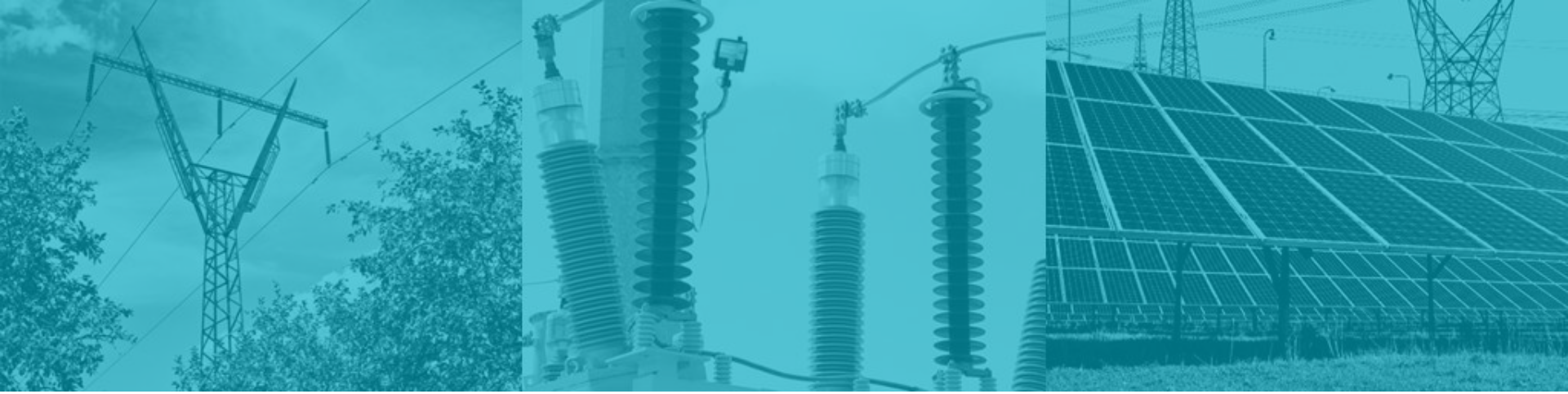


ERCOT Market Education

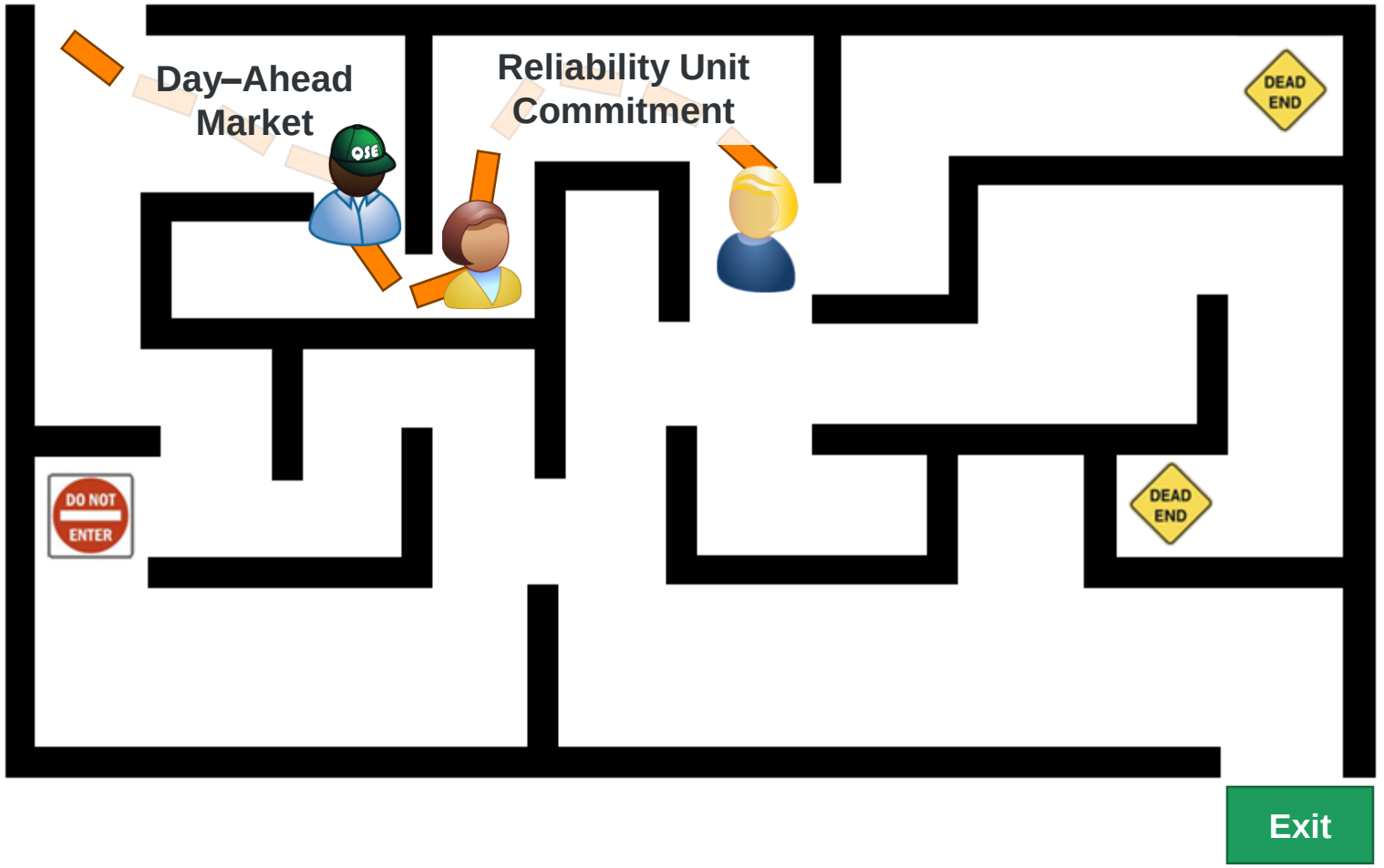
Wholesale Markets 201

Reliability Unit Commitment

Module Overview

Enter

Introduction

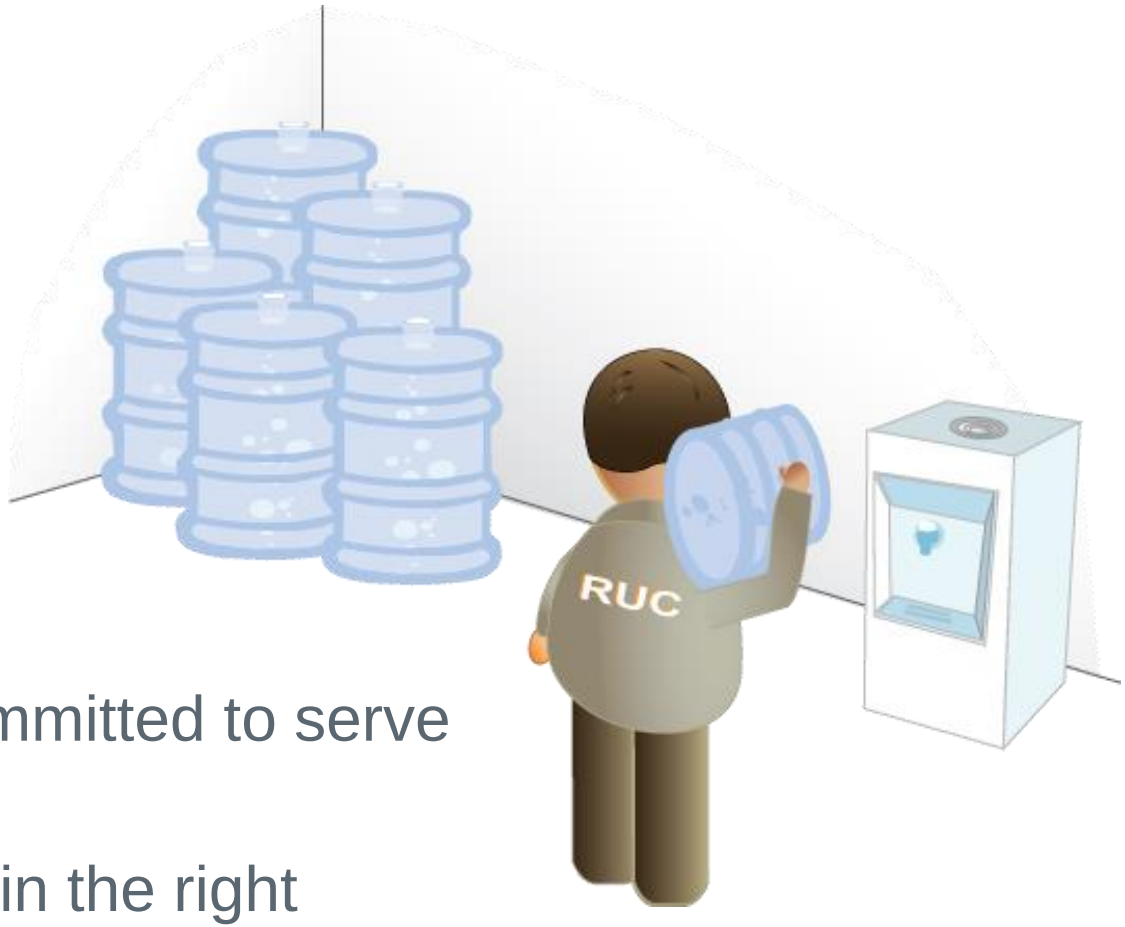


Exit

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

- Describe the purpose of the Reliability Unit Commitment (RUC) process
- Distinguish the timelines of the Day-Ahead RUC and the Hourly RUC
- Summarize the impacts of ERCOT, TSPs and QSEs on this process
- Identify the financial impacts of Reliability Unit Commitment

Purpose of Reliability Unit Commitment (RUC)



It ensures:

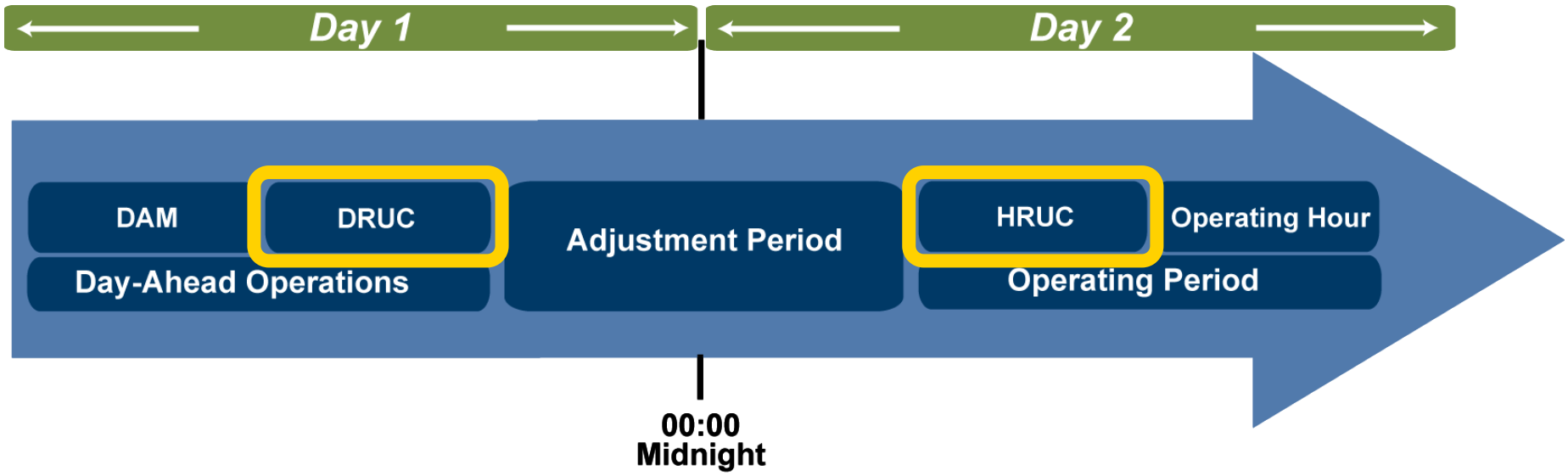
- Enough capacity is committed to serve the forecasted load
- Committed capacity is in the right locations

Capacity Considerations

- QSEs have already committed Resource capacity
- Some capacity committed as Ancillary Service
- RUC ensures enough “dispatchable” capacity to meet security constraints
  - Power Balance
  - Transmission Constraints

When does Reliability Unit Commitment (RUC) occur?

- Day-Ahead Reliability Unit Commitment (DRUC)
- Hourly Reliability Unit Commitment (HRUC)

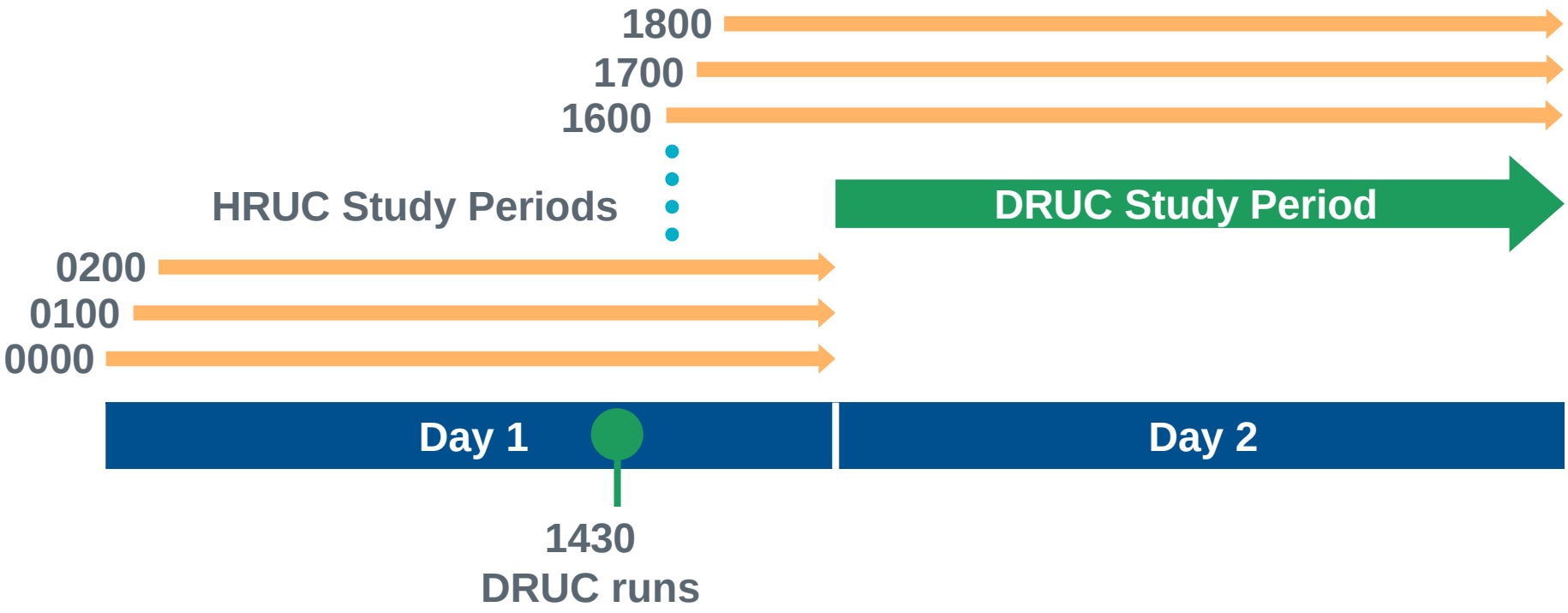


DRUC Timing and Study Period

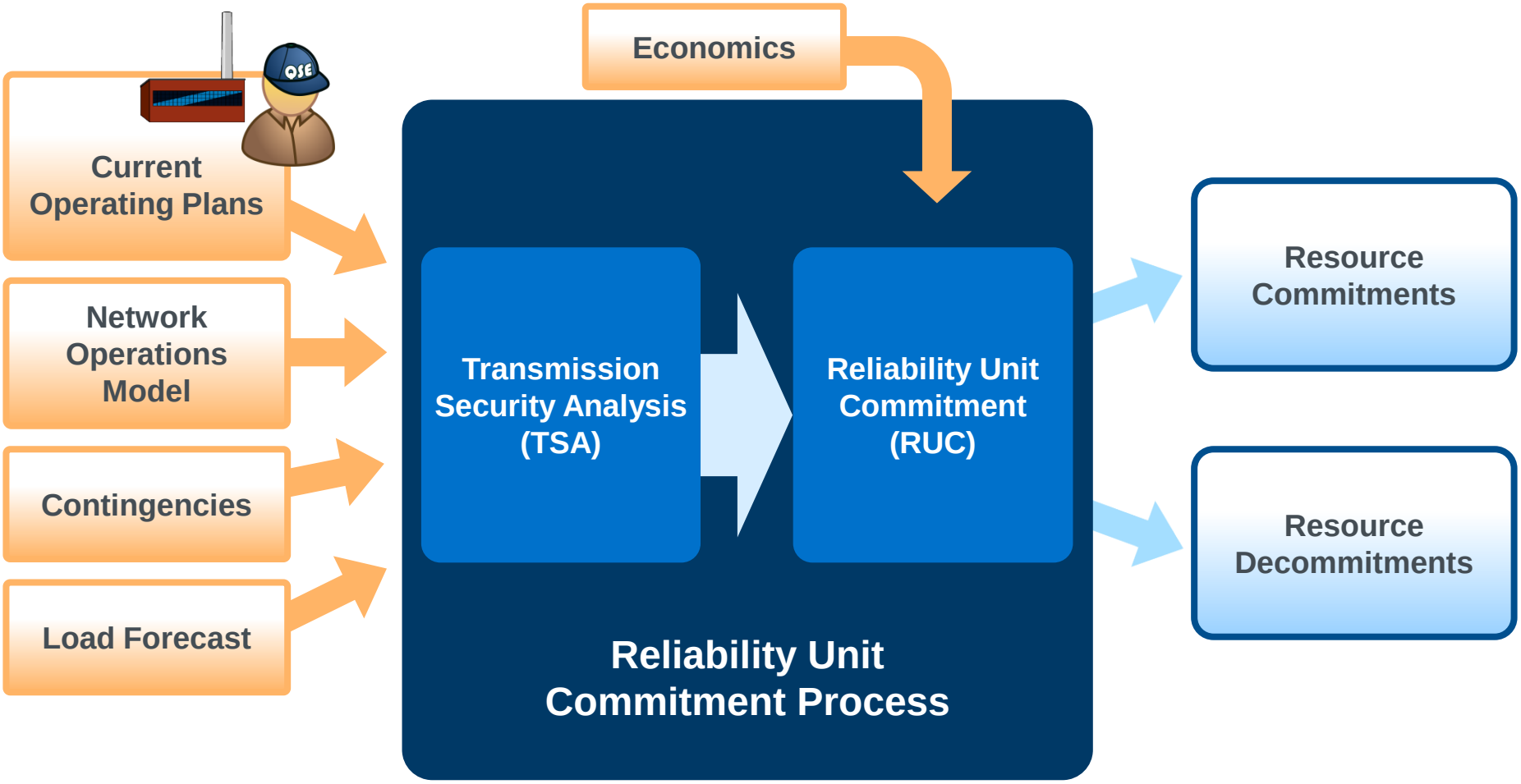
- Runs once a day
- Studies all hours of the next day

HRUC Timing and Study Period

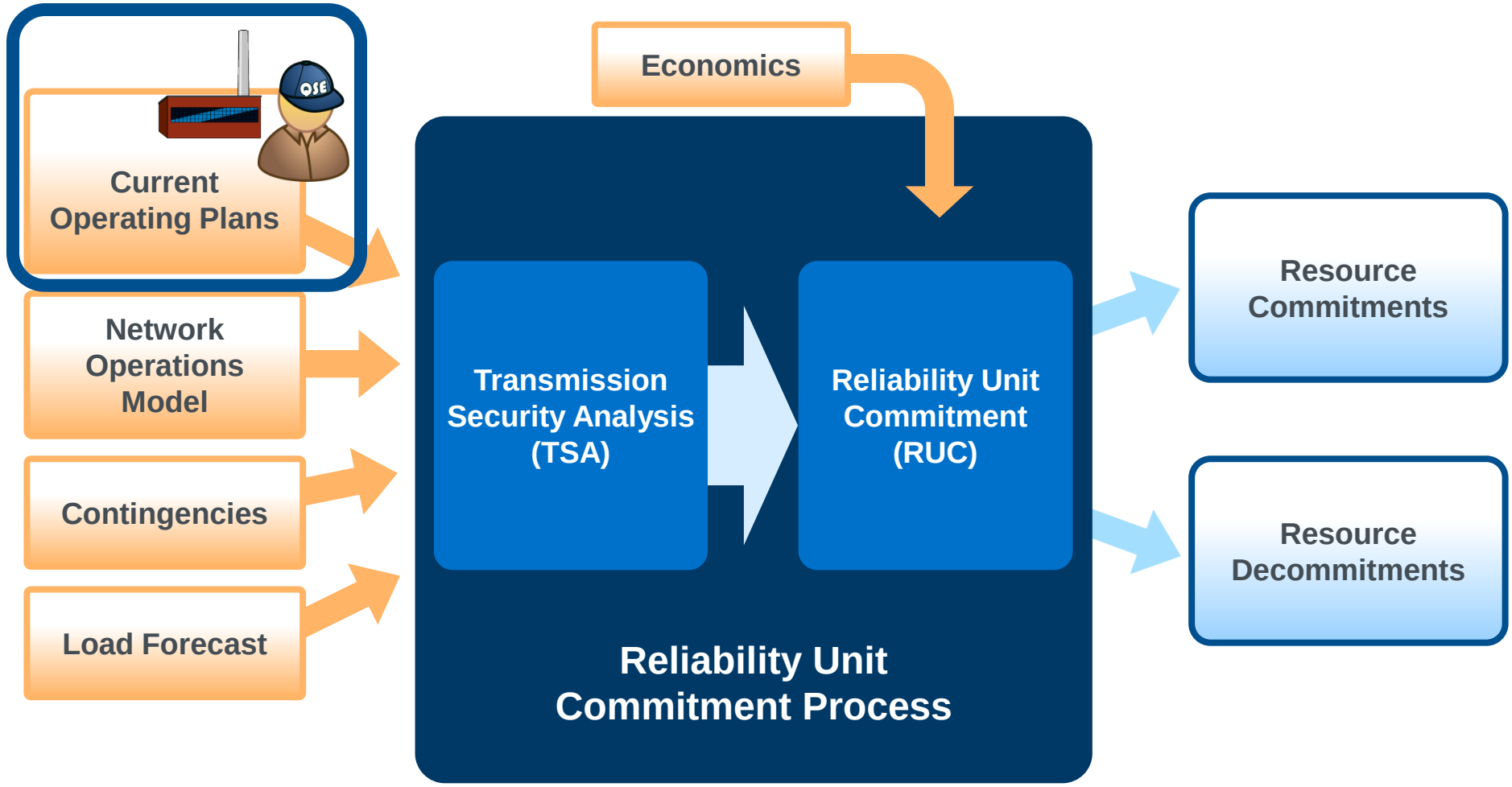
- Runs every hour
- Studies all hours already studied by DRUC



The Reliability Unit Commitment Process



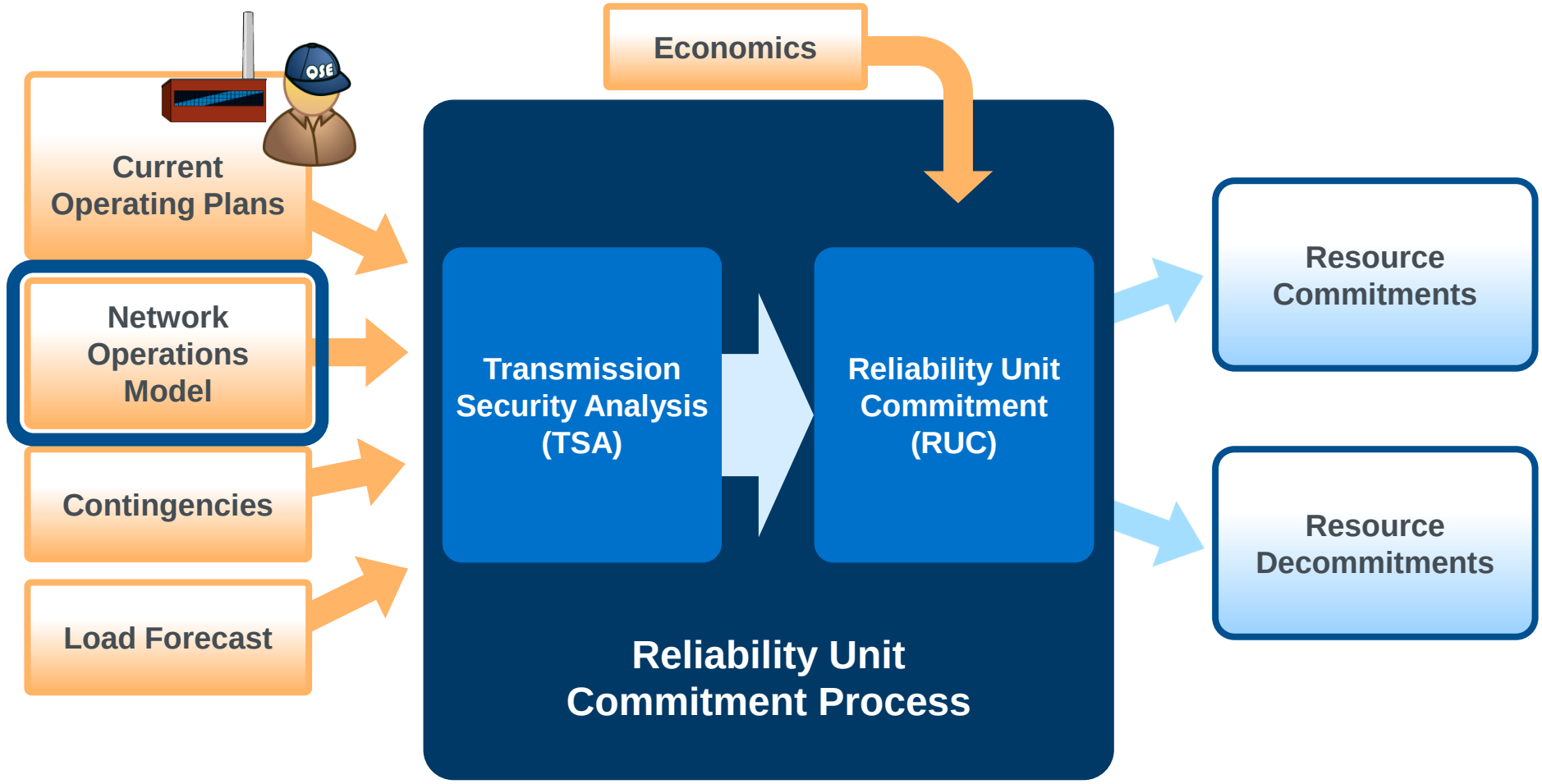
The Reliability Unit Commitment Inputs



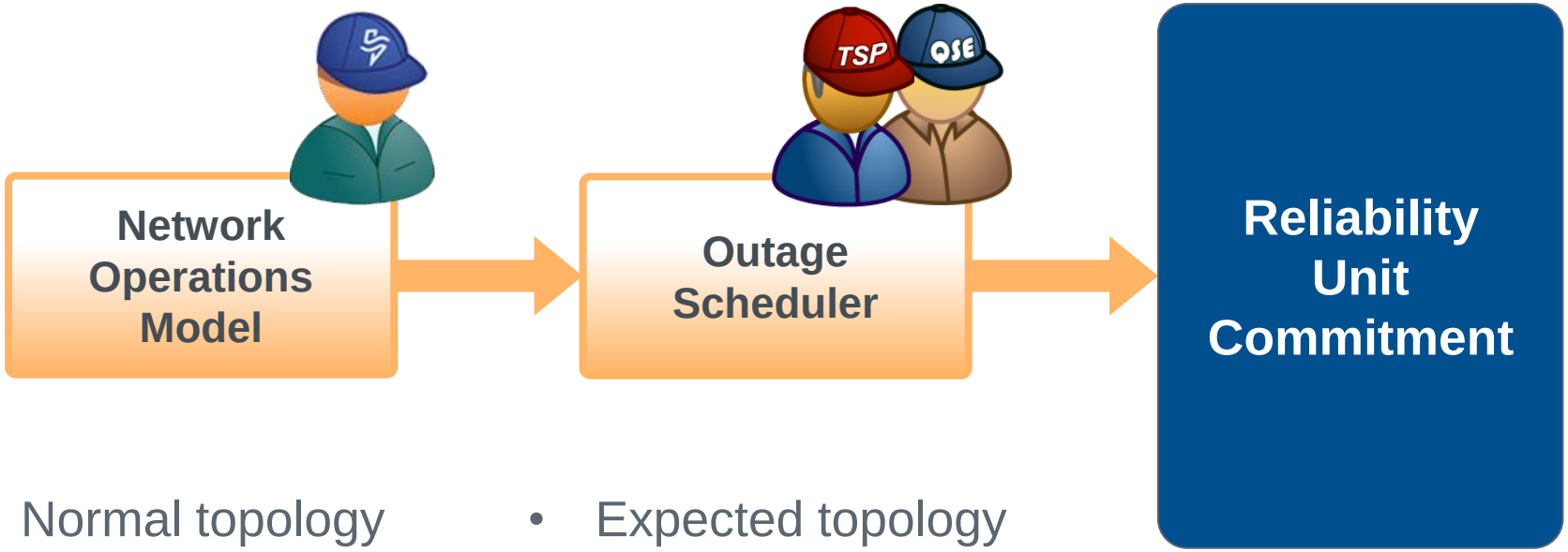
Current Operating Plan

- **ON** (any variety): Resource capacity is committed
- **OFF**: Resource is offline but available for RUC commitment
- **ONRR**: Resource is online acting as a synchronous condenser, but available for RUC commitment
- **OUT**: Resource is not available

The Reliability Unit Commitment Inputs



Network Operations Model

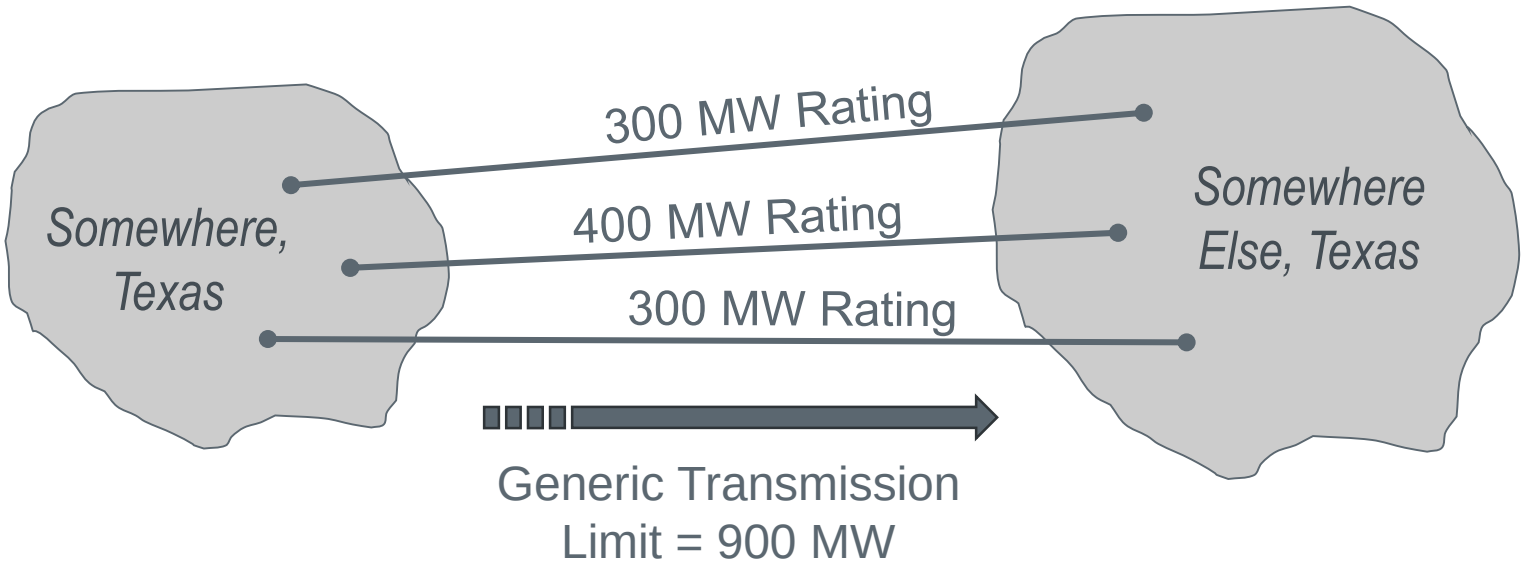


- Normal topology
- Equipment Ratings
- Generic Constraints

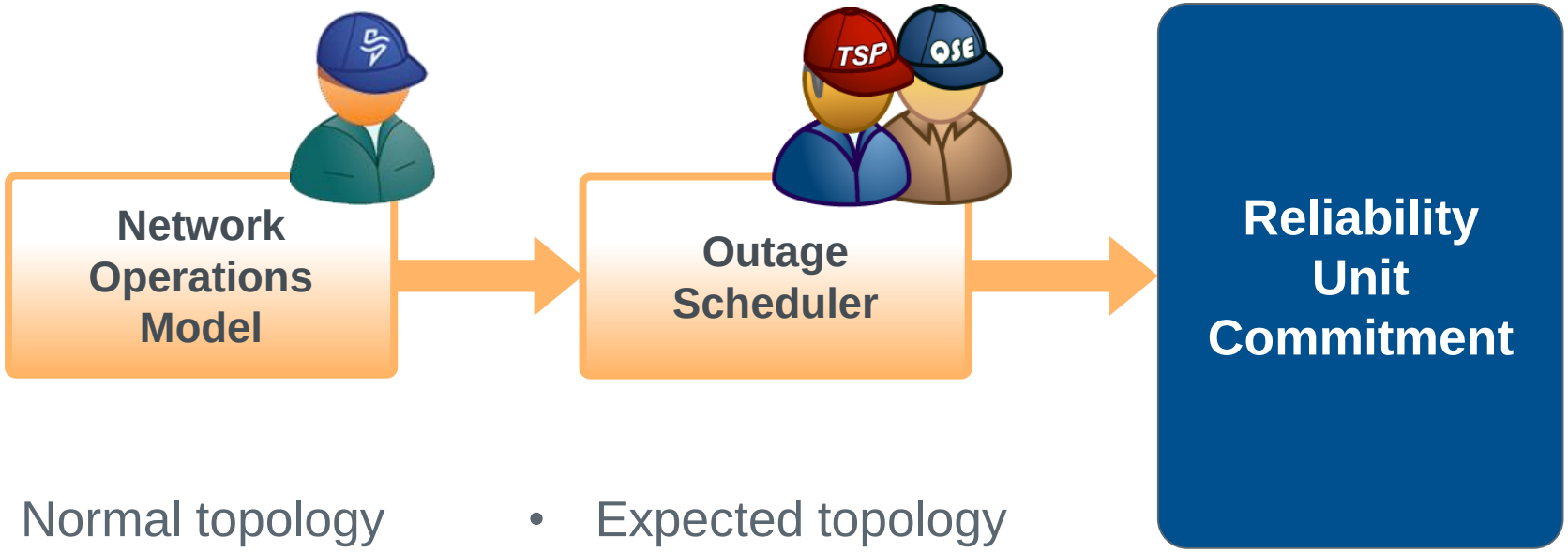
- Expected topology changes

Generic Transmission Constraints

- Represent stability and voltage limits between areas
- More constraining than thermal limits



Network Operations Model



- Normal topology
- Equipment Ratings
- Generic Constraints
- Other constraint management plans

- Expected topology changes

Other Constraint Management Plans

RAS — Remedial Action Scheme

- Automatically activated
- Maintain system security
- Transmission, Load or Resource solution

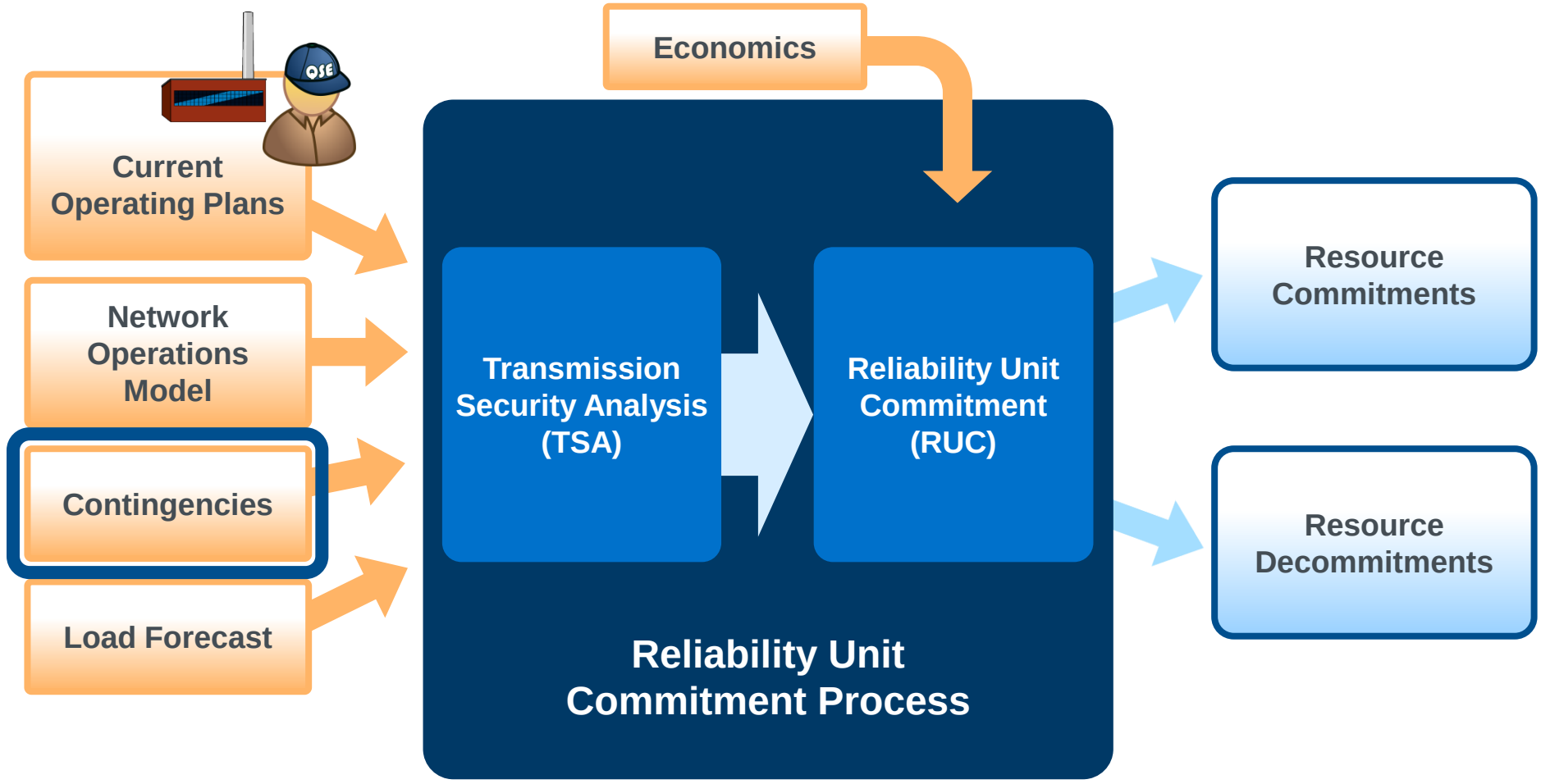
AMP — Automatic Mitigation Plan

- Automatically activated
- Manage only localized voltage issues
- Switches series reactors

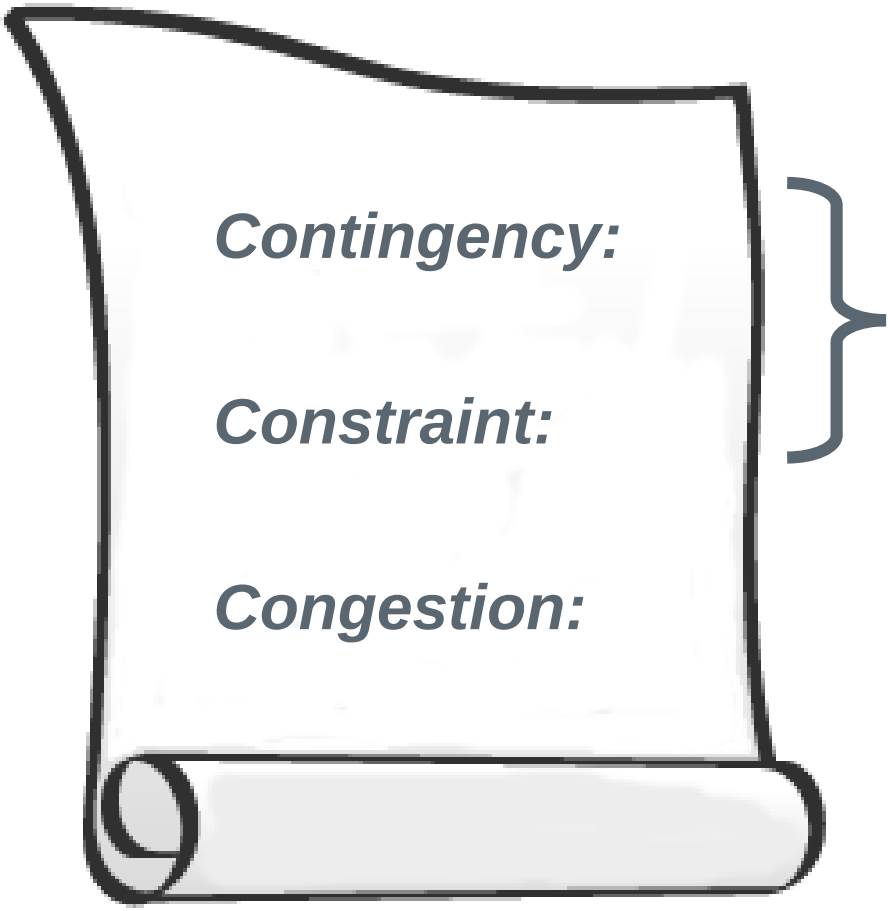
RAP — Remedial Action Plan

- Manually activated by ERCOT and TSP
- Maintain system security
- Transmission solution

The Reliability Unit Commitment Inputs

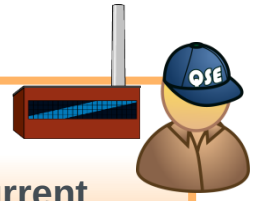


The Three C's of Transmission Security



Security Violation is always a Contingency/Constraint pair

The Reliability Unit Commitment Inputs



Current Operating Plans

Network Operations Model

Contingencies

Load Forecast

Economics

Transmission Security Analysis (TSA)

Reliability Unit Commitment (RUC)

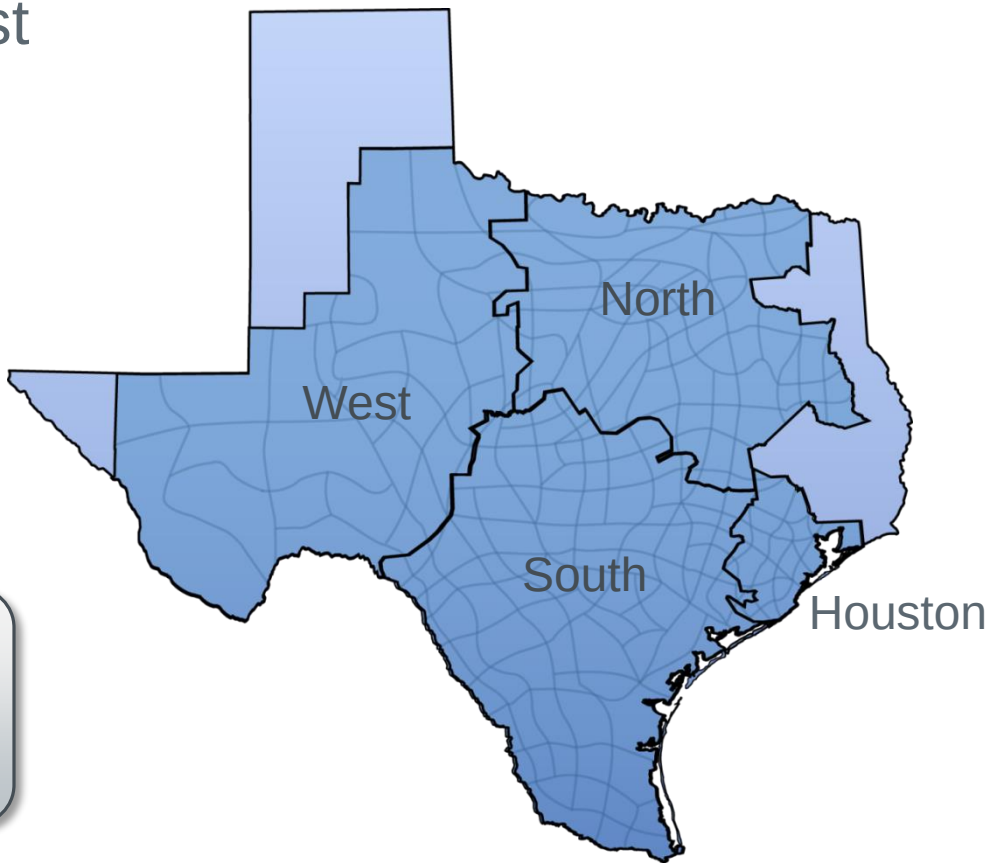
Reliability Unit Commitment Process

Resource Commitments

Resource Decommitments

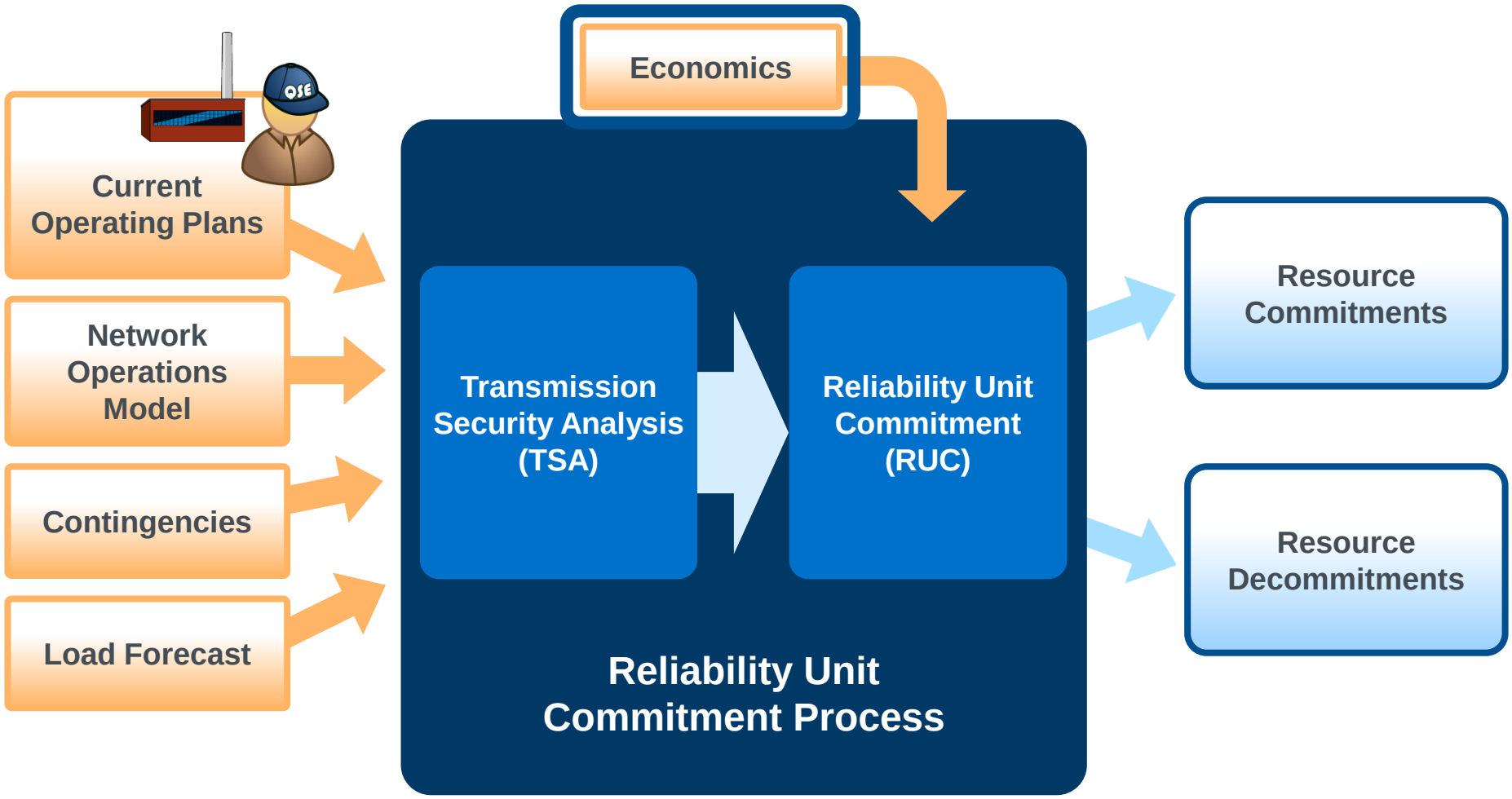
Load Distribution Factors

- Distribute the Load Forecast to individual buses within a Load Zone
- Allows RUC to model power flows



Load Distribution Factors are chosen based on “cold,” “mild,” or “hot” proxy days.

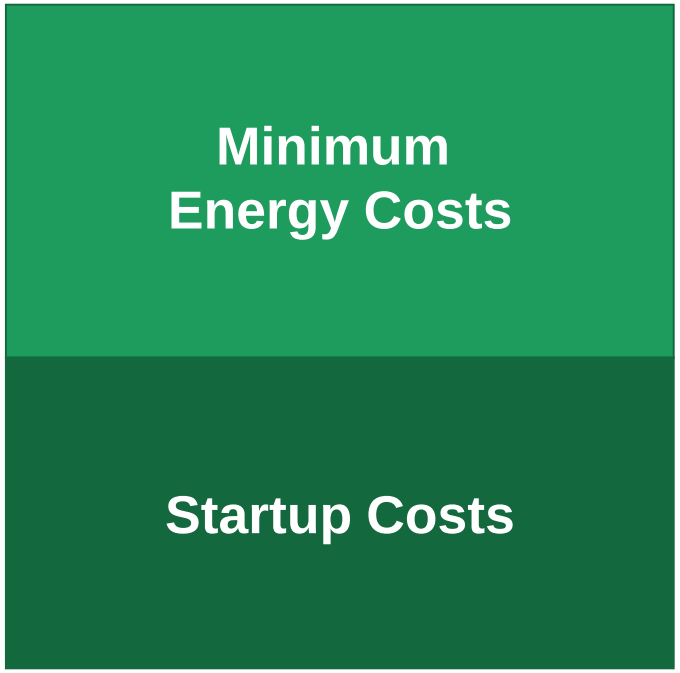
The Reliability Unit Commitment Inputs



RUC Engine Optimizes Commitment Costs

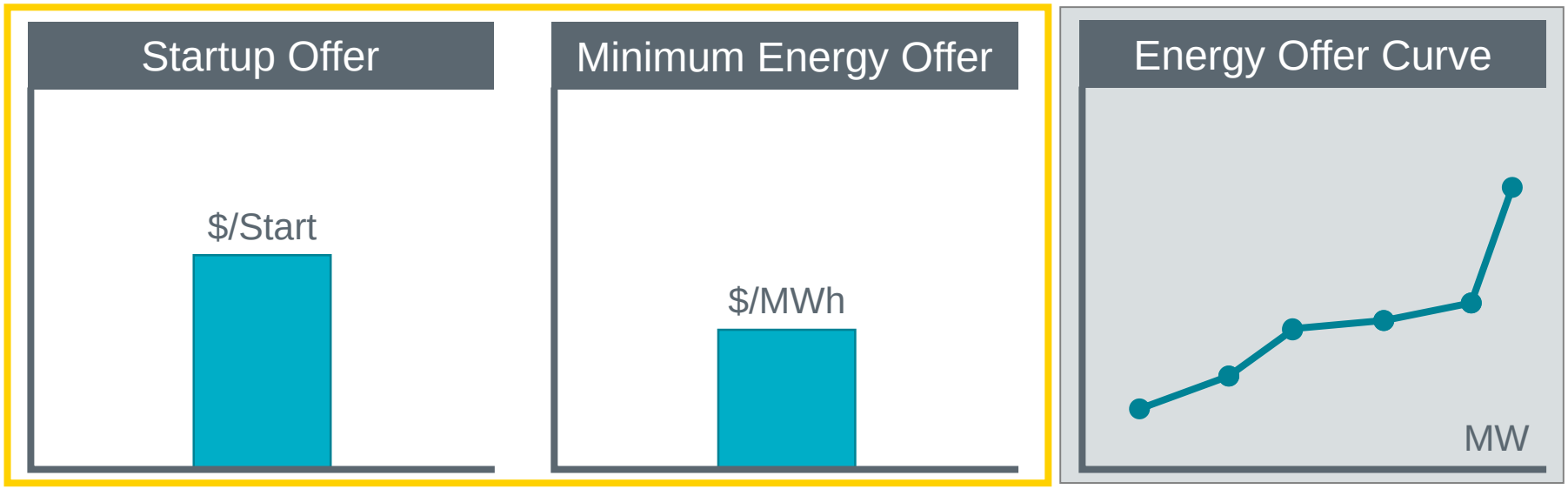
Source of these costs depends on circumstances

- Start-Time > 1hr
- Start-Time ≤ 1hr



Costs Considered

Three-Part Supply Offer

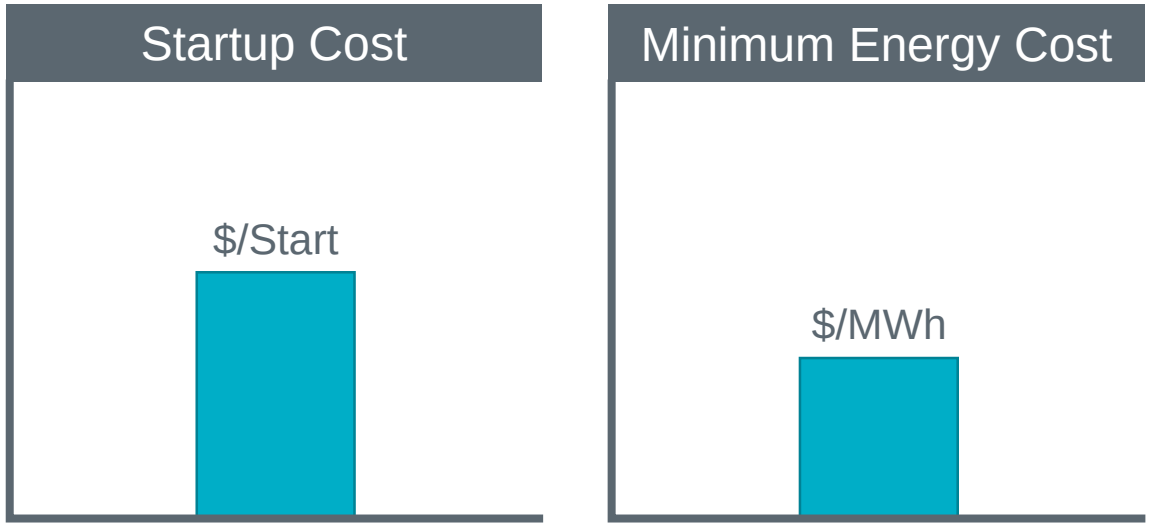


RUC uses only:

- Startup Offer
- Minimum Energy Offer

Capped at maximum of Generic or Verifiable Costs

No Three-Part Supply Offer from QSE

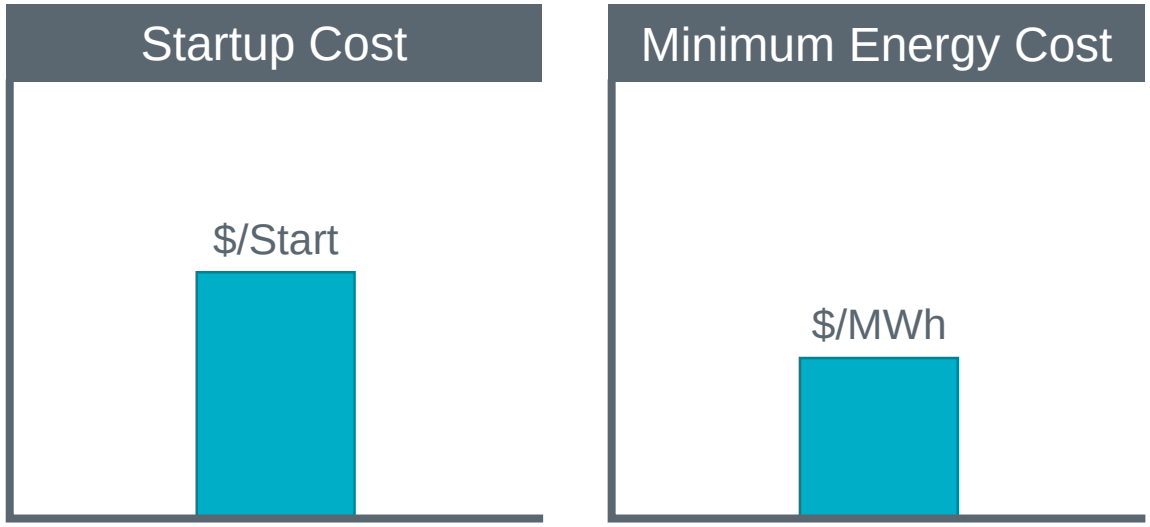


Based on:

- Approved Verifiable Costs
- Resource Generic Costs

Scaled up to 150%

Regardless of what QSE submits



Based on:

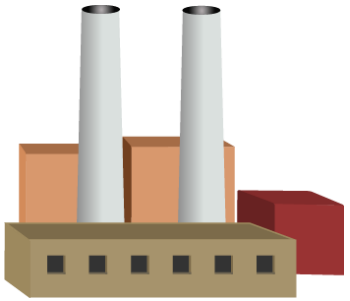
- Approved Verifiable Costs
- Resource Generic Costs

Scaled down to 20%*

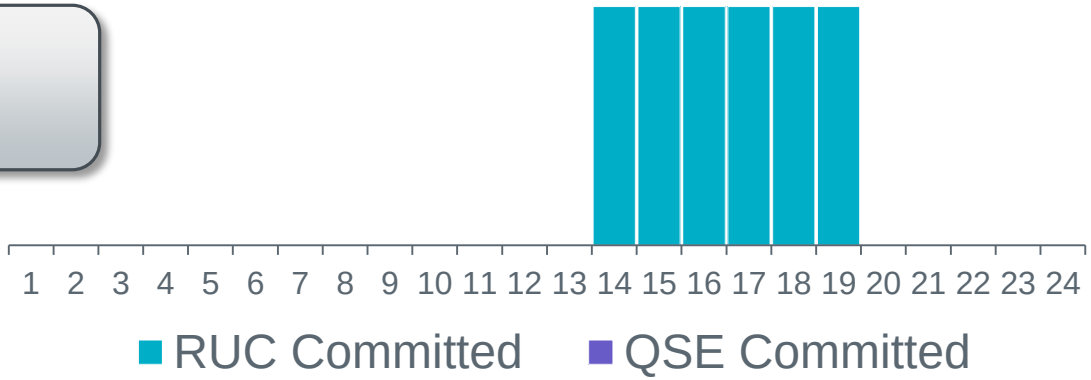
* Maximum and currently approved value

Startup Cost Considered?

- No QSE commitments
- RUC initially commits

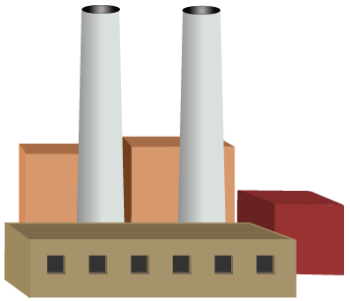


RUC will consider Startup Costs

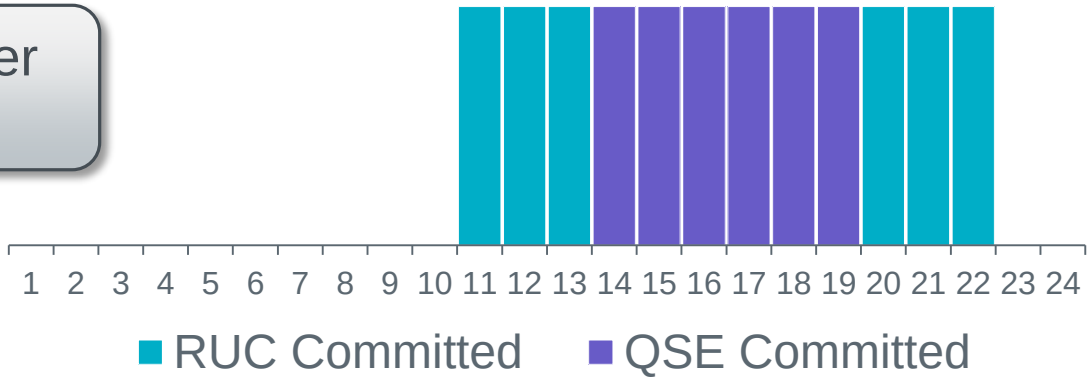


Startup Cost Considered?

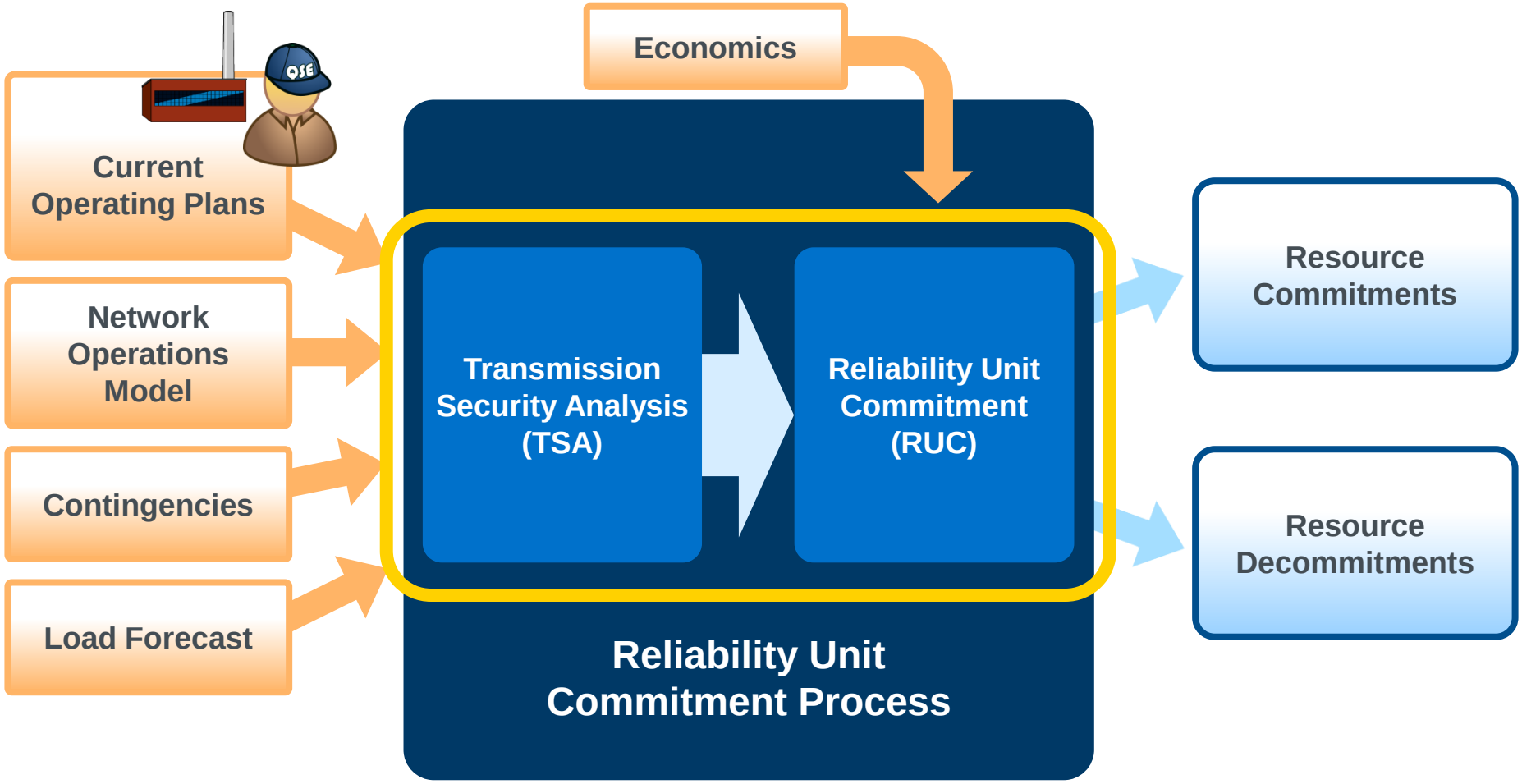
- QSE initially commits
- RUC extends commitment



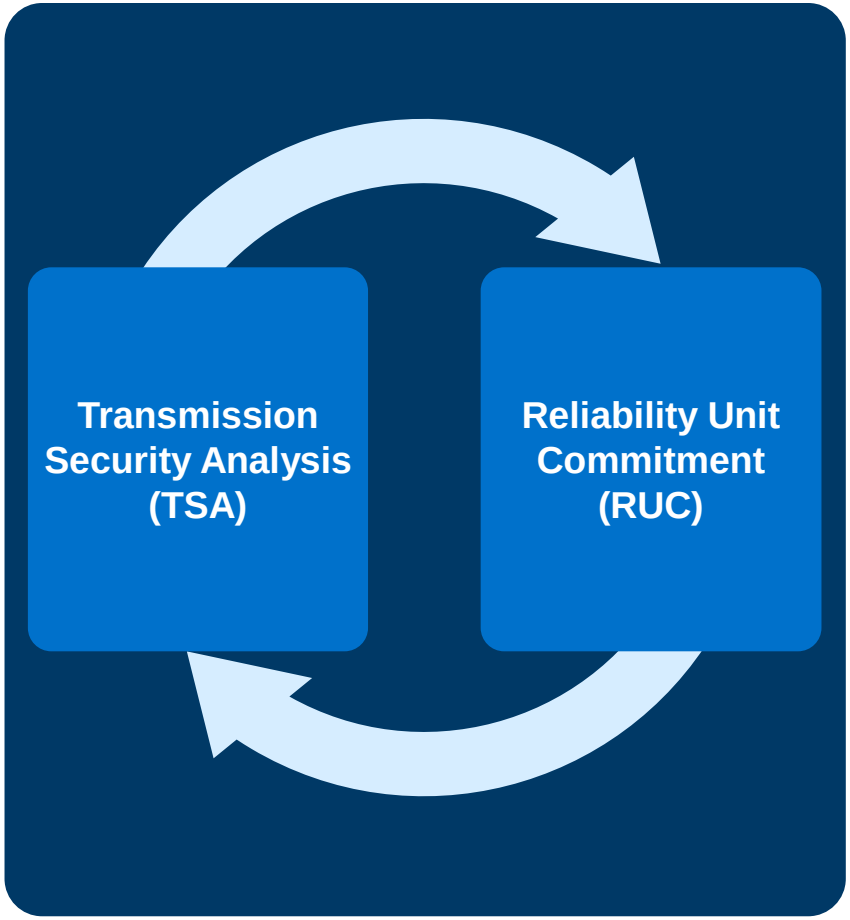
RUC will not consider Startup Costs



The Reliability Unit Commitment Process

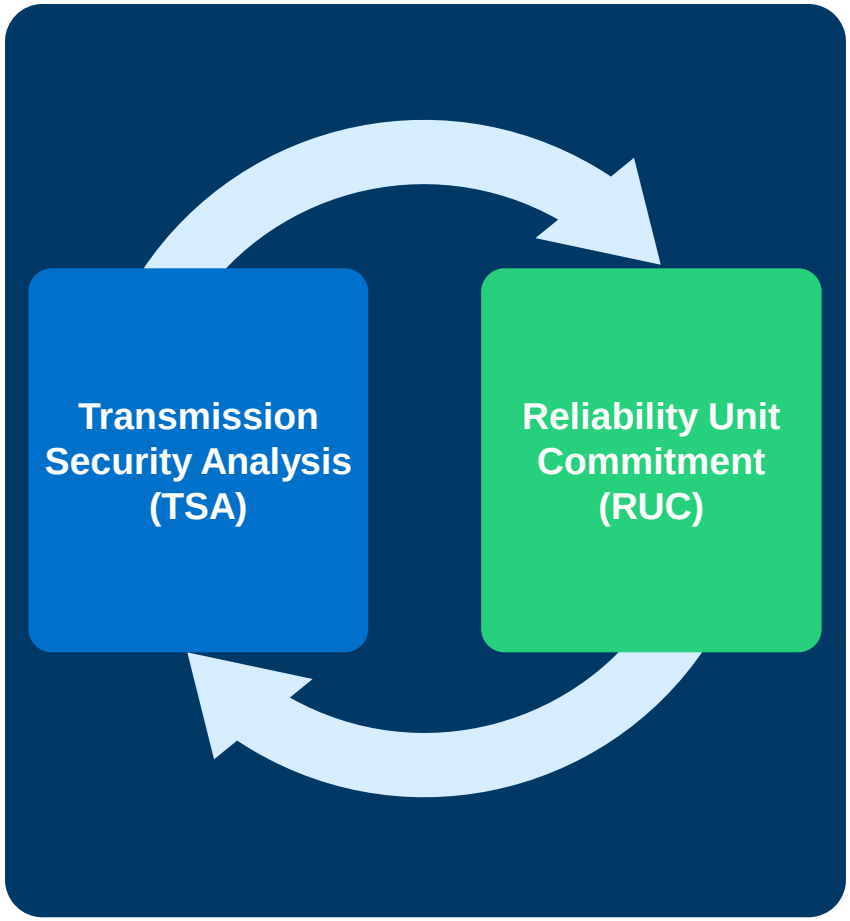


The Reliability Unit Commitment Process



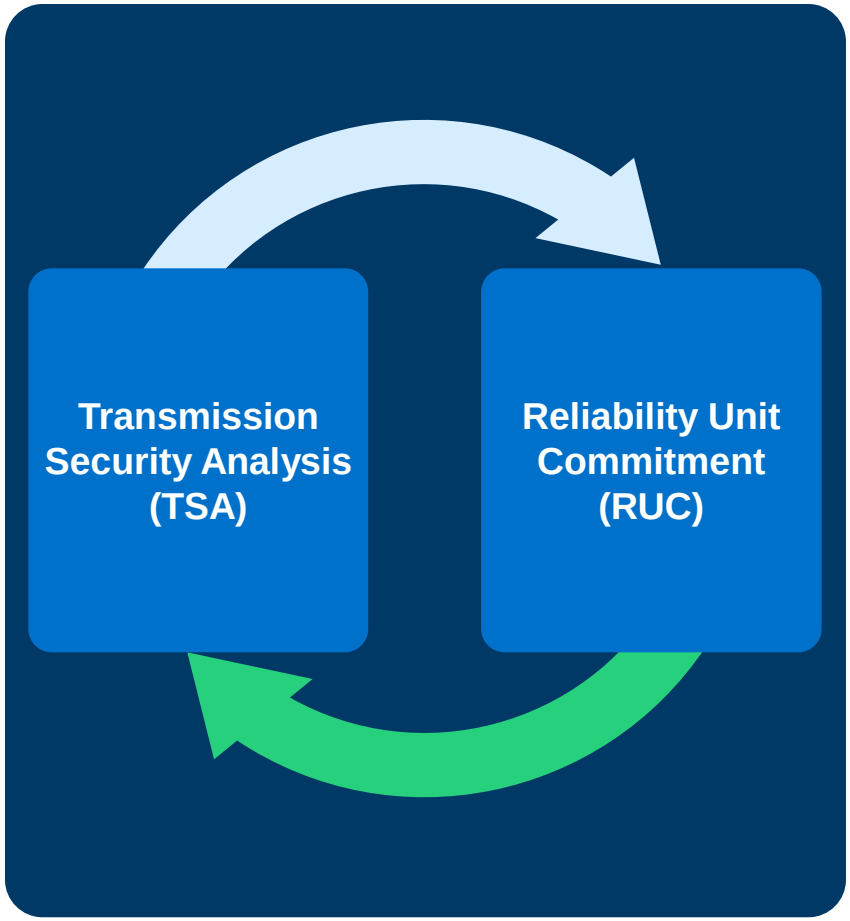
1. Determine initial unit commitment

- Includes Resources previously committed
- May commit additional Resources to meet Load Forecast
- Does not recognize Transmission Constraints



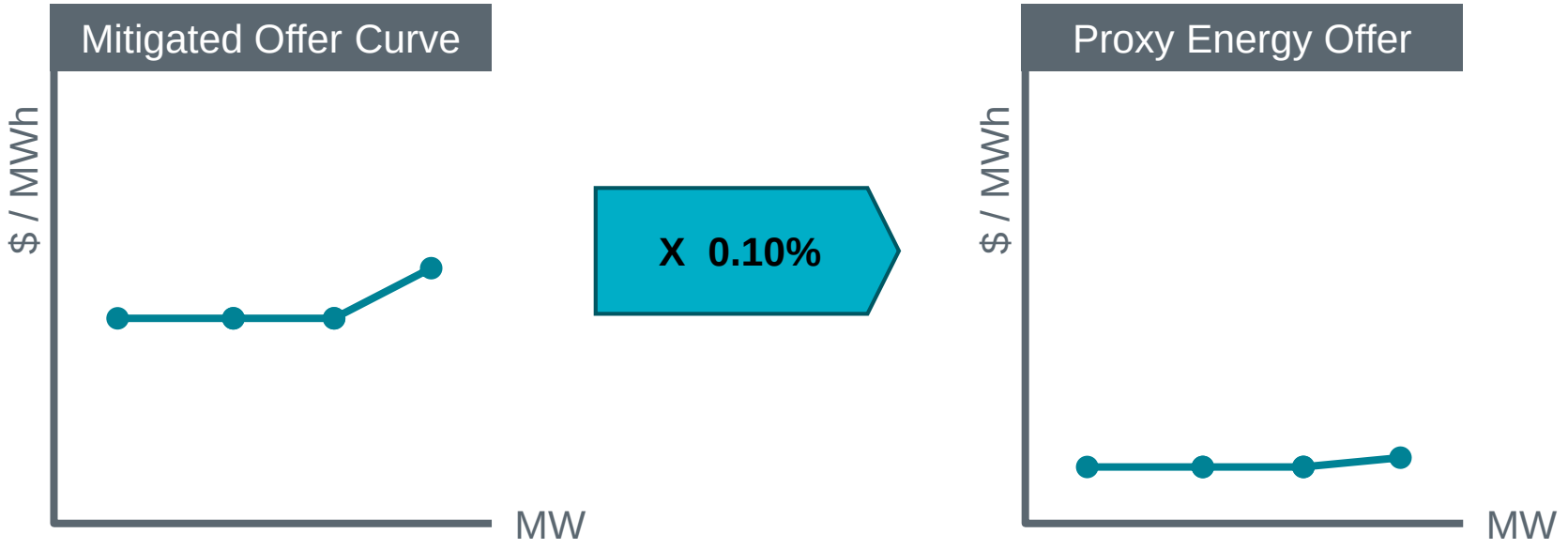
1. Determine initial unit commitment

Produces a dispatch solution for input to Transmission Security Analysis



Proxy Energy Offer Curve

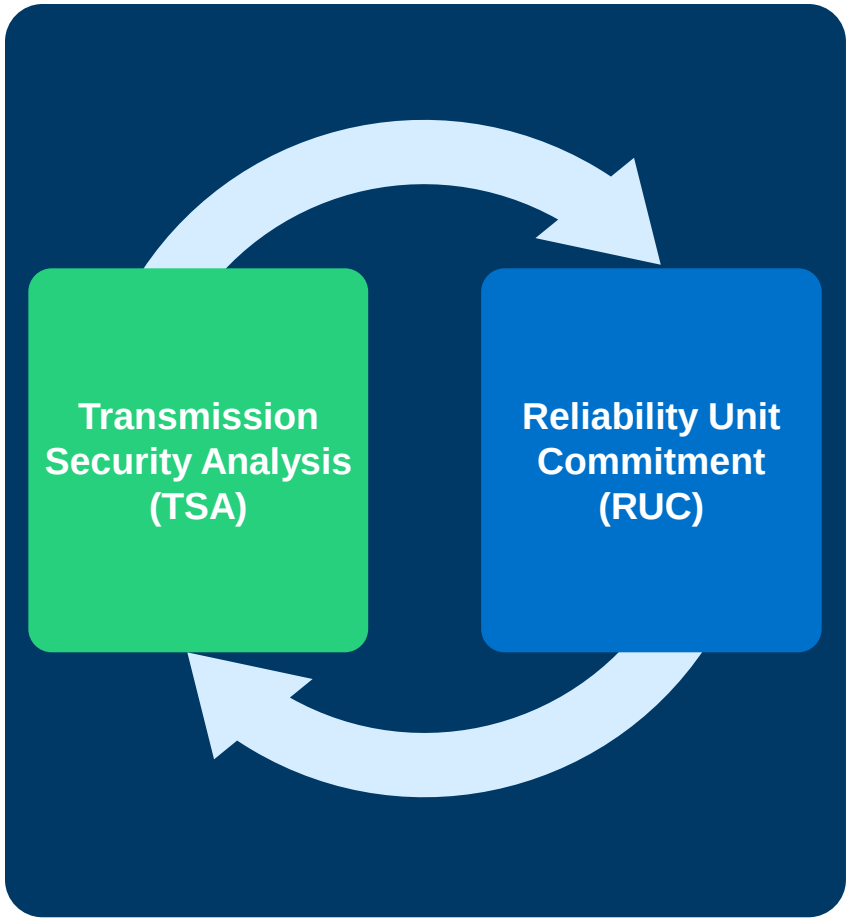
- Allows RUC to calculate a “dispatch solution”
- Derived from Mitigated Offer Cap



2. Check to see if dispatch solution is secure

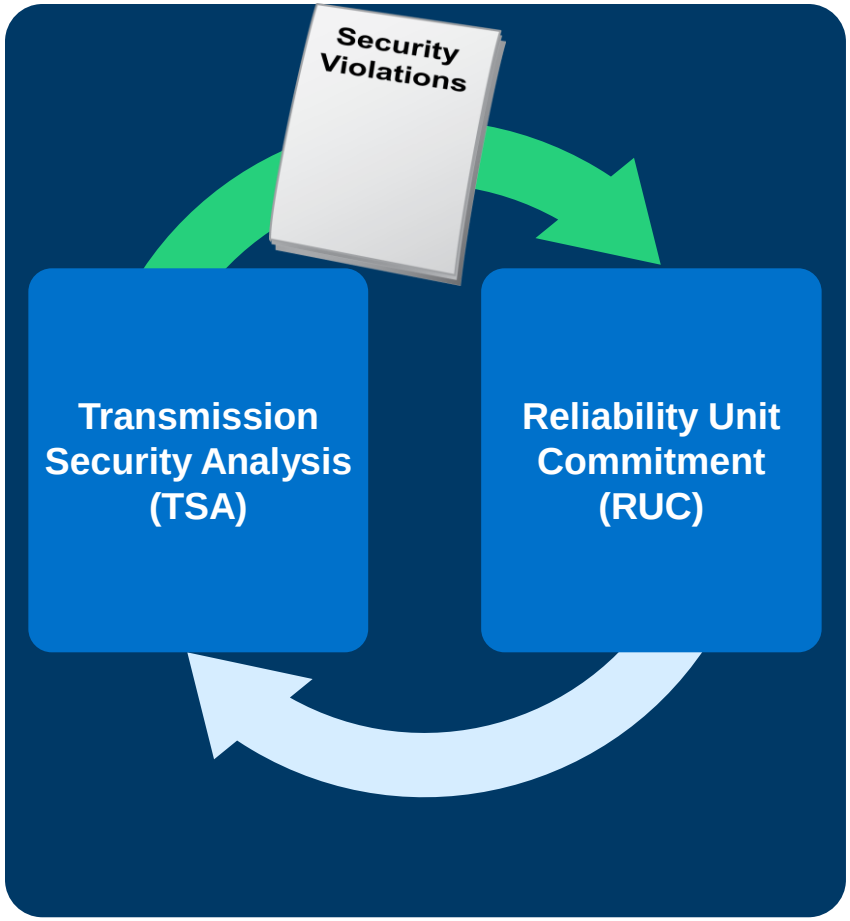
- Tests base case and contingency cases
- Determines Transmission Constraints

Any contingency that triggers a RAP, AMP or RAS is ignored



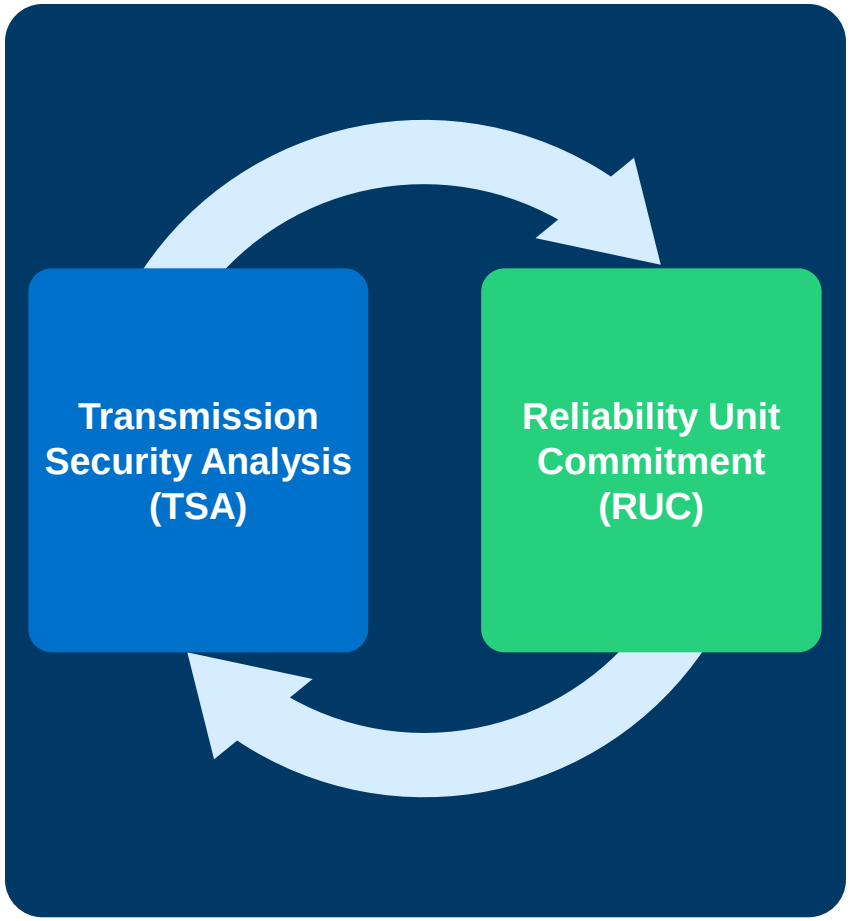
2. Check to see if dispatch solution is secure

Produces a set of Security Violations to be solved by RUC

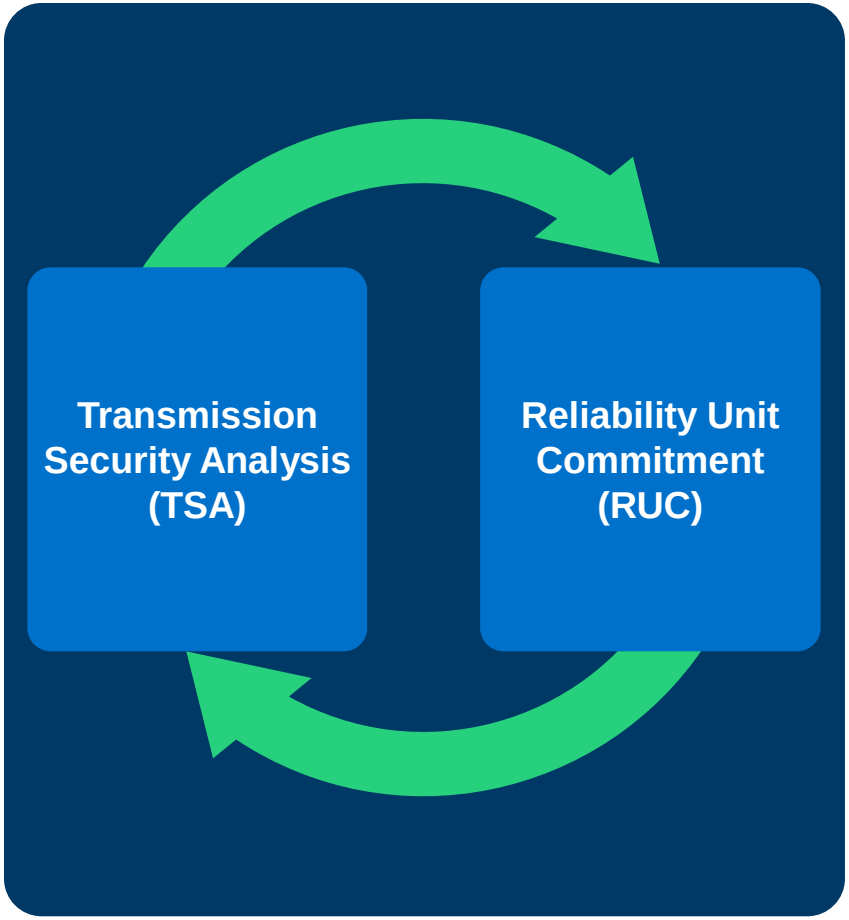


3. Determine revised unit commitment

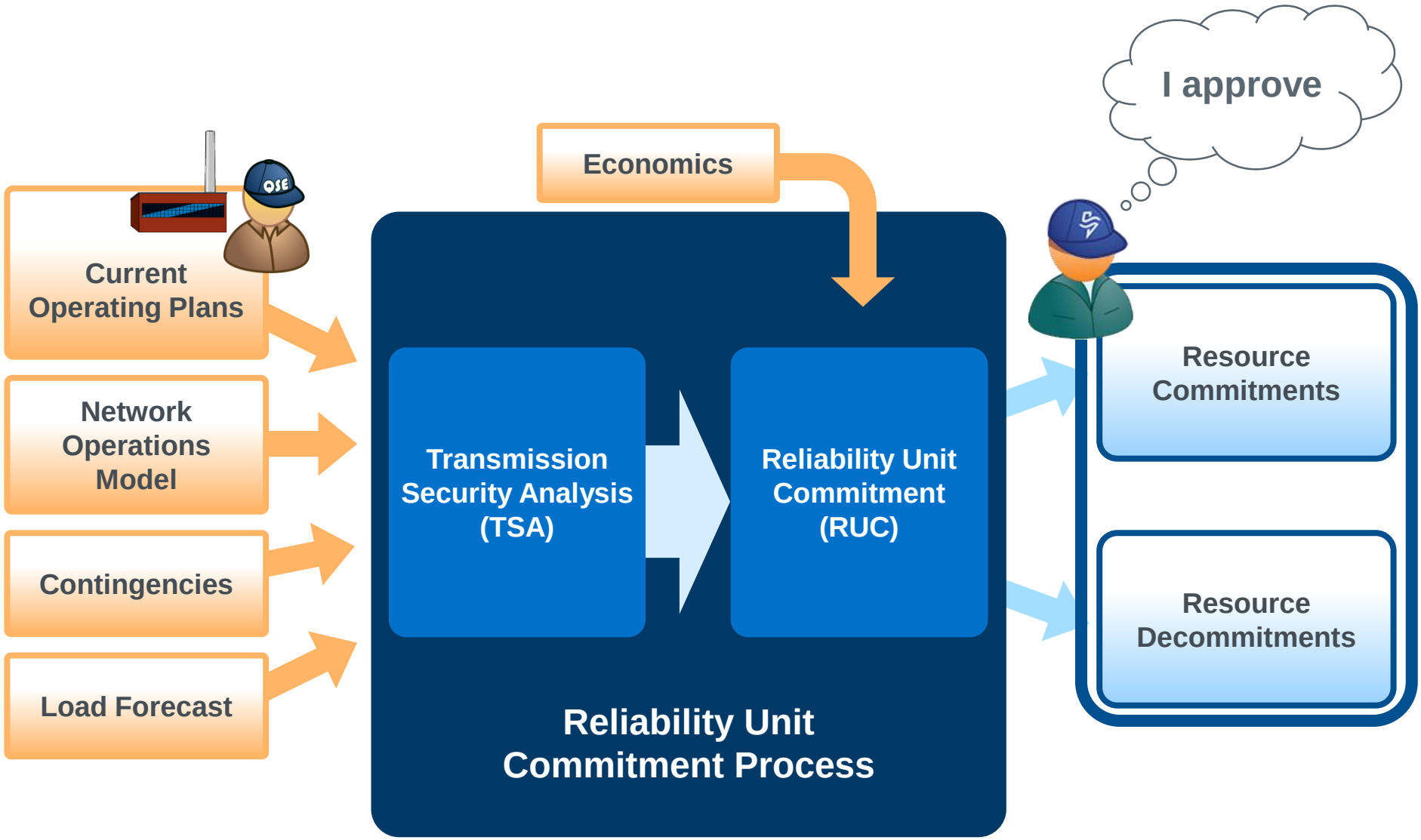
- Enforces Transmission Constraints
- Revise Resource Commitments as needed to resolve Security Violations



4. Repeat process until solutions converge



The Reliability Unit Commitment Results



RUC Commitment of a Resource

Commitment Responsibilities:

ERCOT:	QSE:
Communicates the start interval and duration for which the Resource is required to be at least LSL	Updates COP to confirm change in Resource status

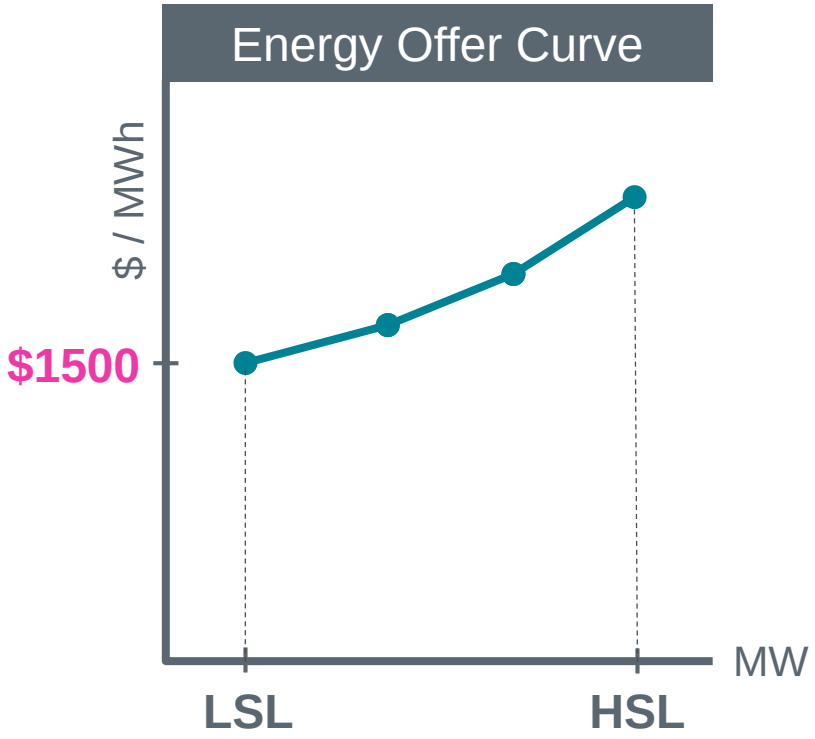
Communication:

- May be electronic
- May be verbal

Energy Offer Curve for a RUC-Committed Resource

- All energy above LSL subject to offer floor
- QSE may update by end of Adjustment Period
- ERCOT will adjust if QSE does not

Applies only to hours in the RUC Commitment Period



RUC Decommitment of a Resource

Decommitments:

RUC may decommit a Resource for a transmission security violation that is otherwise unresolvable.

Decommitment Responsibilities:

ERCOT:	QSE:
Communicates the interval in which the Resource is required to be Off-Line, duration, and reason for decommitment	Updates COP to confirm change in Resource status

MIS Postings upon completion of RUC

All active and binding transmission constraints used in the commitment process

All Resources committed or decommitted by RUC

Breakout Session

For each input below, discuss:

- How is it used in the overall RUC process?
- What are the impacts?

- **Current Operating Plan**
- **Equipment Ratings**
- **RAPs and RASs**
- **Contingencies**
- **Load Forecast**
- **Three Part Supply Offer**

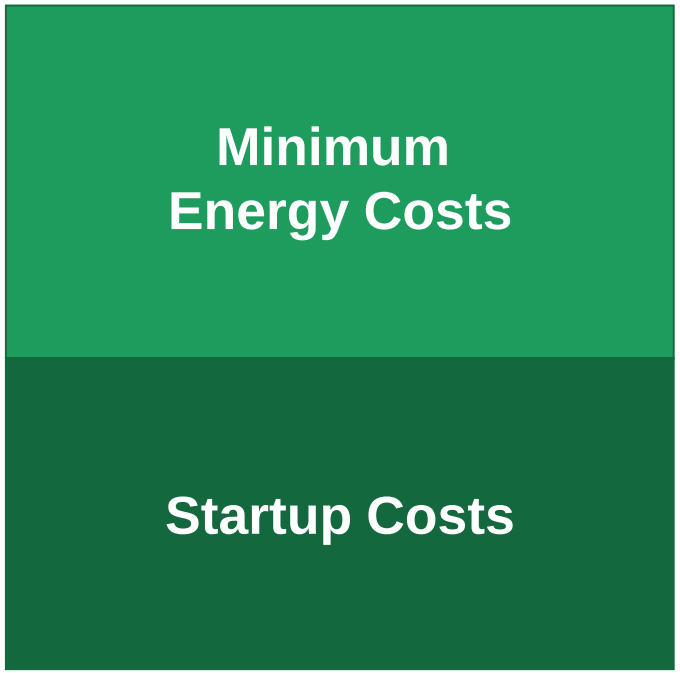
Reliability Unit Commitment: Financial Impacts

If ERCOT commits a Resource through RUC

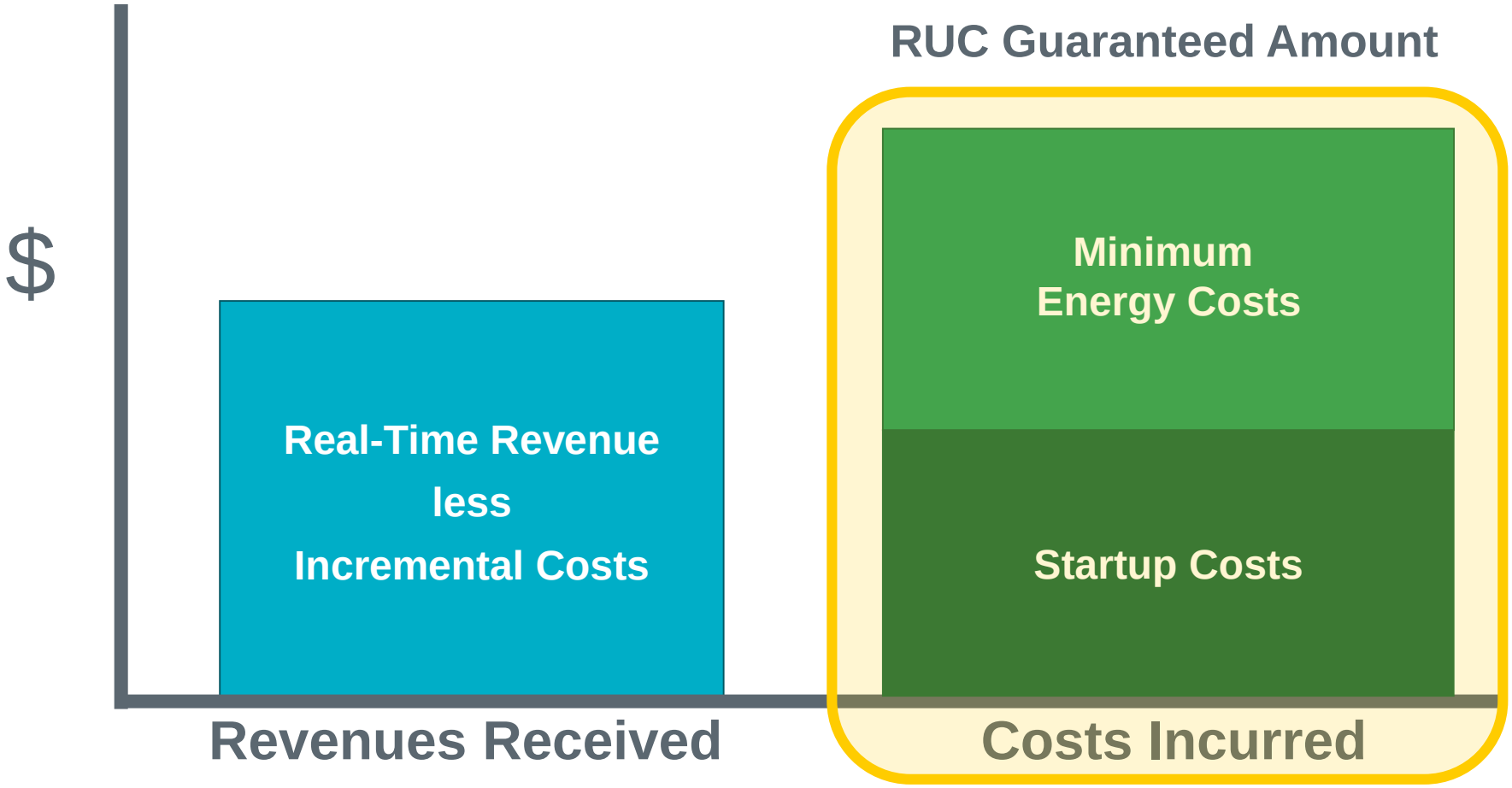
- ERCOT guarantees the QSE will recover Startup and Minimum Energy Costs

A few conditions

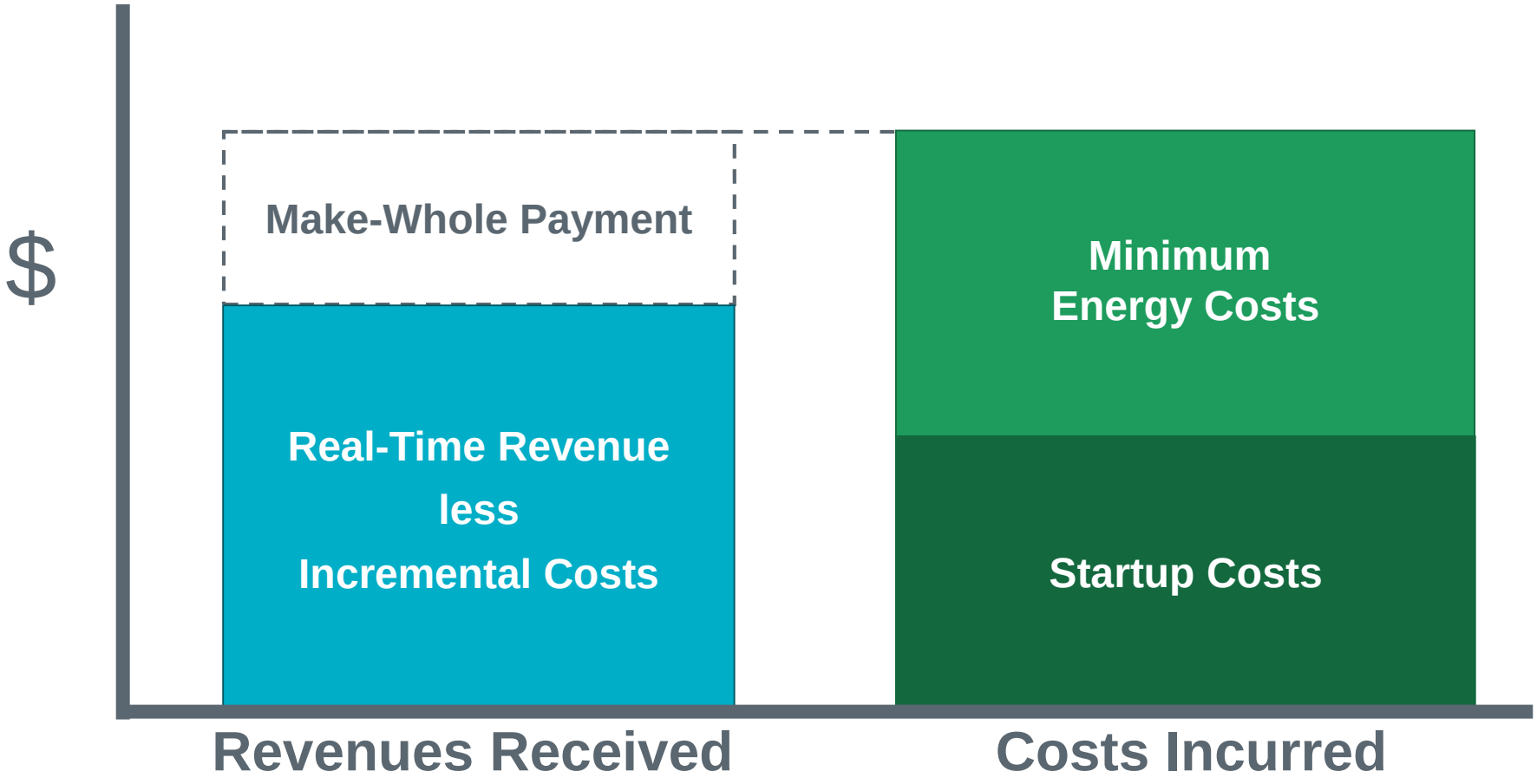
- Must actually incur the costs
- Startup costs included for starts incurred due to the RUC Commitment



ERCOT compares revenues received to costs incurred



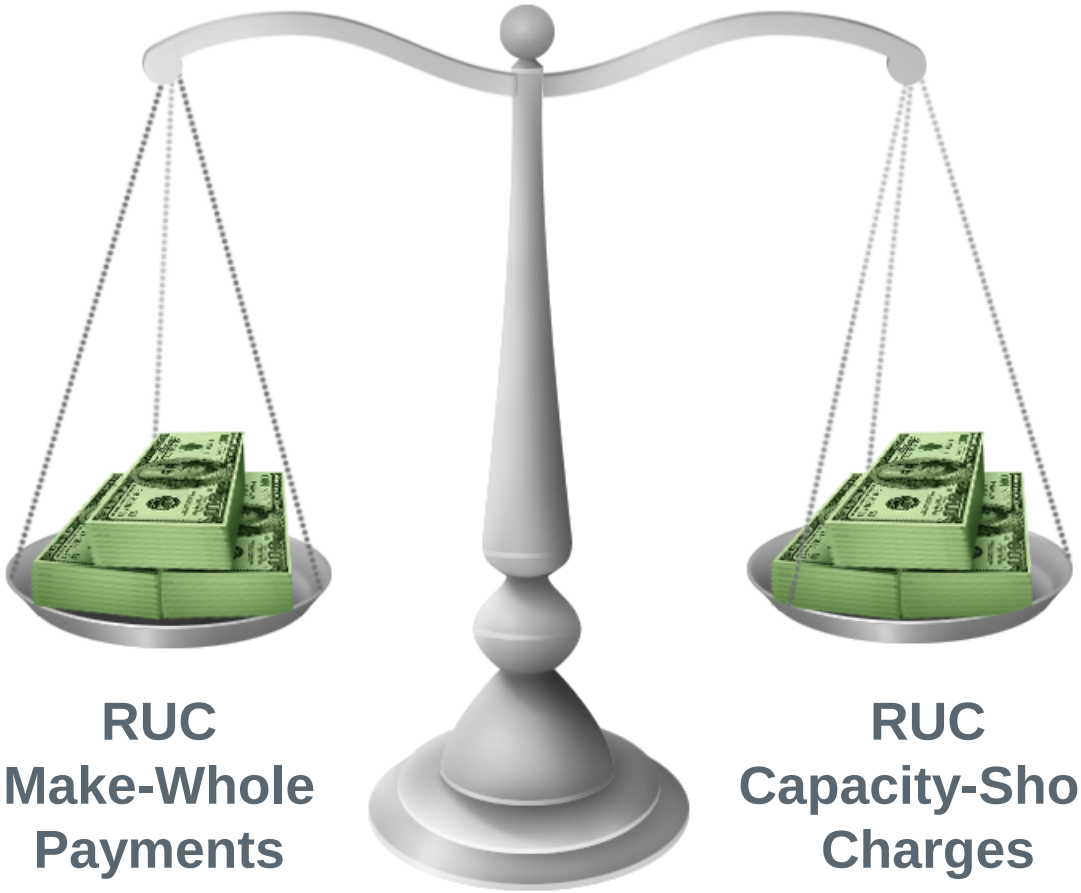
What if revenues are less than costs?



Make-Whole Payments and Caps

- Look to Three-Part Supply Offer for cost data
- Capped at Verifiable Costs if available
- Otherwise, capped at Generic Costs

Funding for RUC Make Whole Payments

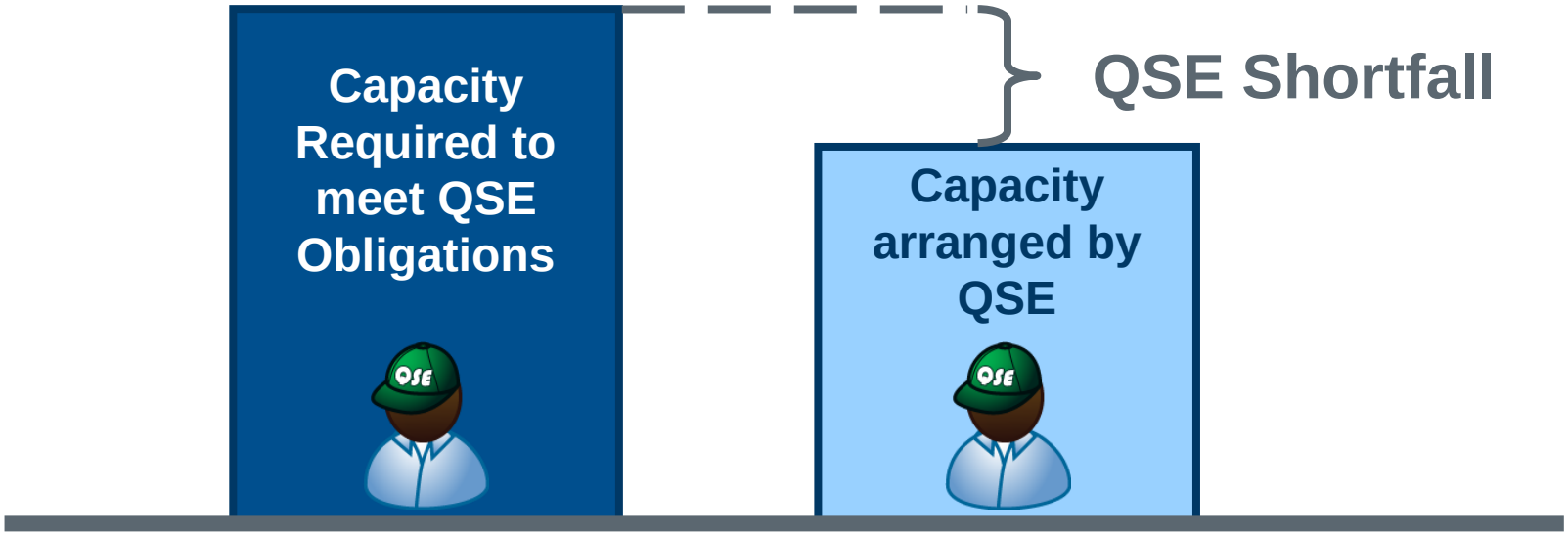


RUC Make-Whole Payments

RUC Capacity-Short Charges

RUC Capacity-Short Charge

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



What is included in a QSEs capacity obligation?

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

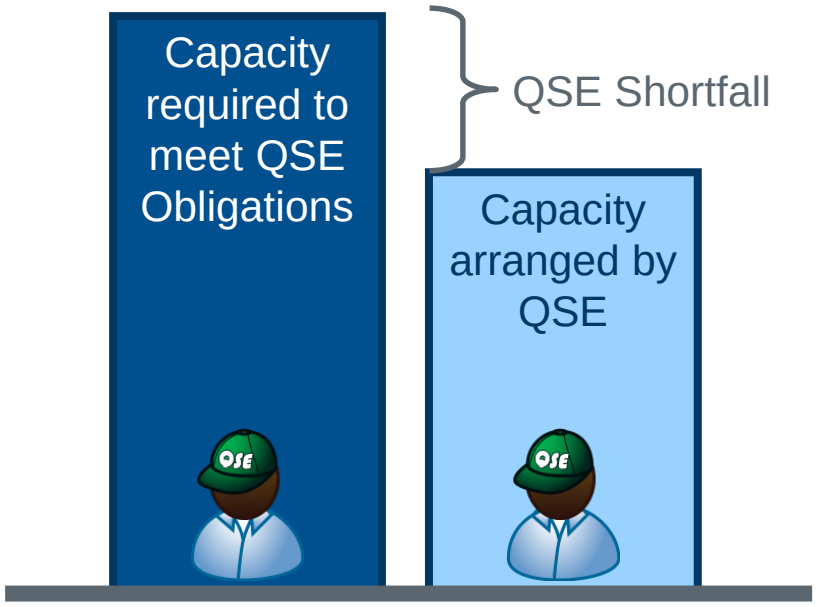
How can a QSE arrange to meet these obligations?

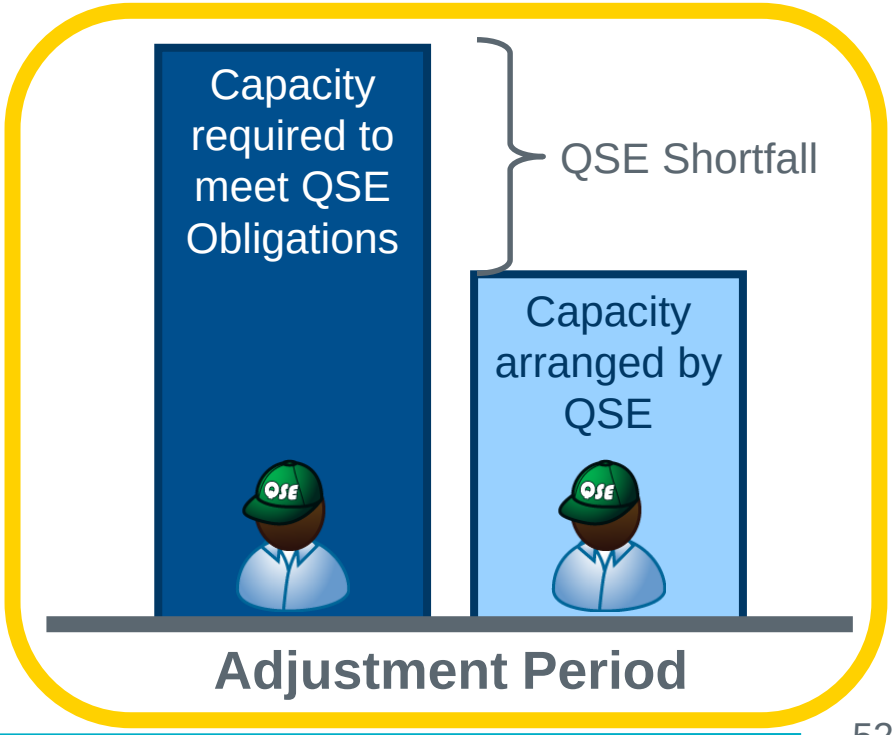
- Show capacity from its Resources in its COP
- Capacity Trades where the QSE is a buyer
- Energy Trades where the QSE is a buyer
- Cleared DAM Energy Bids

When does ERCOT make the comparison?

- Execution of RUC
- Close of Adjustment Period

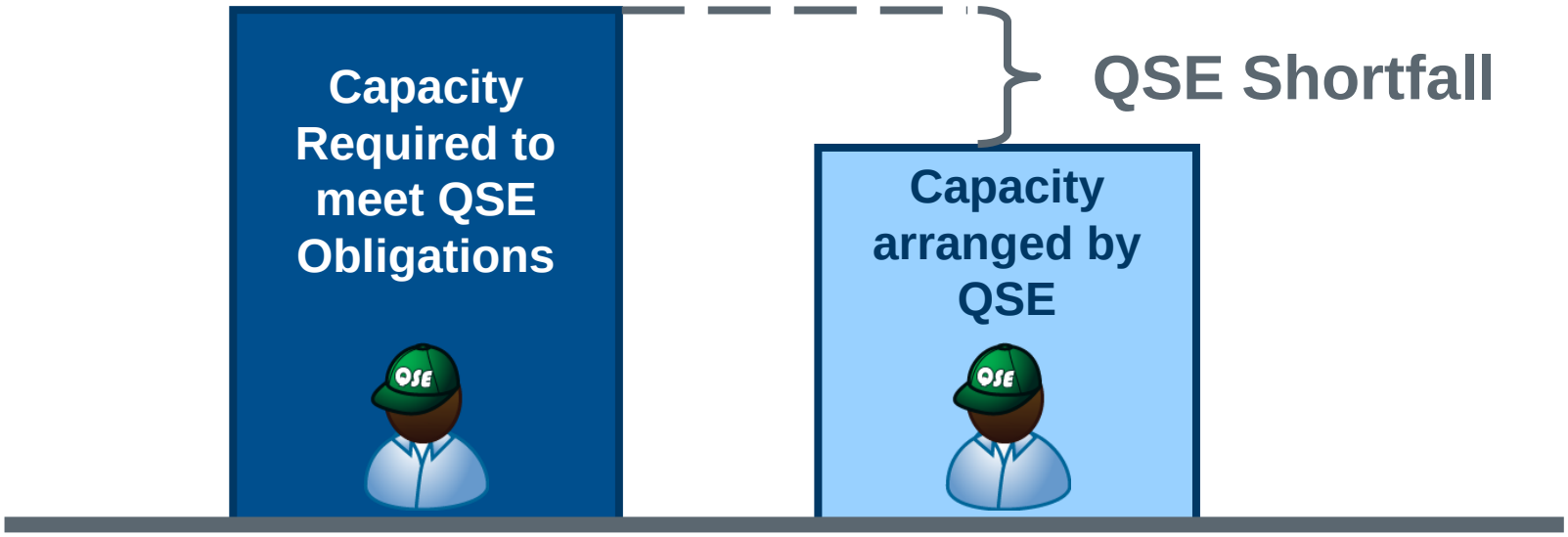
Charge based on largest shortfall





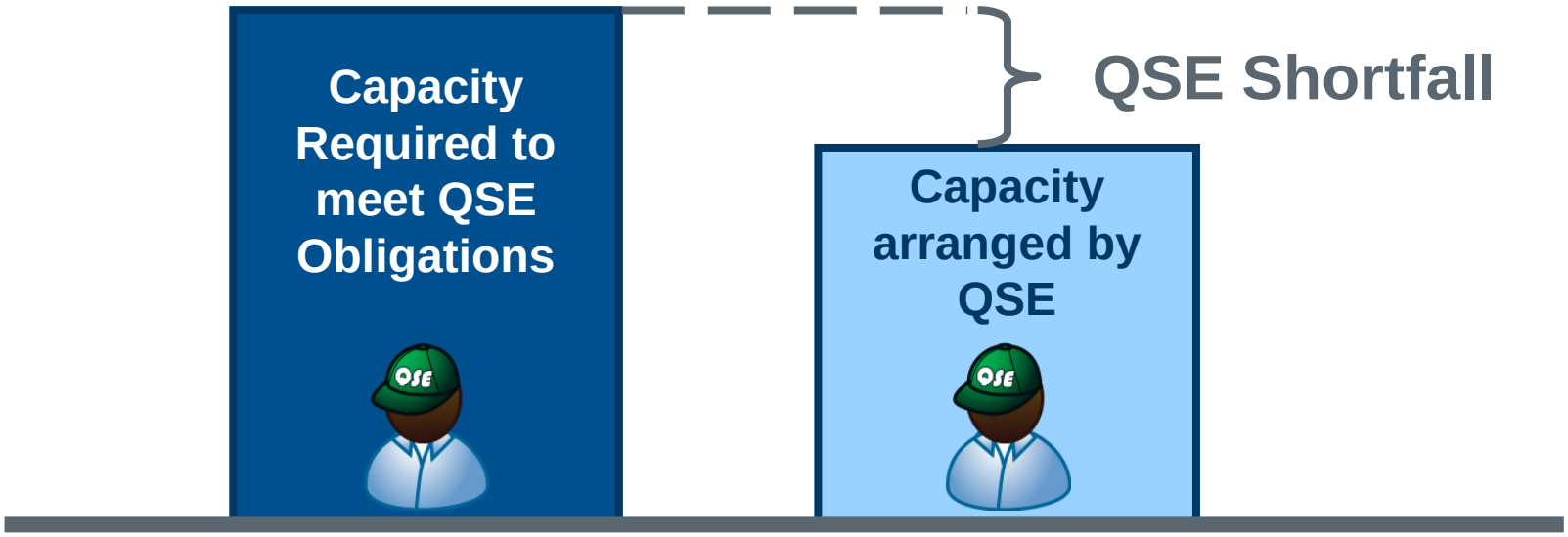
Discussion

Can a QSE have a capacity shortfall if they have no Load?



Discussion

Can a QSE reduce their shortfall if they have no Resources?



RUC Capacity-Short Charge

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

RUC Capacity-Short Charge = **RUC Capacity Shortfall Ratio Share** * (**RUC Make-Whole Total**)

by 15-Minute Settlement Interval

Short Charge Cap

The charge to each QSE is capped at

$$2 * \text{RUC Capacity Shortfall} * \frac{\text{RUC Make-Whole Total}}{\text{RUC Capacity Total}}$$

RUC Capacity-Short Charge

A QSE with a capacity shortfall will pay the lesser of

$$\text{RUC Capacity Shortfall Ratio Share} * \left(\text{RUC Make-Whole Total}\right)$$

or their cap

$$2 * \text{RUC Capacity Shortfall} * \frac{\text{RUC Make-Whole Total}}{\text{RUC Capacity Total}}$$

Breakout Session

Split into groups:

- Maximum of 5 people per group
- Minimum of 3

Read & Respond:

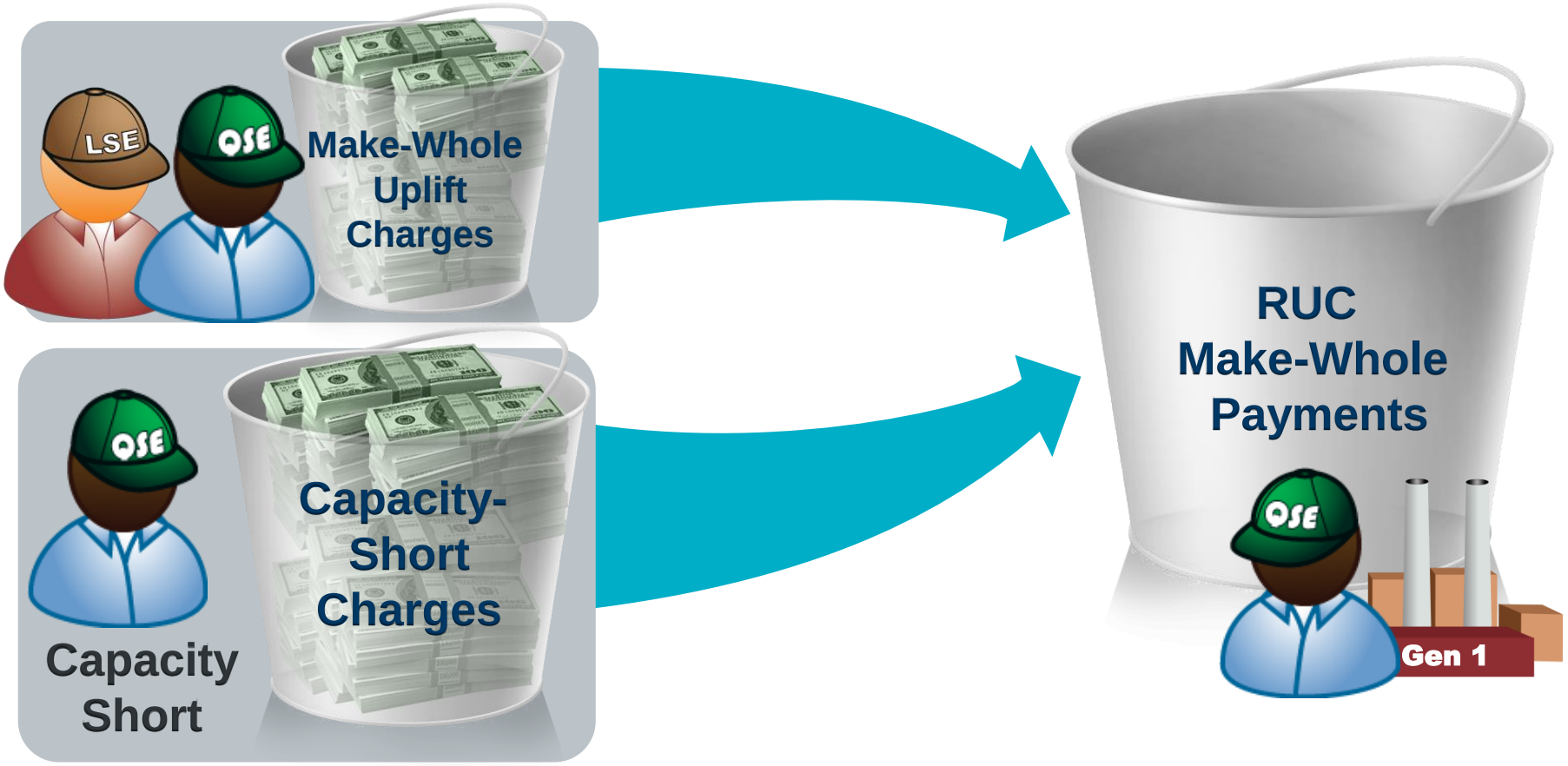
- ERCOT Commits capacity through RUC
- ERCOT pays $100 in RUC Make-Whole Payments during the cases shown in the following table
- Complete the table
- Determine how much each QSE will pay in each case

RUC Capacity-Short Charge Activity

RUC Procurement	RUC Capacity Total = 100 MW			
RUC Payment	RUC Make Whole Total = $100			
QSE 1 Shortfall	40 MW	60 MW	20 MW	40 MW
QSE 2 Shortfall	0	0	20 MW	20 MW
QSE 1 Shortfall Ratio Share				
QSE 2 Shortfall Ratio Share				
QSE 1 Short Charge Cap				
QSE 1 Calculated Short Charge				
QSE 2 Short Charge Cap				
QSE 2 Calculated Short Charge				

Capacity-Short Charges may not cover Make-Whole

Difference uplifted to QSEs representing Load

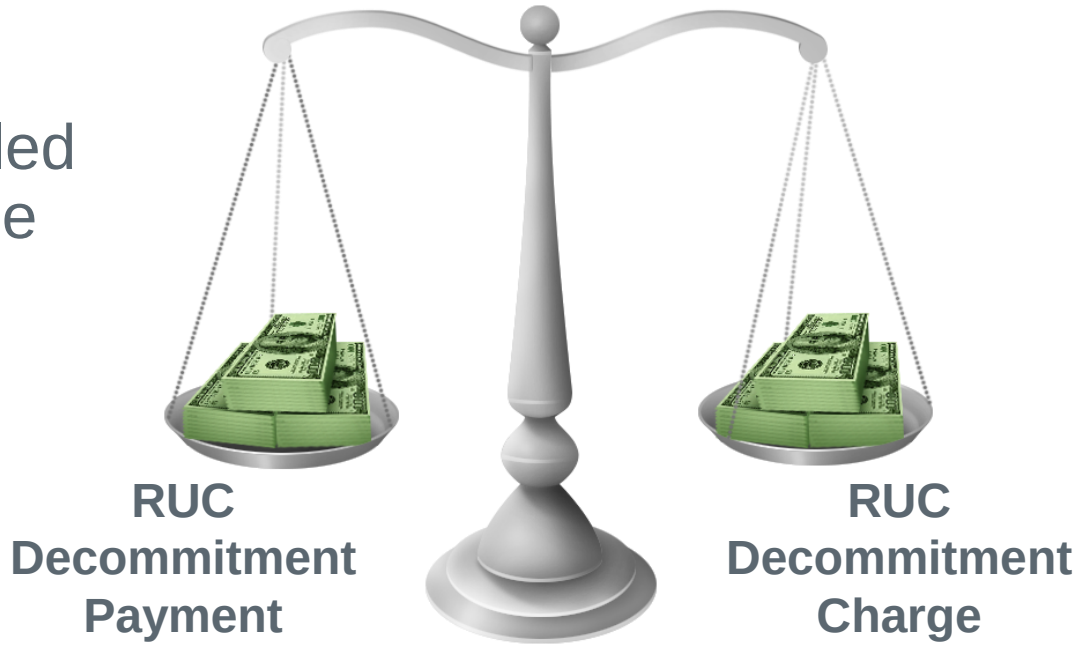


If ERCOT decommits a Resource through RUC

- ERCOT may pay QSE the cost to restart

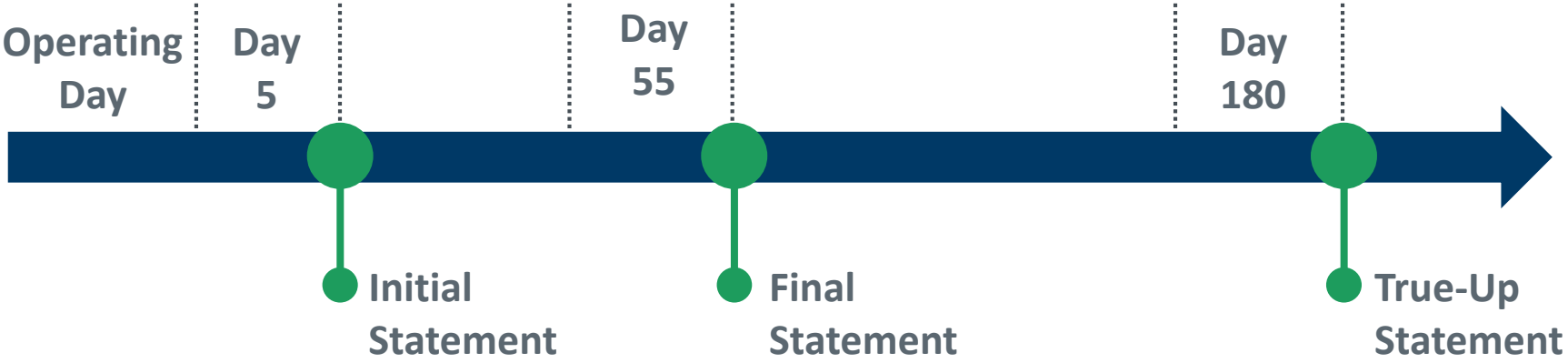
A few conditions

- Resource was QSE-Committed
- Resource not scheduled to shut down within the Operating Day



Payments and Charges for RUC-Committed Hours

- Appear on Real-Time Statements
- Initial Statements posted 5 days after Operating Day



You have learned about:

- The purpose of the Reliability Unit Commitment (RUC) process
- The timelines of the Day-Ahead RUC and the Hourly RUC
- The impacts of ERCOT, TSPs and QSEs on this process
- The financial impacts of Reliability Unit Commitment