- Regulation Up (Reg-Up)
- Regulation Down (Reg-Down)
- Responsive Reserve
- Non-Spin

By 0600 Day-Ahead, ERCOT posts each QSE's AS Obligation to the MIS Certified Area.

- Per QSE
- Per type of Ancillary Service (AS)
- Per hour

In the Day-Ahead Market:

QSE may Self-arrange by 1000:

- Self Supply its AS Obligation
- Trade to cover AS Obligation

QSE may Offer AS by 1000:

- Offer available capacities by AS Type
- Offers include MW and Price

ERCOT procures:

- Ancillary Services not self-arranged

Ancillary Services in the Day-Ahead Market

DAM

Participation in DAM

- Energy
- AS
- PTP Obligations

Outcome #1

Payment to QSE for Awarded AS Offer in DAM

Outcome #2

Charge to QSE for ERCOT procuring AS on its behalf

DAM Settlements: Payment of an Awarded AS Offer

- QSE4 offers to sell AS in the Day-Ahead Market

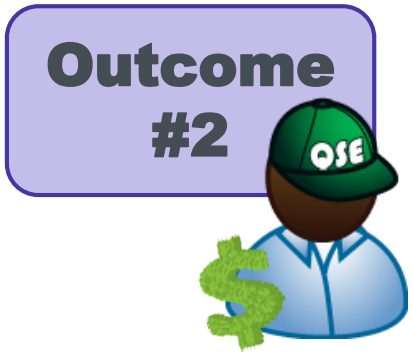
- Resource
- Quantity (tenths of MWs)
- Price
- Ancillary Service type
- Range of hours offered
- Expiration date and time of offer

DAM Settlements: Payment of an Awarded AS Offer

- QSE4 submits an Offer to sell Ancillary Service capacity
  - Regulation Up (Reg-Up)
  - 100 MW for at least $4/MW
- ERCOT executes the DAM Clearing Process
- **DAM sets Day-Ahead Market Clearing Price for Capacity (Reg-up) at $4/MW and awards QSE4's Offer**

DAM Settlements: Payment of an Awarded AS Offer

- QSE4 sold:
  - 60 MW of Regulation Up (Reg-Up)
  - Day-Ahead Market Clearing Price for Capacity of $4/MW



- Settled hourly
- Settlement calculation is:

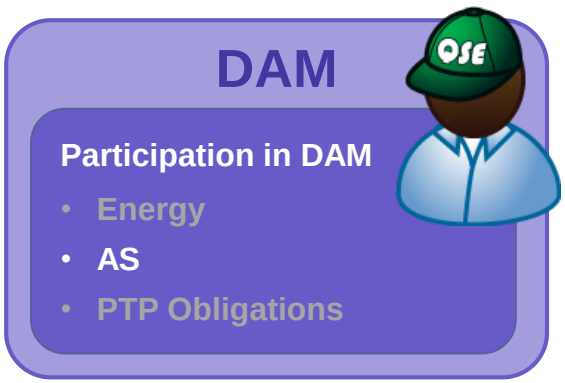
$$(-1) * (\text{Price}) * (\text{Quantity})$$

$$(-1) * (\$4/\text{MW}) * (60\ \text{MW}) = -\$240$$

Regulation Up Service Payment

$$PCRUAMT_{q} = (-1) * MCPCRU_{DAM} * PCRU_{q, DAM}$$

$$\$-240_{QSE4} = (-1) * \$4/MW_{DAM} * 60MW_{QSE4}$$

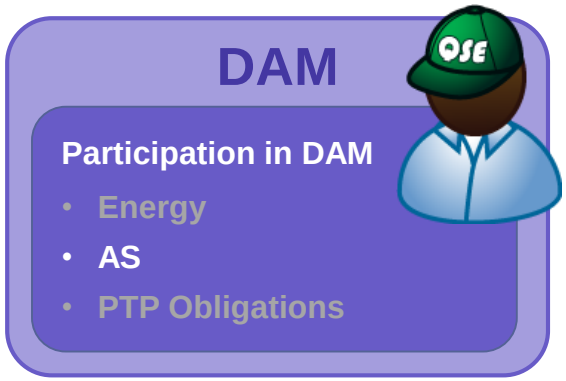


DAM = Day-Ahead Market

q = QSE

Determinants
Procured Capacity Reg-Up Amount
Procured Capacity Reg-Down Amount
Procured Capacity Responsive Reserve Amount
Procured Capacity Non-Spin Amount
Market Clearing Price Capacity Reg-Up
Market Clearing Price Capacity Reg-Down
Market Clearing Price Capacity Resp. Reserve
Market Clearing Price Capacity Non-Spin
Procured Capacity Reg-Up
Procured Capacity Reg-Down
Procured Capacity Responsive Reserve
Procured Capacity Non-Spin

Day-Ahead Market Ancillary Services Payments



Regulation Up Service Payment

$$PCRUAMT_q = (-1) * MCPCRU_{DAM} * PCRU_{q,DAM}$$

Regulation Down Service Payment

$$PCRDAMT_q = (-1) * MCPCRD_{DAM} * PCRD_{q,DAM}$$

Responsive Reserve Service Payment

$$PCRRAMT_q = (-1) * MCPCRR_{DAM} * PCRR_{q,DAM}$$

Non-Spinning Reserve Service Payment

$$PCNSAMT_q = (-1) * MCPCNS_{DAM} * PCNS_{q,DAM}$$

Determinants
Procured Capacity Reg-Up Amount
Procured Capacity Reg-Down Amount
Procured Capacity Responsive Reserve Amount
Procured Capacity Non-Spin Amount
Market Clearing Price Capacity Reg-Up
Market Clearing Price Capacity Reg-Down
Market Clearing Price Capacity Resp. Reserve
Market Clearing Price Capacity Non-Spin
Procured Capacity Reg-Up
Procured Capacity Reg-Down
Procured Capacity Responsive Reserve
Procured Capacity Non-Spin

Ancillary Services in the Day-Ahead Market

DAM

Participation in DAM

- Energy
- AS
- PTP Obligations

Outcome #1

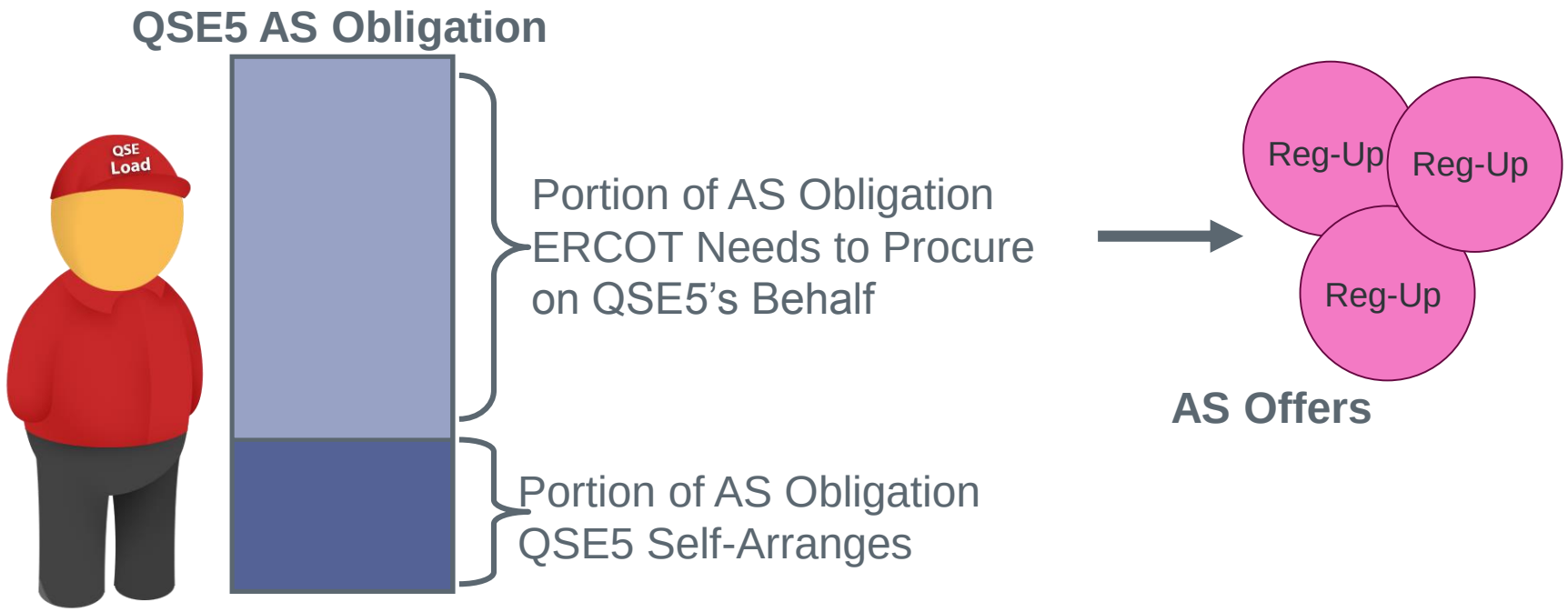
Payment to QSE for Awarded AS Offer in DAM

Outcome #2

Charge to QSE for ERCOT procuring AS on its behalf

If a QSE does not self-arrange all of its AS Obligation:

- ERCOT will procure the remaining portion in DAM
- ERCOT procures AS from available AS Offers



A QSE may submit negative Self-Arranged AS Quantities:

- Limited to -500 MW for each Ancillary Service
- Limited in magnitude to net AS Trades (compliance only)

A QSE may submit negative Self-Arranged AS Quantities:

- Limited to -500 MW for each Ancillary Service
- Limited in magnitude to net AS Trades (compliance only)

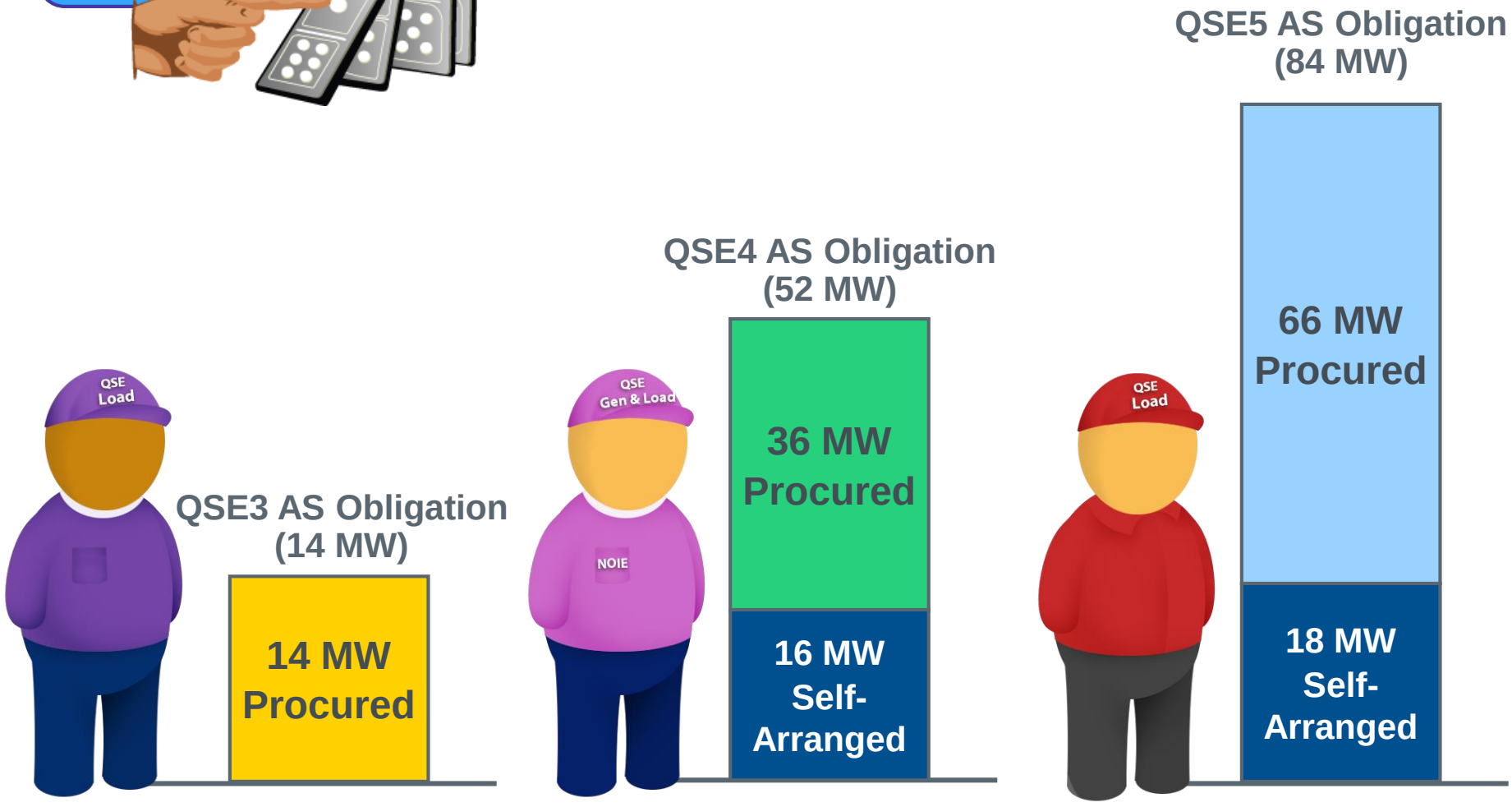
Impact:

ERCOT will charge the QSE for their share of the Ancillary Service Capacities procured in DAM.

This provision applies only to DAM; not allowed in SASMs.

DAM Settlements: Charge for ERCOT Procurement of AS

QSE3, QSE4, & QSE5 did not Self-Arrange entire AS Obligation for Responsive Reserve Service (RRS)

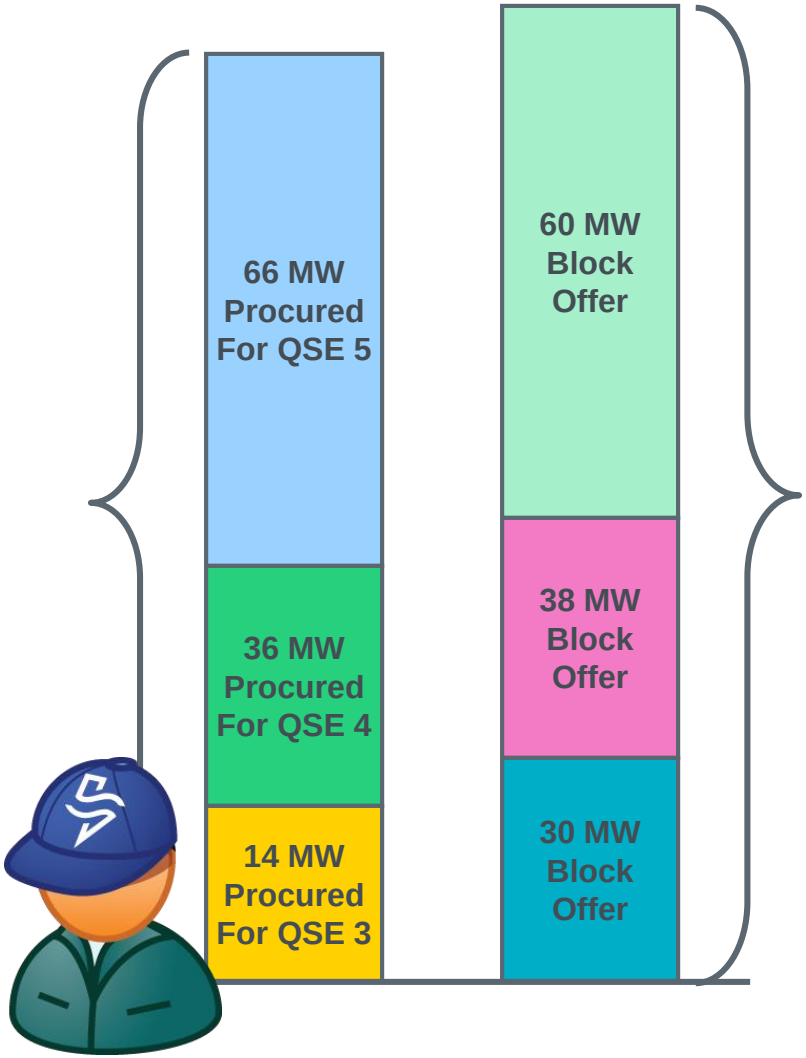


DAM Settlements: Charge for ERCOT Procurement of AS

- ERCOT needs to procure total of 116 MW of RRS
- ERCOT executes the DAM Clearing Process and procures additional AS from AS Offers

Total RRS:

- **Total Quantity Needed = 116MW**
- **Total Quantity Procured = 128MW**
- **Total Cost = $512**



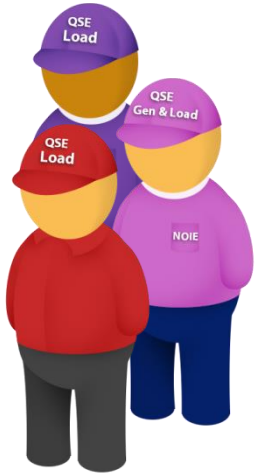
DAM Settlements: Charge for ERCOT Procurement of AS

Trigger #2

- ERCOT needs to procure total of 116 MW of RRS
- ERCOT executes the DAM Clearing Process and procures 128 MW RRS from AS Offers

Outcome #2

- Charged per QSE
- Settlement calculation:



$$(Price) * (Quantity)$$

$$(-1) * \left(\frac{\text{Total Cost of RRS}}{\text{Total RRS Needed}} \right) * \left(\text{QSE obligation not Self-Arranged} \right)$$

DAM Settlements: Charge for ERCOT Procurement of AS

Outcome #2

$$(-1) * \left(\frac{\text{Total Cost of RRS}}{\text{Total RRS Needed}} \right) * \left(\text{QSE obligation not Self-Arranged} \right)$$

QSE	Price $512 / 116 MW	Quantity Procured on behalf of QSE	Total
QSE3	?	?	?
QSE4	?	?	?
QSE5	?	?	?

Responsive Reserve Quantity

$$DARRQ_q = DARRO_q - DASARRQ_q$$

QSE3

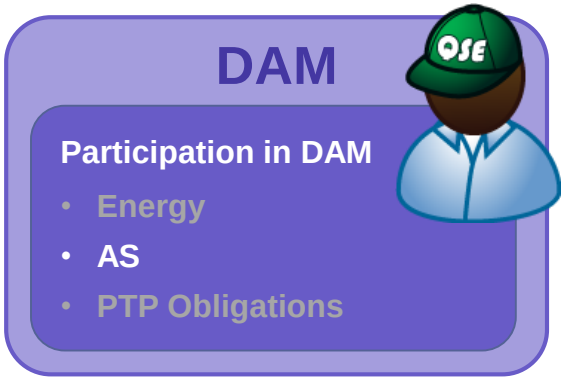
14MW = 14MW – 0MW

QSE4

36MW = 52MW – 16MW

QSE5

66MW = 84MW – 18MW



Determinants
Day-Ahead Resp Reserve Quantity Day-Ahead Resp Reserve Obligation Day-Ahead Self-Arranged Resp Reserve Quantity
Day-Ahead Reg-Down Quantity Day-Ahead Reg-Down Obligation Day-Ahead Self-Arranged Reg-Down Quantity
Day-Ahead Reg-Up Quantity Day-Ahead Reg-Up Obligation Day-Ahead Self-Arranged Reg-Up Quantity
Day-Ahead Non-Spin Quantity Day-Ahead Non-Spin Obligation Day-Ahead Self-Arranged Non-Spin Quantity

Day-Ahead Market Ancillary Services Charges – Quantity (continued)

Responsive Reserve Quantity

$$DARRQ_q = DARRO_q - DASARRQ_q$$

Regulation Down Quantity

$$DARDQ_q = DARDO_q - DASARDQ_q$$

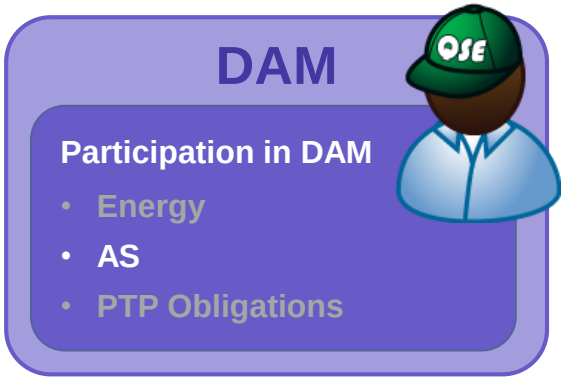
Regulation Up Quantity

$$DARUQ_q = DARUO_q - DASARUQ_q$$

Non-Spinning Reserve Quantity

$$DANSQ_q = DANSO_q - DASANSQ_q$$

q = QSE

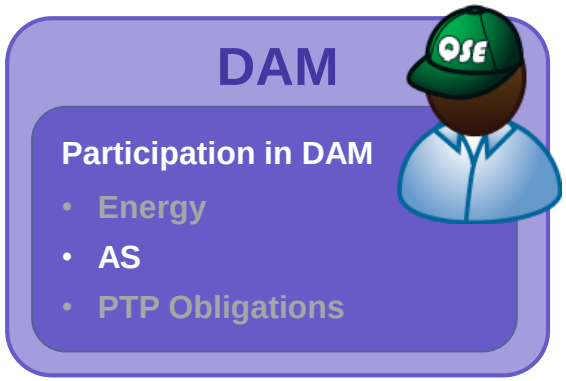


Determinants
Day-Ahead Resp Reserve Quantity Day-Ahead Resp Reserve Obligation Day-Ahead Self-Arranged Resp Reserve Quantity
Day-Ahead Reg-Down Quantity Day-Ahead Reg-Down Obligation Day-Ahead Self-Arranged Reg-Down Quantity
Day-Ahead Reg-Up Quantity Day-Ahead Reg-Up Obligation Day-Ahead Self-Arranged Reg-Up Quantity
Day-Ahead Non-Spin Quantity Day-Ahead Non-Spin Obligation Day-Ahead Self-Arranged Non-Spin Quantity

Responsive Reserve Price

DARRPR = (-1) * PCRRAMTTOT / DARRQTOT

$4.41/MW = (-1) * $-512 / 116 MW



Determinants
Day-Ahead Responsive Reserve Price Procured Capacity for Responsive Reserve Amount Total Day-Ahead Responsive Reserve Quantity Total
Day-Ahead Reg-Down Price Procured Capacity for Reg-Down Amount Total Day-Ahead Reg-Down Quantity Total
Day-Ahead Reg-Up Price Procured Capacity for Reg-Up Amount Total Day-Ahead Reg-Up Quantity Total
Day-Ahead Non-Spin Price Procured Capacity for Non-Spin Amount Total Day-Ahead Non-Spin Quantity Total

Day-Ahead Market Ancillary Services Charges – Price (continued)

Responsive Reserve Price

DARRPR

= (-1) * **PCRRAMTTOT** / **DARRQTOT**

Regulation Down Price

DARDPR

= (-1) * **PCRDAMTTOT** / **DARDQTOT**

Regulation Up Price

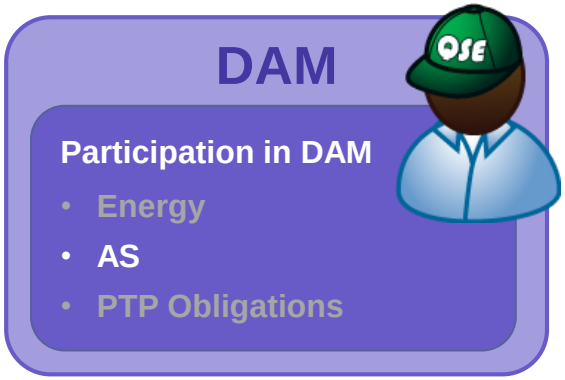
DARUPR

= (-1) * **PCRUAMTTOT** / **DARUQTOT**

Non-Spinning Reserve Price

DANSPR

= (-1) * **PCNSAMTTOT** / **DANSQTOT**



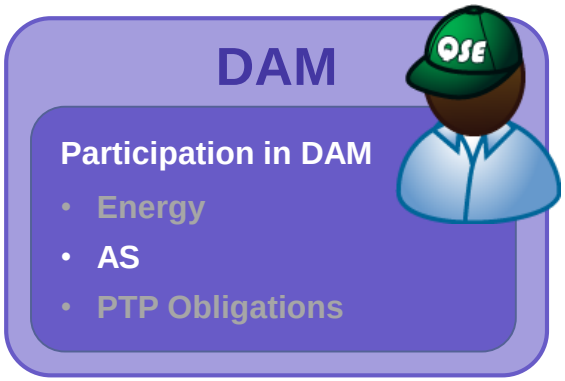
Determinants
Day-Ahead Responsive Reserve Price Procured Capacity for Responsive Reserve Amount Total Day-Ahead Responsive Reserve Quantity Total
Day-Ahead Reg-Down Price Procured Capacity for Reg-Down Amount Total Day-Ahead Reg-Down Quantity Total
Day-Ahead Reg-Up Price Procured Capacity for Reg-Up Amount Total Day-Ahead Reg-Up Quantity Total
Day-Ahead Non-Spin Price Procured Capacity for Non-Spin Amount Total Day-Ahead Non-Spin Quantity Total

DAM Settlements: Charge for ERCOT Procurement of AS

Responsive Reserve Service Charge

$$DARRAMT_{q} = DARRPR * DARRQ_{q}$$

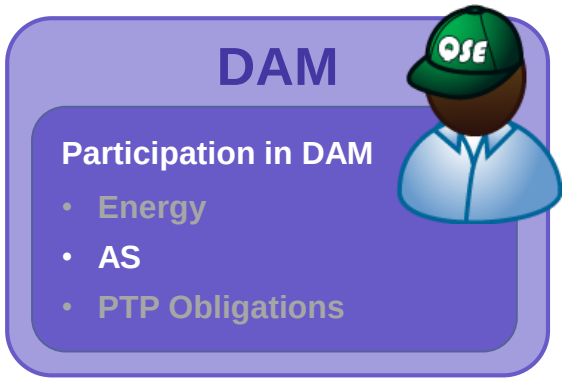
$$\$61.74_{QSE3} = \$4.41/MW * 14MW_{QSE3}$$



Determinants
Day-**A**head **R**esponsive **R**eserve **Am**ount **D**ay-**A**head **R**esponsive **R**eserve **Pr**ice **D**ay-**A**head **R**esponsive **R**eserve **Q**uantity
Day-**A**head **R**eg **D**own **Am**ount **D**ay-**A**head **R**eg **D**own **Pr**ice **D**ay-**A**head **R**eg **D**own **Q**uantity
Day-**A**head **R**eg **U**p **Am**ount **D**ay-**A**head **R**eg **U**p **Pr**ice **D**ay-**A**head **R**eg **U**p **Q**uantity
Day-**A**head **N**on-**S**pinning Reserve **Am**ount **D**ay-**A**head **N**on-**S**pinning Reserve **Pr**ice **D**ay-**A**head **N**on-**S**pinning Reserve **Q**uantity

q = QSE

DAM Settlements: Charge for ERCOT Procurement of AS



Responsive Reserve Service Charge

$$DARRAMT_q = DARRPR * DARRQ_q$$

Regulation Down Service Charge

$$DARDAMT_q = DARDPR * DARDQ_q$$

Regulation Up Service Charge

$$DARUAMT_q = DARUPR * DARUQ_q$$

Non-Spinning Reserve Service Charge

$$DANSAMT_q = DANSPR * DANSQ_q$$

q = QSE

Determinants
Day-Ahead Responsive Reserve Amount Day-Ahead Responsive Reserve Price Day-Ahead Responsive Reserve Quantity
Day-Ahead Reg Down Amount Day-Ahead Reg Down Price Day-Ahead Reg Down Quantity
Day-Ahead Reg Up Amount Day-Ahead Reg Up Price Day-Ahead Reg Up Quantity
Day-Ahead Non-Spinning Reserve Amount Day-Ahead Non-Spinning Reserve Price Day-Ahead Non-Spinning Reserve Quantity

Day-Ahead Market Settlements

DAM

Participation in DAM

- Energy
- Ancillary Services
- **PTP Obligations**

DAM Commitment

- Make-Whole

Settlement of CRRs in the DAM

PTP Obligations Acquired in the Day-Ahead Market

DAM

Participation in DAM

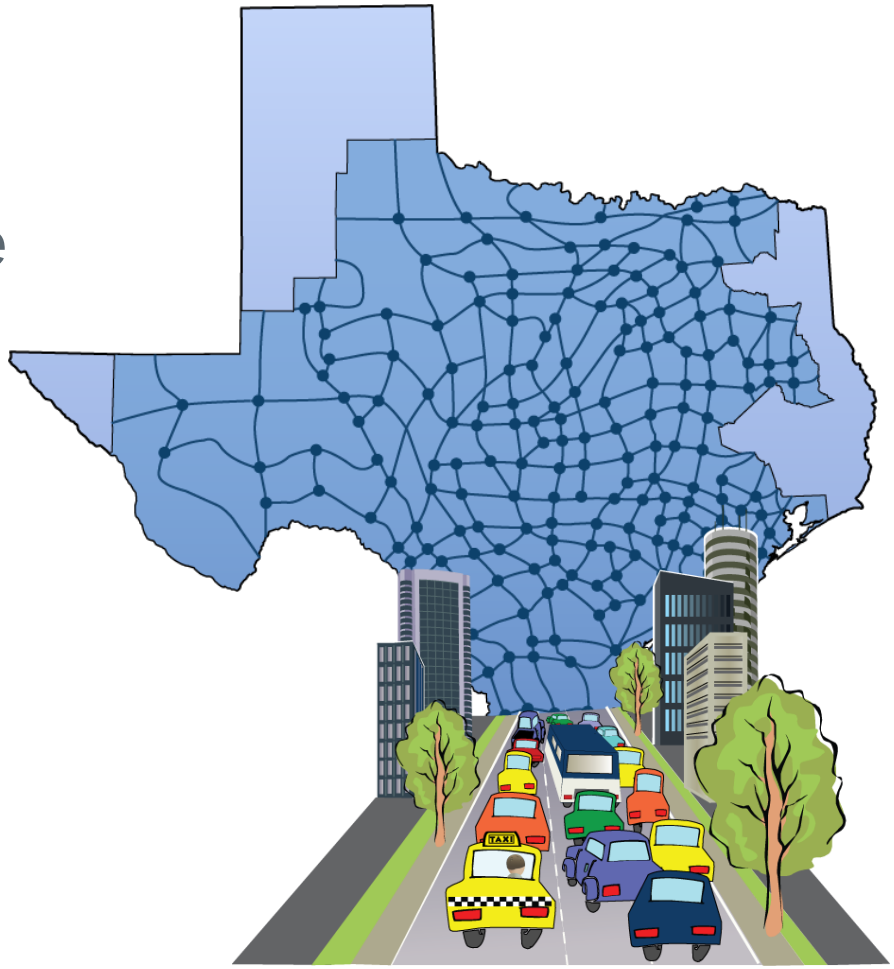
- Energy
- AS
- **PTP Obligations**

Outcome #1

Charge to QSE for Awarded PTP Obligation Bid in DAM

Day-Ahead Market PTP Obligations

- Hedge against congestion costs in Real-Time
- Charge or payment when Grid is congested in Real-Time



PTP 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*

DAM Settlements: Charge for Purchased PTP Obligation

- QSE3 Bids to buy a PTP Obligation in the DAM

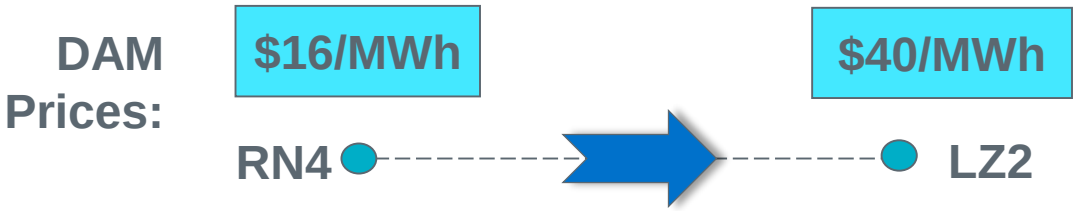
- Source and Sink of PTP Obligation
- Not-to-Exceed Price ($ / MW / hr)
- Quantity (MW)
- Range of hours

DAM Settlements: Charge for Purchased PTP Obligation

- QSE3 Bids to buy a PTP Obligation in the DAM
  - Not-to-Exceed Price = $26/MWh
  - Quantity = 10 MW
  - Source Resource Node 4 (RN4)
  - Sink Load Zone 2 (LZ2)
- ERCOT executes the DAM Clearing Process

DAM Settlements: Charge for Purchased PTP Obligation

- QSE3 Bids to buy a PTP Obligation in the DAM
  - Not-to-Exceed Price = $26/MWh
  - Quantity = 10 MW
  - Source is Resource Node 4 (RN4)
  - Sink is Load Zone 2 (LZ2)
- ERCOT executes the DAM Clearing Process



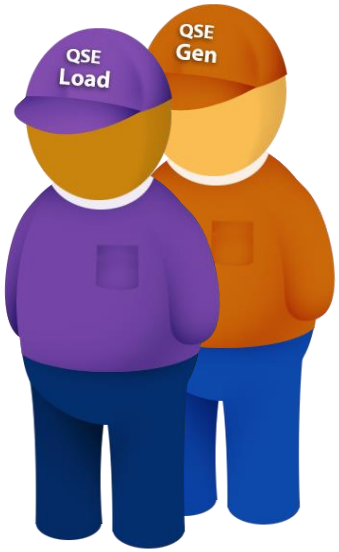
PTP Obligation Price is $24/MWh

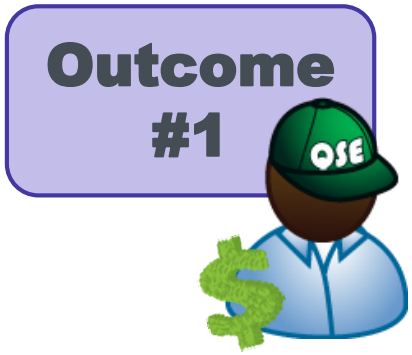
ERCOT awards QSE3 its PTP Obligation Bid

DAM Settlements: Charge for Purchased PTP Obligation

QSE3 purchased:

- 10 MW of PTP Obligation
- Source Resource Node 4 (RN4)
- Sink Load Zone 2 (LZ2)
- Price of $24/MWh





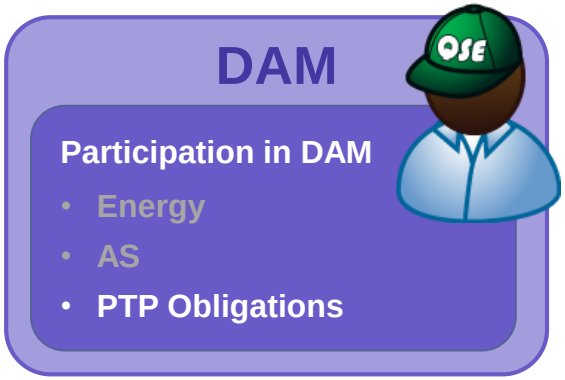
- Settled hourly
- Settlement calculation is:

(Price) * (Quantity)

(SPP at Sink – SPP at Source) * (Quantity)

($24/MWh) * (10 MW) = $240

Settlement for PTP Obligations Acquired in the DAM



$$DARTOBLAMT_{q,(j,k)} = DAOBLPR_{(j,k)} * RTOBL_{q,(j,k)}$$

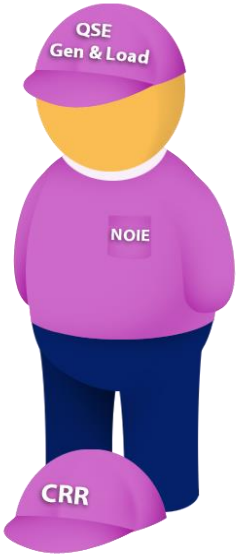
$$DAOBLPR_{(j,k)} = DASPP_{k} - DASPP_{j}$$

Determinants
Day-Ahead Real-Time Obligation Amount
Day-Ahead Obligation Price
Real-Time Obligation
Day-Ahead Settlement Point Price

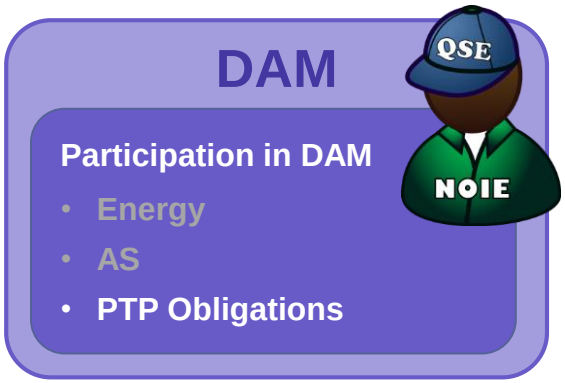
q = QSE
j = Source Settlement Point
k = Sink Settlement Point

Special Product for NOIEs

- A NOIE (or their QSE) can buy PTP Obligations linked to PTP Options they own.
- Cash out PTP Options in DAM
- Buy like quantity of DAM PTP Obligations
- No charge in Real-time if price spread is negative



Settlement for DAM PTP Obligations with Links to Options



$$DARTOBLLOAMT_{q,(j,k)} = Max(0, DAOBLPR_{(j,k)}) * RTOBLLO_{q,(j,k)}$$

$$DAOBLPR_{(j,k)} = DASPP_{k} - DASPP_{j}$$

Determinants
Day-Ahead Real-Time Obligation with Links to an Option Amount
Day-Ahead Obligation Price
Real-Time Obligation with Links to an Option
Day-Ahead Settlement Point Price

q = QSE
j = Source Settlement Point
k = Sink Settlement Point

Day-Ahead Market Settlements

DAM

Participation in DAM

- Energy
- Ancillary Services
- PTP Obligations

DAM Commitment

- Make-Whole

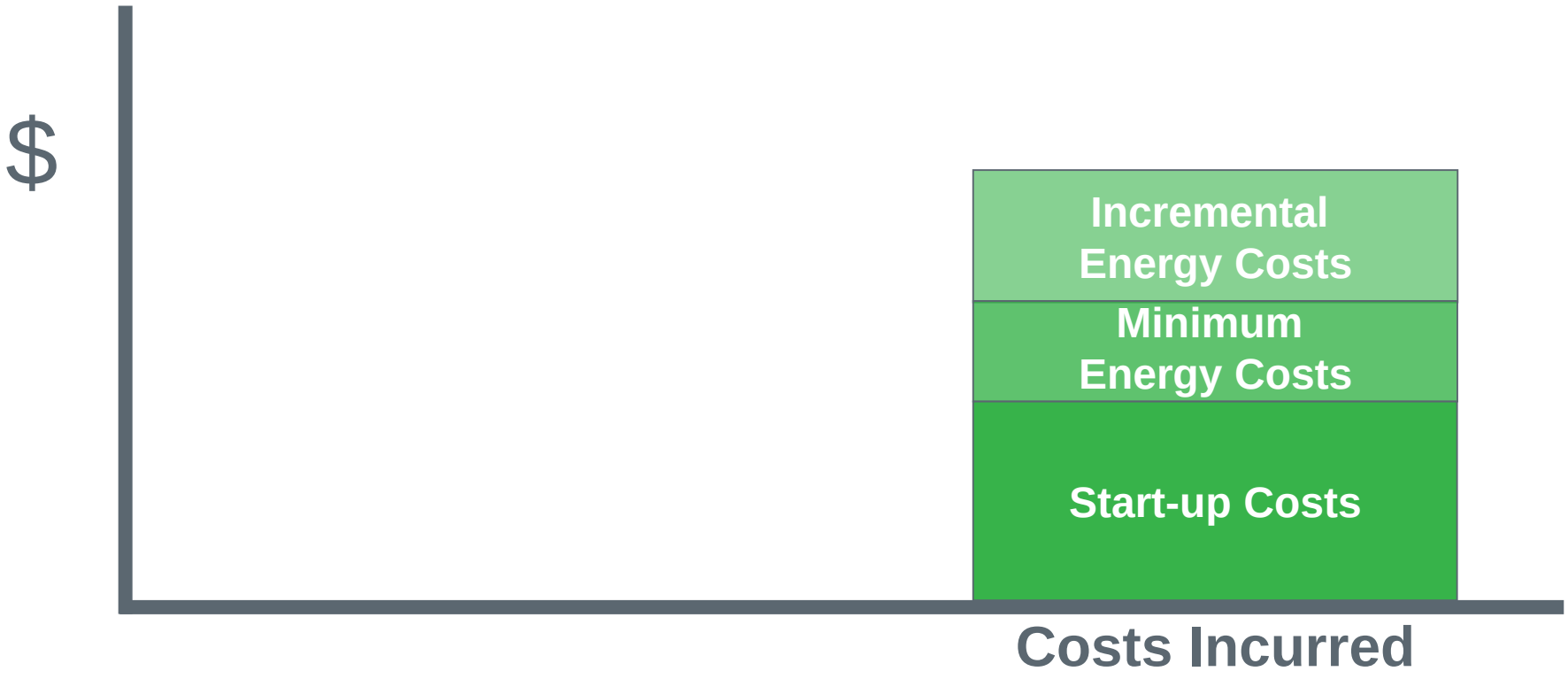
Settlement of CRRs in the DAM

Outcome #1

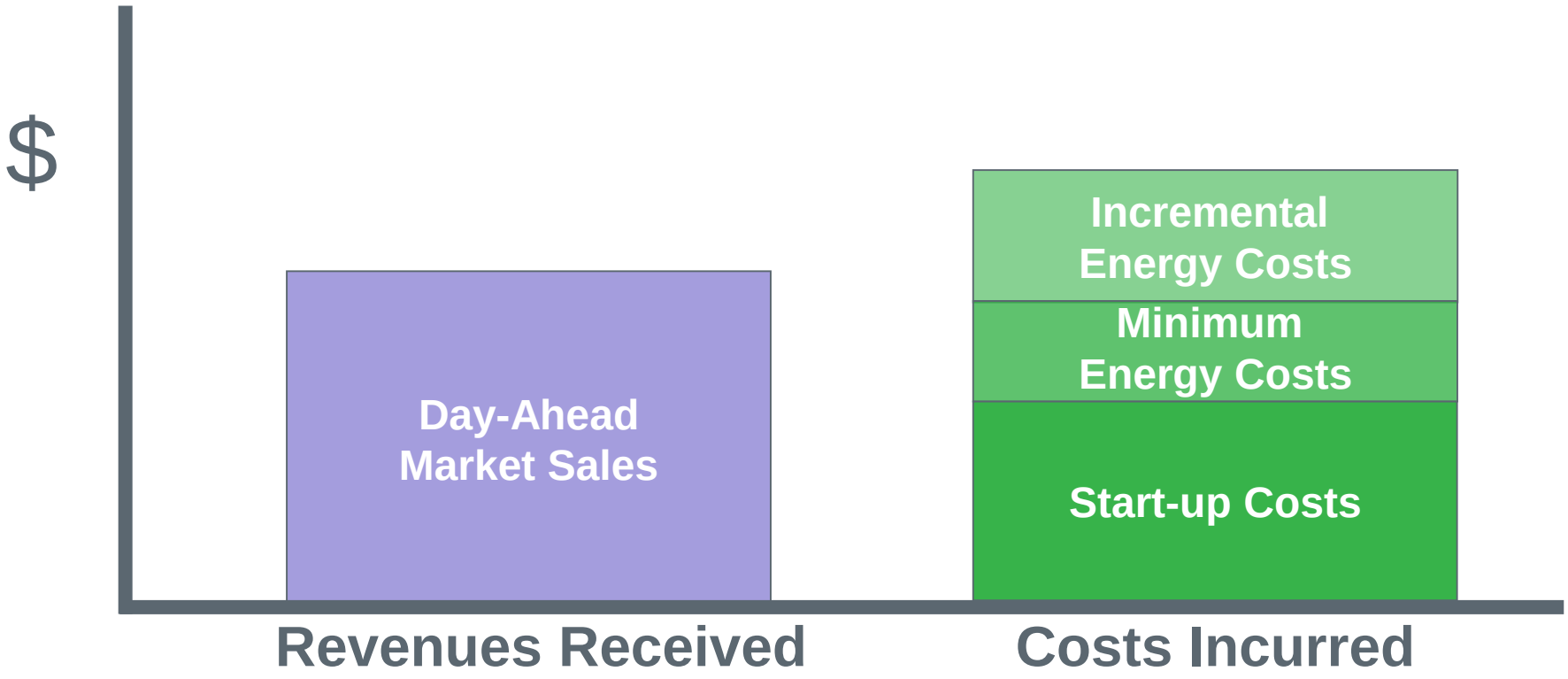
Make-Whole Payment to DAM-Committed QSE with a Three-Part Supply Offer

What:	A payment to ensure generation costs are met when Resource is DAM-committed
Why:	Guarantees that a DAM-committed Resource with a Three-Part Supply Offer recovers its allowable cost to Start-Up and its operating energy costs

Calculating the Day-Ahead Make-Whole Payment



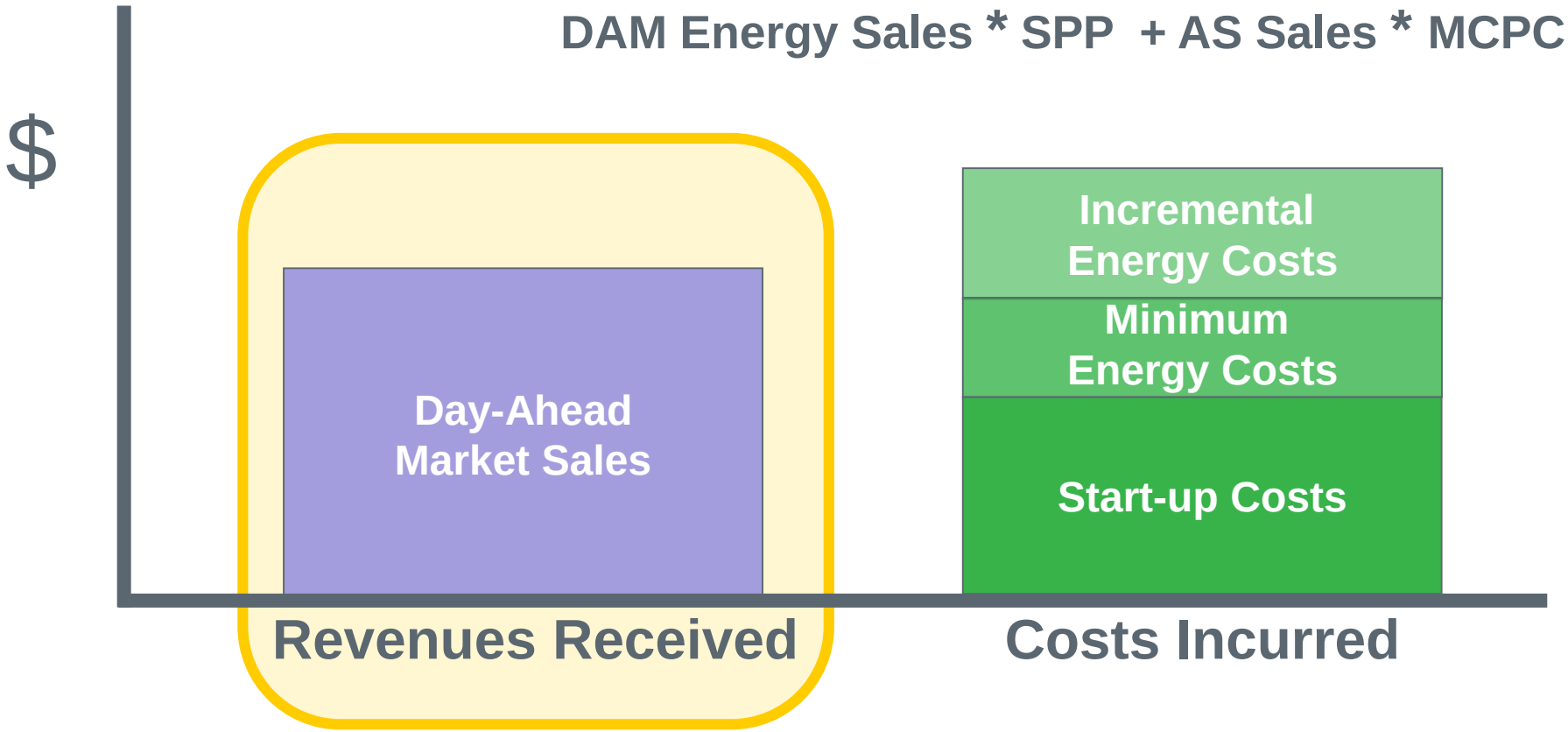
Calculating the Day-Ahead Make-Whole Payment



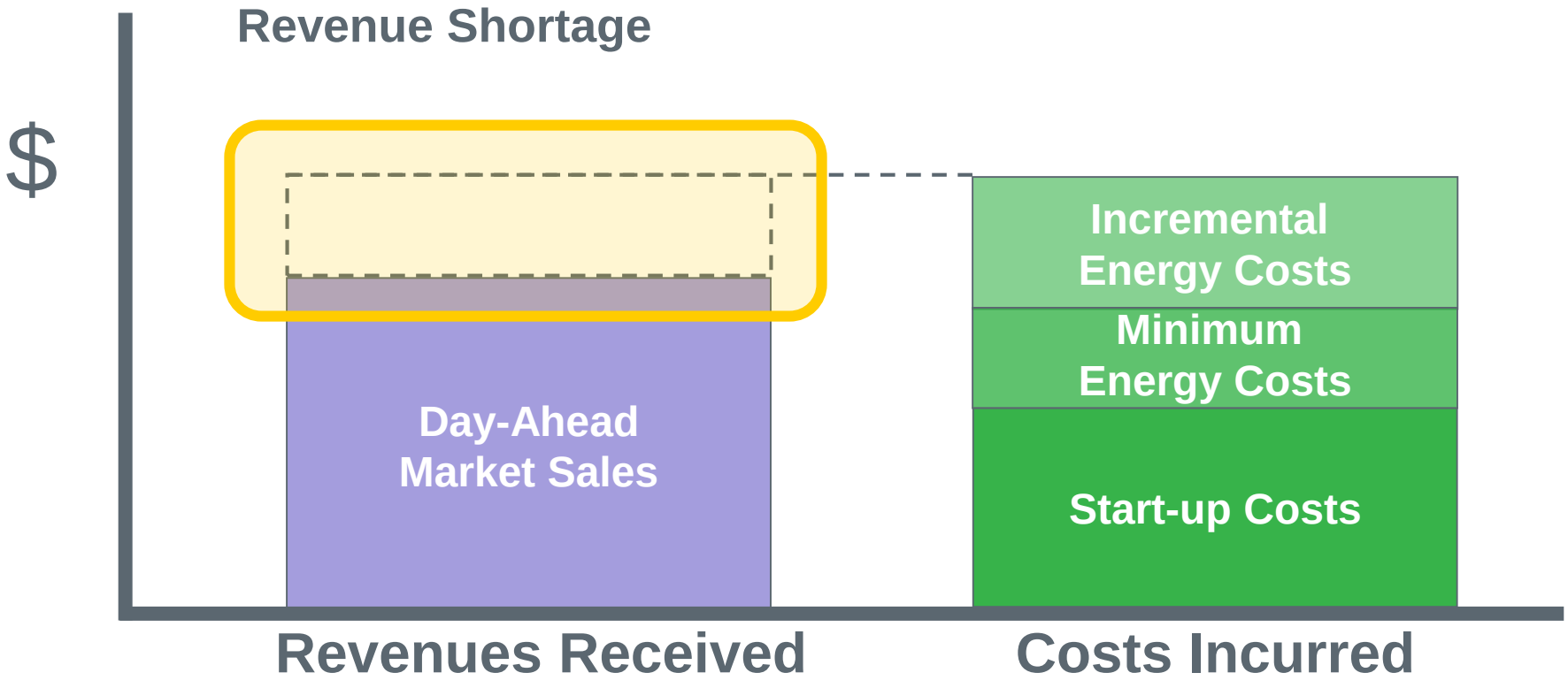
Calculating the Day-Ahead Make-Whole Payment

Day-Ahead Market Sales =

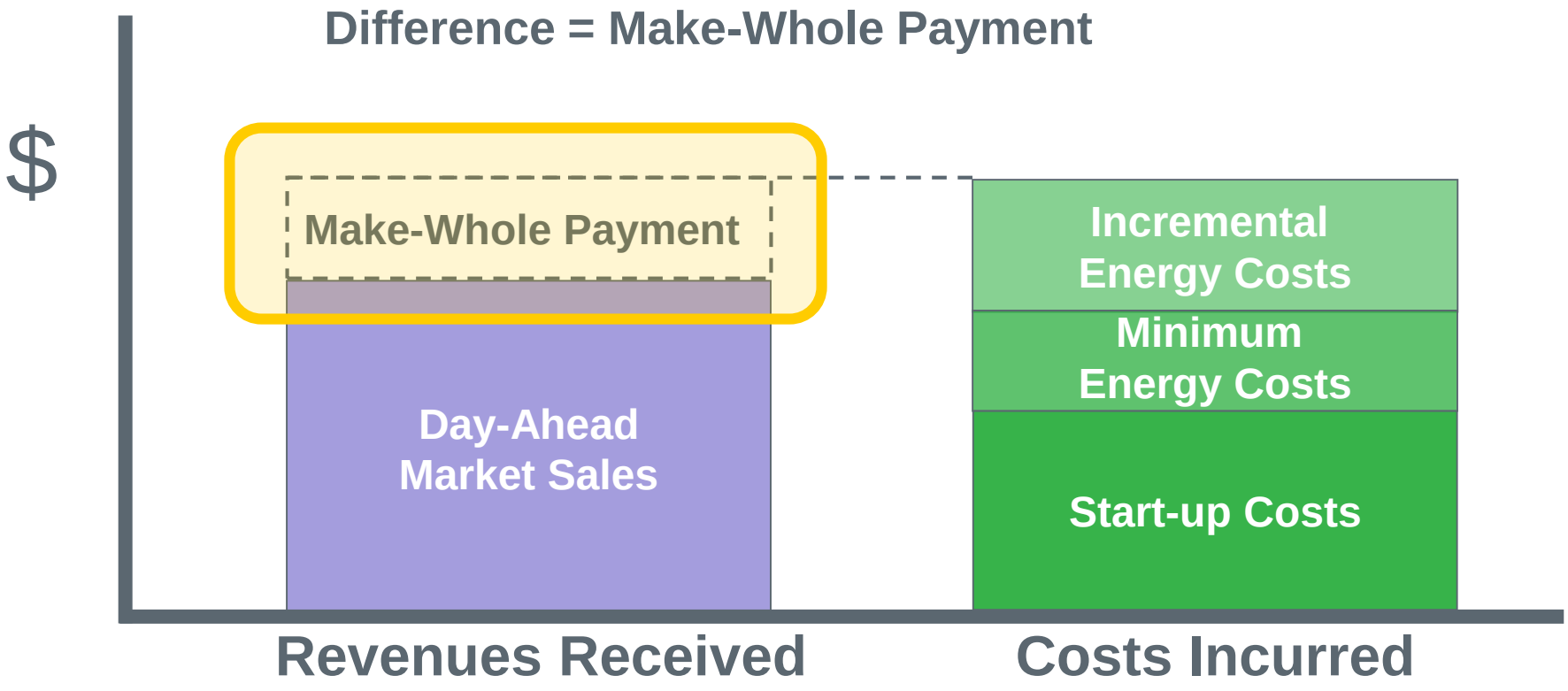
DAM Energy Sales * SPP + AS Sales * MCPC



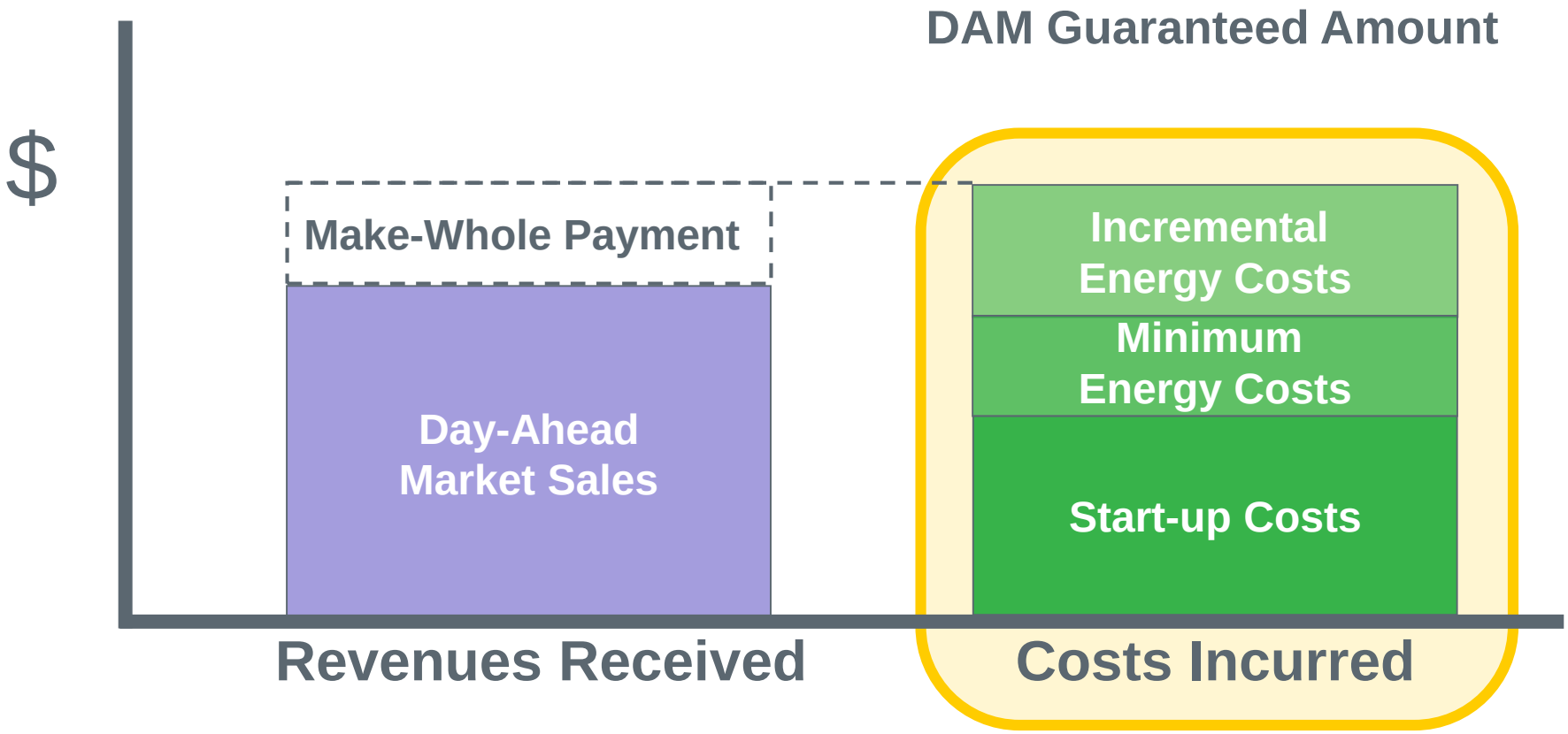
What if revenues are less than costs?



What if revenues are less than costs?



What if revenues are less than costs?



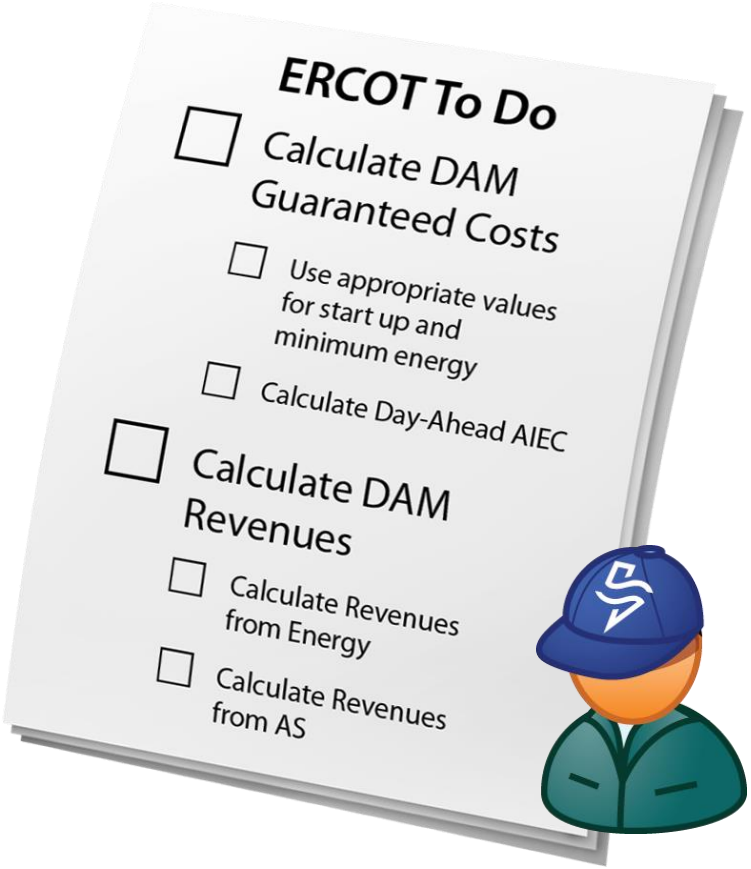
Day-Ahead Make-Whole Payment

$$\left(\text{DAM Revenues}\right) < \left(\text{DAM Guaranteed Amount}\right)$$

A QSE will receive a Make-Whole Payment if its revenues from the DAM are less than the Startup, Minimum Energy, and Operating costs

Day-Ahead Make-Whole Payment

(DAM Revenues) < (DAM Guaranteed Amount)



Calculate DAM Guaranteed Costs

DAM Guaranteed Costs = (Startup costs + Minimum energy costs + Incremental Energy Costs)

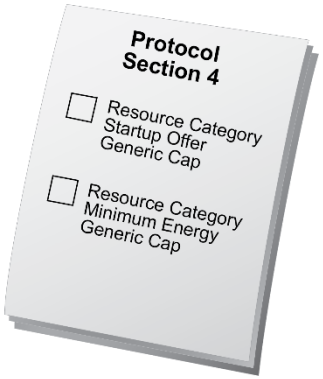
Calculate DAM Guaranteed Costs

DAM Guaranteed Costs =

(Startup costs + Minimum energy costs + Incremental Energy Costs)

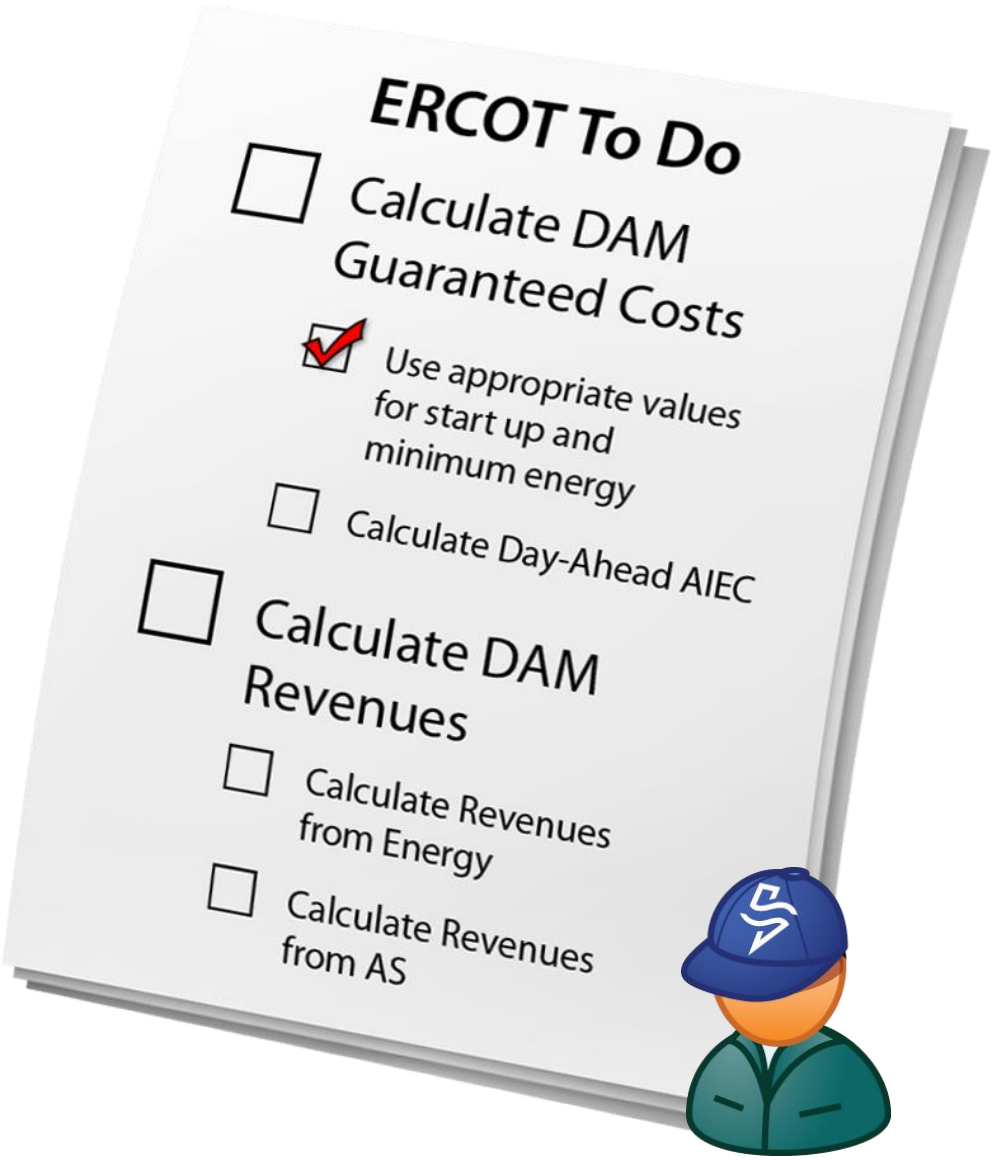
- Minimum Energy Offer (MEO)
- Low Sustained Limit (LSL)

Startup and Minimum Energy costs subject to caps

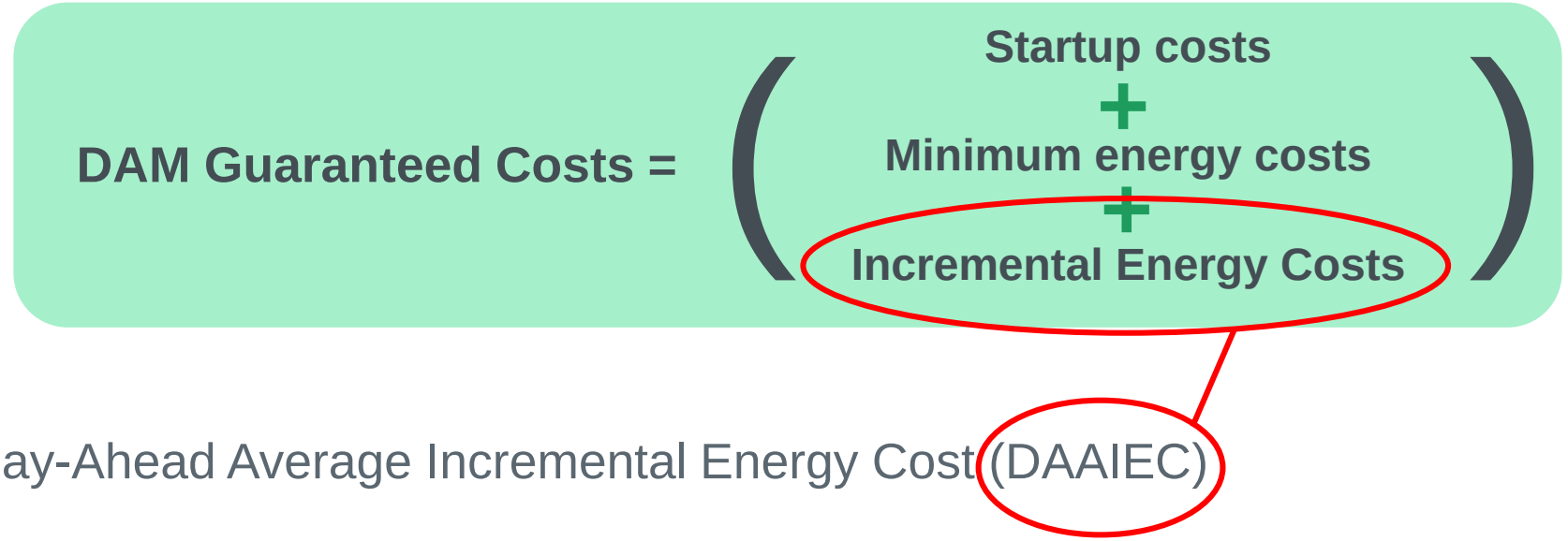


If ERCOT has Verifiable Costs		Otherwise		
Startup Cap	=	Verifiable Startup Costs	Startup Cap	= Resource Category Startup Offer Generic Cap
Minimum Energy Cap	=	Verifiable Minimum-Energy Costs	Minimum Energy Cap	= Resource Category Minimum-Energy Generic Cap

Day-Ahead Make-Whole Payment



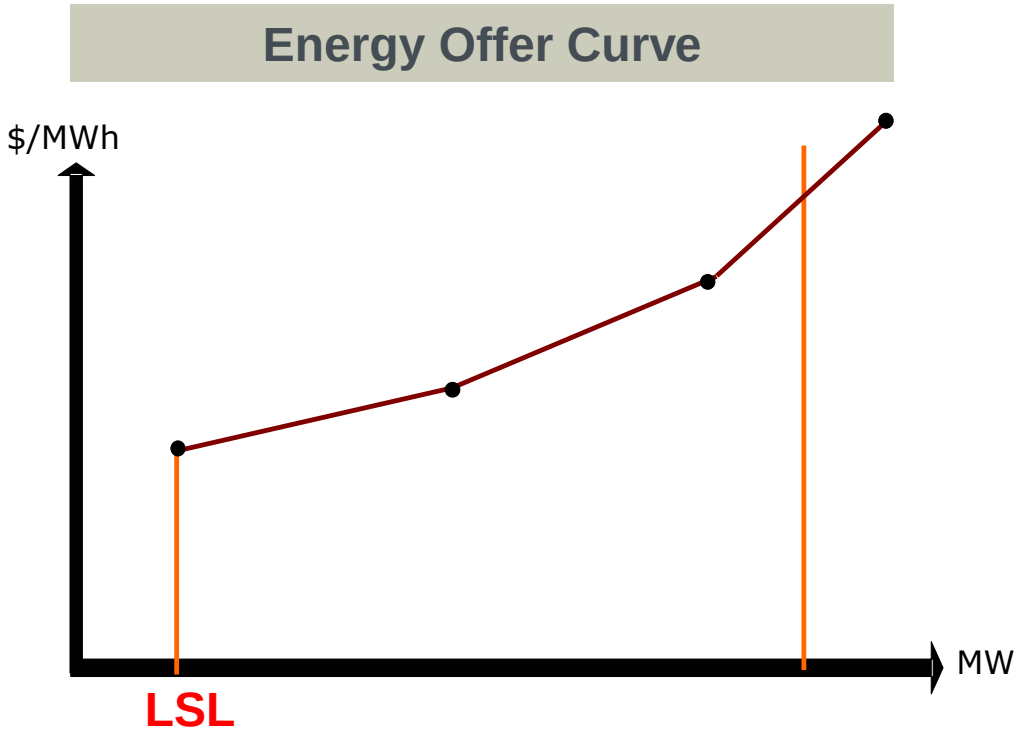
Calculate DAM Guaranteed Costs



- Day-Ahead Average Incremental Energy Cost (DAAIEC)

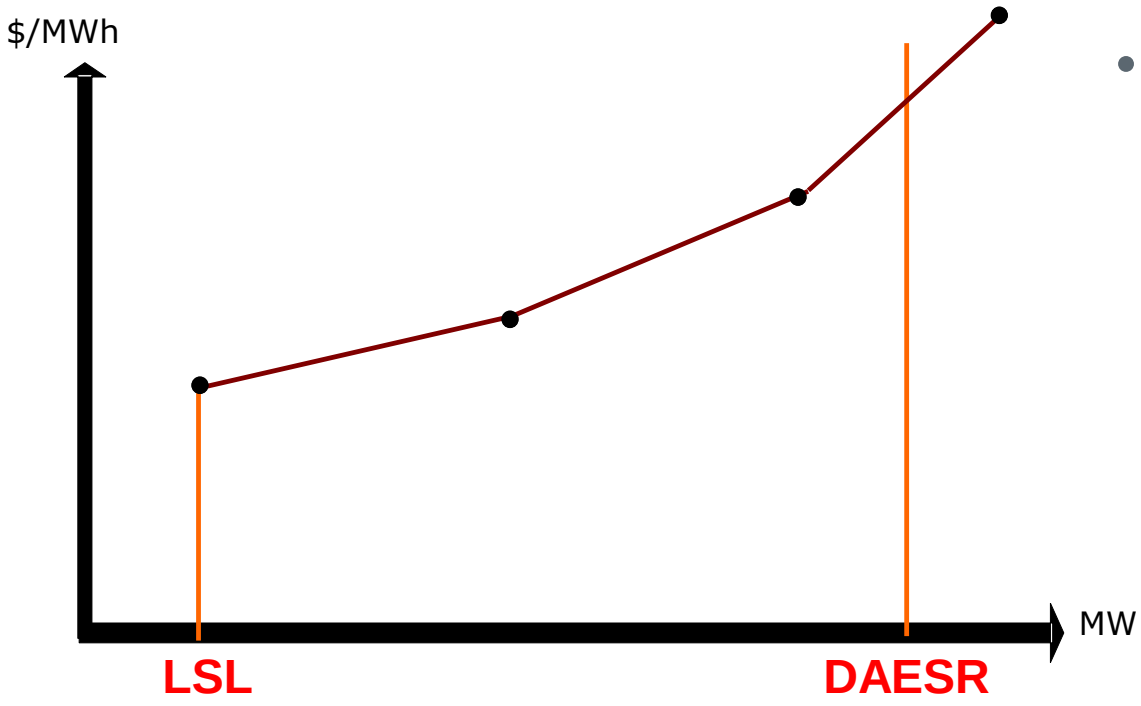
Calculate DAM Guaranteed Costs

Calculate Average Incremental Energy Cost (AIEC)



Calculates the additional cost for a Generation Resource to produce energy above its LSL

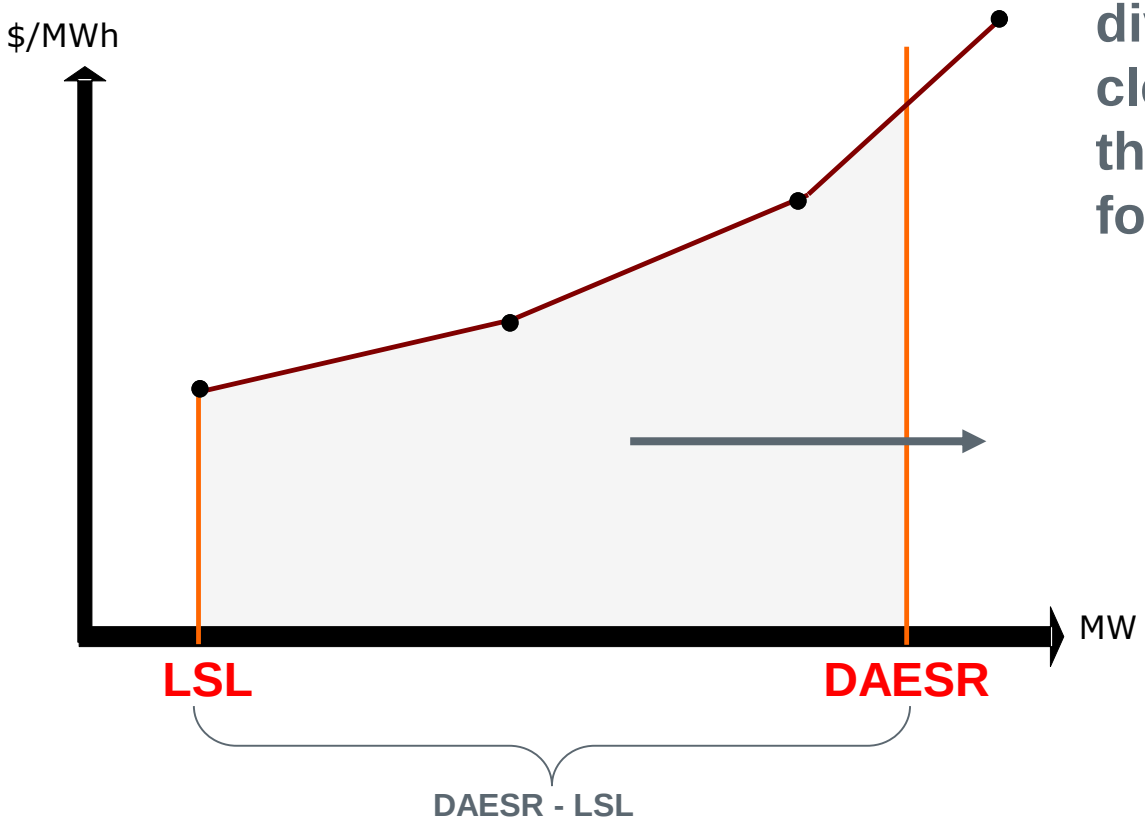
Average Incremental Energy Cost (AIEC)



- LSL is the minimum sustained energy production
- DAESR is amount of energy that was cleared in the DAM

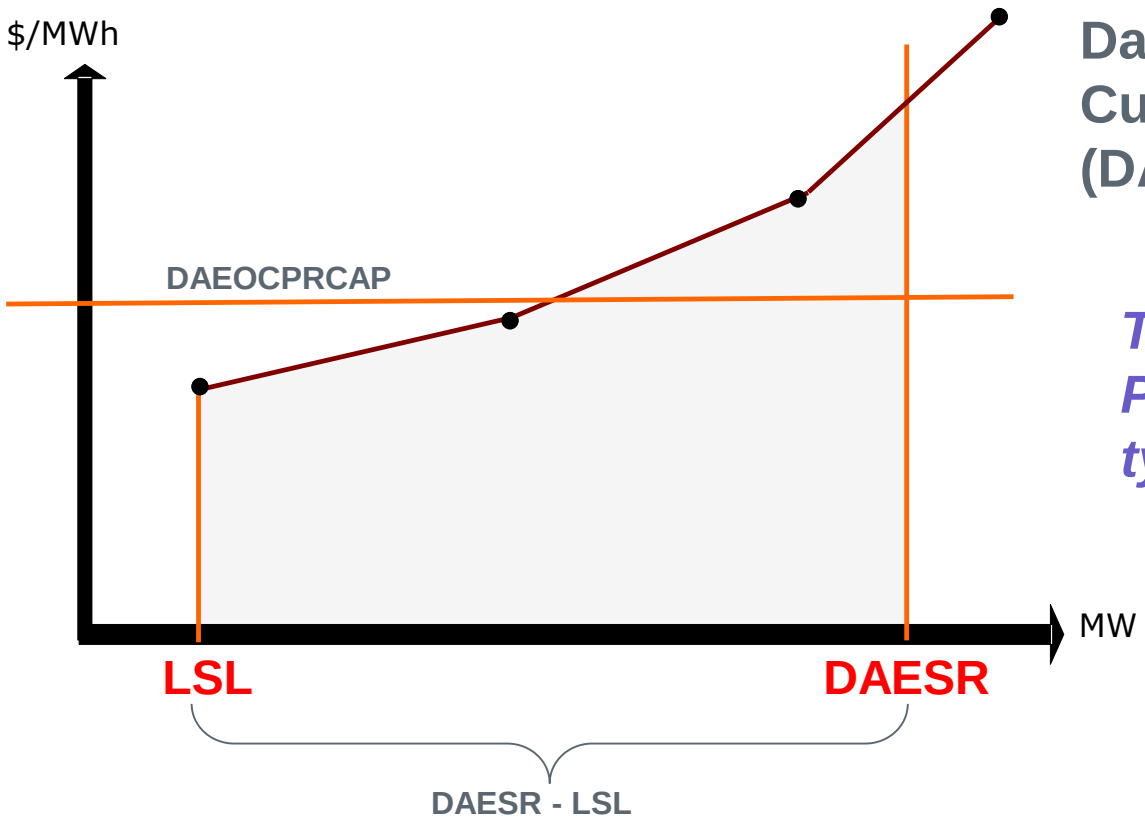
Determinants
Low **S**ustained **L**imit
Day-**A**head **E**nergy **S**ale from **R**esource

Average Incremental Energy Cost (AIEC)



The area under the curve divided by the energy cleared above LSL gives the average cost per MWh for that energy.

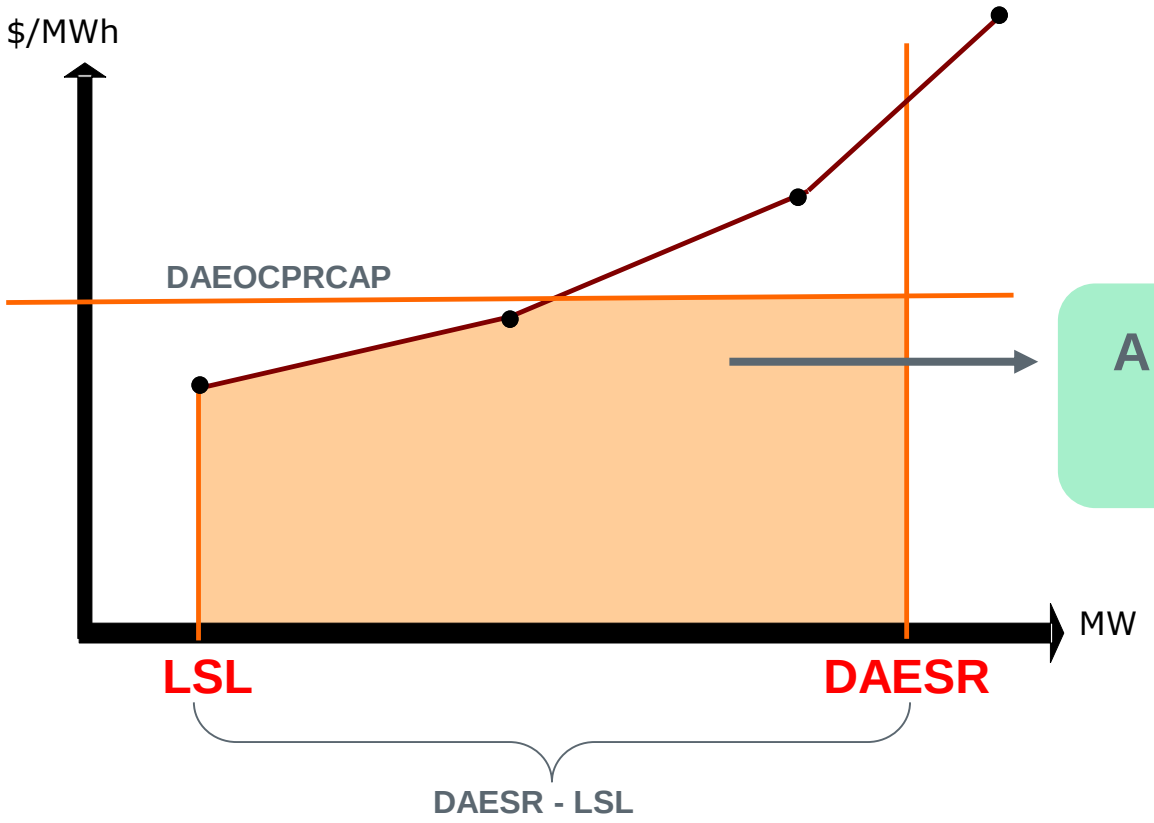
Average Incremental Energy Cost (AIEC)



For calculating Make-Whole, the curve is capped by the Day-Ahead Energy Offer Curve Price Cap (DAEOCPRCAP)

The cap is defined in the Protocols by technology type.

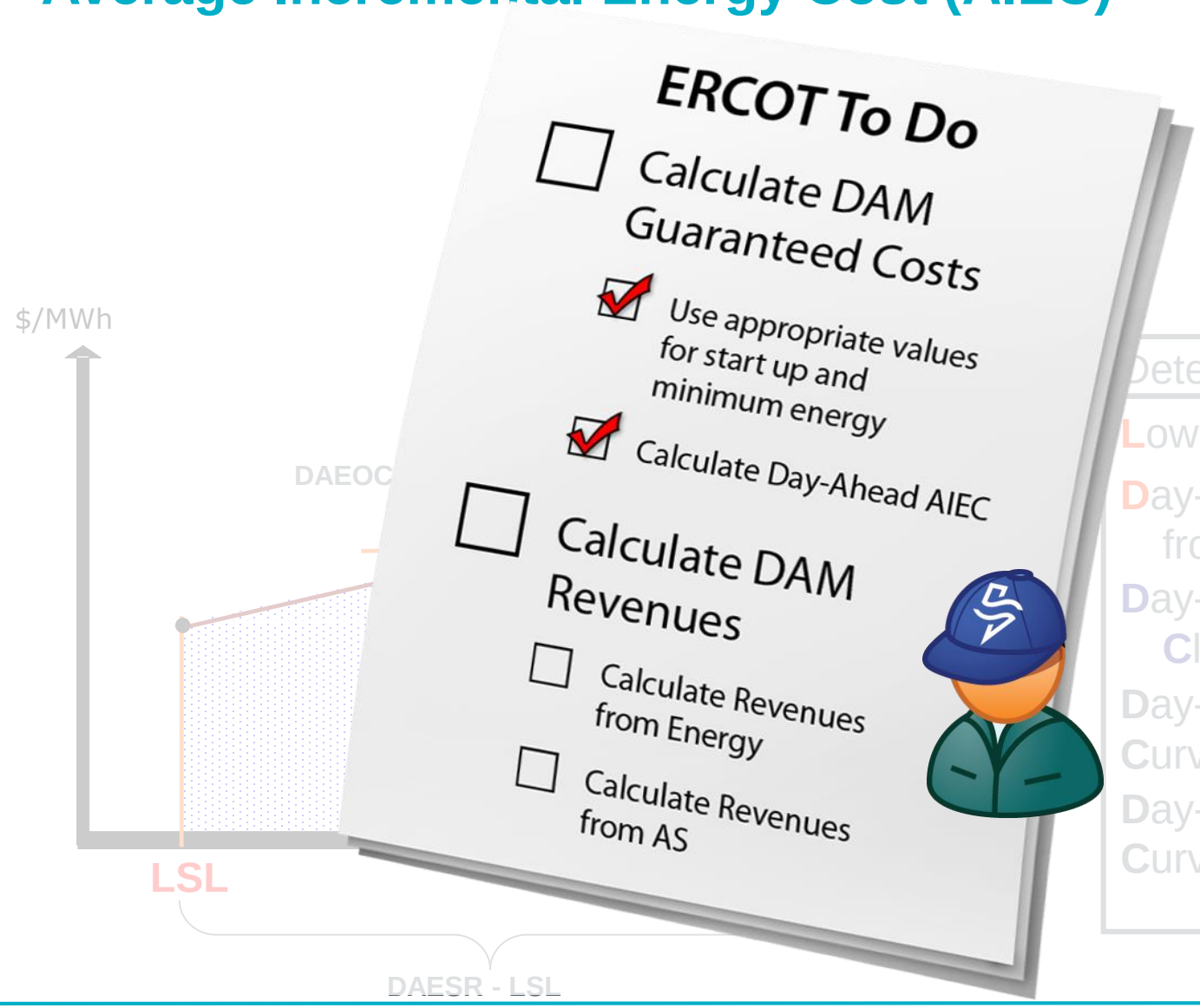
Average Incremental Energy Cost (AIEC)



$$AIEC = \frac{\text{Area under curve}}{\text{(DAESR-LSL)}}$$

Average cost for supplying energy from the LSL to the DAESR for the hour

Average Incremental Energy Cost (AIEC)



Determinants

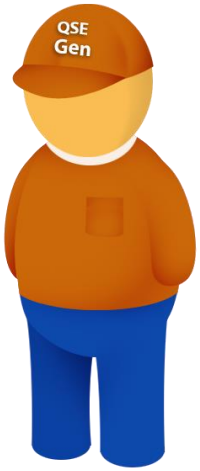
- Low Sustained Limit
- Day-Ahead Energy Sale from Resource
- Day-Ahead Energy Sale Clearing Price
- Day-Ahead Energy Offer Curve Price Cap
- Day-Ahead Energy Offer Curve Quantity Cap

Day-Ahead Make-Whole Payment

(DAM Revenues) < (DAM Guaranteed Amount)

QSE1's Resource is committed for 4 hours

- Awarded 50 MW per hour
- Low Sustained Limit is 10MW
- From Three-Part Supply Offer
  - Startup Offer = $5000
  - Minimum Energy Offer = $10/MWh
  - AIEC = $20/MWh
- Startup Cap = $4,400
- Minimum Energy Cap = $12/MWh

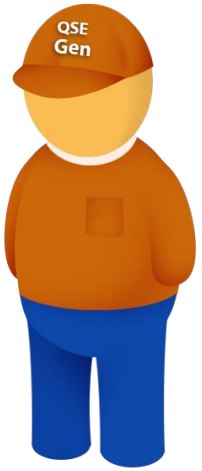


Day-Ahead Make-Whole Payment

(DAM Revenues) < (DAM Guaranteed Amount)

$$DAMGCOST_{q,p,r} = Min(DASUO_{q,p,r}, DASUCAP_{q,p,r}) + \sum(Min(DAMEO_{q,p,r,h}, DAMECAP_{q,p,r,h}) * DALSL_{q,p,r,h}) + \sum(DAAIEC_{q,p,r,h} * (DAESR_{q,p,r,h} - DALSL_{q,p,r,h}))$$

Startup Offer (DASUO) and Cap (DASUCAP)
Minimum Energy Offer (DAMEO) and Cap (DAMECAP)
Low Sustained Limit (DALSL)
Day-Ahead AIEC (DAAIEC)
Day-Ahead Energy Sales (DAESR)



Day-Ahead Make-Whole Payment

(DAM Revenues) < (DAM Guaranteed Amount)

DAMGCOST = Min (DASUO, DASUCAP)
+ ∑(Min (DAMEO, DAMECAP) * DALSL)
+ ∑(DAAIEC * (DAESR – DALSL))

DAMGCOST = Min ($5000, $4400)
+ (Min ($10/MWh, $12/MWh) * 10MW) * 4h
+ ($20/MWh * (50MW –10MW)) * 4h

= $4400 + $400 + $3200

= $8000

Day-Ahead Make-Whole Payment

Trigger #1

ERCOT To Do

- [x] Calculate DAM Guaranteed Costs
  - [x] Use appropriate values for start up and minimum energy
  - [x] Calculate Day-Ahead AIEC
- [ ] Calculate DAM Revenues
  - [ ] Calculate Revenues from Energy
  - [ ] Calculate Revenues from AS

$DAMGCOST_{q, p, r} = M$

$+ \sum($ $, r, h$) * $DALSL_{q, p, r, h}$)

$+ \sum$ $DALSL_{q, p, r, h}$))

(DAM Guaranteed Amount)

Startup Offer (DA
Minimum Energy P)
Low Sustained
Day-Ahead AIEC (
Day-Ahead Energy Sales (DAESR)

Day-Ahead Make-Whole Payment

(DAM Revenues) < ($8000)

Revenues from Energy

+

Revenues from Ancillary Services

Day-Ahead Make-Whole Payment

(DAM Revenues) < ($8000)

Energy Revenues for Hour 1

Revenues = (-1) * (Price) * (Quantity)

DAEREV = (-1) * DASPP * DAESR

= (-1) * $30/MWh * 50 MW

= -$1500

Day-Ahead Make-Whole Payment

(DAM Revenues) < ($8000)

Ancillary Services Revenues for Hour 1

Revenues = (-1) * (Price) * (Quantity)

$$DAASREV_{q,r,h} = ((-1) * MCPCRU_{DAM,h} * PCRUR_{r,q,DAM,h}) + ((-1) * MCPCRD_{DAM,h} * PCRDR_{r,q,DAM,h}) + ((-1) * MCPCRR_{DAM,h} * PCRRR_{r,q,DAM,h}) + ((-1) * MCPCNS_{DAM,h} * PCNSR_{r,q,DAM,h})$$

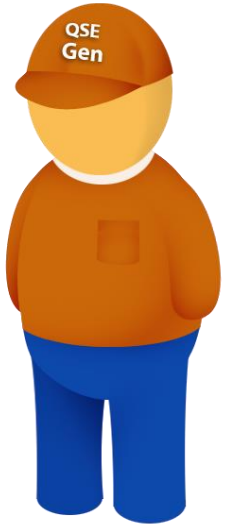
$$-\$180_{q,r,h} = ((-1) * \$5/MW * 10\ MW) + ((-1) * \$5/MW * 10\ MW) + ((-1) * \$10/MW * 5\ MW) + ((-1) * \$15/MW * 2\ MW)$$

Day-Ahead Make-Whole Payment

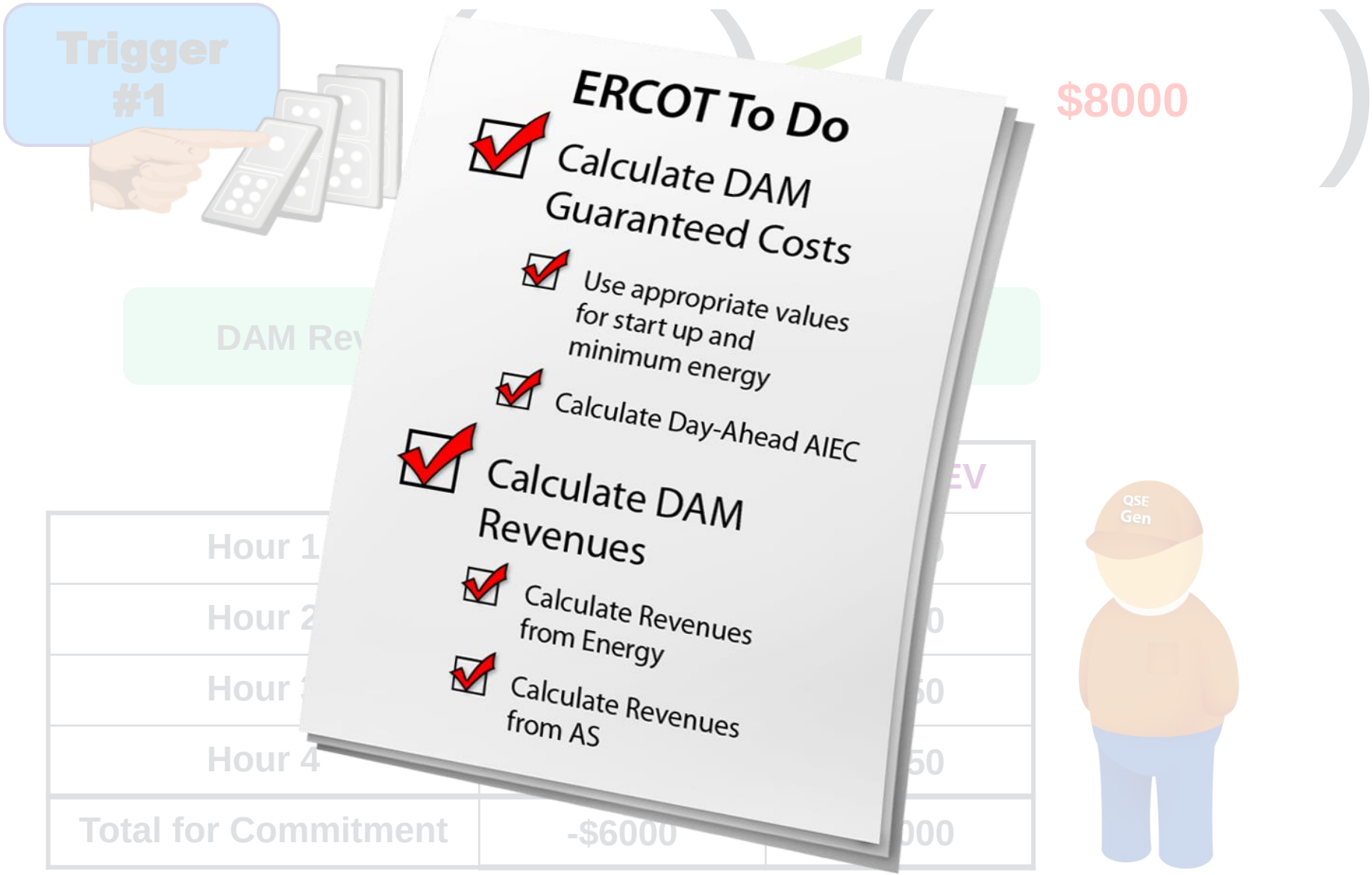
($7000) < ($8000)

DAM Revenues = DAEREV + DAASREV

	DAEREV	DAASREV
Hour 1	-$1500	-$180
Hour 2	-$1500	-$220
Hour 3	-$1500	-$250
Hour 4	-$1500	-$350
Total for Commitment	-$6000	-$1000

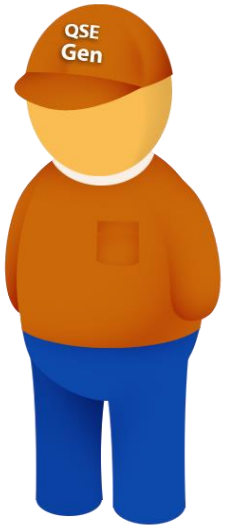


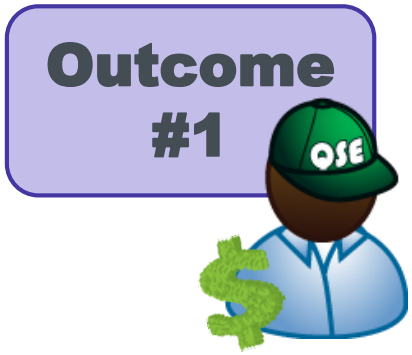
Day-Ahead Make-Whole Payment



Day-Ahead Make-Whole Payment

($7000) < ($8000)

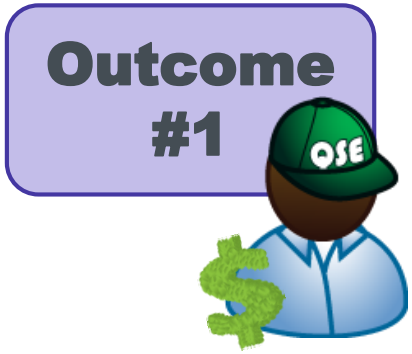




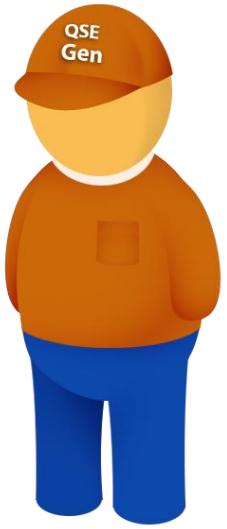
- DAM Revenues are less than DAM Guaranteed Costs for QSE1 unit 5
- QSE1 eligible for DAM Make-Whole Payment

Day-Ahead Make-Whole Payment

($7000) < ($8000)



DAM Make-Whole Payment for each hour



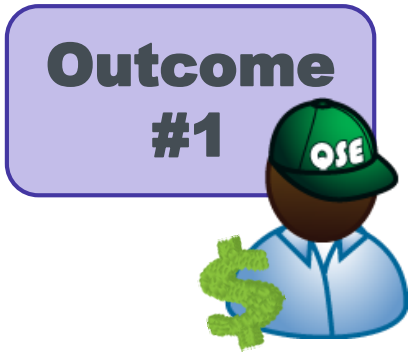
$$DAMWAMT_{q, p, r, h} =$$

$$(-1) * \text{Max}\,(0, DAMGCOST_{q, p, r} + \sum DAEREV_{q, p, r, h} + \sum DAASREV_{q, r, h})$$

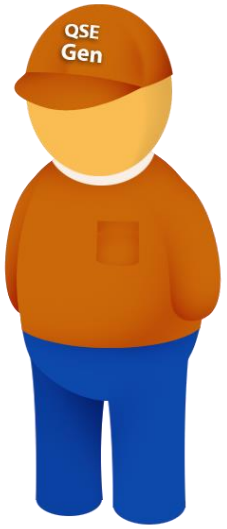
$$* (DAESR_{q, p, r, h} / \sum DAESR_{q, p, r, h})$$

Day-Ahead Make-Whole Payment

($7000) < ($8000)



DAM Make-Whole Payment for each hour



DAMWAMT = (-1) * Max (0, **$8000** + **$-6000** + **$-1000**)
* **50 MW** / (**200 MW**)

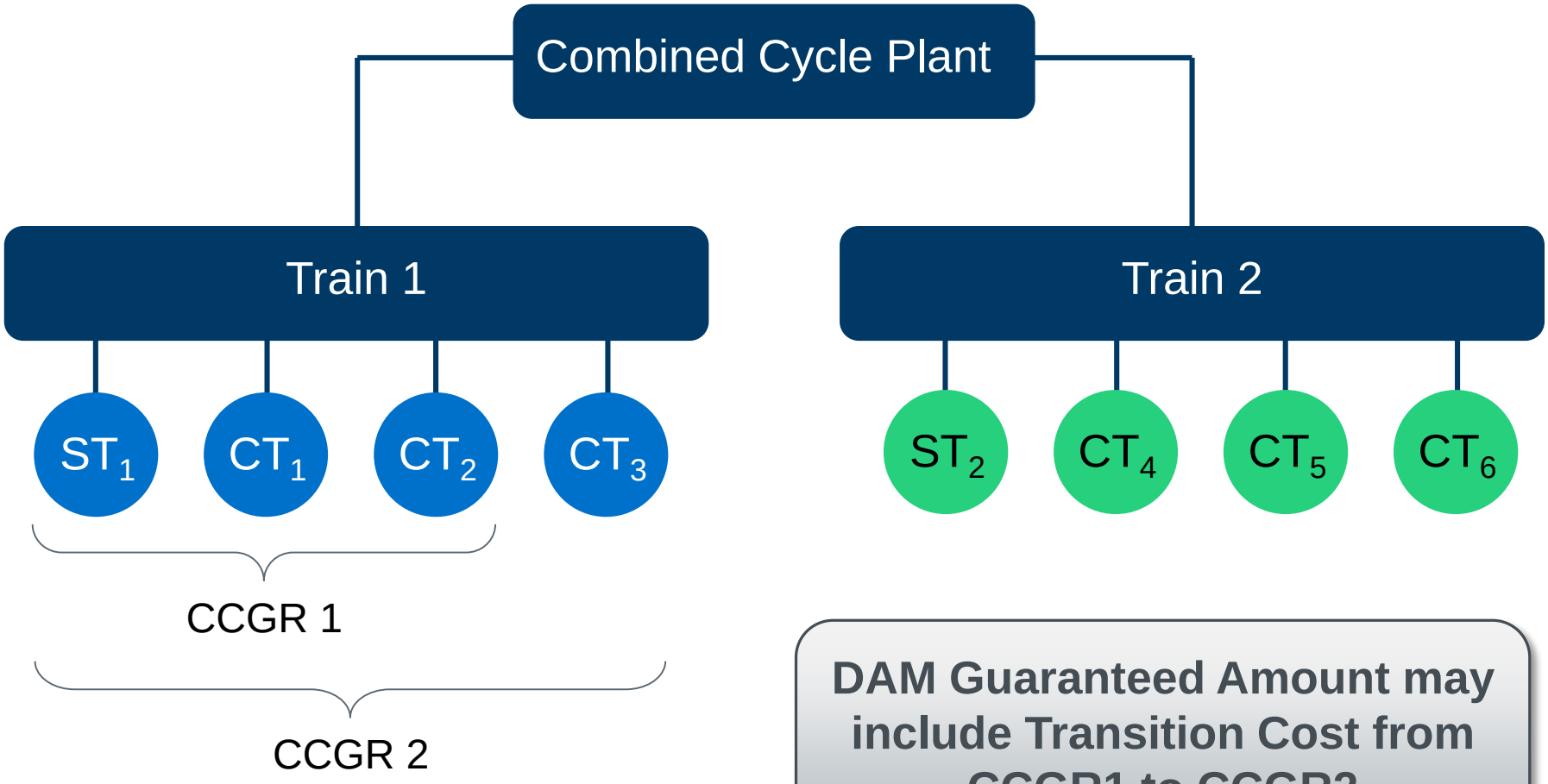
= (-1) * Max (0, $1000) * **0.25** = **-$250**

What if the DAM-committed Resource is part of a Combined Cycle Plant?

- Make-Whole is paid at the Train level
- DAM Guaranteed Amount
  - Start-up Costs
  - Minimum and Incremental Energy Costs
  - May include Transition Costs

DAM may start any offered CCGR and transition from one offered CCGR to another

Day-Ahead Make Whole - Combined Cycle Resources



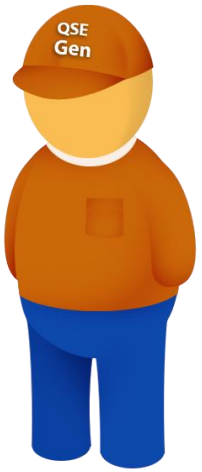
DAM Guaranteed Amount may include Transition Cost from CCGR1 to CCGR2

Day-Ahead Make Whole - Combined Cycle Resources

(DAM Revenues) < (DAM Guaranteed Amount)

$$DAMGCOST_{q,p,r} = Min(DASUO_{q,p,r}, DASUCAP_{q,p,r}) + \text{Transition Cost} + \sum(Min(DAMEO_{q,p,r,h}, DAMECAP_{q,p,r,h}) * DALSL_{q,p,r,h}) + \sum(DAAIEC_{q,p,r,h} * (DAESR_{q,p,r,h} - DALSL_{q,p,r,h}))$$

Startup Offer (DASUO) and Cap (DASUCAP)
Minimum Energy Offer (DAMEO) and Cap (DAMECAP)
Low Sustained Limit (DALSL)
Day-Ahead AIEC (DAAIEC)
Day-Ahead Energy Sales (DAESR)



Day-Ahead Make Whole – Transition Cost

(DAM Revenues) < (DAM Guaranteed Amount)

$$\text{Transition Cost} = \text{Max}(0, \text{Min}(\text{DASUO}_{\text{afterCCGR}}, \text{DASUCAP}_{\text{afterCCGR}}) - \text{Min}(\text{DASUO}_{\text{beforeCCGR}}, \text{DASUCAP}_{\text{beforeCCGR}}))$$

afterCCGR: The CCGR to which a Combined Cycle Train transitions

beforeCCGR: The CCGR from which a Combined Cycle Train transitions

Refer to your Settlements Workbook

In a small group, respond to the questions that relate to Scenario #DAM1.

You have 5 – 10 minutes to complete your questions.

If you cannot complete all questions, don't worry – all questions will be reviewed as a class.

DAM

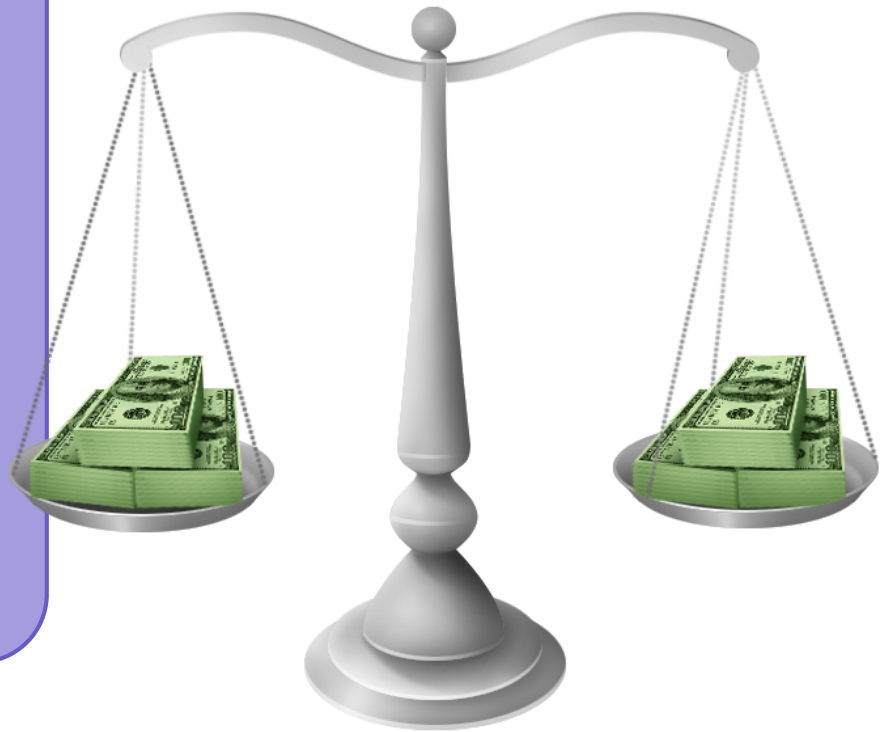
Participation in DAM

- Energy
- Ancillary Services
- PTP Obligations

DAM Commitment

- Make-Whole

Settlement of CRRs in the DAM



Outcome #1

Make-Whole Charge to a QSE with one or more cleared DAM Energy Bids and/or PTP Obligation Bids

What:	Charge to collect all funds needed for the Make-Whole Payment
Why:	Keep ERCOT revenue neutral

Day-Ahead Make-Whole Charge

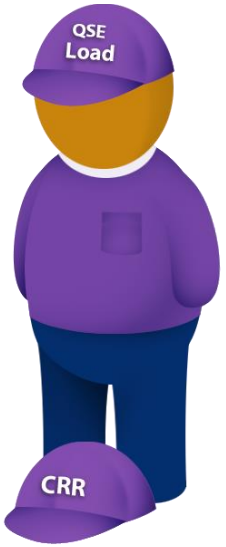
$$\left(\text{Total DAM Make-Whole Payments ERCOT-Wide}\right) * \left(\text{DAM Energy Purchase Ratio Share}\right)$$

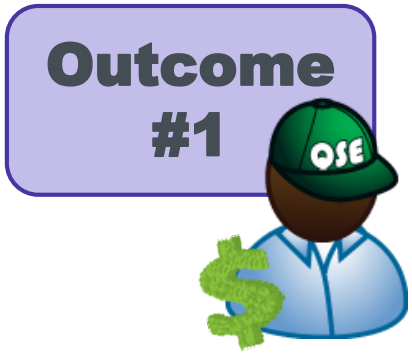
Where…

$$\text{DAM Energy Purchase Ratio Share} = \left(\frac{\text{A QSE's DAM Energy Purchase}}{\text{Total DAM Energy Purchases ERCOT - Wide}}\right)$$

Day-Ahead Make-Whole Charge

- QSE3 has a cleared Energy Bid from DAM
  - Purchased 50 MW in the DAM
- ERCOT-Wide total energy purchases in the DAM:
  - 500 MW

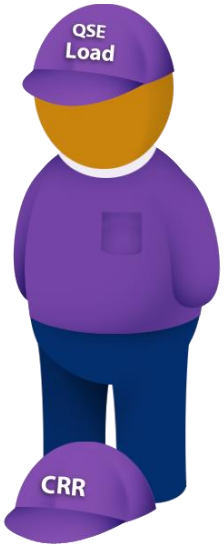


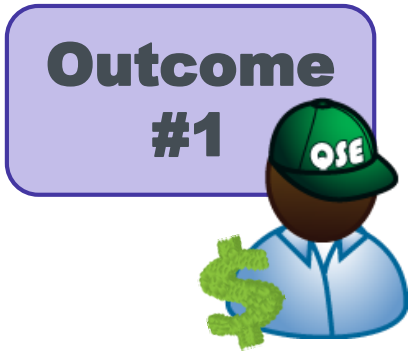


$$\text{Make-Whole Charge} = (-1) * \left(\text{Total DAM Make-Whole Payments}\right) * \left(\frac{\text{QSE's DAM Energy Purchase}}{\text{Total DAM Energy Purchases}}\right)$$

Day-Ahead Make-Whole Charge

- QSE3 has a cleared Energy Bid from DAM
  - Purchased 50 MW in the DAM
- ERCOT-Wide total energy purchases in the DAM:
  - 500 MW





Make-Whole Charge = (-1) * (-$250) * 50MW / 500MW = (-1) * (-$250) * .10 = $25

Day-Ahead Make-Whole Charge

$$\text{Make-Whole Charge} = (-1) * \left(\text{Total DAM Make-Whole Payments}\right) * \left(\frac{\text{QSE's DAM Energy Purchase}}{\text{Total DAM Energy Purchases}}\right)$$

$$LADAMWAMT_q = (-1) * DAMWAMTTOT * DAERS_q$$

q = QSE

Determinants
Load **A**llocated **D**ay-**A**head **M**ake-**W**hole **Am**oun**t**
Day-**A**head **M**ake-**W**hole **Am**oun**t To**tal
Day-**A**head **E**nergy Purchase **R**atio **S**hare

Day-Ahead Market Settlements

CRR Auction

- Charges and Payments for CRRs
- Revenue Distribution

DAM

Participation in DAM

- Energy
- Ancillary Services
- PTP Obligations

DAM Commitment

- Make-Whole

Settlement of CRRs in the DAM

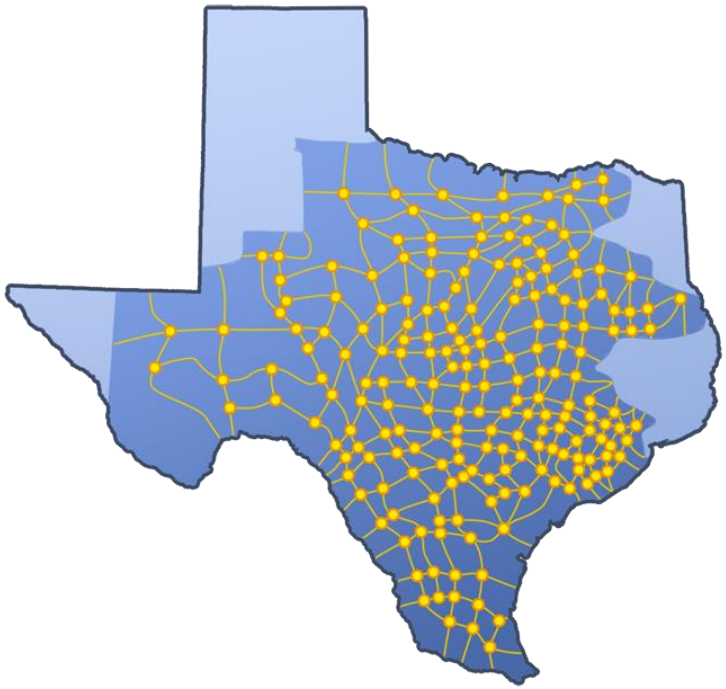
CRR owners may be paid according to their "target" payment.

Or their payments may be reduced:

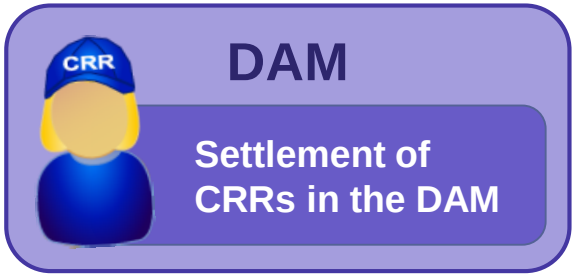
- Derations
- CRR Shortfall Charges

Target Payment

CRRs will be settled at the Target Payment when not derated



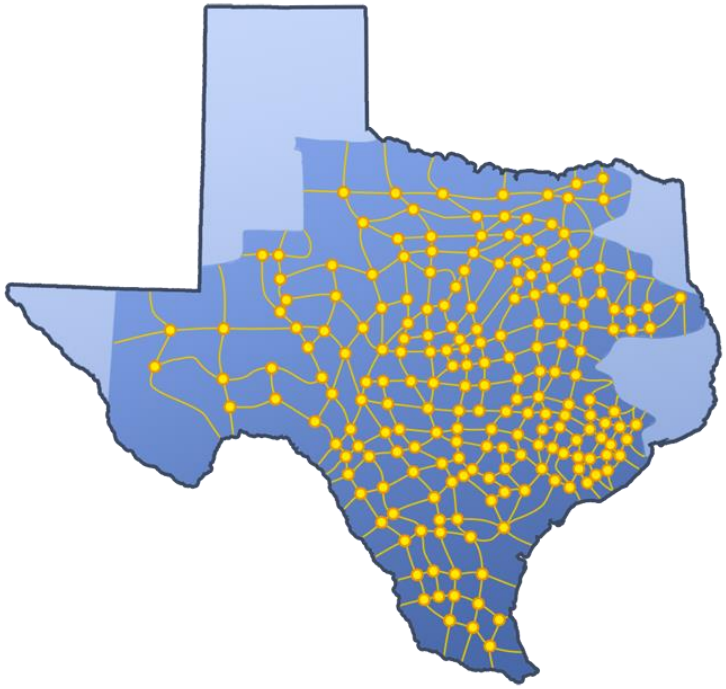
Target Payment = Price * Quantity

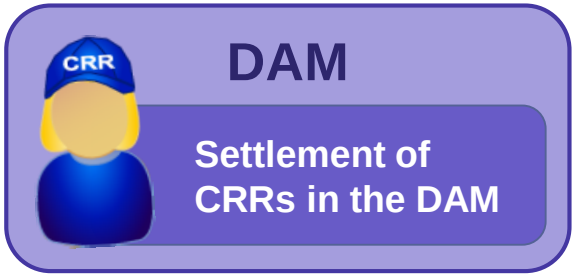


Deration of CRRs

Due to oversold transmission elements, a CRR payment may be derated:

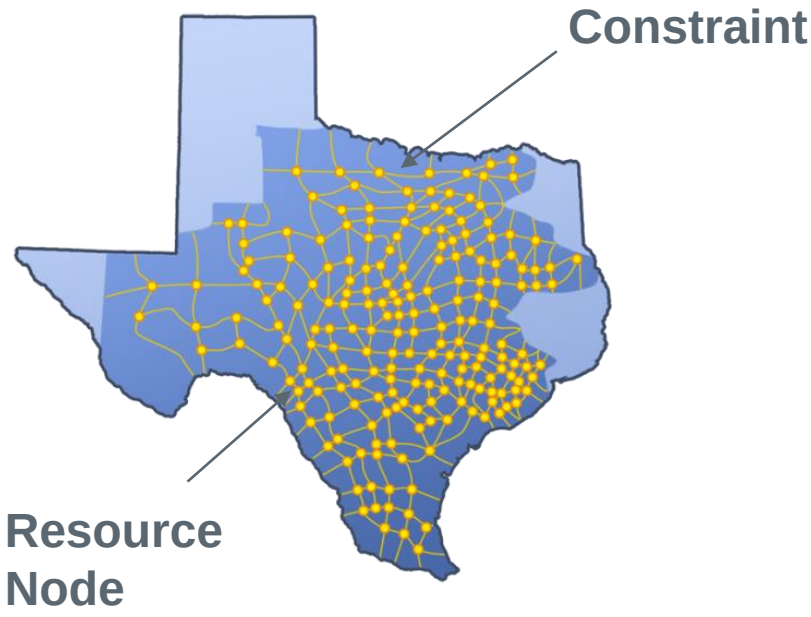
- If sink is a Resource Node
- If the Target Payment is a positive value.



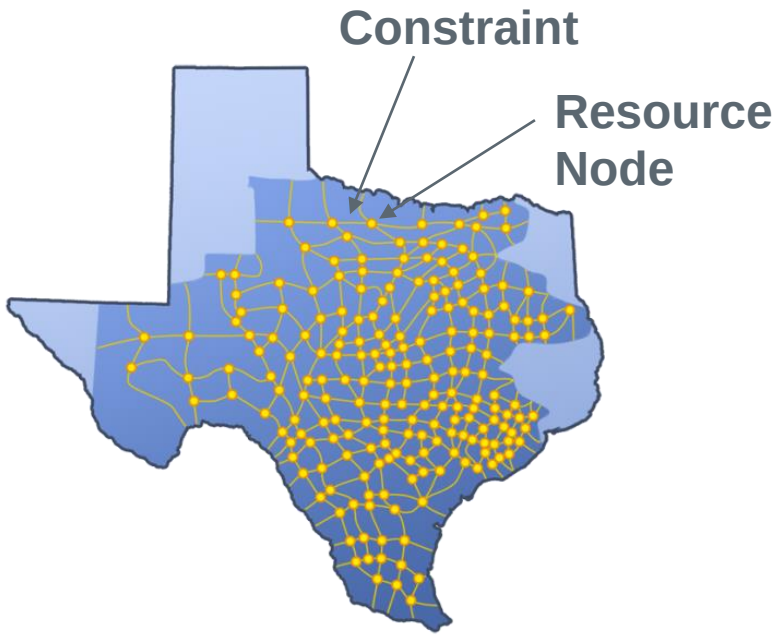


Deration of CRRs

Deration is based on impact of Resource Node on constraints

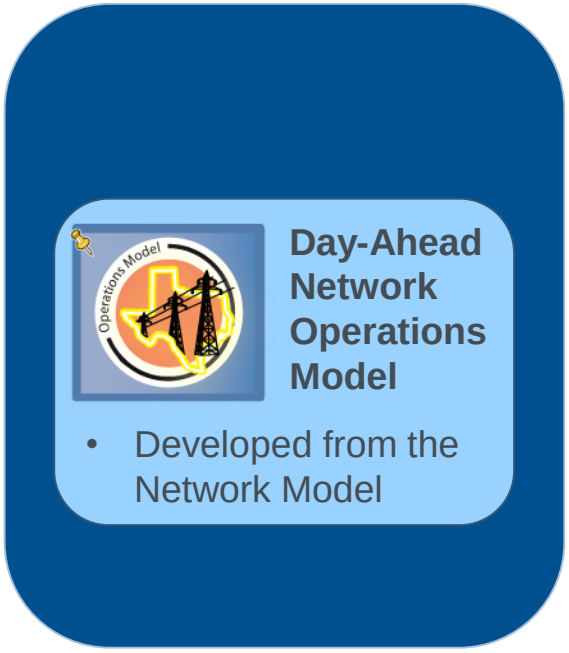


Minimal impact
Minimal deration



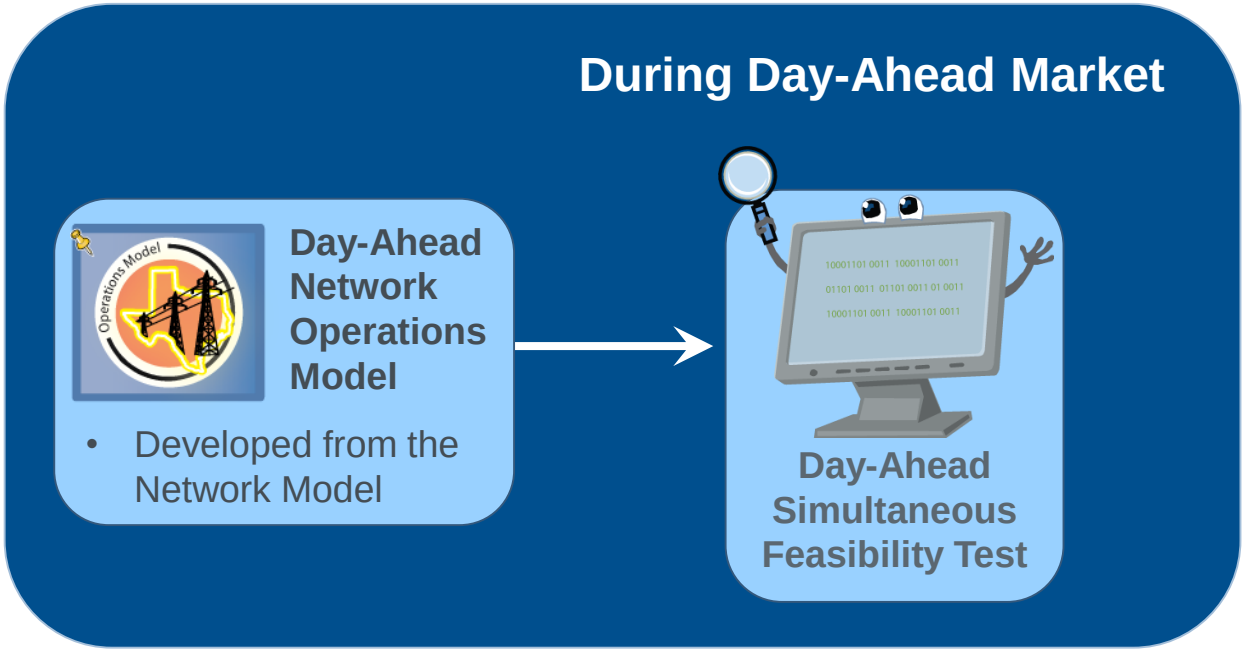
Significant impact
Significant deration

Deration of CRRs



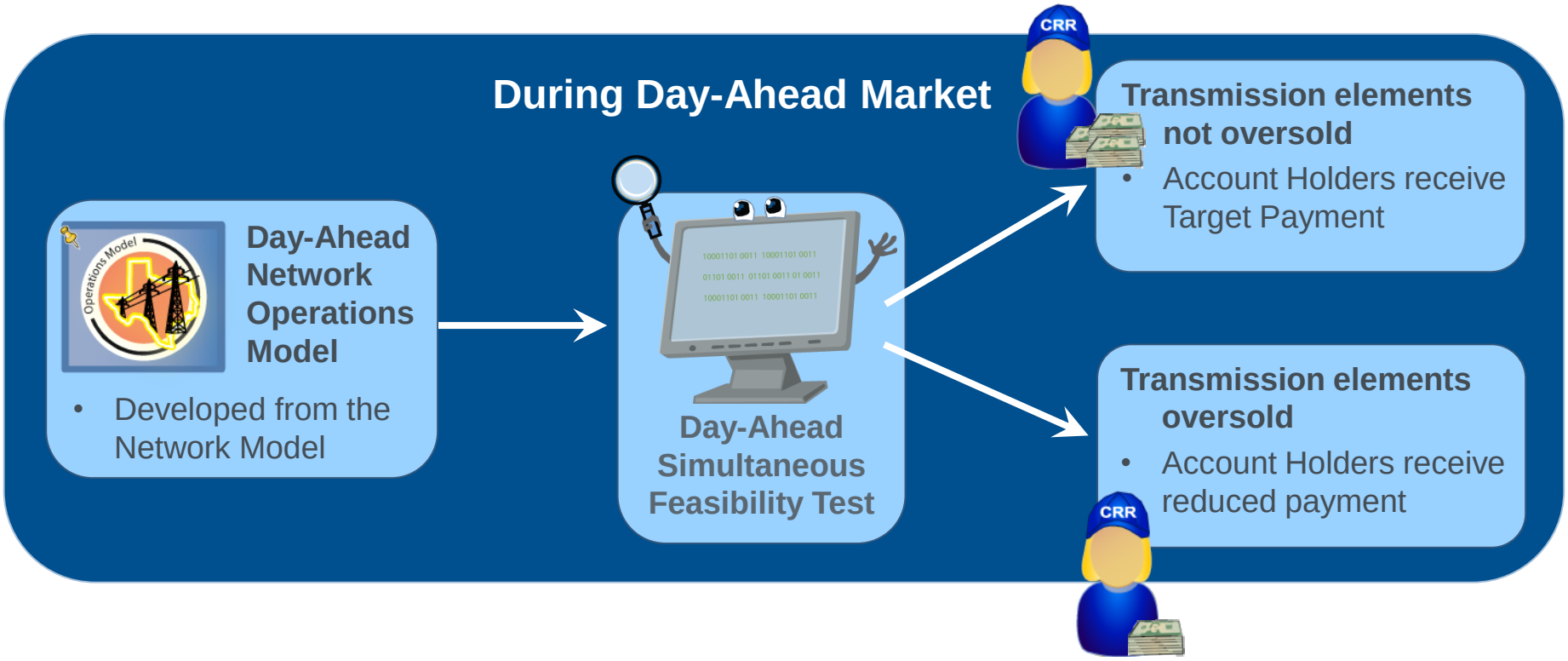
- Developed daily
- Reflects forecasted transmission system for the next day
- Updated with scheduled outages and forecasted system conditions

Deration of CRRs

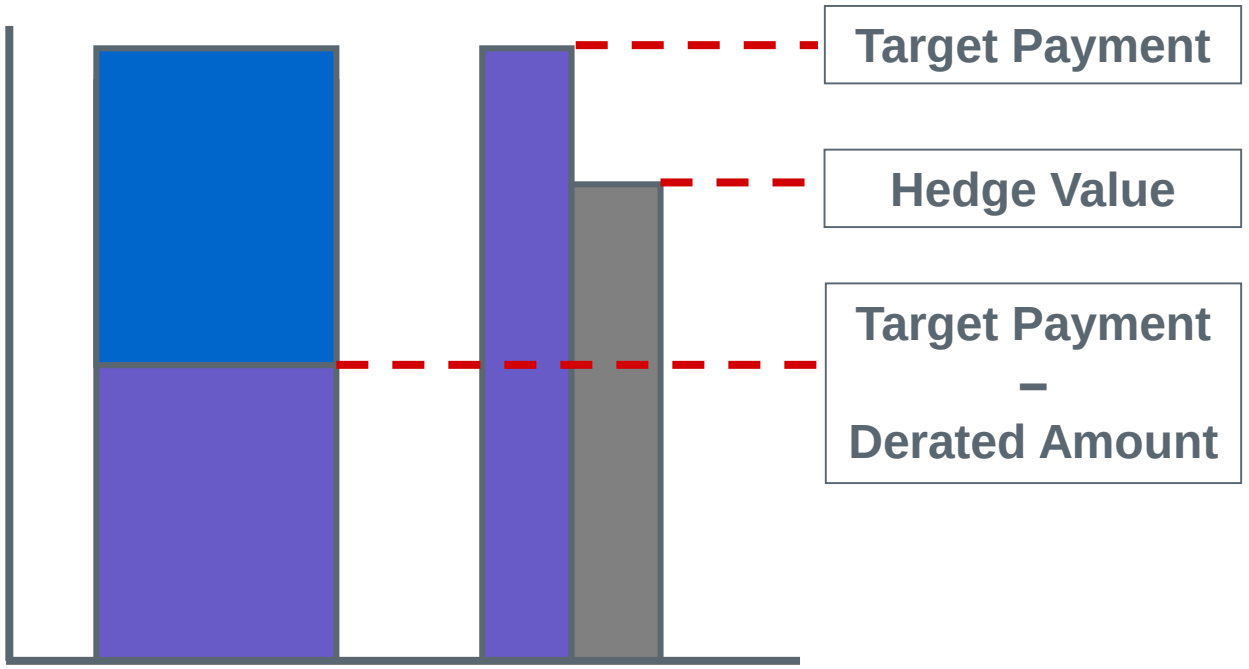


- Executed daily
- Verifies feasibility of CRRs sold in Auction

Deration of CRRs



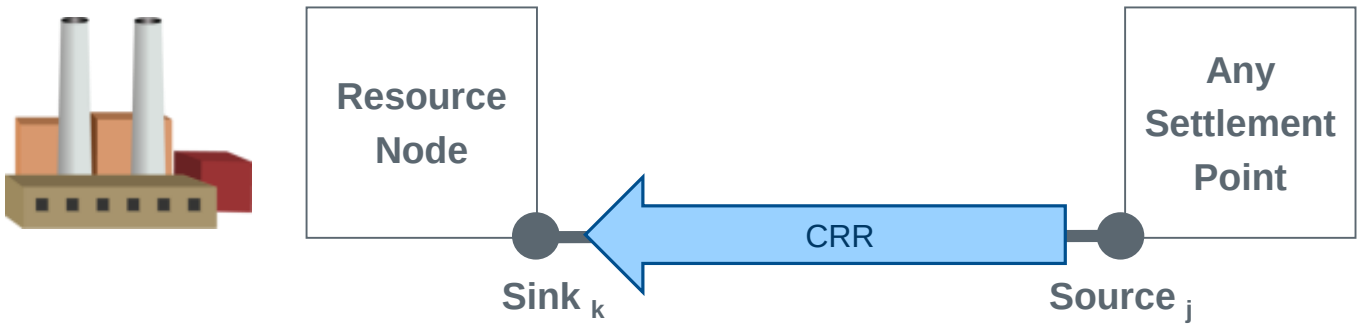
Derated Payment



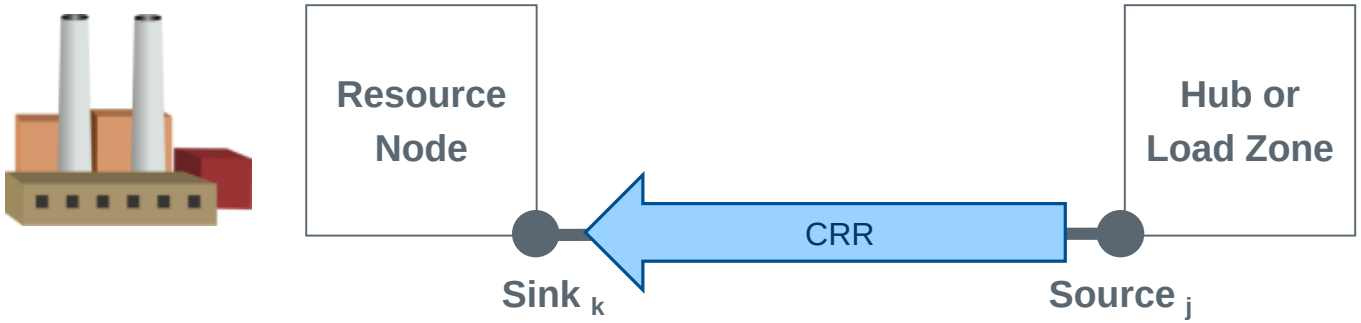
(-1) * Max ((Target Payment – Derated Amount) or Min (Target Payment or Hedge Value))

Derated Payment and Hedge Value

- **Derating CRRs Reduces Gaming Opportunity**
- **Hedge Value maintains value of CRR as Hedge**
  - Maximum Resource Price when Resource Node is Sink
  - Minimum Resource Price when Resource Node is Source



Hedge Value

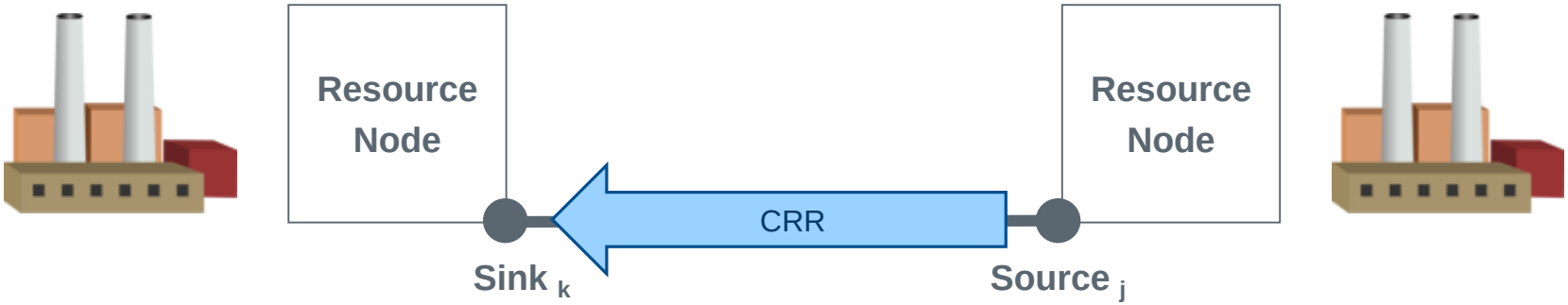


Hedge Value Price

$$\text{HV PRICE}_{(j,k)} = \text{Max}(0, \text{MAXRESPR}_k - \text{DASPP}_j)$$

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

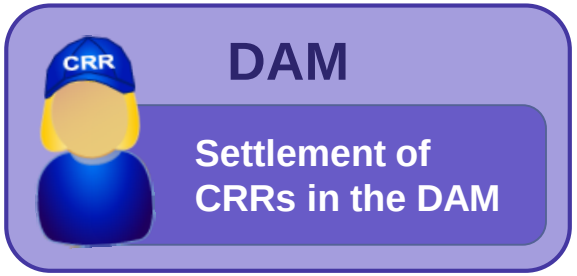


Hedge Value Price

HV PRICE $_{(j, k)}$ = Max (0, MAXRESPR $_k$ – MINRESPR $_j$)

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

CRRs Settled in the DAM



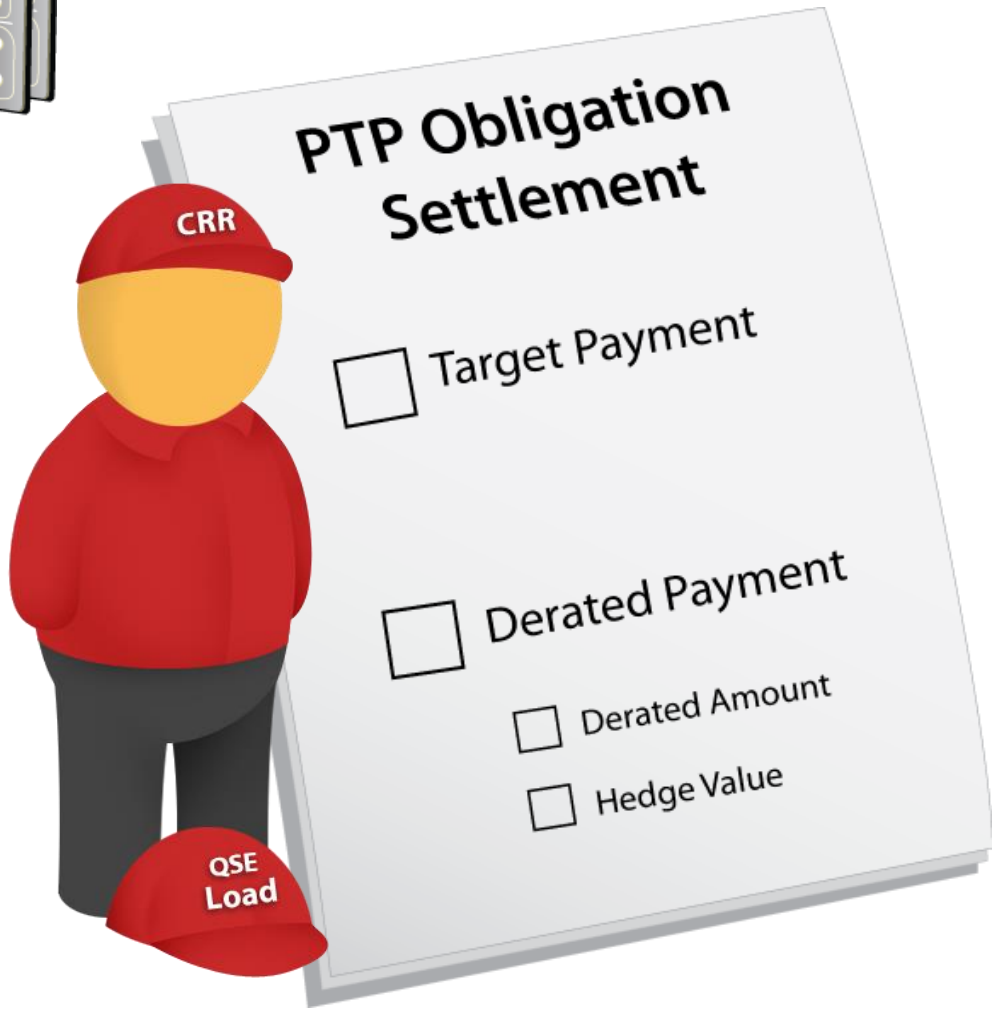
Outcome #1

Payment or Charge to CRRAHs for PTP Obligations settled in the DAM

Outcome #2

Payment to CRRAHs for PTP Options settled in the DAM

CRRAH5 owns a PTP Obligation that settles in the Day-Ahead Market



Target Payment for PTP Obligations

$$DAOBLTP_{o,(j,k)} = DAOBLPR_{(j,k)} \text{ (Price)} * DAOBL_{o,(j,k)} \text{ (Quantity)}$$

$$DAOBLPR_{(j,k)} = DASPP_{k} - DASPP_{j}$$

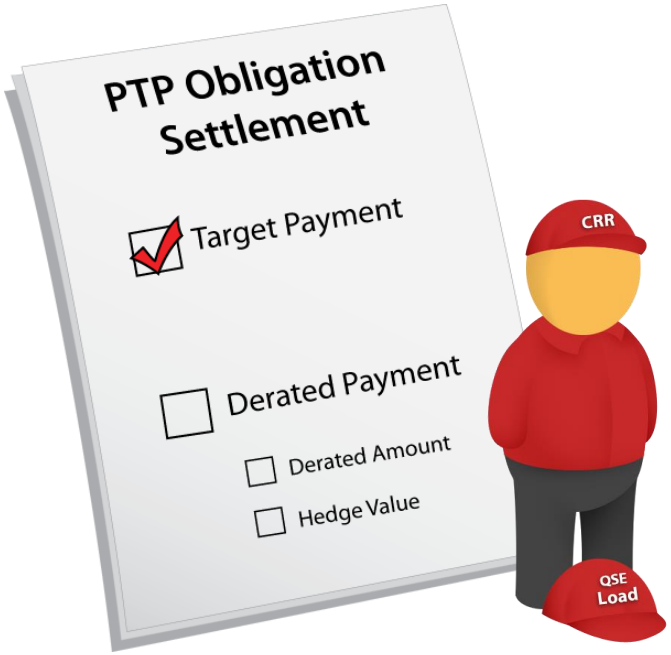
j = Source Settlement Point

k = Sink Settlement Point

o = CRR Owner

Determinants
Day-**A**head **Obl**igation **T**arget **P**ayment
Day-**A**head **Obl**igation **Pr**ice
Day-**A**head **Obl**igation Quantity
Day-**A**head **S**ettlement **P**oint **P**rice

Target Payment



Determinants
Day-**A**head **Obl**igation **Am**oun**t**
Day-**A**head **Obl**igation **T**arget **P**ayment

j = Source Settlement Point

k = Sink Settlement Point

o = CRR Owner

When either

- **Sink is not a Resource Node, or**
- **Target Payment is less than zero**

$$DAOBLAMT_{o,(j,k)} = (-1) * DAOBLTP_{o,(j,k)}$$

Settlement of PTP Obligations

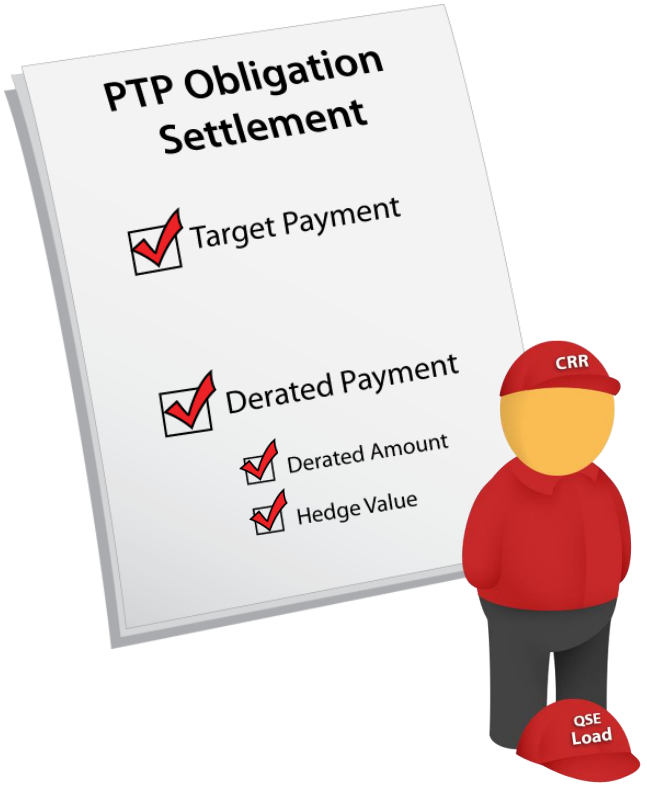
- CRRAH5 owns a PTP Obligation that settles in the Day-Ahead Market
  - Quantity: 10 MW
  - Source: Hub 2
    - $20/MWh
  - Sink: Resource Node 4
    - $30/MWh
  - Price: $10/MWh

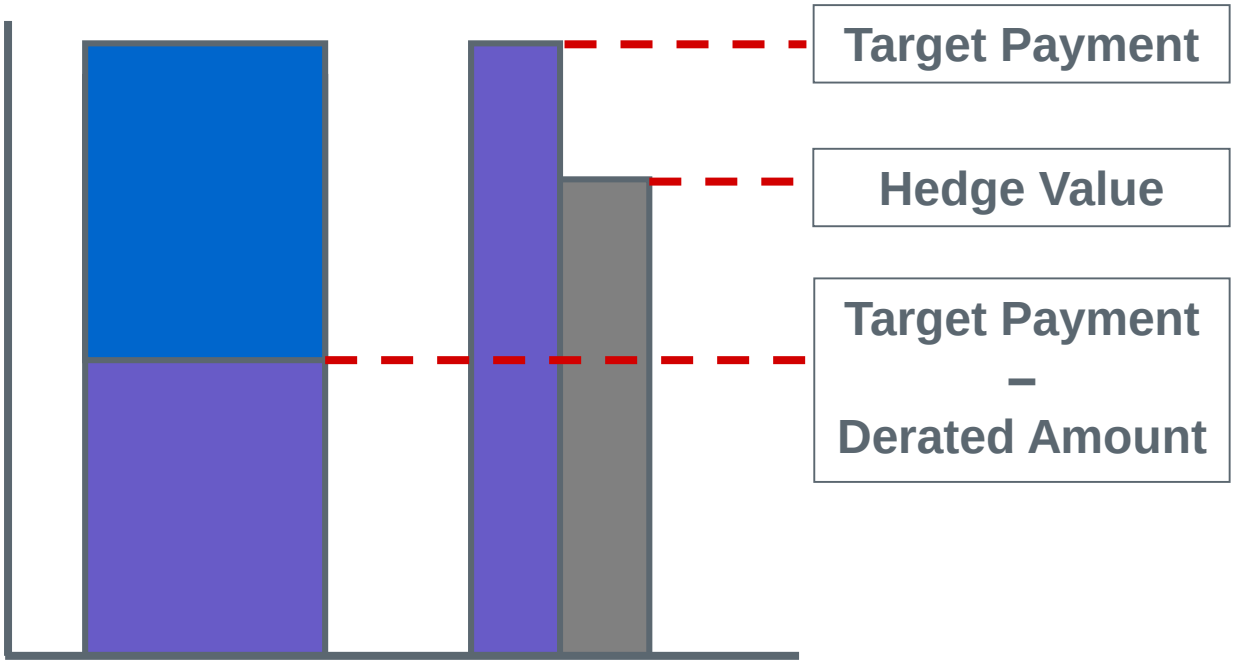
Target Payment = Price * Quantity

Target Payment = $10/MWh * 10 MW

= $100 per hour

When Sink is a Resource Node & Target Payment is greater than zero





$$(-1) * \text{Max}\left[\begin{array}{c}(\text{Target Payment} - \text{Derated Amount}) \\ \text{or} \\ \text{Min}(\text{Target Payment or Hedge Value})\end{array}\right]$$

Derated Amount of PTP Obligations

$$DAOBLDA_{o,(j,k)} = OBLDRPR_{(j,k)} \text{ (Price)} * DAOBL_{o,(j,k)} \text{ (Quantity)}$$

$$OBLDRPR_{(j,k)} = \sum_{c} (\text{Max}(0, DAWASF_{j,c} - DAWASF_{k,c}) * DASP_{c} * DRF_{c})$$

j = Source Settlement Point

k = Sink Settlement Point

o = CRR Owner

c = A constraint

Determinants
Day-**A**head **Obl**igation **D**erated **A**mount
Obligation **D**er**a**tion **Pr**ice
Day-**A**head **Obl**igation Quantity
Day-**A**head **W**eighted **A**verage **S**hift **F**actor
Day-**A**head **S**hadow **P**rice
Der**a**tion **F**actor

Derated Amount of PTP Obligations

$$DAOBLDA_{o,(j,k)} = OBLDRPR_{(j,k)} \text{ (Price)} * DAOBL_{o,(j,k)} \text{ (Quantity)}$$

OBLDRPR = $0.75/MW per hour

DAOBLDA = OBLDRPR * DAOBL

= $0.75/MW * 10 MW

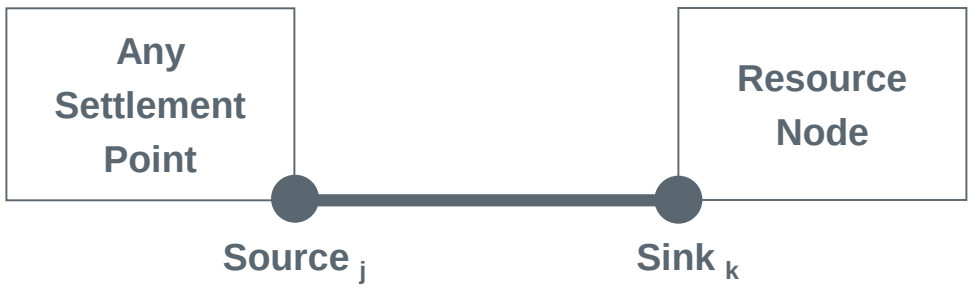
= $7.50

Determinants
Day-Ahead Obligation Derated Amount
Obligation Deration Price
Day-Ahead Obligation Quantity
Day-Ahead Weighted Average Shift Factor
Day-Ahead Shadow Price
Deration Factor

Hedge Value for PTP Obligations

$$DAOBLHV_{o,(j,k)} = DAOBLHVPR_{(j,k)} \text{ (Price)} * DAOBL_{o,(j,k)} \text{ (Quantity)}$$

$$DAOBLHVPR_{(j,k)} = \text{Max}(0, MAXRESPR_{k} - DASPP_{j})$$



Determinants
Day-Ahead Obligation Hedge Value Day-Ahead Obligation Hedge Value Price Day-Ahead Obligation Quantity
Maximum Resource Price Day-Ahead Settlement Point Price

Hedge Value for PTP Obligations

$$DAOBLHV_{o,(j,k)} = DAOBLHVPR_{(j,k)} \text{ (Price)} * DAOBL_{o,(j,k)} \text{ (Quantity)}$$

DAOBLHVPR = Max (0, $36 – $20)

= $16/MWh

Resource is Combined Cycle > 90MW

FIP = $4

Determinants
Day-Ahead Obligation Hedge Value
Day-Ahead Obligation Hedge Value Price
Day-Ahead Obligation Quantity
Maximum Resource Price
Day-Ahead Settlement Point Price

Hedge Value for PTP Obligations

$$DAOBLHV_{o,(j,k)} = DAOBLHVPR_{(j,k)} \text{ (Price)} * DAOBL_{o,(j,k)} \text{ (Quantity)}$$

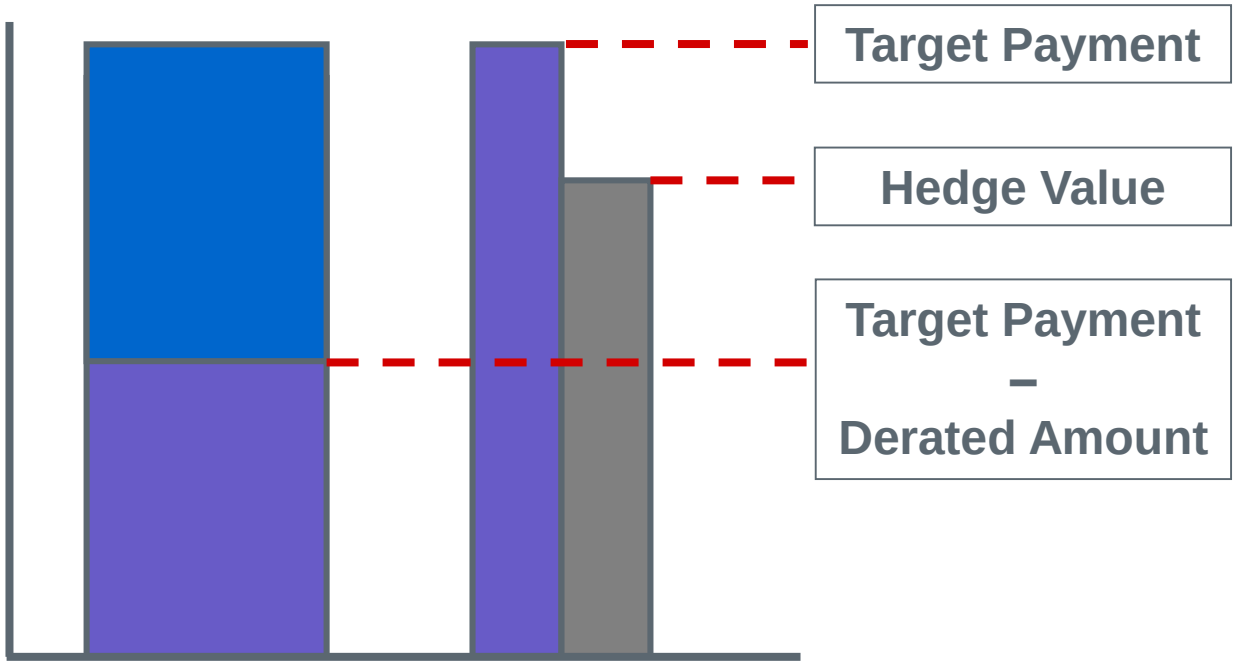
$$DAOBLHV = DAOBLHVPR * DAOBL$$

$$= \$16/MWh * 10\ MW$$

$$= \$160 \text{ per hour}$$

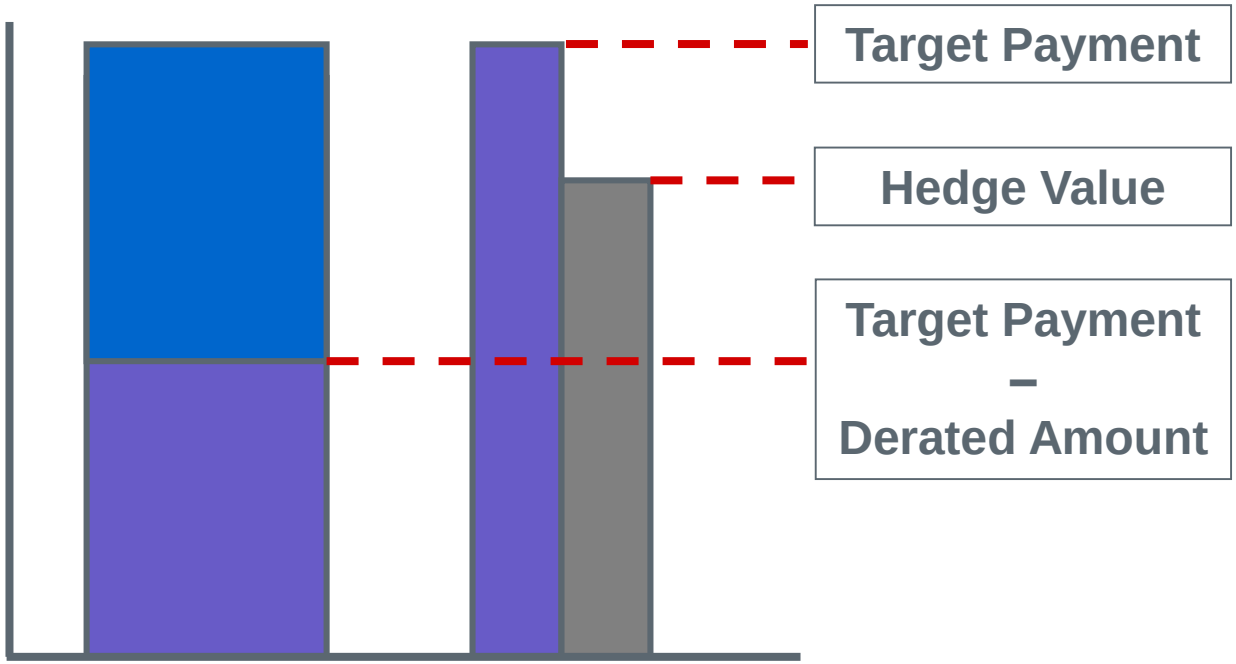
Determinants
Day-Ahead Obligation Hedge Value Day-Ahead Obligation Hedge Value Price Day-Ahead Obligation Quantity
Day-Ahead Settlement Point Price Minimum Resource Price

Settlement of PTP Obligations



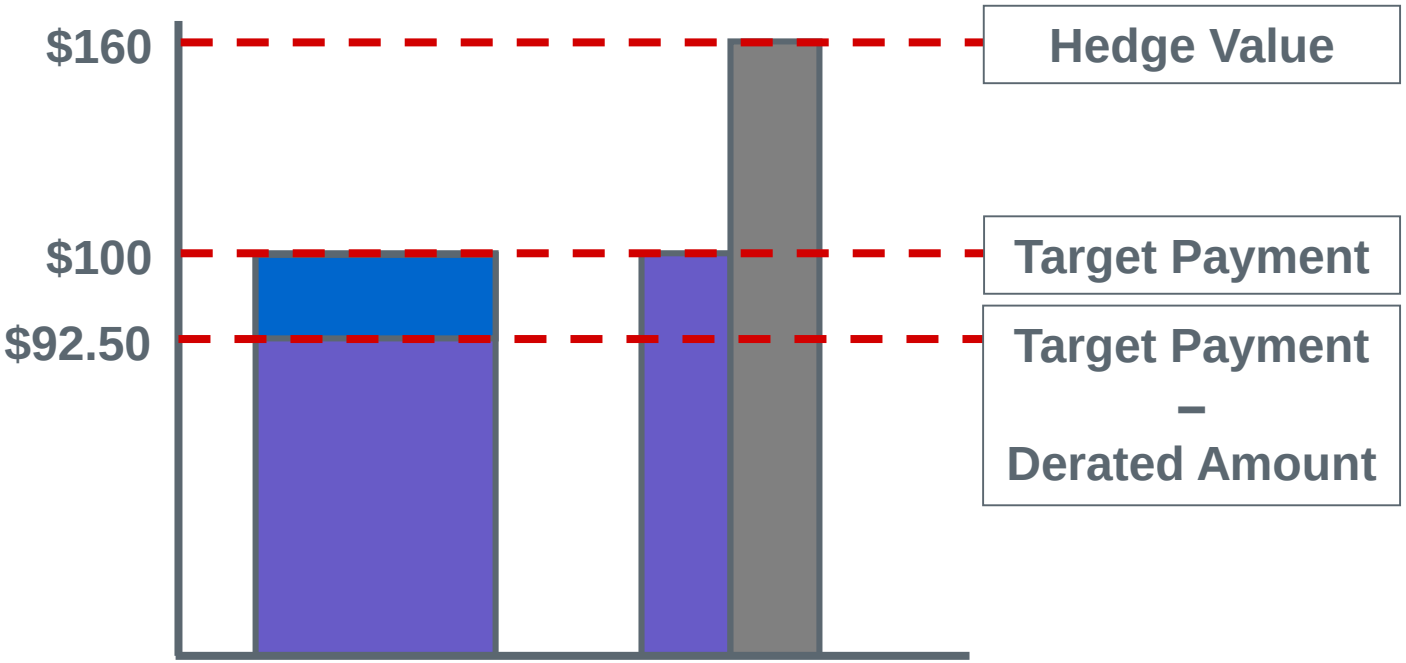
DAOBLAMT = (-1) * Max ((Target Payment – Derated Amount) or Min (Target Payment or Hedge Value))

Settlement of PTP Obligations



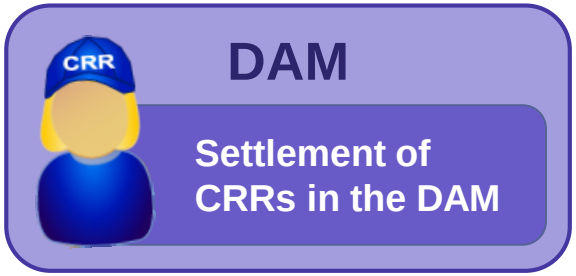
$$\text{DAOBLAMT} = (-1) * \text{Max} \left(\begin{array}{c} (\text{DAOBLTP}_{o,(j,k)} - \text{DAOBLDA}_{o,(j,k)}) \\ \text{or} \\ \text{Min}\,(\text{DAOBLTP}_{o,(j,k)} \text{ or } \text{DAOBLHV}_{o,(j,k)}) \end{array} \right)$$

Settlement of PTP Obligations



DAOBLAMT = (-1) * Max (($100 – $7.50) or Min ($100 or $160)) = **-$100**

CRRs Settled in the DAM



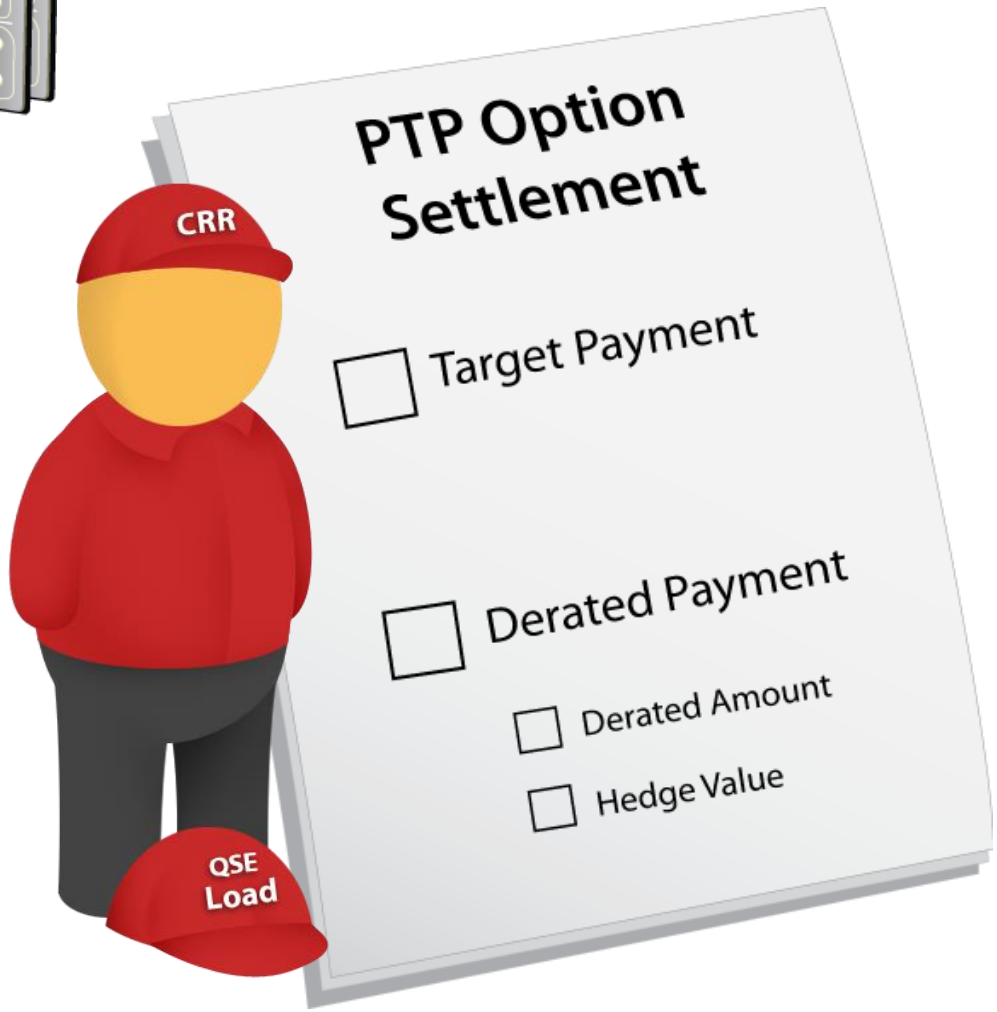
Outcome #1

Payment or Charge to CRRAHs for PTP Obligations settled in the DAM

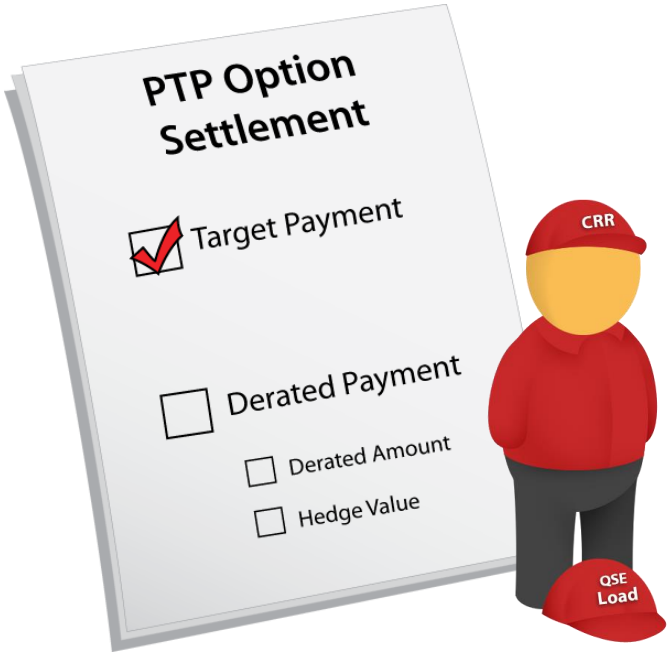
Outcome #2

Payment to CRRAHs for PTP Options settled in the DAM

CRRAH5 also owns a PTP Option that settles in the Day-Ahead Market



Target Payment



Determinants
Day-**A**head **Opt**ion **Am**oun**t**
Day-**A**head **Opt**ion **T**arget **P**ayment

j = Source Settlement Point

k = Sink Settlement Point

o = CRR Owner

When sink is not a Resource Node

$$DAOPTAMT_{o,(j,k)} = (-1) * DAOPTTP_{o,(j,k)}$$

Settlement of PTP Options

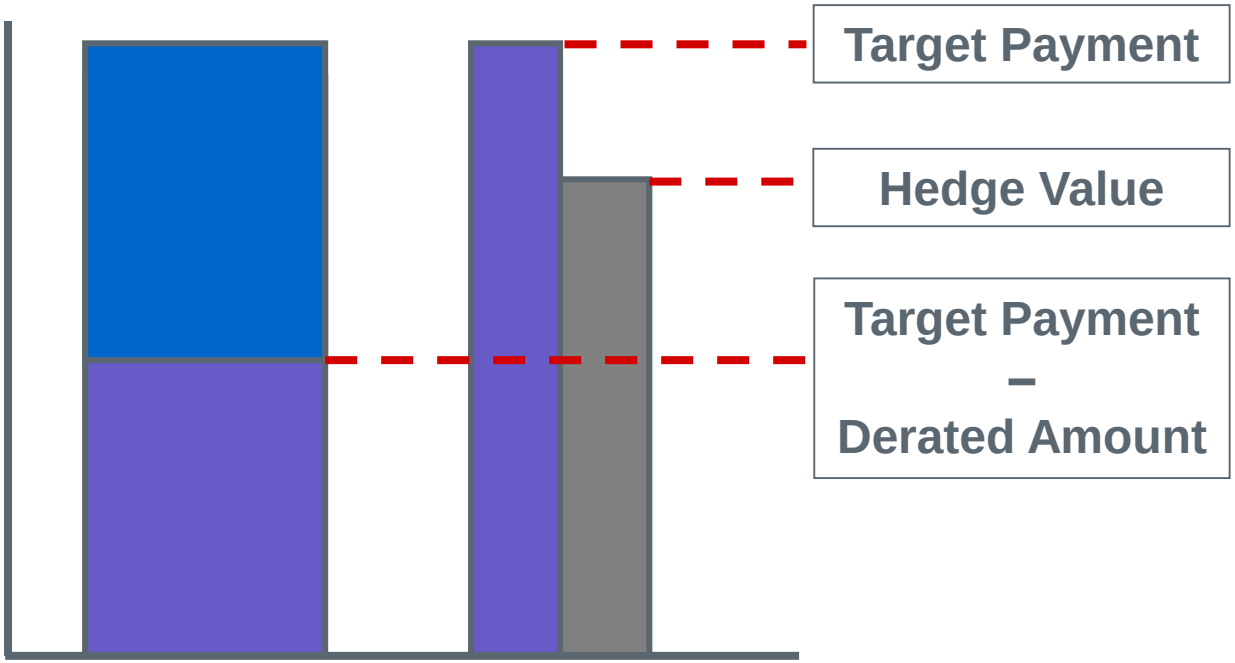
- CRRAH5 owns a PTP Option that settles in the Day-Ahead Market
  - Quantity: 10 MW
  - Source: Resource Node 1
    - $10/MWh
  - Sink: Resource Node 3
    - $30/MWh
  - Price: $20/MWh

Target Payment = Price * Quantity

Target Payment = $20/MWh * 10 MW

= $200 per hour

When Sink is a Resource Node & Target Payment is not zero



(-1) * Max ((Target Payment – Derated Amount) or Min (Target Payment or Hedge Value))

Outcome #2

$DAOPTTP_{o,(j,k)} = \$200$

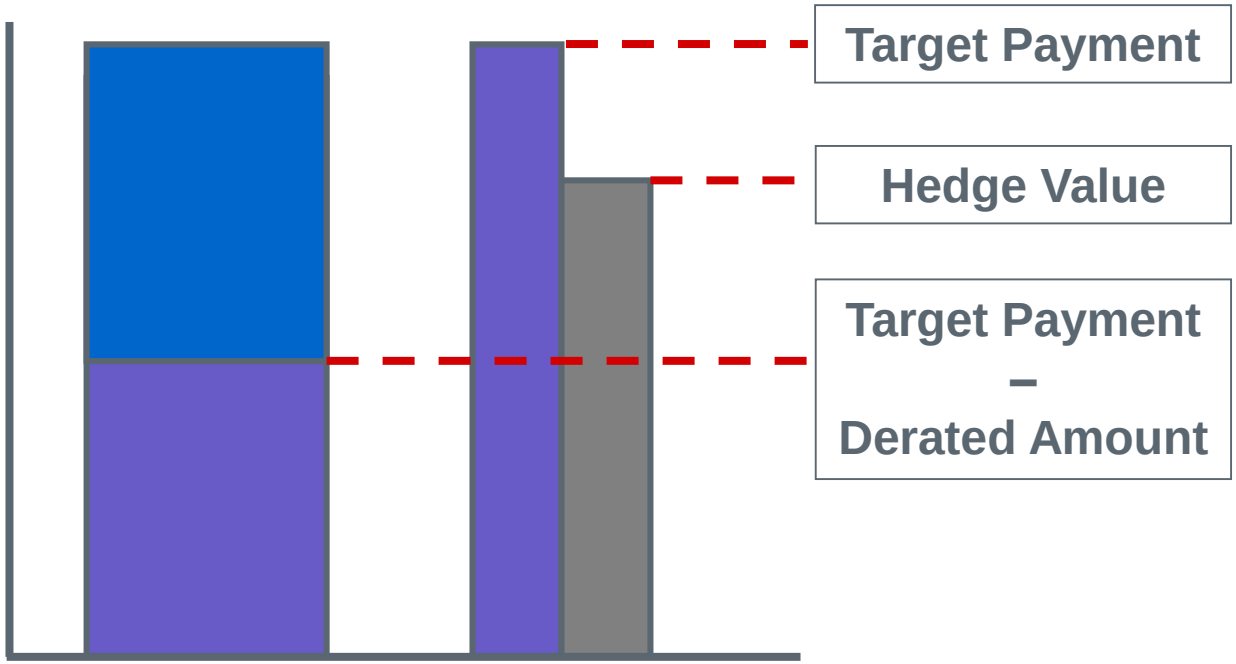
$DAOPTDA_{o,(j,k)} = \$25$

$DAOPTHV_{o,(j,k)} = \$150$

Determinants
Day-**A**head **Opt**ion **T**arget **P**ayment
Day-**A**head **Opt**ion **D**erated **A**mount
Day-Ahead Option Hedge Value

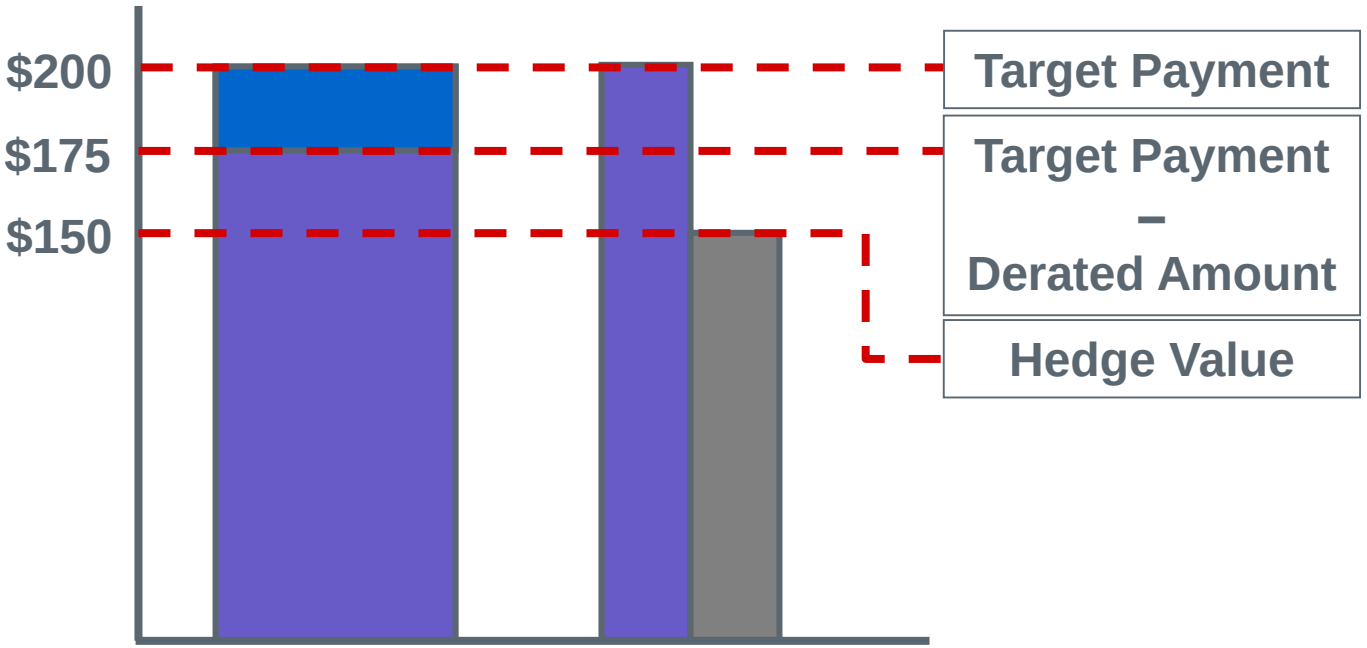
$$DAOPTAMT = (-1) * \text{Max}\left[\begin{array}{c}(\text{Target Payment} - \text{Derated Amount}) \\ \text{or} \\ \text{Min}(\text{Target Payment or Hedge Value})\end{array}\right]$$

Settlement of PTP Options



$$DAOPTAMT = (-1) * Max \left(\begin{array}{c} (DAOPTTP_{o,(j,k)} - DAOPTDA_{o,(j,k)}) \\ or \\ Min\,(DAOPTTP_{o,(j,k)} \text{ or } DAOPTHV_{o,(j,k)}) \end{array} \right)$$

Settlement of PTP Options



DAOPTAMT = (-1) * Max (($200 – $25) or Min ($200 or $150)) = **-$175**

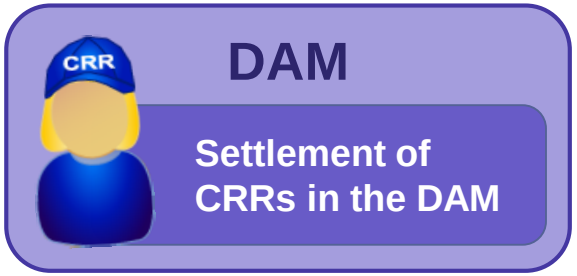
Refer to your Settlements Workbook

In a small group, respond to the questions that relate to Scenario #DAM2.

You have 5 – 10 minutes to complete your questions.

If you cannot complete all questions, don't worry – all questions will be reviewed as a class.

PCRRs Settled in the DAM

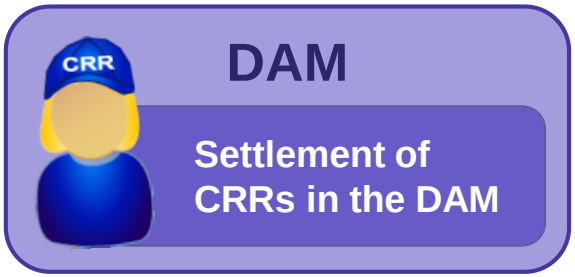


Outcome #1

Payment or Charge to CRRAHs for settled PTP Obligations with Refund

Outcome #2

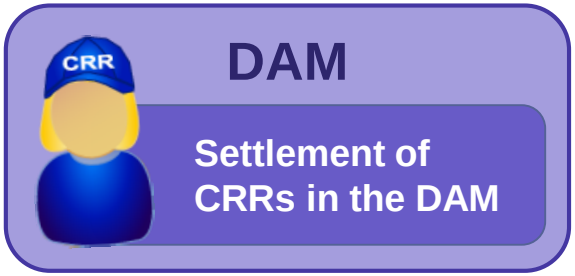
Payment to CRRAHs for settled PTP Options with Refund



The Quantity depends on the Resource output in Real-Time

Price	Quantity (Lesser of)
DAM PCRR Price between Source and Sink	PCRR Quantity Held by the NOIE
	Output Schedule of the Resource

ERCOT uses time-weighted generation, if there is not an Output Schedule.



For Example

Price	Obligation Quantity (Lesser of)	
$50/MWh	100 MW	PTP Obligation Quantity Held by the NOIE
	90 MW	Resource Real-Time Output based on its Output Schedules
PTP Obligation w/Refund Payment	**$50/MWh x 90MW = $4500/h**	

Target Payment for PTP Obligations with Refund

$$DAOBLRAMT_{o,(j,k)} = (-1) * DAOBLPR_{(j,k)} * \text{Min}(DAOBLR_{o,(j,k)}, OBLRACT_{o,(j,k)})$$

Quantity = Lesser of

(Obligations held or Actual Obligations used)

j = Source Settlement Point

k = Sink Settlement Point

o = CRR Owner

Determinants
Day-**A**head **Obl**igation with **R**efund **Am**oun**t**
Day-**A**head **Obl**igation **Pr**ice
Day-**A**head **Obl**igation with **R**efund Quantity
Obligation with **R**efund **Act**ual Usage

Target Payment for PTP Options with Refund

$$DAOPTRAMT_{o,(j,k)} = (-1) * DAOPTPR_{(j,k)} * \text{Min}(OPTR_{o,(j,k)}, OPTRACT_{o,(j,k)})$$

Quantity = Lesser of

(Options held or Actual Options used)

j = Source Settlement Point

k = Sink Settlement Point

o = CRR Owner

Determinants
Day-**A**head **Opt**ion with **R**efund **Am**oun**t**
Day-**A**head **Opt**ion **Pr**ice
Option with **R**efund Quantity
Option with **R**efund **Act**ual Usage

Outcome #1

Charge to CRR AHs when there are insufficient funds to settle CRRs in the DAM

What:	Charge to CRR Account Holders based on a Credit Share Ratio
Why:	Congestion Rent collected in the DAM may not be adequate to pay the amount due to CRR Owners in the DAM

Target Payment of CRRs Settled in the Day-Ahead

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)

Shortfall Charge for CRRs Settled in Day-Ahead

Trigger #1

- **Insufficient funds collected to pay CRR Account Holders**

Payment due to CRR Account Holders
(Target Payment)

Outcome #1

$$\text{Day-Ahead Shortfall Charge} = \left(\text{Total CRR Shortfall}\right) * \left(\frac{\text{CRR Owner Target Payment}}{\text{Total CRR Target Payments for hour}}\right)$$

Shortfall Charge for CRRs Settled in Day-Ahead - Activity

Day-Ahead Shortfall Charge = (**Total CRR Shortfall**) * (**CRR Owner Target Payment** / **Total CRR Target Payments for hour**)

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 Credit Ratio Share	?
CRR Owner's Shortfall Charge	?

Day-Ahead CRR Shortfall Amount

$$DACRRSAMT_o = DACRRSAMTTOT * CRRCRRSDA_o$$

$$DACRRSAMTTOT = (-1) * Min (0, (DACONGRENT + DACRRCRTOT + DACRRCHTOT))$$

Payment due to CRR Account Holders
(Target Payment)

o = CRR Owner

Determinants
Day-**A**head **CRR S**hort **Amount**
Day-**A**head **CRR S**hort **Amount Total**
CRR Credit **R**atio **S**hare **D**ay-**A**head

Day-Ahead Congestion Rent

DACONGRENT = DAESAMTTOT + DAEPAMTTOT
+ DARTOBLAMTTOT + DARTOBLLOAMTTOT

DACONGRENT	
DAESAMTTOT	Day-Ahead Energy Sale Amount Total
DAEPAMTTOT	Day-Ahead Energy Purchase Amount Total
DARTOBLAMTTOT	Day-Ahead Real-Time Obligation Amount Total
DARTOBLLOAMTTOT	Day-Ahead Real-Time Obligation with Links to an Option Amount Total

Payment due to CRR Account Holders (Target Payment)

$$\frac{\text{Charges} + \text{Payments}}{\text{DACRRCHTOT} + \text{DACRRCRTOT}}$$

DACRRCHTOT	
DAOBLCHTOT	Day-Ahead Obligation Charge Total
DAOBLRCHTOT	Day-Ahead Obligation with Refund Charge Total

DACRRCRTOT	
DAOBLCRTOT	Day-Ahead Obligation Credit Total
DAOBLRCRTOT	Day-Ahead Obligation with Refund Credit Total
DAOPTAMTTOT	Day-Ahead Option Amount Total
DAOPTRAMTTOT	Day-Ahead Option with Refund Amount Total

Day-Ahead CRR Shortfall Amount

$$DACRRSAMT_o = DACRRSAMTTOT * CRRCRRSDA_o$$

$$CRRCRRSDA_o = \left(\frac{\text{Target Payment per CRR Owner}}{\text{Total CRR Payments for hour}} \right)$$

o = CRR Owner

Determinants
Day-**A**head **CRR S**hort **Am**oun**t**
Day-**A**head **CRR S**hort **Am**oun**t To**tal
CRR Credit **R**atio **S**hare **D**ay-**A**head

CRR Credit Ratio Share (Day-Ahead)

$$CRRCRRSDA_o = \left(\frac{\text{Target Payment per CRR Owner}}{\text{Total CRR Payments for hour}} \right)$$

Target Payment per CRR Owner	
DAOBLCROTOT	Day-Ahead Obligation Credit Total
DAOBLRCROTOT	Day-Ahead Obligation with Refund Credit Total
DAOPTAMTOTOT	Day-Ahead Option Amount Total
DAOPTRAMTOTOT	Day-Ahead Option with Refund Amount Total

Total CRR Payments	
DACRRCRTOT	Day-Ahead CRR Credit Total

Module Conclusion

CRR Auction

Charges & Payments for CRRs

Revenue Distribution

CRR Balancing Account

Reconcile CRR Short payments

DAM

Participation in DAM
- Energy
- AS
- PTP Obligations

DAM Commitment
- Make-Whole

Settlement of CRRs purchased in the Auction

RUC

Commitment
- Make-Whole
- Clawback

Decommitment

Real-Time

Real-Time Activities
- Imbalances
- Base Point Deviations
- Other odds & ends

Settlement of PTP Obligations purchased in the DAM

Real Time Ancillary Service Settlements

Revenue Neutrality