Module 5: Reliability Unit
Commitment
Module Objectives: Reliability Unit Commitment

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

- Describe the overall Reliability Unit Commitment settlement process.
- Identify Market and ERCOT actions that impact RUC Settlements.
- Explain the RUC Make-Whole process
  - Calculate Make-Whole Payment
  - Calculate RUC Capacity Short Charge
- Describe and calculate the RUC Clawback payment and charge.
Purpose of Reliability Unit Commitment (RUC)

It ensures:

• Enough capacity is committed to serve the forecasted load

• Committed capacity is in the right locations
The Reliability Unit Commitment Process

- Current Operating Plans
- Network Operations Model
- Contingencies
- Load Forecast

- Offers Three-Part Supply Offers
- Transmission Security Analysis
- Reliability Unit Commitment

- Commitments
  - Resource Commitments
  - Resource Decommitments
Reliability Unit Commitment

Committing Enough Capacity

- Current Operating Plans
- Network Operations Model
- Contingencies
- Load Forecast

Offers
- Three-Part Supply Offers

Transmission Security Analysis

Reliability Unit Commitment

Commitments
- Resource Commitments
- Resource Decommitments
Reliability Unit Commitment

Committing Capacity in the Right Locations

- Current Operating Plans
- Network Operations Model
- Contingencies
- Load Forecast

Offers
Three-Part Supply Offers

Transmission Security Analysis
Reliability Unit Commitment

Commitments
- Resource Commitments
- Resource Decommitments
Reliability Unit Commitment

What if ERCOT must commit additional capacity?
Reliability Unit Commitment

Final Results of RUC Process:

- Resource Commitments
- Resource Decommitments
- Nothing
Day-Ahead Reliability Unit Commitment (DRUC)

- Occurs once a day
- Ensures enough capacity committed for next Operating Day

DRUC runs on Day 1 at 1430

DRUC studies all hours of Day 2
**Hourly** Reliability Unit Commitment (HRUC)

- Occurs hourly
- Reviews all hours already studied by DRUC

DRUC Study Period

- 0000
- 0100
- 0200
- 1600
- 1700
- 1800

HRUC runs each hour

Day 1

Day 2

1430 DRUC runs
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
• Settled at a Logical Resource Node

CCGR is offered, committed, dispatched and settled as a single Resource.
Reliability Unit Commitment - Combined Cycle Resources

Combined Cycle Plant

Train 1

- ST₁
- CT₁
- CT₂
- CT₃

CCGR 1

Train 2

- ST₂
- CT₄
- CT₅
- CT₆

CCGR 2

RUC may start an entire CCGR or transition from one CCGR to another
Reliability Unit Commitment: Settlements

CRR Auction
- Charges and Payments for CRRs
- Revenue Distribution

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
### Outcome #1

QSE’s Representing RUC committed resources may receive a Make-Whole payment

<table>
<thead>
<tr>
<th>What:</th>
<th>Payment when the Real-Time revenues are less than actual costs for a RUC-Committed Resource</th>
</tr>
</thead>
<tbody>
<tr>
<td>Why:</td>
<td>To ensure that a QSE recovers its costs to run a RUC-Committed Resource</td>
</tr>
</tbody>
</table>
Calculating RUC Make-Whole Payment

- Incremental Energy Costs
- Minimum Energy Costs
- Start-up Costs

Revenues Received vs. Costs Incurred
Calculating RUC Make-Whole Payment

- Real-Time Revenues
- Incremental Energy Costs
- Minimum Energy Costs
- Start-up Costs

Revenues Received vs. Costs Incurred
Calculating RUC Make-Whole Payment

Real-Time Revenues = RT SPP * Metered Generation

- Revenues Received
- Costs Incurred
  - Incremental Energy Costs
  - Minimum Energy Costs
  - Start-up Costs
What if revenues are less than cost?

<table>
<thead>
<tr>
<th>Revenues Received</th>
<th>Costs Incurred</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real-Time Revenues</td>
<td>Incremental Energy Costs</td>
</tr>
<tr>
<td></td>
<td>Minimum Energy Costs</td>
</tr>
<tr>
<td></td>
<td>Start-up Costs</td>
</tr>
</tbody>
</table>
What if revenues are less than cost?

\[
\text{Difference} = \text{Make-Whole Payment}
\]

- **Real-Time Revenues**
- **Make-Whole Payment**
- **Incremental Energy Costs**
- **Minimum Energy Costs**
- **Start-up Costs**
Now we re-arrange the balance sheet slightly . . .

Subtract incremental energy costs from both columns.

- Make-Whole Payment
- Incremental Energy Costs
- Real-Time Revenues

- Incremental Energy Costs
- Minimum Energy Costs
- Start-up Costs

Revenues Received

Costs Incurred
What if revenues are less than cost?

Real-Time Revenues – Incremental Energy Costs

\[ \text{Revenues Received} - \text{Start-up Costs} = \text{RT SPP} \times \text{Metered Generation} - \text{AIEC} \times \left( \text{Metered Generation Above LSL} \right) \]
What if revenues are less than cost?

- Make-Whole Payment
  - Real-Time Revenues
  - Incremental Energy Costs

- Costs Incurred
  - Minimum Energy Costs
  - Start-up Costs

RUC Guaranteed Amount
RUC Make-Whole Payment

A QSE is paid the Real-time Settlement Point Price for all energy produced by its Resource

A QSE will also receive a Make-Whole Payment if its Resource’s net revenues are less than its Startup and Minimum Energy Costs
RUC Make-Whole Payment

Trigger #1

\[ \text{(Resource Revenues)} < \text{(RUC Guaranteed Amount)} \]

RUC: QSE To Do

- Submit:
  - Three-Part Supply Offer in DAM
  - Verifiable Costs
- Use Generic Costs
- Resource is RUC-Committed
- Resource starts & runs during RUC-Committed hours

RUC: ERCOT To Do

- Calculate RUC Guaranteed Amount
- Calculate Startup Costs
- Calculate Minimum Energy Costs
- Calculate Resource Revenues
  - Calculate Minimum Energy Revenue
  - Calculate Revenue Less Cost Above LSL During RUC-Committed Hours
  - Calculate Revenue Less Cost During QSE-Clawback Intervals
Calculate RUC Guaranteed Amount

RUC Guaranteed Amount = (Startup costs + Minimum energy costs)

- Startup Offer
- Minimum-Energy Offer
- Energy Offer Curve

$ to Start Up

$/MWh at LSL

$/MWh Above LSL
Calculate RUC Guaranteed Amount
Calculate Startup Costs without a Three-Part Supply Offer

**Verifiable Costs**

- Startup Price = Verifiable Startup Costs
- Minimum Energy Price = Verifiable Minimum-Energy Costs

**Generic Costs**

- Startup Price = Resource Category Generic Startup Cost
- Minimum Energy Price = Resource Category Generic Minimum Energy Cost
RUC: ERCOT To Do

- Calculate RUC Guaranteed Amount
  - Startup Costs
  - Minimum Energy Costs

- Calculate Resource Revenues
  - Calculate Minimum Energy Revenue
  - Calculate Revenue Less Cost Above LSL During RUC-Committed Hours
  - Calculate Revenue Less Cost During QSE-Clawback Intervals
### RUC Make-Whole Payment

**Trigger #1**

\[
RUCG_{q,r,d} = \sum_s (\text{SUPR}_{q,r,s} \times \text{RUCSUFLAG}_{q,r,s}) + \sum_t (\text{MEPR}_{q,r,t} \times \text{Min}((\text{LSL}_{q,r,t} \times (1/4)), \text{RTMG}_{q,r,t}))
\]

<table>
<thead>
<tr>
<th>Startup Price (SUPR)</th>
<th>$5000</th>
</tr>
</thead>
<tbody>
<tr>
<td>RUC Startup Flag (RUCSUFLAG)</td>
<td>1</td>
</tr>
<tr>
<td>Minimum Energy Price (MEPR)</td>
<td>$10/MWh</td>
</tr>
<tr>
<td>Low Sustained Limit (LSL)</td>
<td>20MW</td>
</tr>
<tr>
<td>Real-Time Metered Generation (RTMG)</td>
<td>50MWh</td>
</tr>
</tbody>
</table>

QSE4’s Resource is committed for 5 hours.
RUC Make-Whole Payment

**Trigger #1**

RUC Guaranteed Amount

(R resource revenues)

\[
\text{RUCG} = (\text{SUPR} \times \text{RUCSUFLAG}) + \sum (\text{MEPR} \times \text{Min} ((\text{LSL} \times (\frac{1}{4})), \text{RTMG}))
\]

\[
\text{RUCG} = (\$5000 \times 1) + (\$10/\text{MWh} \times \text{Min}(20\text{MW} \times \frac{1}{4} \text{h}, 50\text{MWh}) \times 4\text{i/h} \times 5\text{h})
\]

\[
= \$5000 + (\$10/\text{MWh} \times (20\text{MW} \times \frac{1}{4} \text{h}) \times 4\text{i/h} \times 5\text{h})
\]

\[
= \$5000 + (\$10/\text{MWh} \times 100\text{MWh})
\]

\[
= \$6000
\]
RUC Make-Whole Payment

**Trigger #1**

\[
(\text{Resource Revenues}) \leq (\text{RUC Guaranteed Amount})
\]

<table>
<thead>
<tr>
<th>RUC Guaranteed Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>QSE1</strong></td>
</tr>
<tr>
<td><strong>QSE4</strong></td>
</tr>
<tr>
<td><strong>QSE6</strong></td>
</tr>
</tbody>
</table>

- Per QSE
- Per Resource
- Per Operating Day with RUC Commitment
RUC: ERCOT To Do

- Calculate RUC Guaranteed Amount
  - Startup Costs
  - Minimum Energy Costs

- Calculate Resource Revenues
  - Calculate Minimum Energy Revenue
  - Calculate Revenue Less Cost Above LSL During RUC-Committed Hours
  - Calculate Revenue Less Cost During QSE-Clawback Intervals
RUC Make-Whole Payment

Trigger #1

\[
\text{Resource Revenues} = \left( \begin{array}{c}
\text{Minimum-Energy Revenue up to LSL} \\
\text{Revenue Less Cost above LSL} \\
\text{Revenue Less Cost during QSE-Clawback intervals}
\end{array} \right)
\]

\[
\begin{align*}
\text{Resource Revenues} & < \\
\text{RUC Guaranteed Amount}
\end{align*}
\]
Calculate Resource Revenues

Minimum-Energy revenue up to LSL

- Per QSE
- Per Resource
- Per Operating Day with RUC Commitment
Calculate Resource Revenues

Minimum-Energy revenue up to LSL

RUC Minimum Energy Revenue
= \((\text{Price}) \times (\text{Quantity})\)

Quantity = Minimum of:

- Real-Time Metered Generation
- \(\frac{1}{4}\) of LSL
Calculate Resource Revenues

Minimum-Energy revenue up to LSL

\[ \text{RUCMEREV}_{q,r,d} = \sum (\text{RTSPP}_{p,i} \times \text{Min}(\text{RTMG}_{q,r,i}, (\text{LSL}_{q,r,i} \times (\frac{1}{4})))) \]

Determinants

- RUC Minimum-Energy Revenue
- Real-Time Settlement Point Price
- Real-Time Metered Generation
- Low Sustained Limit
Calculate Resource Revenues

Minimum-Energy revenue up to LSL

\[
\text{RUCMEREV} = \sum (\text{RTSPP} \times \text{Min} (\text{RTMG}, (\text{LSL} \times (\frac{1}{4}))))
\]

\[
\text{RUCMEREV} = \$50/\text{MWh} \times \text{Min} (50\text{MWh}, (20\text{MW} \times \frac{1}{4}\text{h})) \times 4/\text{h} \times 5\text{h}
\]

\[
= \$50/\text{MWh} \times (20\text{MW} \times \frac{1}{4}\text{h}) \times 4/\text{h} \times 5\text{h}
\]

\[
= \$50/\text{MWh} \times 100\text{MWh}
\]

\[
= \$5000
\]
## RUC Make-Whole Payment

**Trigger #1**

\[ \begin{align*}
\text{Resource Revenues} & \quad \text{RUC Guaranteed Amount} \\
\text{RUC Guaranteed Amount} & \quad \text{Minimum-Energy revenue up to LSL} \\
\text{Revenue Less Cost Above LSL During RUC-Committed Hours} & \quad \text{Revenue Less Cost During QSE-Clawback Intervals}
\end{align*} \]

<table>
<thead>
<tr>
<th></th>
<th>RUC Guaranteed Amount</th>
<th>Minimum-Energy revenue up to LSL</th>
<th>Revenue Less Cost Above LSL During RUC-Committed Hours</th>
<th>Revenue Less Cost During QSE-Clawback Intervals</th>
</tr>
</thead>
<tbody>
<tr>
<td>QSE1</td>
<td>$4,000</td>
<td>$2,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>QSE4</td>
<td>$6,000</td>
<td>$5,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>QSE6</td>
<td>$8,000</td>
<td>$4,000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
RUC Make-Whole Payment

Calculate Resource Revenues

Revenue Less Cost Above LSL During RUC-Committed Hours

- Per QSE
- Per Resource
- Per Operating Day with RUC Commitment

Energy Offer Curves for RUC-Committed Resources must be priced at the System-Wide Offer Cap
Calculate Resource Revenues

### Revenue Less Cost Above LSL During RUC-Committed Hours

<table>
<thead>
<tr>
<th>Revenues</th>
<th>Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy Revenue above LSL</td>
<td>Average Incremental Energy Cost above LSL</td>
</tr>
<tr>
<td>Voltage Support Service</td>
<td></td>
</tr>
<tr>
<td>Emergency Power Increase</td>
<td></td>
</tr>
</tbody>
</table>
Calculate Resource Revenues

Revenue Less Cost Above LSL During RUC-Committed Hours

\[
RUCEXRR_{q,r,d} = \text{Max} \left\{ 0, \sum [RTSPP_{p,i} \ast \text{Max} \left\{ 0, RTMG_{q,r,i} - (LSL_{q,r,i} \ast \left(\frac{1}{4}\right)) \right\} + (-1) \ast (VSSVARAMT_{q,r,i} + VSSEAMT_{q,r,i}) + (-1) \ast EMREAMT_{q,r,i} - RTAIEC_{q,r,i} \ast \text{Max} \left\{ 0, RTMG_{q,r,i} - (LSL_{q,r,i} \ast \left(\frac{1}{4}\right)) \right\} \} \right\}
\]

Additional Determinants

- Revenue Less Cost Above LSL (RUCEXRR)
- Voltage Support Service VAR Amount
- Voltage Support Service Energy Amount
- Emergency Energy Amount
- Real-Time Average Incremental Energy Cost
Calculate Resource Revenues

Revenue Less Cost Above LSL During RUC-Committed Hours

\[
\text{RUCExRR}_{q,r,d} = \max \{0, \sum [\text{RTSPP}_{p,i} \times \max (0, \text{RTMG}_{q,r,i} - (\text{LSL}_{q,r,i} \times \frac{1}{4}))]
+ (-1) \times (\text{VSSVARAMT}_{q,r,i} + \text{VSSEAMT}_{q,r,i})
+ (-1) \times \text{EMREAMT}_{q,r,i}
- \text{RTAI}EC_{q,r,i} \times \max (0, \text{RTMG}_{q,r,i} - (\text{LSL}_{q,r,i} \times \frac{1}{4}))\}
\]

<p>| | |</p>
<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Real-Time Metered Generation (RTMG)</td>
<td>50MWh</td>
</tr>
<tr>
<td>Average Incremental Energy Cost (RTAI EC)</td>
<td>$20/MWh</td>
</tr>
<tr>
<td>RT Settlement Point Price (RTSPP)</td>
<td>$50/MWh</td>
</tr>
</tbody>
</table>
RUC Make-Whole Payment

Calculate Resource Revenues

Revenue Less Cost Above LSL During RUC-Committed Hours

\[
\text{RUCEXRR} = \max \left\{ 0, \sum [\text{RTSPP} \cdot \max (0, \text{RTMG} - (\text{LSL} \cdot \frac{1}{4})) - \text{RTAIEC} \cdot \max (0, \text{RTMG} - (\text{LSL} \cdot \frac{1}{4})))] \right\}
\]

\[
\text{RUCEXRR} = \max \left\{ 0, \left[ 50\$/\text{MWh} \cdot \max (0, 50\text{MWh} - (20\text{MW} \cdot \frac{1}{4})) - 20\$/\text{MWh} \cdot \max (0, 50\text{MWh} - (20\text{MW} \cdot \frac{1}{4})) \right] \cdot 4\text{h} \cdot 5\text{h} \right\}
\]

\[
= \max \left\{ 0, [50\$/\text{MWh} \cdot \max (0, 45\text{MWh}) - 20\$/\text{MWh} \cdot \max (0, 45\text{MWh})] \cdot 4\text{h} \cdot 5\text{h} \right\}
\]

\[
= \max \left\{ 0, 45\text{MWh} \cdot (50\$/\text{MWh} - 20\$/\text{MWh}) \right\} \cdot 4\text{h} \cdot 5\text{h}
\]

\[
= 1350 \cdot 4\text{h} \cdot 5\text{h}
\]

\[
= 27,000
\]
### RUC Make-Whole Payment

**Trigger #1**

\[
\text{(Resource Revenues)} < \text{(RUC Guaranteed Amount)}
\]

<table>
<thead>
<tr>
<th></th>
<th>RUC Guaranteed Amount</th>
<th>Minimum-Energy revenue up to LSL</th>
<th>Revenue Less Cost Above LSL During RUC-Committed Hours</th>
<th>Revenue Less Cost During QSE-Clawback Intervals</th>
</tr>
</thead>
<tbody>
<tr>
<td>QSE1</td>
<td>$4,000</td>
<td>$2,000</td>
<td>$1,000</td>
<td></td>
</tr>
<tr>
<td>QSE4</td>
<td>$6,000</td>
<td>$5,000</td>
<td>$27,000</td>
<td></td>
</tr>
<tr>
<td>QSE6</td>
<td>$8,000</td>
<td>$4,000</td>
<td>$4,000</td>
<td></td>
</tr>
</tbody>
</table>
Calculate Resource Revenues

- QSE-Committed Interval
- Contiguous block with one RUC-Committed hour
- QSE-Committed AFTER RUC-Commitment

Revenue Less Cost During QSE Clawback Intervals

QSE-Committed

RUC-Committed
## Calculate Resource Revenues

Revenue Less Cost During QSE Clawback Intervals

<table>
<thead>
<tr>
<th>Revenues</th>
<th>Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy Revenue</td>
<td>Minimum Energy Costs</td>
</tr>
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<td>Average Incremental Energy Cost above LSL</td>
</tr>
<tr>
<td>Emergency Power Increase</td>
<td></td>
</tr>
</tbody>
</table>
Calculate Resource Revenues

Revenue Less Cost During QSE Clawback Intervals

\[ \text{RUCEXRQC}_{q,r,d} = \max \{0, \sum [(\text{RTSPP}_{p,i} \times \text{RTMG}_{q,r,i}) + (-1) \times (\text{VSSVARAMT}_{q,r,i} + \text{VSSEAMT}_{q,r,i}) + (-1) \times \text{EMREAMT}_{q,r,i} - [\text{MEPR}_{q,r,i} \times \min (\text{RTMG}_{q,r,i}, (\text{LSL}_{q,r,i} \times (\frac{1}{4})))] - \text{RTAIEC}_{q,r,i} \times \max (0, \text{RTMG}_{q,r,i} - (\text{LSL}_{q,r,i} \times (\frac{1}{4})))} \} \]

Additional Determinants

| Revenue Less Cost (RUCEXRQC) |
Calculate Resource Revenues

Revenue Less Cost During QSE Clawback Intervals

\[
\text{RUCEXRQC}_{q,r,d} = \max \{0, \sum [(\text{RTSPP}_{p,i} \times \text{RTMG}_{q,r,i}) \\
+ (-1) \times (\text{VSSVARAMT}_{q,r,i} + \text{VSSEAMT}_{q,r,i}) \\
+ (-1) \times \text{EMREAMT}_{q,r,i} \\
- [\text{MEPR}_{q,r,i} \times \min (\text{RTMG}_{q,r,i}, (\text{LSL}_{q,r,i} \times \frac{1}{4}))]] \\
- \text{RTAIEC}_{q,r,i} \times \max (0, \text{RTMG}_{q,r,i} - (\text{LSL}_{q,r,i} \times \frac{1}{4})))\}
\]

<table>
<thead>
<tr>
<th>Real-Time Metered Generation (RTMG)</th>
<th>50MWh</th>
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</thead>
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<tr>
<td>Average Incremental Energy Cost (RTAIEC)</td>
<td>$20/MWh</td>
</tr>
<tr>
<td>RT Settlement Point Price (RTSPP)</td>
<td>$50/MWh</td>
</tr>
</tbody>
</table>
Calculate Resource Revenues

Revenue Less Cost During QSE Clawback Intervals

\[
RUCEXRQC = \max\{0, \sum (RTSPP \times RTMG) - [MEPR \times \min(RTMG, (LSL \times \frac{1}{4}))] - RTAIEC \times \max(0, RTMG - (LSL \times \frac{1}{4}))\}
\]

\[
RUCEXRQC = \max\{0, \left[ (\$50/\text{MWh} \times 50\text{MWh}) - \left( \$10/\text{MWh} \times \min(50\text{MWh}, (20\text{MW} \times \frac{1}{4})) \right) - \$20/\text{MWh} \times \max(0, 50\text{MWh} - (20\text{MW} \times \frac{1}{4})) \right] \times 4i/h \times 2h \}
\]

\[
= \max\{0, \left[ (\$50/\text{MWh} \times 50\text{MWh}) - \left[ \$10/\text{MWh} \times 5\text{MWh} \right] - (\$20/\text{MWh} \times 45\text{MWh}) \right] \times 4i/h \times 2h \}
\]

\[
= \max\{0, \left[ 2500 - 50 - 900 \right] \times 4i/h \times 2h \}
\]

\[
= 1550 \times 4i/h \times 2h = 12,400
\]
## RUC Make-Whole Payment

**Trigger #1**

(\(\text{Resource Revenues}\) < \(\text{RUC Guaranteed Amount}\))

<table>
<thead>
<tr>
<th></th>
<th>RUC Guaranteed Amount</th>
<th>Minimum-Energy revenue up to LSL</th>
<th>Revenue Less Cost Above LSL During RUC-Committed Hours</th>
<th>Revenue Less Cost During QSE-Clawback Intervals</th>
</tr>
</thead>
<tbody>
<tr>
<td>QSE1</td>
<td>$4,000</td>
<td>$2,000</td>
<td>$1,000</td>
<td>$0</td>
</tr>
<tr>
<td>QSE4</td>
<td>$6,000</td>
<td>$5,000</td>
<td>$27,000</td>
<td>$12,400</td>
</tr>
<tr>
<td>QSE6</td>
<td>$8,000</td>
<td>$4,000</td>
<td>$4,000</td>
<td>$8,000</td>
</tr>
</tbody>
</table>
## RUC Make-Whole Payment

**Trigger #1**

- **Resource Revenues**
- **RUC Guaranteed Amount**

<table>
<thead>
<tr>
<th>RUC Guaranteed Amount</th>
<th>Resource Revenues</th>
</tr>
</thead>
<tbody>
<tr>
<td>QSE1 $4,000</td>
<td>$2,000 + $1,000 + $0 = $3,000</td>
</tr>
<tr>
<td>QSE4 $6,000</td>
<td>$5,000 + $27,000 + $12,400 = $44,400</td>
</tr>
<tr>
<td>QSE6 $8,000</td>
<td>$4,000 + $4,000 + $8,000 = $16,000</td>
</tr>
</tbody>
</table>
RUC: ERCOT To Do

- Calculate RUC Guaranteed Amount
- Startup Costs
- Minimum Energy Costs

- Calculate Resource Revenues
- Calculate Minimum Energy Revenue
- Calculate Revenue Less Cost Above LSL During RUC-Committed Hours
- Calculate Revenue Less Cost During QSE-Clawback Intervals
RUC Make-Whole Payment

**Trigger #1**

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

**Outcome #1**

<table>
<thead>
<tr>
<th></th>
<th>RUC Guaranteed Amount</th>
<th>Resource Revenues</th>
<th>Eligible for Make-Whole Payment?</th>
</tr>
</thead>
<tbody>
<tr>
<td>QSE1</td>
<td>$4,000</td>
<td>$3,000</td>
<td>?</td>
</tr>
<tr>
<td>QSE4</td>
<td>$6,000</td>
<td>$44,400</td>
<td>?</td>
</tr>
<tr>
<td>QSE6</td>
<td>$8,000</td>
<td>$16,000</td>
<td>?</td>
</tr>
</tbody>
</table>
• QSE1 Resource is RUC-Committed
• QSE1 is eligible for a Make-Whole Payment

\[ \text{RUCMWAMT} = (-1) \times \text{Max} \left( 0, \text{RUCG} - \text{RUCMER EV} - \text{RUCEXRR} - \text{RUCEXRC} \right) / \sum \text{RUCHR} \]

RUCHR will be set to 1 for each RUC-Committed hour of the day.
• QSE1 is RUC-Committed
• QSE1 is eligible for a Make-Whole Payment

\[
RUCMWAMT = \frac{(-1) \times \text{Max}(0, RUCG - RUCMEREV - RUCEXRR - RUCEXRQC)}{\sum RUCHR}
\]

\[
RUCMWAMT = \frac{(-1) \times \text{Max}(0, \$4000 - \$2000 - \$1000 - 0)}{5}
\]

= - $200 per hour
### RUC Make-Whole Payment for CCGR Transitions

<table>
<thead>
<tr>
<th>Step</th>
<th>Event</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. DAM to RUC</td>
<td>RUC is contiguous to DAM commitment, RUC committed in different configuration, Train is online and generating in the RUC committed configuration for at least 1 minute</td>
<td></td>
</tr>
<tr>
<td>2. RUC to RUC</td>
<td>RUC is contiguous to previous RUC, RUC committed in different configuration, Train is online and generating in the RUC committed configuration for at least 1 minute</td>
<td></td>
</tr>
<tr>
<td>3. SELF to RUC</td>
<td>RUC is contiguous to previous SELF commitment, RUC committed in different configuration, Train is online and generating in the RUC committed configuration for at least 1 minute</td>
<td></td>
</tr>
</tbody>
</table>
RUC Make-Whole Payment for CCGR Transitions

Transition cost is the difference between Start-up costs of the two CCGRs.
**RUC Make-Whole Payment for CCGR Transitions**

**Trigger #1**

\[
\text{RUCG}_{q,r,d} = \sum (\text{SUPR}_{q,r,s} \times \text{RUCSUFLAG}_{q,r,s}) + \sum \text{(Transition costs)} + \sum (\text{MEPR}_{q,r,i} \times \text{Min}\left(\left(\frac{1}{4}\right) \times \text{LSL}_{q,r,i}, \text{RTMG}_{q,r,i}\right))
\]

Transition costs:

\[
\begin{align*}
\text{Max}(0, \text{SUPR}_{\text{afterCCGR}} - \text{SUPR}_{\text{beforeCCGR}}) \\
\text{and} \\
\text{Max}(0, \text{SUPR}_{\text{beforeCCGR}} - \text{SUPR}_{\text{afterCCGR}})
\end{align*}
\]

*Transition to RUC*

*RUC-to-QSE Transition*
Reliability Unit Commitment: Settlements

CRR Auction
- Charges and Payments for CRRs
- Revenue Distribution

DAM
- Participation in DAM
  - Energy
  - AS
  - PTP Obligations
- DAM Commitment
  - Make-Whole
- Settlement of CRRs purchased in the Auction

RUC
- RUC Commitment
  - Make-Whole
  - Clawback
- Decommitment
To remain revenue neutral, ERCOT will first try to directly assign all costs incurred for Make-Whole Payments. Costs are distributed based on QSE’s shortfalls in each 15-minute interval.
### Outcome #1

**Charge to a QSE that was capacity-short in a RUC**

<table>
<thead>
<tr>
<th>What:</th>
<th>Charge to QSEs that are capacity short</th>
</tr>
</thead>
<tbody>
<tr>
<td>Why:</td>
<td>Collect funds to pay the Make-Whole Payments to eligible QSEs</td>
</tr>
</tbody>
</table>
RUC Capacity Short Charge

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

What is included in the total QSE obligation?

- Adjusted Metered Load
- Capacity Trades where the QSE is a seller
- Energy Trades where the QSE is a seller
- Cleared DAM Energy Offers
RUC Capacity Short Charge

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
RUC Capacity Short Charge

When does ERCOT compare QSE capacity versus obligation?

- Execution of RUC
- Real-time Operations
RUC Capacity Short Charge

The larger QSE capacity shortfall is used for capacity short calculations.
RUC Capacity Short Charge

All QSEs who were capacity short in each RUC will pay a portion of the RUC Make Whole Payments for that particular RUC:

\[
\text{RUC Capacity Short Charge} = \text{RUC Capacity Shortfall Ratio Share} \times \left( \text{RUC Make Whole Total} \right) \quad \text{by 15-Minute Settlement Interval}
\]
Short Charge Cap

The charge to each QSE is capped at

\[
2 \times \text{RUC Capacity Shortfall} \times \frac{\text{RUC Make Whole Total}}{\text{RUC Capacity Total}}
\]

... which is the same as

\[
2 \times \text{RUC Capacity Shortfall} \times \left( \frac{\text{Price / MW}}{\text{of RUC Procurement}} \right)
\]
RUC Capacity Short Charge

A QSE with a capacity shortfall will pay the lesser of

RUC Capacity Shortfall Ratio Share \(\times\) (RUC Make Whole Total)

or their cap

\[2 \times (\text{RUC Capacity Shortfall}) \times (\text{Price / MW of RUC Procurement})\]
RUCCSAMT = \((-1) \times \max \left( \left( \frac{\text{RUCSFRS}_{ruc, i, q} \times \text{RUCMWAMTRUCTOT}_{ruc, h}}{\text{RUCCAPTOT}_{ruc, h}} \right), \left( 2 \times \text{RUCSF}_{ruc, i, q} \times \frac{\text{RUCMWAMTRUCTOT}_{ruc, h}}{\text{RUCCAPTOT}_{ruc, h}} \right) \right) \right) / 4\)
RUC Shortfall Ratio Share

- Per RUC process
- Per QSE
- Per 15-minute Interval

\[ RUCSFRS_{ruc,i,q} = \frac{RUCSF_{ruc,i,q}}{RUCSFTOT_{ruc,i}} \]

<table>
<thead>
<tr>
<th>Determinants</th>
</tr>
</thead>
<tbody>
<tr>
<td>RUC Shortfall Ratio Share</td>
</tr>
<tr>
<td>RUC Shortfall</td>
</tr>
<tr>
<td>RUC Shortfall Total</td>
</tr>
</tbody>
</table>
RUC Capacity-Short Charge

Determining a QSE’s RUC Shortfall

ERCOT takes Snapshots:

- QSE’s market position each time RUC is executed
- QSE’s market position at end of each Adjustment Period
RUC Snapshot (DRUC)

Looks at QSE’s market position for each hour during the RUC Study Period
RUC Capacity-Short Charge

Adjustment Period Snapshot

Looks at QSE’s market position at the end of each Adjustment Period

1 2 3 4 5 6 7 8
ADJ 1 ADJ 2 ADJ 3 ... ADJ 6 ...  

9 10 11 12 13 14 15 16  
ADJ 12 ...  

17 18 19 20 21 22 23 24  
ADJ 22 ...  

...
Determine QSE’s RUC Shortfall

For each hour:

- ERCOT compares the Adjustment Snapshot with the corresponding hour in the RUC Snapshot
- The QSE’s RUC shortfall is based on the snapshot that is the most short
RUC Shortfall

\[
\text{RUCSF}_{\text{ruc},i,q} = \text{Max} (0, \text{Max} (\text{RUCSF}_{\text{SNAP}}_{\text{ruc},i,q}, \text{RUCSF}_{\text{ADJ}}_{\text{ruc},i,q})) - \sum_{\text{Prior RUCs}} \text{RUCCAPCREDIT}_{q,i,z}
\]

- **RUCSF\text{SNAP}**
  - Snapshot of the QSEs market position each time a RUC is executed
  - Different RUC\text{SNAP} for each RUC

<table>
<thead>
<tr>
<th>Determinants</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RUC Shortfall</strong></td>
</tr>
<tr>
<td><strong>RUC Short Fall at Snapshot</strong></td>
</tr>
<tr>
<td><strong>RUC Short Fall at Adjustment Period</strong></td>
</tr>
<tr>
<td><strong>RUC Capacity Credit</strong></td>
</tr>
</tbody>
</table>
RUC Capacity-Short Charge

RUC Shortfall

\[ \text{RUCSF}_{\text{SNAP}}_{\text{ruc},q,i} = \max(0, (\sum \text{RTAML}_{q,p,i} \times 4) + \sum \text{RTDCEXP}_{q,p,i} - \text{RUCCAPS}_{\text{SNAP}}_{\text{ruc},q,i}) \]

Capacity at snapshot:

- QSE-to-QSE Energy Purchases – QSE-to-QSE Energy Sales (Energy Trades)
- Day-Ahead Energy Purchases – Day-Ahead Energy Sales
- Capacity Purchase – Capacity Sales (Capacity Trades)
- High Ancillary Service Limits + DC Tie Imports
RUC Capacity-Short Charge

RUC Shortfall

\[
\text{RUCSFSNAP}_{\text{ruc},q,i} = \max(0, ((\sum \text{RTAML}_{q,p,i} \times 4) + \sum \text{RTDCEXP}_{q,p,i} - \text{RUCCAPSnap}_{\text{ruc},q,i}))
\]

\[
\text{RUCCAPSnap}_{\text{ruc},q,i} = \sum \text{HASLSNAP}_{q,r,h} + (\text{RUCCPSnap}_{q,h} - \text{RUCCSSnap}_{q,h}) + (\sum \text{DAEP}_{q,p,h} - \sum \text{DAES}_{q,p,h}) + (\sum \text{RTQQEPSnap}_{q,p,i} - \sum \text{RTQQESSnap}_{q,p,i}) + \sum \text{DCIMPSnap}_{q,p,i}
\]

Determinants

<table>
<thead>
<tr>
<th>Real-Time DC Tie Export</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Oklaunion Exemption)</td>
</tr>
<tr>
<td>RUC Capacity Snapshot at time of RUC</td>
</tr>
<tr>
<td>High Ancillary Service Limit at Snapshot</td>
</tr>
<tr>
<td>RUC Capacity Purchase</td>
</tr>
<tr>
<td>RUC Capacity Sale</td>
</tr>
<tr>
<td>Day-Ahead Energy Purchase</td>
</tr>
<tr>
<td>Day-Ahead Energy Sale</td>
</tr>
<tr>
<td>QSE-to-QSE Energy Purchase</td>
</tr>
<tr>
<td>QSE-to-QSE Energy Sale</td>
</tr>
<tr>
<td>DC Import at Snapshot</td>
</tr>
</tbody>
</table>
RUC SFADJ

- Snapshot of the QSEs market position at the end of the Adjustment period
- Built over time
- Complete at the end of the last Adjustment period of the day

\[
RUCSF_{ruc,i,q} = \max(0, \max(RUCSF_{SNAP\ ruc,q,i}, RUCSF_{ADJ\ ruc,q,i}) - \sum_{\text{Prior RUCs}} RUC_{CAPCREDIT\ q,i,z})
\]
RUC Capacity-Short Charge

RUC Shortfall

\[
RUCSFADJ_{ruc,q,i} = \max(0, (\sum RTAML_{q,p,i} \times 4) + \sum RTDCEXP_{q,p,i} - \sum HASLSNAP_{ruc,q,r,h} - RUCCAPADJ_{q,i}))
\]

Capacity at Adjustment Period:

- QSE-to-QSE Energy Purchases – QSE-to-QSE Energy Sales (Energy Trades)
- Day-Ahead Energy Purchases – Day-Ahead Energy Sales
- Capacity Purchase – Capacity Sales (Capacity Trades)
- High Ancillary Service Limits + DC Tie Imports
RUC Capacity-Short Charge

**RUC Shortfall**

\[
\text{RUCSFADJ}_{ruc,q,i} = \text{Max} \left( 0, \left( \sum \text{RTAML}_{q,p,i} \times 4 \right) + \sum \text{RTDCEXP}_{q,p,i} 
- \sum_{WGR} \text{HASLSNAP}_{ruc,q,r,h} - \text{RUCCAPADJ}_{q,i} \right)
\]

**RUCCAPADJ**

\[
\text{RUCCAPADJ}_{q,i} = \sum \text{HASLADJ}_{q,r,h} 
+ (\text{RUCCPADDJ}_{q,h} - \text{RUCCSADJ}_{q,h}) 
+ (\sum \text{DAEP}_{q,p,h} - \sum \text{DAES}_{q,p,h}) 
+ (\sum \text{RTQQEPA}_{q,p,i} - \sum \text{RTQQESADJ}_{q,p,i}) 
+ \sum \text{DCIMPADJ}_{q,p,i}
\]
Activity: Now it’s your turn!

Refer to your Settlements Workbook

In a small group, respond to the questions that relate to Scenario #RUC1

You have 10 minutes to complete your questions.

If you can not complete all questions, don’t worry – all questions will be reviewed as a class.
RUC Capacity-Short Charge

RUC Shortfall

\[
RUCSF_{ruc,i,q} = \text{Max} \left( 0, \text{Max} \left( RUCSFSNAP_{ruc,q,i}, RUCSFADJ_{ruc,q,i} \right) \right) - \sum_{\text{Prior RUCs}} \text{RUCCAPCREDIT}_{q,i,z}
\]

- Capacity Credit
  - Credit to QSEs to ensure not charged twice for the same capacity shortage

<table>
<thead>
<tr>
<th>Determinants</th>
</tr>
</thead>
<tbody>
<tr>
<td>RUC Shortfall</td>
</tr>
<tr>
<td>RUC Short Fall at Snapshot</td>
</tr>
<tr>
<td>RUC Short Fall at Adjustment Period</td>
</tr>
<tr>
<td>RUC Capacity Credit</td>
</tr>
</tbody>
</table>
RUC Capacity-Short Charge

RUC Shortfall

\[ \text{RUCCAPCREDIT}_{ruc,i,q} = \text{Min} \left[ \text{RUCSF}_{ruc,i,q} \times (\text{RUCCAPTOT}_{ruc,h} \times \text{RUCSFRS}_{ruc,i,q}) \right] \]
Refer to your Settlements Workbook

In a small group, respond to the questions that relate to Scenario #RUC2.

You have 5 minutes to complete your questions.

*If you can not complete all questions, don’t worry – all questions will be reviewed as a class.*
RUC Capacity-Short Charge

RUC Shortfall Ratio Share

• QSE3 is capacity-short for a RUC process
  • 20 MW
  • Total short is
  • 100 MW

RUCSFRS = RUCSF / RUCSFTOT

= 20 MW / 100 MW

= 0.20
Trigger #1

- **QSE3:**
  - RUC Shortfall: 20 MW
  - RUC Shortfall Ratio Share of: 20%
- **ERCOT-wide Values**
  - Total RUC Make-Whole Payments: -$800
  - RUC Capacity Total: 400 MW

\[
\text{RUCCSAMT} = (-1) \times \max \left( \left( RUCSFRS \times RUCMWAMTRUCTOT \right), \left( 2 \times RUCSF \times \left( \frac{RUCMWAMTRUCTOT}{RUCCAPTOT} \right) \right) \right) / 4
\]

\[
\text{RUCCSAMT} = (-1) \times \max \left( \left( 0.20 \times -$800 \right), \left( 2 \times 20 \text{ MW} \times \left( -$800/400 \text{ MW} \right) \right) \right) / 4
\]

\[
= (-1) \times \max \left[ \left( -$160 \right), \left( -$80 \right) \right] / 4
\]

\[
= \$20
\]
RUC Capacity-Short Charge

- **QSE3:**
  - RUC Shortfall: 20 MW
  - RUC Shortfall Ratio Share of: 20%
- **ERCOT-wide Values**
  - Total RUC Make-Whole Payments: -$800
  - RUC Capacity Total: 400 MW

RUC Capacity Short Charge is limited to $20 by the Short Charge Cap.

Without cap, charge would have been $40.
If after all the Capacity-Short charges have been collected and...

...then ERCOT needs to procure additional funds to pay the Make-Whole Payments.
RUC Make-Whole Uplift Charge

Outcome #1

Charge to all QSEs to collect enough funds to pay the RUC Make-Whole Payments

| What: | If the revenues from the Capacity-Short Charge don’t cover all RUC Make-Whole Payments then additional funds will be uplifted to QSEs on a Load Ratio Share basis |
| Why: | Keep ERCOT revenue neutral |
LARUCAMT_{q,i} = (-1) \times (\frac{RUCMWAMTTOT_h}{4} + \frac{RUCCSAMTTOT_i}{4}) \times LRS_{q,i}

Total RUC Make-Whole Payments / 4

Uplifted at Load Ratio Share

Total Capacity-Short Charges for the interval

Determinants

<table>
<thead>
<tr>
<th>RUC Make-Whole Uplift Charge</th>
</tr>
</thead>
<tbody>
<tr>
<td>RUC Make-Whole Amount Total</td>
</tr>
<tr>
<td>RUC Capacity Amount Total</td>
</tr>
<tr>
<td>Load Ratio Share</td>
</tr>
</tbody>
</table>
RUC Make-Whole Uplift Charge

- QSE5 represents Load
  - Load Ratio Share = .25
- ERCOT-wide Values
  - Total RUC Make-Whole Payments: -$800
  - RUC Capacity-Short Charge Total: $100
- ERCOT needs additional funds to pay Make-whole Payments

\[
LARUCAMT = (-1) \times \left( \frac{RUCMWAMTTOT}{4} + \frac{RUCCSAMTTOT}{4} \right) \times LRS
\]

\[
LARUCAMT = (-1) \times \left( \frac{-800}{4} + \frac{100}{4} \right) \times 0.25
\]

\[
= (-1) \times (-200 + 25) \times 0.25
\]

\[
= (-1) \times (-175) \times 0.25
\]

\[
= 43.75
\]

\[
= $25
\]
Reliability Unit Commitment: Settlements

CRR Auction
- Charges and Payments for CRRs
- Revenue Distribution

DAM
- Participation in DAM
  - Energy
  - AS
  - PTP Obligations
- DAM Commitment
  - Make-Whole
- Settlement of CRRs purchased in the Auction

RUC
- RUC Commitment
  - Make-Whole
  - Clawback

Decommitment
RUC Clawback Charge

Outcome #1
Charge to all QSEs whose revenues exceed the RUC Guarantee

<table>
<thead>
<tr>
<th>What:</th>
<th>Collects a portion of revenue above costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Why:</td>
<td>Resource was committed for reliability. Excess revenue should be returned to Load</td>
</tr>
</tbody>
</table>
What if revenues are greater than cost?

- **Revenues Received**
  - Real-Time Revenues
  - Incremental Energy Costs

- **Costs Incurred**
  - Minimum Energy Costs
  - Start-up Costs
What if revenues are greater than cost?

But how does ERCOT determine how much to clawback?
### RUC Clawback Charge

## Clawback Factors

<table>
<thead>
<tr>
<th></th>
<th>Three-Part Supply Offer in DAM</th>
<th>No Three-Part Supply Offer in DAM</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RUC Clawback Factor</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>for RUC hours</td>
<td>50%</td>
<td>100%</td>
</tr>
<tr>
<td><strong>RUC Clawback Factor</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>for QSE hours</td>
<td>0%</td>
<td>50%</td>
</tr>
</tbody>
</table>
Trigger #1

\[
\left( \text{Resource Revenues} \right) > \left( \text{RUC Guaranteed Amount} \right)
\]

Outcome #1

<table>
<thead>
<tr>
<th>Outcome</th>
<th>RUC Guaranteed Amount</th>
<th>Resource Revenues</th>
<th>Receive a RUC Clawback Charge?</th>
</tr>
</thead>
<tbody>
<tr>
<td>QSE1</td>
<td>$4,000</td>
<td>$3,000</td>
<td>?</td>
</tr>
<tr>
<td>QSE4</td>
<td>$6,000</td>
<td>$44,400</td>
<td>?</td>
</tr>
<tr>
<td>QSE6</td>
<td>$8,000</td>
<td>$16,000</td>
<td>?</td>
</tr>
</tbody>
</table>
### RUC Clawback Charge

**Calculate Clawback Amount**

\[
\text{RUCCBAMT} = \left[ (\text{RUCMEREV}_{q, r, d} + \text{RUCEXRR}_{q, r, d} - \text{RUCG}_{q, r, d}) \times \text{RUCCBFR}_{q, r, d} \\
+ (\text{RUCEXRQC}_{q, r, d} \times \text{RUCCBFC}_{q, r, d}) \right] / \sum \text{RUCHR}_{q, r, d}
\]

<table>
<thead>
<tr>
<th>RUCCBAMT (_{q, r, h})</th>
<th>RUC Clawback Charge Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>RUCMEREV (_{q, r, d})</td>
<td>RUC Minimum-Energy Revenue</td>
</tr>
<tr>
<td>RUCEXRR (_{q, r, d})</td>
<td>Revenue Less Cost Above LSL from RUC Hours</td>
</tr>
<tr>
<td>RUCG (_{q, r, d})</td>
<td>RUC Guarantee</td>
</tr>
<tr>
<td>RUCEXRQC (_{q, r, d})</td>
<td>Revenue Less Cost from QSE Clawback Intervals</td>
</tr>
<tr>
<td>RUCCBFR (_{q, r, d})</td>
<td>RUC Clawback Factor for RUC-Committed Hours</td>
</tr>
<tr>
<td>RUCCBFC (_{q, r, d})</td>
<td>RUC Clawback Factor for QSE Clawback Intervals</td>
</tr>
<tr>
<td>RUCHR (_{q, r, d})</td>
<td>RUC Hour</td>
</tr>
</tbody>
</table>

**ERGOT**
RUC Clawback Charge

**Trigger #1**

- QSE4’s Resource Revenues are greater than its RUC Guaranteed Amount
- QSE4’s Resource was committed with a Three-Part Supply Offer

**RUCCBAMT** = \[\left(\text{RUCMEREV} + \text{RUCEXRR} - \text{RUCG} \right) \times \text{RUCCBFR} + \left(\text{RUCEXRQC} \times \text{RUCCBFC}\right) / \sum \text{RUCHR}\]

= \[\left[\left(\$5,000 + \$27,000 - \$6000\right) + \left(\$12,400 \times 0\right)\right] / 5\]

= \[\left[\$26,000 \times 0.5\right] / 5\]

= \$2600 per hour
RUC Clawback Payment

Outcome #1
Payment to all QSEs that represent Load

What: Revenue collected above costs through Clawback charge

Why: Keep ERCOT revenue neutral
• ERCOT receives funds from Clawback charges
• QSE5 represents Load
  • Load Ratio Share (LRS) of 30%

\[ \text{LARUCCBAMT} = (-1) \times (\text{RUCCBAMTTOT} \times \frac{1}{4} \times \text{QSE's LRS}) \]

\[ = (-1) \times ($2600 \times \frac{1}{4} \times 0.30) \]

\[ = (-1) \times ($650 \times 0.30) \]

\[ = -$195 \]
Reliability Unit Commitment: Settlements

CRR Auction
- Charges and Payments for CRRs
- Revenue Distribution

DAM
- Participation in DAM
  - Energy
  - AS
  - PTP Obligations
- DAM Commitment
  - Make-Whole
- Settlement of CRRs purchased in the Auction

RUC
- RUC Commitment
  - Make-Whole
  - Clawback
- Decommitment

ERCOT
RUC Payment for Decommitment

Outcome #1
Payment to QSE for a QSE-committed Resource that the RUC process decommitted

If all criteria met:
- ERCOT pays QSE for decommitment
- Payment occurs only for Operating Day of decommitment
- QSE gets RUC Capacity Credit
### RUC Payment for Decommitment

#### Decommitment of a QSE-Committed Resource

**RUC Decommitment Payment**

- Start-up Price (SUPR)
- Less cost savings (MEPR – RTSPP), if any
- Distributed across Decommitted Hours (NCDCHR)

<table>
<thead>
<tr>
<th>Three-Part Supply Offer</th>
<th>Verifiable Costs</th>
<th>Generic Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SUPR</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Startup Offer</td>
<td>Verifiable Startup Costs</td>
<td>Resource Category Generic Startup Cost</td>
</tr>
<tr>
<td><strong>MEPR</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
RUC Payment for Decommitment

- ERCOT decommits QSE1 Unit 1
  - QSE-Committed Resource
  - Resource is NOT scheduled to shutdown within the Operating Day

### Outcome #1

\[
\text{RUCDCAMT} = (-1) \times \max \{0, [\text{SUPR} - (\max (0, \text{MEPR} - \text{RTSPP}) \times (\text{LSL} \times (\frac{1}{4})))]/\text{NCDCHR}\}
\]

\[
\text{RUCDCAMT} = (-1) \times \max \{0, [\$1200 - (\max (0, \$30 - \$40) \times (10\text{MW} \times (\frac{1}{4})))]/6
\]

\[
= (-1) \times \$1200 / 6 = -\$200
\]
RUC Payment for Decommitment

- ERCOT decommits QSE1 Unit 1
  - QSE-Committed Resource
  - Resource is scheduled to shutdown within the Operating Day

QSE will not receive payment for decommitment
**RUC Decommitment Charge**

**Outcome #1**

**Charge to QSEs that represent Load**

<table>
<thead>
<tr>
<th>What:</th>
<th>Charge to fund Decommitment Payments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Why:</td>
<td>Keep ERCOT revenue neutral</td>
</tr>
</tbody>
</table>
- Resource are decommitted by the RUC process and are eligible to receive a decommitment payment
- QSE5 represents Load
  - Load Ratio Share of 30%

RUC Decommitment Charge

\[
\text{LARUCDCAMT}_{q,i} = (-1) \times \left( \frac{\text{RUCDCAMTTOT}_h}{4} \times \text{LRS}_{q,i} \right)
\]

\[
= (-1) \times \left[ \frac{-200}{4} \times 0.30 \right]
\]

\[
= (-1) \times \left[ -50 \times 0.30 \right]
\]

\[
= 15
\]
Module Summary

$ Describe the overall Reliability Unit Commitment Settlement process

$ Identify Market and ERCOT actions that impact RUC Settlements.

$ Calculate various charges and payments associated with RUC Commitments and Decommitments