Settlement: Energy and DAM PTP Obligations

2026_02 E & PTP

Greetings and Introductions

Housekeeping

Attendance

Questions

Presentation Materials

PROTOCOL DISCLAIMER

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

For more information, please visit:

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

Concept

Math

Protocols

Example

Settlement Equation

Topics in this course include:

1. Energy Bids
2. Energy Offers
3. Real-Time Energy Imbalance
4. DC-Tie Import Transactions
5. DAM PTP Obligation Bids
6. DAM PTP Obligation Bids with Links to an Option

Which Markets and Which Participants?

Proposal to buy

- A Product
- At a Location
- For a Max Price

Proposal to Sell

- A Product
- At a Location
- For a Min Price

Settlement Locations

Resource Node (RN)

Load Zone (LZ)

Hub (HB)

Where is the Payment (-) or the Charge (+) to the QSE?

Energy Bid

Energy Bid: Concept

Awarded Energy Bid at Load Zone 1 for a given hour

- DAM Awarded Energy Bid Quantity = 68MW
- DAM Settlement Point Price (SPP) at LZ1 = $40/MWh

Awarded Energy Bid = DAM SPP * Quantity

Awarded Energy Bid = $40/MWh * 68MW

$2,720 for the hour at LZ1

DAEPAMT = Day-Ahead Energy Purchase Amount

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

DASPP	Day-Ahead Settlement Point Price
DAEP	Day-Ahead Energy Purchase
q, p	QSE, Settlement Point

Settle Awarded Energy Bid at Hub 1 for Hour 14

- DAM Awarded Energy Bid Quantity = 75MW
- DAM SPP at HB1 = $35/MWh

Energy Offer

Energy Offer: Concept

Awarded Energy Offer at Resource Node 1 for a given hour

- DAM Awarded Energy Bid Quantity = 100MW
- DAM SPP at RN1 = $30/MWh

Awarded Energy Offer = (-1) * DAM SPP * Quantity

Awarded Energy Offer = (-1) * $30/MWh * 100MW

-$3,000 for the hour at RN1

DAESAMT = Day-Ahead Energy Sale Amount

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

DASPP	Day-Ahead Settlement Point Price
DAES	Day-Ahead Energy Sale
q, p	QSE, Settlement Point

Settle Awarded Energy-Only Offer at Hub 1 for Hour 13 & 14

- DAM Awarded Energy-Only Offer Quantity both hours = 135MW
- DAM SPP at HB1 for Hour 13 = $35/MWh
- DAM SPP at HB1 for Hour 14 = $38/MWh

DAEPAMTQSETOT = Day-Ahead Energy Purchase Amount QSE Total

$$DAEPAMTQSETOT_q = \sum_p DAEPAMT_{q,p}$$

DAESAMTQSETOT = Day-Ahead Energy Sale Amount QSE Total

$$DAESAMTQSETOT_q = \sum_p DAESAMT_{q,p}$$

q, p	QSE, Settlement Point

Real-Time Energy Imbalance

Real-Time Settlement Point Prices Concept

Real-Time Settlement Point Pricing: Concept

Reliability Adder for Energy: Concept

RTRDPA = Real-Time Reliability Deployment Price Adder

Produced each SCED Interval

RTRDP = Real-Time Reliability Deployment Price

Time-Weighted Average

Estimates the impact to Energy Prices due to Reliability Deployments

Real-Time Settlement Point Prices =

RTRDP + Ave (LMPs)

Resource Node

Load Zone

Hub

… for each 15-minute interval

Real-Time Energy Imbalance Concept

The basic idea at any Settlement Point:

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

Now, fill in the elements

Real-Time

Supplies & Obligations include DAM Energy & Trade Energy

- DAM Energy settled in hourly MWs
- Trade Energy reported in hourly MWs
- Real-Time Energy Imbalance settles in 15-minute MWhs

Multiply DAM & Trade Energy by ¼ hour

Real-Time

Real-Time Energy Imbalance at a Hub

$$= (-1)\left[\left(\text{DAM Energy Purchases} + \text{Trade Energy Purchases}\right) - \left(\text{DAM Energy Sales} + \text{Trade Energy Sales}\right)\right] * \text{RTSPP}$$

Supplies Obligations

Each Settlement Point settled separately

RTSPP = Real-Time Settlement Point Price

Settles
Financial
Energy
Transactions

RTSPP = RTRDP +
Time-Weighted & Simple Average (LMPs)

Real-Time Energy Imbalance at a Load Zone

$$= (-1)\left[\left(\text{DAM Energy Purchases} + \text{Trade Energy Purchases}\right) - \left(\text{DAM Energy Sales} + \text{Trade Energy Sales}\right)\right] * \text{RTSPP}$$

$$+ (-1)\left[\text{Settlement Only Generation (SOG)} - \text{Adjusted Metered Load}\right] * \text{RTSPPEW}$$

Supplies Obligations

Each Settlement Point settled separately

RTSPP = Real-Time Settlement Point Price

Settles
Financial
Energy
Transactions

RTSPP = RTRDP +
MW-Weighted & Time-Weighted Average (LMPs)

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RTSPPEW = Real-Time Settlement Point Price Energy-Weighted

Settles
Physical
Energy
Consumption

RTSPPEW = RTRDP +
(MW * Time)-Weighted Average (LMPs)

Real-Time Energy Imbalance at a Resource Node

$$= (-1)\left[\left(\text{DAM Energy Purchases} + \text{Trade Energy Purchases}\right) - \left(\text{DAM Energy Sales} + \text{Trade Energy Sales}\right)\right] * \text{RTSPP}$$

$$+ (-1)\left(\text{Metered Generation}\right) * \text{RTRMPR}$$

Supplies Obligations

Each Settlement Point settled separately

RTSPP = Real-Time Settlement Point Price

Settles
Financial
Energy
Transactions

RTSPP = RTRDP +
Time-Weighted Average (LMPs)

RTRMPR = Real-Time Resource Meter Price

Settles
Physical
Energy
Production

RTRMPR = RTRDP +
(Base-Point * Time)-Weighted Average (LMPs)

Real-Time Energy Imbalance Hub

Supplies & Obligations at Hub 3 for a given interval

- DAM Awarded Energy Purchase Quantity for the given hour = 128MW
- DAM Awarded Energy Sale Quantity for the given hour = 80MW
- Real-Time SPP at HB3 = $41/MWh

HB Imbalance = (-1) * RTSPP * (Supplies * ¼ – Obligations * ¼)

HB Imbalance = (-1) * $41/MWh * (32MWh – 20MWh)

-$492 for the interval at HB3

RTEIAMT = Real-Time Energy Imbalance Amount

$$RTEIAMT_{q,p} = (-1) * RTSPP_p * \{(DAEP_{q,p} * 1/4) + (RTQQEP_{q,p} * 1/4) - (DAES_{q,p} * 1/4) - (RTQQES_{q,p} * 1/4)\}$$

RTSPP	Real-Time Settlement Point Price
DAE(P/S)	Day-Ahead Energy (Purchase or Sale)
RTQQE(P/S)	Real-Time QSE to QSE Energy (Purchase or Sale)
q, p	QSE, Settlement Point

Real-Time

Example 3: Real-Time Energy Imbalance at Hub

Settle Energy Imbalance at Hub 4 for Interval 0830

- DAM Awarded Energy Purchase Quantity for Hour 9 = 20MW
- Trade Energy Sale Quantity for Hour 9 = 40MW
- Real-Time SPP at HB4 = $35/MWh

Real-Time

Real-Time Energy Imbalance Load Zone

Supplies & Obligations at Load Zone 2 for a given interval

- DAM Awarded Energy Purchase Quantity for the given hour = 120MW
- Trade Energy Purchase Quantity for the given hour = 200MW
- Adjusted Metered Load Quantity = 100MWh
- Real-Time SPP at LZ2 = $90/MWh & RTSPPEW at LZ2 = $91/MWh

LZ Imbalance = (-1) * RTSPP * (Supplies * ¼ – Obligations * ¼)
+ (-1) * RTSPPEW * (SOG – AML)

LZ Imbalance = (-1) * $90/MWh * (30MWh + 50MWh – 0)
+ (-1) * $91/MWh * (0 – 100MWh)

LZ Imbalance = -$7,200 + $9,100

$1,900 for the interval at LZ2

RTEIAMT = Real-Time Energy Imbalance Amount

$$RTEIAMT_{q,p} = (-1) * RTSPP_p * [(DAEP_{q,p} * 1/4) + (RTQQEP_{q,p} * 1/4) - (DAES_{q,p} * 1/4) - (RTQQES_{q,p} * 1/4)] + (-1) * RTSPPEW_p * (RTMGSOGZ_{q,p} - RTAML_{q,p})$$

RTSPP	Real-Time Settlement Point Price
RTSPPEW	Real-Time Settlement Point Price Energy-Weighted
DAE(P/S)	Day-Ahead Energy (Purchase or Sale)
RTQQE(P/S)	Real-Time QSE to QSE Energy (Purchase or Sale)
RTMGSOGZ	Real-Time Metered Generation from SOG Zonal
RTAML	Real-Time Adjusted Metered Load
q, p	QSE, Settlement Point

Example 4: Real-Time Energy Imbalance at Load Zone

Settle Energy Imbalance at Load Zone 3 for Interval 0830

- DAM Awarded Energy Purchase Quantity for Hour 9 = 60MW
- Trade Energy Sale Quantity for Hour 9 = 20MW
- Adjusted Metered Load = 8MWh
- Real-Time SPP at LZ3 = $51/MWh & RTSPPEW at LZ3 = $50/MWh

Real-Time Energy Imbalance Resource Node

Real-Time Energy Imbalance at a Resource Node

$$= (-1)\left[\left(\text{DAM Energy Purchases} + \text{Trade Energy Purchases}\right) - \left(\text{DAM Energy Sales} + \text{Trade Energy Sales}\right)\right] * \text{RTSPP}$$

$$+ (-1)\left(\text{Metered Generation}\right) * \text{RTRMPR}$$

Supplies Obligations

If all Generation Sites were simple …

But in reality …

Many Generation Sites are complex

- Multiple generators per meter
- Multiple owners
- Load and generation

Resource Share of Revenue = Splitting Percentage * Site Payment

Splitting Percentage

- QSE Share per Resource
- Calculated from telemetry

Site Payment = ∑ (Price * Meter)

- For all Resources at Site
- For all QSE at Site

Real-Time Energy Imbalance at a Resource Node

$$= (-1)\left[\left(\text{DAM Energy Purchases} + \text{Trade Energy Purchases}\right) - \left(\text{DAM Energy Sales} + \text{Trade Energy Sales}\right)\right] * \text{RTSPP}$$

$$+ (-1)\left(\text{Resource Share of Revenue}\right)$$

Supplies Obligations

Methodology for all Generation Sites

Supplies & Obligations at Resource Node 12 for a given interval

- DAM Awarded Energy Sale Quantity for the given hour = 200MW
- Trade Energy Sale Quantity for the given hour = 200MW
- Real-Time SPP at RN12= $30/MWh
- QSE owns 50% of Resource 12
- Meter Energy at Bus = 150MWh
- Real-Time Resource Meter Price = $31/MWh

Resource Share of Revenue = Splitting Percentage * Site Payment

Resource Share of Revenue = Splitting Percentage * ∑ (Price * Meter)

Resource Share of Revenue = 50% * $31/MWh * 150MWh

$2,325 for the interval @ RN12

Supplies & Obligations at Resource Node 12 for a given interval

- DAM Awarded Energy Sale Quantity for the given hour = 200MW
- Trade Energy Sale Quantity for the given hour = 200MW
- Real-Time SPP at RN12= $30/MWh
- Resource Share of Revenue = $2,325

RN Imbalance = (-1) * {Resource Revenue + RTSPP * [Supplies * ¼ – Obligations * ¼]}

RN Imbalance = (-1) * {$2,325 + $30/MWh * [0 – (50MWh + 50MWh)]}

RN Imbalance = (-1) * {$2,325 + $30/MWh * [-100MWh]}

RN Imbalance = (-1) * {$2,325 + -$3,000}

$675 for the interval @ RN12

RTEIAMT = Real-Time Energy Imbalance Amount

$$RTEIAMT_{q,p} = (-1) * \{\sum_r(RESREV) + RTSPP_p * [(DAEP_{q,p} * 1/4) + (RTQQEP_{q,p} * 1/4) - (DAES_{q,p} * 1/4) - (RTQQES_{q,p} * 1/4)]\}$$

RESREV	Resource Share Revenue Settlement Payment
RTSPP	Real-Time Settlement Point Price
DAE(P/S)	Day-Ahead Energy (Purchase or Sale)
RTQQE(P/S)	Real-Time QSE to QSE Energy (Purchase or Sale)
q, p, r	QSE, Settlement Point, Generation Resource

Real-Time

RESREV = Resource Share Revenue Settlement Payment

Where: $RESREV_{q,r,s,p} = GSPLITPER_{q,r,p} * NMSAMTTOT_s$

Where: $NMSAMTTOT_s = \sum(RTRMPR_b * MEB_{s,b})$

GSPLITPER	Generation Resource SCADA Splitting Percentage
NMSAMTTOT	Net Metering Settlement
RTRMPR	Real-Time Resource Meter Price
MEB	Metered Energy at Bus
b, q, p	Electrical Bus, QSE, Settlement Site
r, s	Generation Resource, Generation Site

Real-Time

Example 5: Real-Time Energy Imbalance at Resource Node

Settle Energy Imbalance at Resource Node 37 for Interval 0830

- DAM Awarded Energy Sale Quantity for Hour 9 = 80MW
- Real-Time SPP at RN37 = $25/MWh
- QSE owns 100% of Resource 37
- Resource Share of Revenue = $1,040

Real-Time

Volumetric Determinants (informational)

$RESMEB_q$ = GSPLITPER * $\sum_s$(MEB)

$RNIMBAL_q$ = MWh Imbalance for all transactions (RN)

$LZIMBAL_q$ = MWh Imbalance for all transactions (LZ)

$HBIMBAL_q$ = MWh Imbalance for all transactions (HB)

RESMEB	Resource Share of total Metered Energy at Bus
RNIMBAL	Resource Node Energy Imbalance
LZIMBAL	Load Zone Energy Imbalance
HBIMBAL	Hub Energy Imbalance
q, s	QSE, Generation Site

Real-Time

DC-Tie Import Transactions

Export = Load

Import = Generation

Real-Time

Financial and Physical Export Transactions

Resource Node

Load Zone

Hub

Real-Time

Scheduled Import at DC Tie 1 for a given interval

- Final Import Quantity for the given hour = 100MW
- Real-Time SPP at DC Tie 1 = $50/MWh

DC Tie Import = (-1) * RTSPP * (Quantity * ¼)

DC Tie Import = (-1) * $50/MWh * 25MWh

-$1,250 for the interval @ DC1

Real-Time

RTDCIMPAMT = Real-Time DC Import Amount

$$RTDCIMPAMT_{q,p} = (-1) * RTSPP_{p} * (RTDCIMP_{q,p} * 1/4)$$

Real-Time

RTSPP	Real-Time Settlement Point Price
RTDCIMP	Real-Time DC Import
q, p	QSE, Settlement Point

Example 6: DC Tie Import

Settle Schedule Import at DC Tie 2 for Interval 1645

- Final Import Quantity for Hour 17 = 136MW
- Real-Time SPP at DC Tie 2 = $47/MWh

Real-Time

DAM PTP Obligation Bids

DAM PTP Obligation Bid
Day-Ahead Market Award

DAM PTP Obligation Bid: Concept

Like a coupled Offer and Bid

Purchase Price = Sink – Source

Awarded PTP Obligation Bid for a given hour

- PTP Obligation Bid Path: Resource Node 1 (Source) / Load Zone 1 (Sink)
- DAM Awarded PTP Obligation Bid Quantity = 50MW
- DAM SPPs at RN1 = $14/MWh & at LZ1 = $18/MWh

Awarded PTP = Price * Quantity

Awarded PTP = (Sink Price – Source Price) * Quantity

Awarded PTP = ($18/MWh – $14/MWh) * 50MW

Awarded PTP = $4/MWh * 50MW

$200 for the hour (RN1 to LZ1)

DARTOBLAMT = Day-Ahead Real-Time Obligation Amount

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

Where: $DAOBLPR_{(j,k)} = DASPP_k - DASPP_j$

DAOBLPR	Day-Ahead Obligation Price
DASPP	Day-Ahead Settlement Point Price
RTOBL	Real-Time Obligation
q, j & k	QSE, Source & Sink Settlement Point

Example 7: DAM PTP Obligation Bid

Settle Awarded PTP Obligation Bid for Hour 12

- PTP Obligation Bid Path: Hub 3 (Source) / Load Zone 3 (Sink)
- DAM Awarded PTP Obligation Bid Quantity = 75MW
- DAM SPPs at HB3 = $27/MWh & at LZ3 = $62/MWh

DAM PTP Obligation Bid
Real-Time Market Ownership

Hourly product settled with 15-minute prices

- Settled Price = Average of Sink – Source
- If Sink Price > Source Price, QSE is paid

Owned PTP Obligation Bid for a given hour

- PTP Obligation Bid Path: Resource Node 1 (Source) / Load Zone 1 (Sink)
- Owned PTP Obligation Bid Quantity = 50MW
- Average Real-Time SPPs

Interval	LZ1 $	RN1 $	Spread $
0415	$21/MWh	$17/MWh	$4/MWh
0430	$22/MWh	$17/MWh	$5/MWh
0445	$21/MWh	$16/MWh	$5/MWh
0500	$21/MWh	$15/MWh	$6/MWh

Average Price = ∑(Sink RTSPP – Source RTSPP) / 4

Average Price = ($4 + $5 + $5 + $6) / 4

Average Price = ($20/MWh) / 4 = $5/MWh

Owned PTP Obligation Bid for a given hour

- PTP Obligation Bid Path: Resource Node 1 (Source) / Load Zone 1 (Sink)
- Owned PTP Obligation Bid Quantity = 50MW
- Average of Real-Time SPPs = $5/MWh

Owned PTP = (-1) * Average Price * Quantity

Owned PTP = (-1) * $5/MWh * 50MW

-$250 for the hour (RN1 to LZ1)

RTOBLAMT = Real-Time Obligation Amount

$$RTOBLAMT_{q,(j,k)} = (-1) * RTOBLPR_{(j,k)} * RTOBL_{q,(j,k)}$$

Where: $RTOBLPR_{(j,k)} = \sum(RTSPP_k - RTSPP_j) / 4$

RTOBLPR	Real-Time Obligation Price
RTSPP	Real-Time Settlement Point Price
RTOBL	Real-Time Obligation
q, j & k	QSE, Source & Sink Settlement Point

Real-Time

Example 8: DAM PTP Obligation Bid Ownership

Settle Owned PTP Obligation Bid for Hour 12

- PTP Obligation Bid Path: Hub 3 (Source) / Load Zone 3 (Sink)
- Owned PTP Obligation Bid Quantity = 75MW
- Average Real-Time SPPs = $50/MWh
  LZ3 ($/MWh) = $75, $74, $76, $75
  HB3 ($/MWh) = $25, $24, $26, $25

DAM PTP Obligation Bids with Links to an Option

DAM PTP Obligation Bid with Links to an Option Day-Ahead Market Award

Special Product for NOIEs

- **Must Own CRR Option**
- **Buy like quantity DAM PTP Obligation**

Settles like Option in Real-Time

Awarded PTP Obligation Bid with Links to an Option for a given hour

- PTP Obligation Bid Path: Resource Node 6 (Source) / Load Zone 6 (Sink)
- DAM Awarded PTP Obligation Bid Quantity = 50MW
- DAM SPPs at RN6 = $16/MWh & at LZ6 = $40/MWh

Awarded PTP with LO = Price * Quantity

Awarded PTP with LO = (Sink Price – Source Price) * Quantity

Awarded PTP with LO = ($40/MWh – $16/MWh) * 50MW

Awarded PTP with LO = $24/MWh * 50MW

$1,200 for the hour (RN6 to LZ6)

DARTOBLLOAMT = Day-Ahead Real-Time Obligation with Links to an Option Amount

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

Where: $DAOBLPR_{(j,k)} = DASPP_k - DASPP_j$

DAOBLPR	Day-Ahead Obligation Price
DASPP	Day-Ahead Settlement Point Price
RTOBLLO	Real-Time Obligation with Links to an Option
q, j & k	QSE, Source & Sink Settlement Point

DAM

Example 9: DAM PTP Obligation Bid with Links to an Option

Settle Awarded PTP Obligation Bid with Links to an Option for Hour 12

- PTP Obligation Bid Path: Resource Node 7 (Source) / Load Zone 7 (Sink)
- DAM Awarded PTP Obligation Bid with Links to an Option Quantity = 50MW
- DAM SPPs at RN7 = $55/MWh & at LZ7 = $50/MWh

DAM

DAM PTP Obligation Bid with Links to an Option Real-Time Market Ownership

Special Product for NOIEs

- Only results in Real-Time Payments
- Real-Time Charges are waived

Owned PTP Obligation Bid with Links to an Option for a given hour

- PTP Obligation Bid Path: Resource Node 6 (Source) / Load Zone 6 (Sink)
- Owned PTP Obligation Bid with Links to an Option Quantity = 50MW
- Average Real-Time SPPs = $29/MWh
  LZ6 ($/MWh) = $50, $49, $41, $39
  RN6 ($/MWh) = $13, $14, $16, $20

Owned PTP with LO = (-1) * Average Price * Quantity

Owned PTP with LO = (-1) * $29/MWh * 50MW

-$1,450 for the hour (RN6 to LZ6)

RTOBLLOAMT = Real-Time Obligation with Links to an Option Amount

$$RTOBLLOAMT_{q,(j,k)} = (-1) * Max(0, RTOBLPR_{(j,k)}) * RTOBLLO_{q,(j,k)}$$

$$\text{Where: } RTOBLPR_{(j,k)} = \sum(RTSPP_k - RTSPP_j) / 4$$

RTOBLPR	Real-Time Obligation Price
RTSPP	Real-Time Settlement Point Price
RTOBLLO	Real-Time Obligation with Links to an Option
q, j & k	QSE, Source & Sink Settlement Point

Real-Time

Example 10: PTP Obligation Bid with Links to an Option Ownership

Settle Owned PTP Obligation Bid with Links to an Option for Hour 12

- PTP Obligation Bid Path: Resource Node 7 (Source) / Load Zone 7 (Sink)
- Owned PTP Obligation Bid with Links to an Option Quantity = 50MW
- Average Real-Time SPPs = -$4/MWh
  LZ7 ($/MWh) = $50, $55, $60, $59
  RN7 ($/MWh) = $60, $60, $60, $60

Real-Time

Topics in this course included:

1. Energy Bids
2. Energy Offers
3. Real-Time Energy Imbalance
4. DC-Tie Import Transactions
5. DAM PTP Obligation Bids
6. DAM PTP Obligation Bids with Links to an Option

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