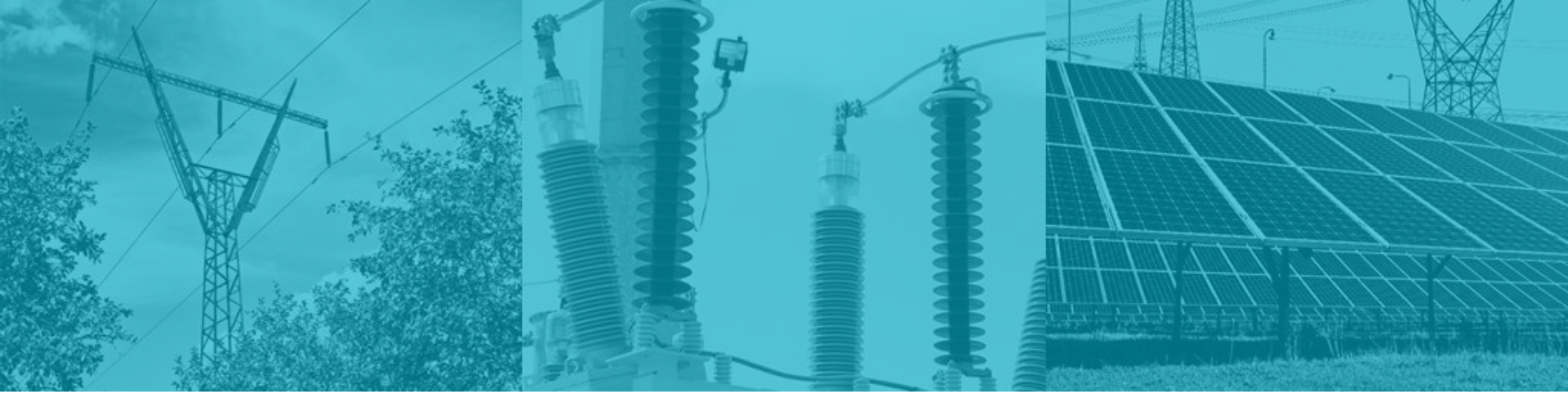


ERCOT Market Education

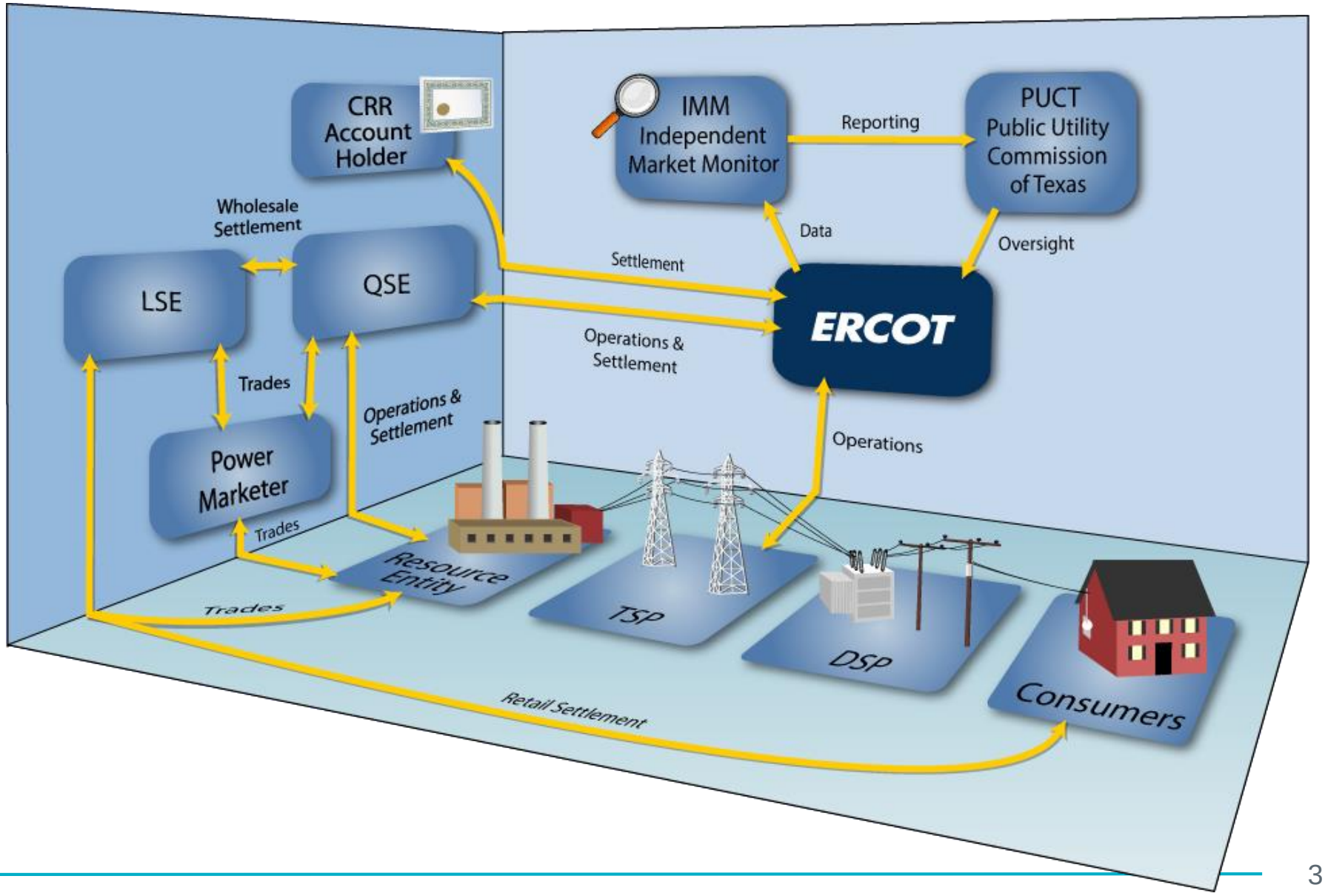
Resource 301

Module 2: Resource Requirements

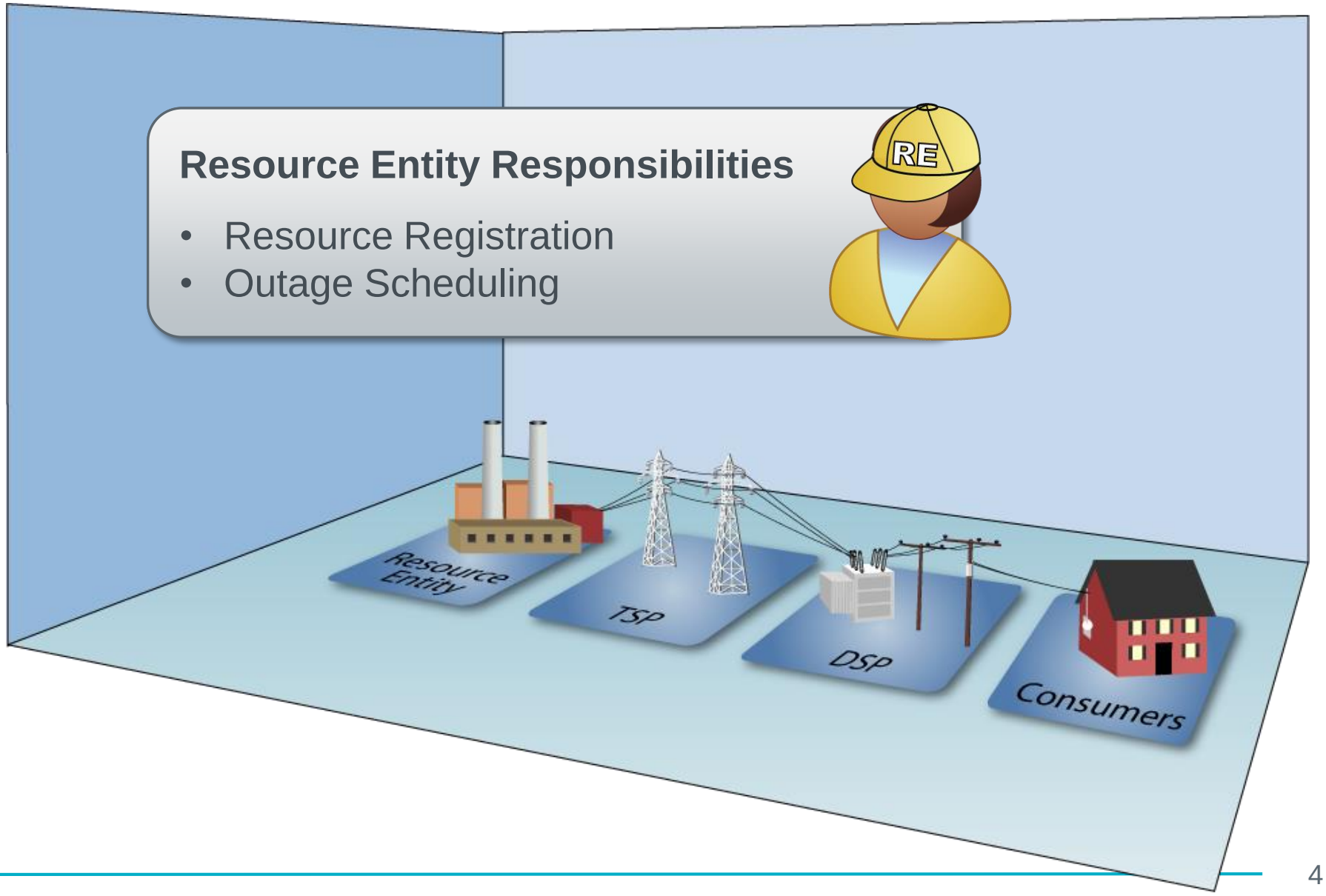
Topics in this module ...

- Resource Entity Responsibilities
- QSE Responsibilities
- Special Resource Requirements
- Resource Nodes

The ERCOT Market Environment



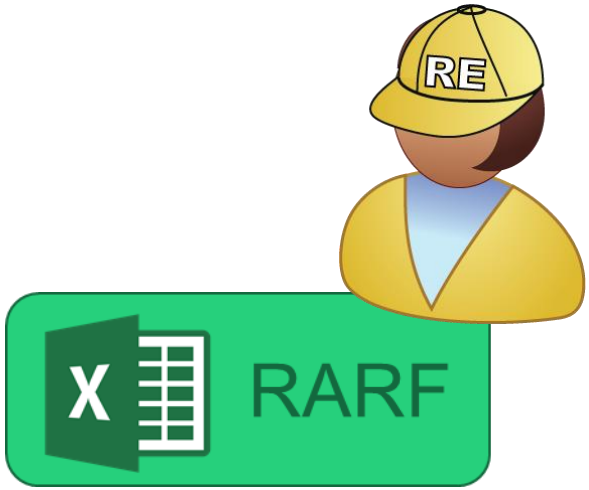
Resource Entity – Resource Registration



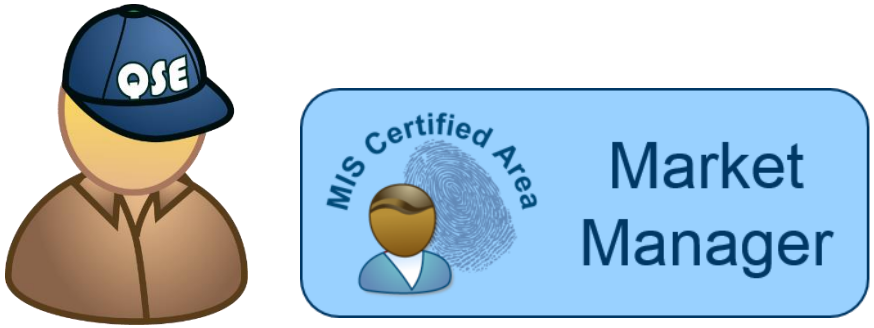
Each Resource Entity shall provide ERCOT with information describing each of its Resources and other facilities connected to the ERCOT system.

Resource Asset Registration Form (RARF)

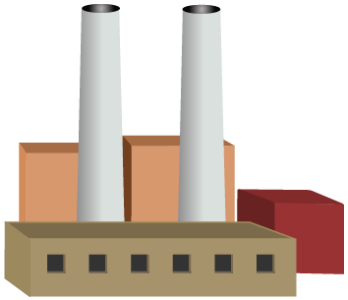
- Resource planning and model data
- Generation substation model data
- Resource Parameters



- Used to form Resource Constraints in ERCOT processes
  - Day-Ahead Market
  - Reliability Unit Commitment
  - Security Constrained Economic Dispatch
  - Load Frequency Control
- The Resource Entity's QSE may update when justifiable



Generation Resource Parameters



Parameter Names
Normal and Emergency Ramp Rate Curves
Minimum and Maximum On-Line Times
Minimum Off-Line Time
Hot, Intermediate and Cold Start Times
Hot-to-Intermediate Time
Intermediate-to-Cold Time
Maximum Daily Starts
Maximum Weekly Starts
Maximum Weekly Energy

Load Resource Parameters

Parameter Names
Minimum and Maximum Interruption Times
Minimum Notice Time
Minimum Restoration Time
Maximum Daily Deployments
Maximum Weekly Deployments
Maximum Weekly Energy

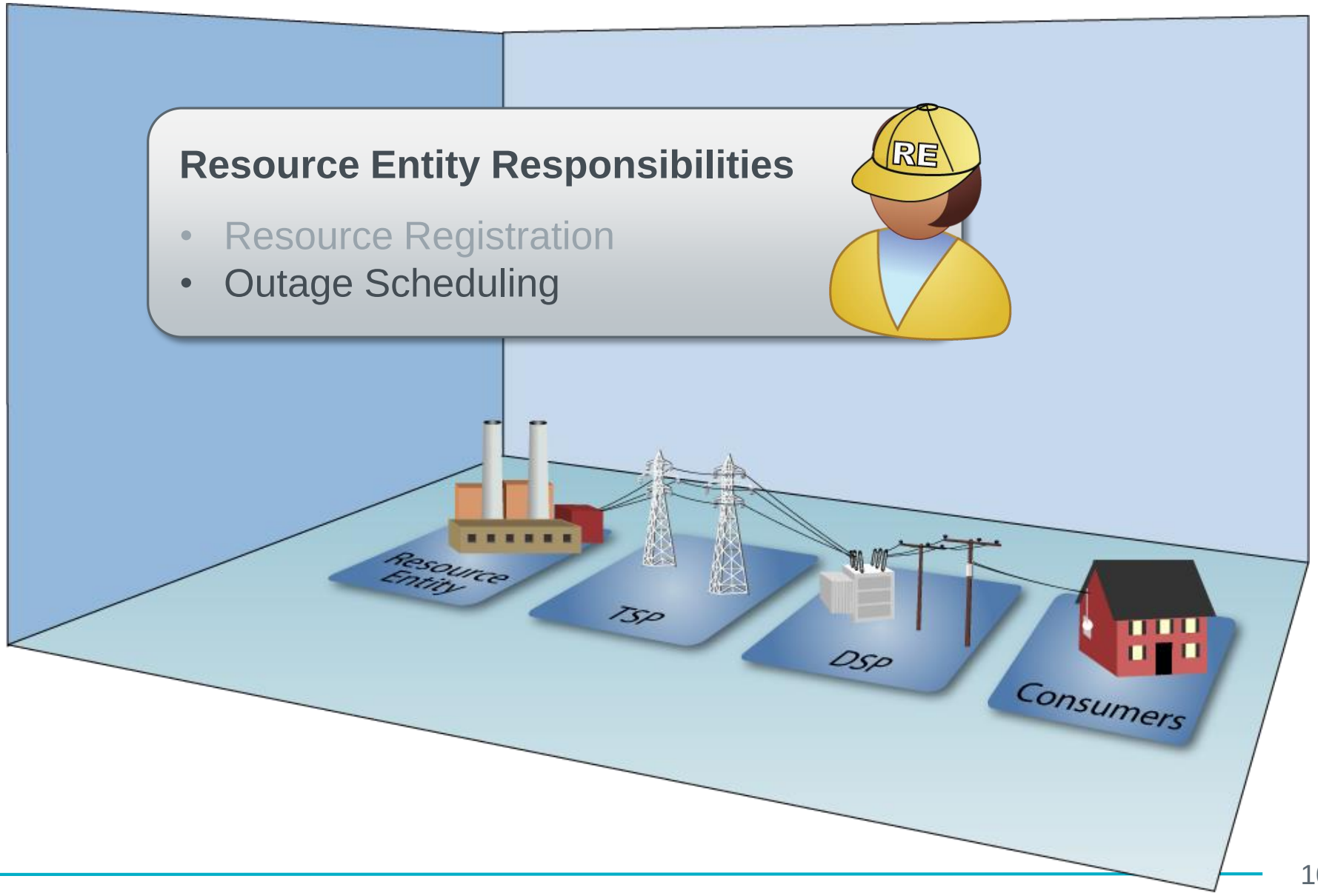
Controllable Load Resource Parameters

Parameter Names
Normal and Emergency Ramp Rate Curves
Maximum Deployment Time
Maximum Weekly Energy

Resource Entity – Outage Scheduling

Resource Entity Responsibilities

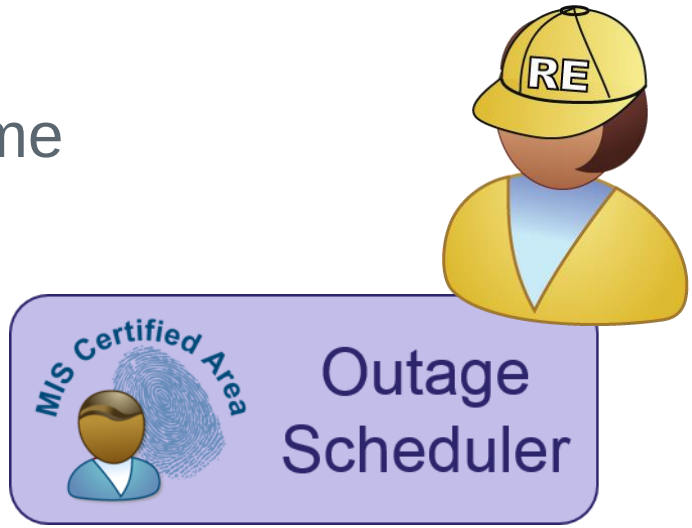
- Resource Registration
- Outage Scheduling



Each Resource Entity shall provide a rolling 12 month Resource Outage Plan with continuous updates.

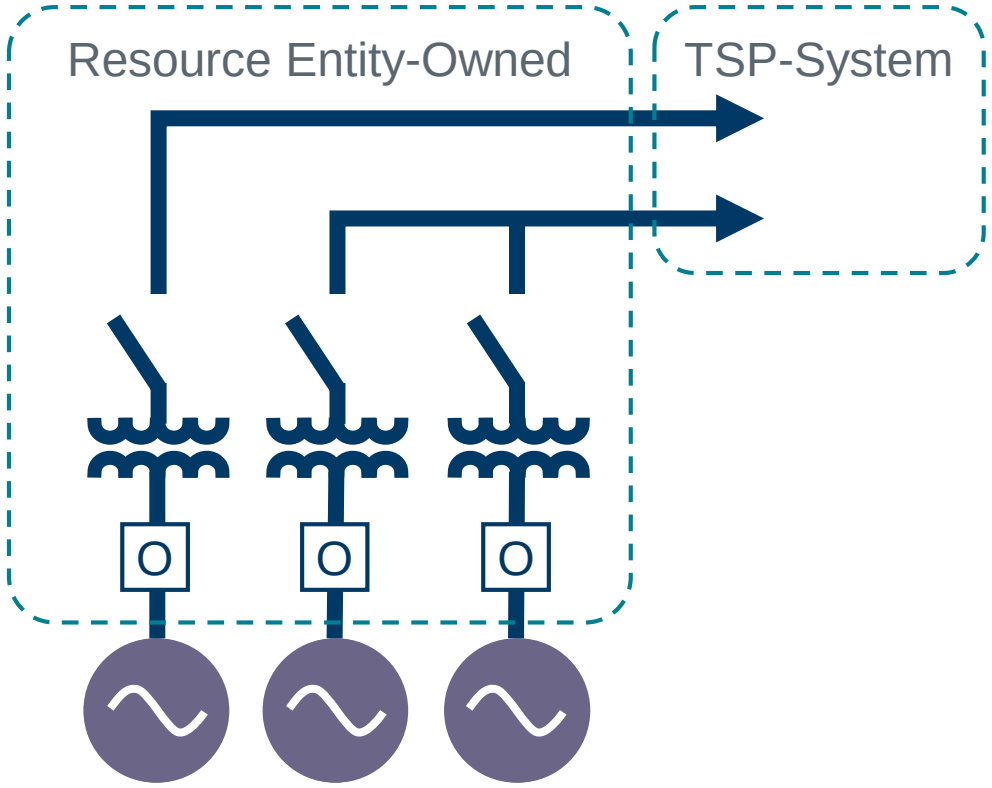
Outage Scheduler entries include

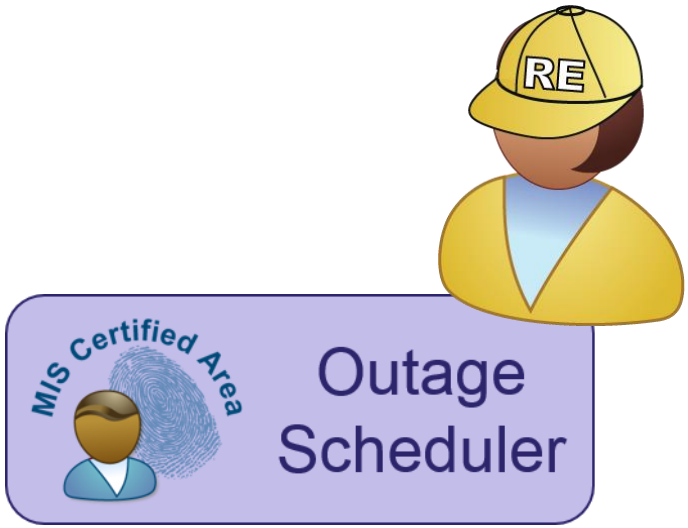
- Estimated start and stop times
- Earliest start time and latest finish time
- Nature of work to be performed



Each Resource Entity shall provide a rolling 12 month Resource Outage Plan with continuous updates.

Also applies to RE-Owned Transmission Elements

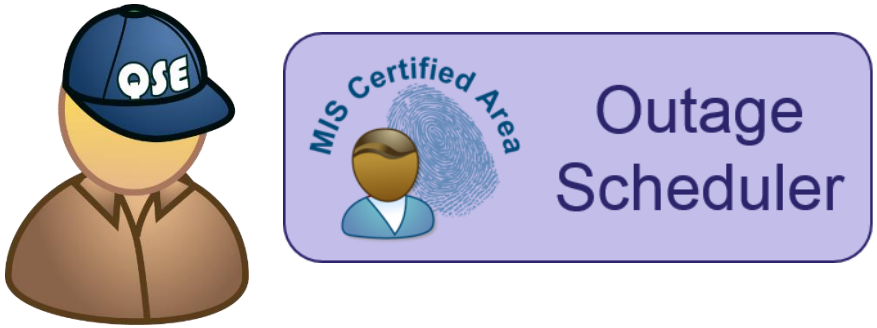




Companies must designate a Single Point of Contact for all ERCOT communications regarding Outage Scheduling.

Resource Entity must designate their QSE

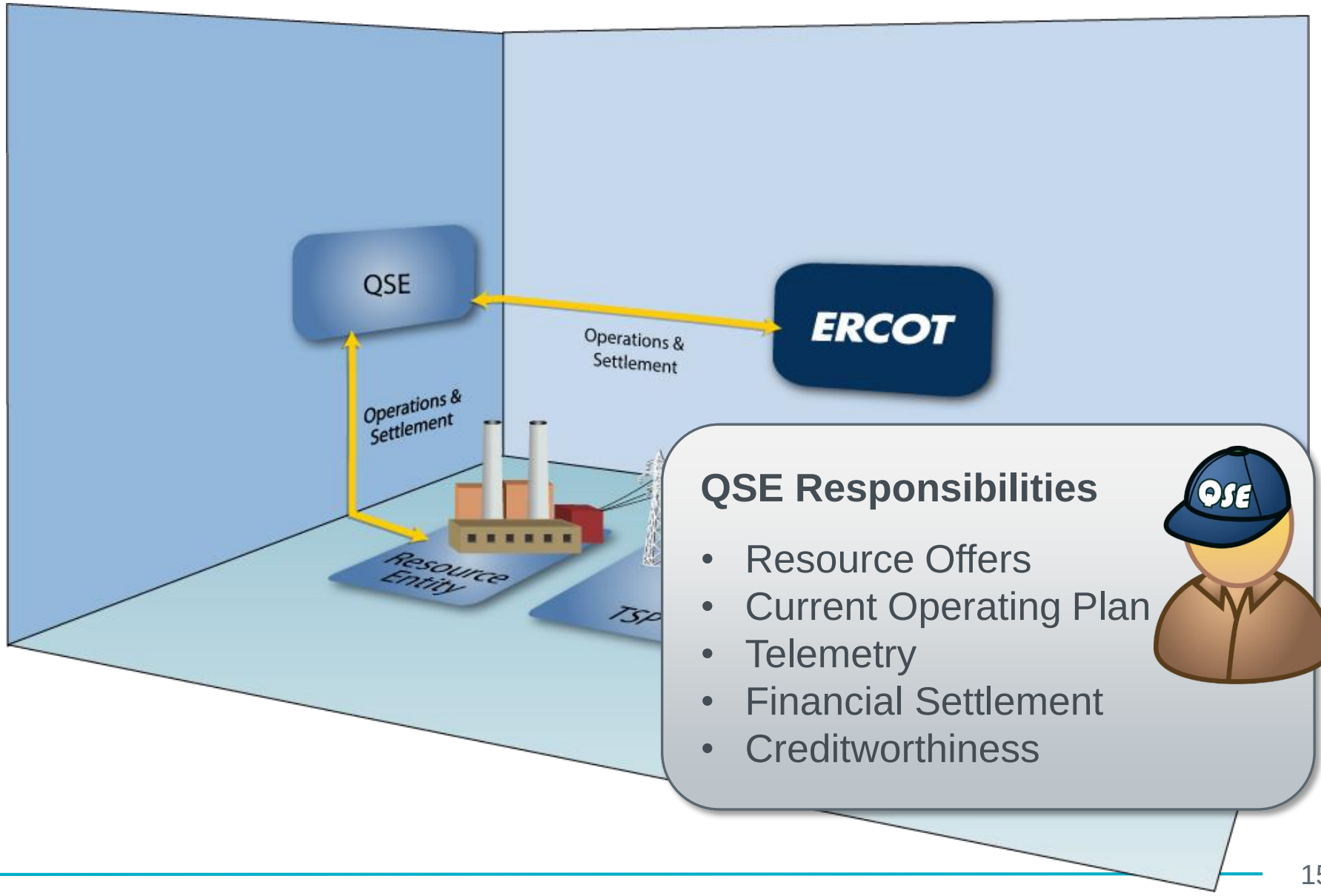
- QSE responsible for Outage Scheduler
- QSE acts on behalf of Resource Entity



ERCOT Action for Resource Outage Requests

Outage Request lead time	ERCOT Action
More than 45 days	Accept, but may discuss alternatives to minimize reliability and cost impacts. Notify the QSE of conflicts with previously scheduled Outages.
9 to 45 days	Approve or Reject within 5 business days after submission. Planned Outages are Accepted after 5 business days.
4 to 8 days	Approve or Reject by 1800 hours, 3 days prior to the Outage
3 days	Approve or Reject by 1800 hours, 2 days prior to the Outage

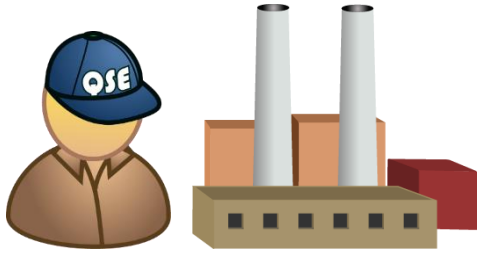
Qualified Scheduling Entity (QSE) – Resource Offers



QSE Responsibilities

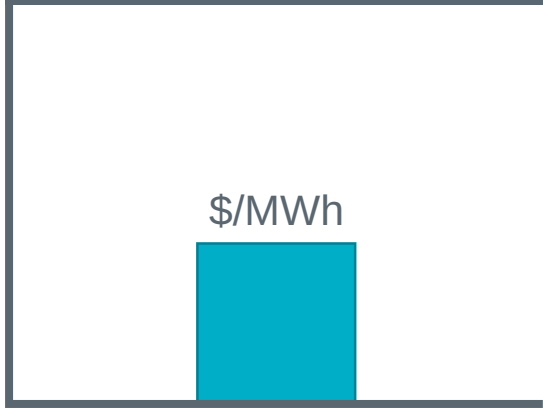
- Resource Offers
- Current Operating Plan
- Telemetry
- Financial Settlement
- Creditworthiness

Three-Part Supply Offer

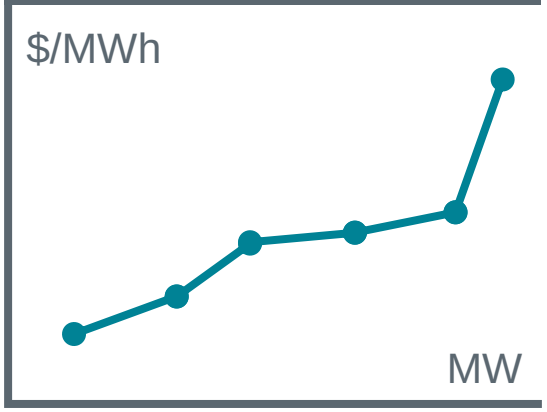


Startup Offer

Minimum-Energy Offer



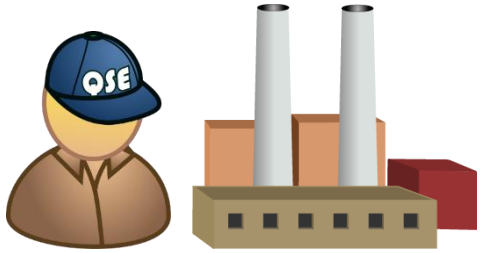
Energy Offer Curve

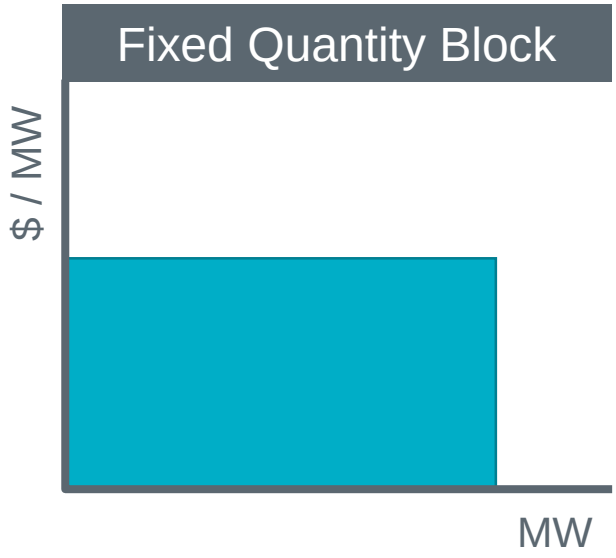


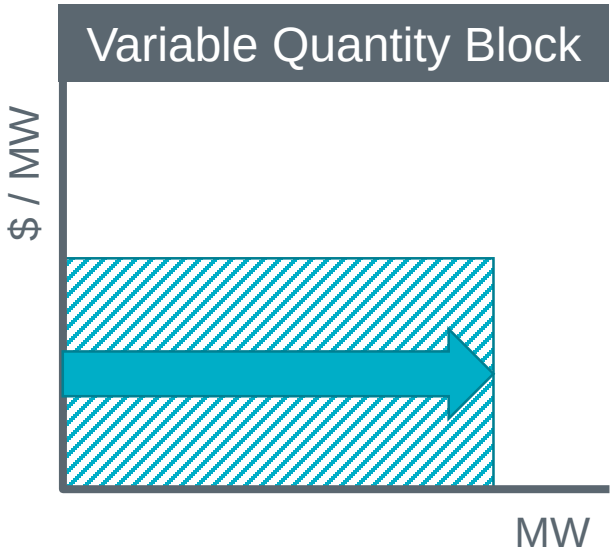
Energy Offer Curve can be submitted without Start-up or Minimum Energy Offers

Ancillary Service (AS) Offers

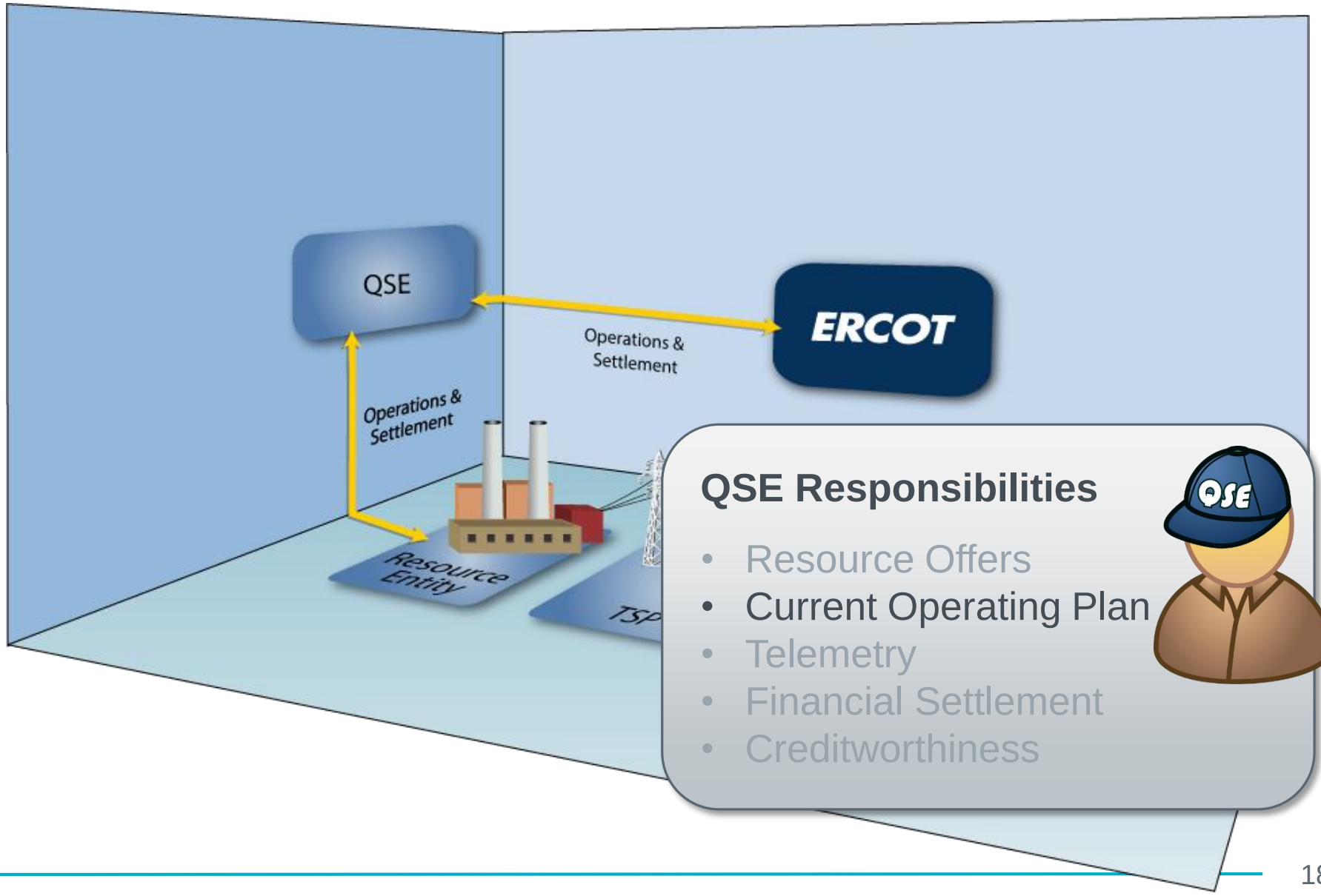
- Block offers
  - Single Price and Quantity
  - Fixed or Variable
- Single Resource may be offered for multiple Services







Qualified Scheduling Entity (QSE) – Current Operating Plan



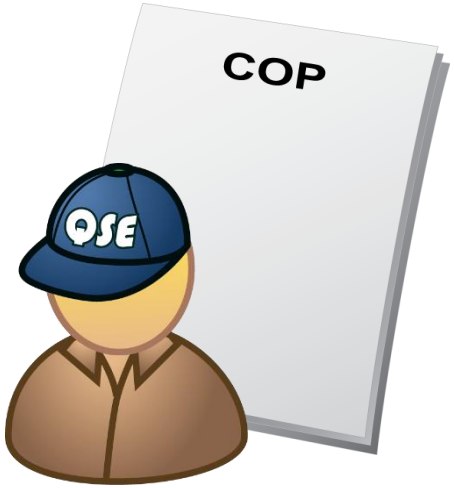
QSE Responsibilities

- Resource Offers
- Current Operating Plan
- Telemetry
- Financial Settlement
- Creditworthiness

Current Operating Plan Information

Resource Name	Hour	Resource Status	Resource Limits				AS Resource Responsibility			
BIGGEN 1	20									
BIGGEN 2	20									
LTLGEN 1	20									
BIGLOAD 1	20									

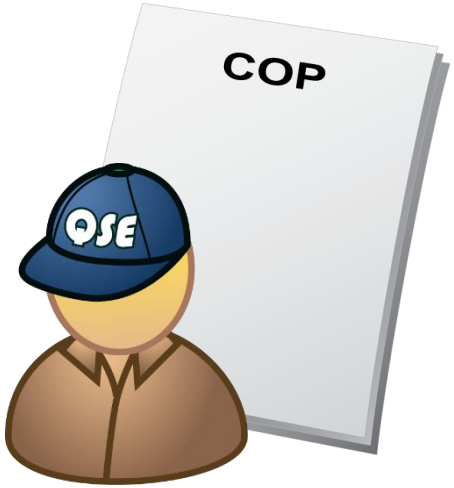
QSE must maintain a COP
- For each hour of the next 7 days
- For each Resource they represent



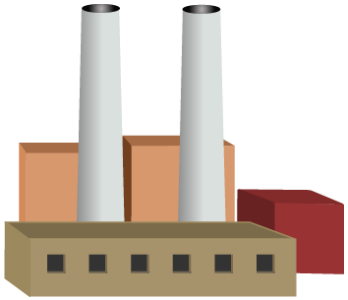
Current Operating Plan – Resource Status

Resource Name	Hour	Resource Status	Resource Limits				AS Resource Responsibility			
BIGGEN 1	20	ONREG								
BIGGEN 2	20	ON								
LTLGEN 1	20	OFFNS								
BIGLOAD 1	20	ONCLR								

QSE must maintain a COP
- For each hour of the next 7 days
- For each Resource they represent

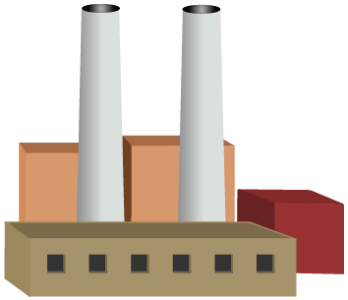


Generation Resource Planning to be Off-Line



Status	Description
OFF	Off but available for commitment
OFFQS	Off but available for SCED Dispatch as a Quick Start Generation Resources
OFFNS	Off but reserved for Non-Spin
EMR	Available for commitment as RMR, or for ERCOT-declared Emergency Conditions
OUT	Off and unavailable

Generation Resources Planning to be On-Line



Status	Description
ON	On with Energy Offer Curve
ONREG	On with Energy Offer Curve and providing Regulation Service
ONOS	On with Output Schedule
ONRR	On as a synchronous condenser
ONRUC	On for RUC-Committed hour
ONOPTOUT	On for RUC Buy-Back hour
ONTEST	On for operational testing
ONEMR	On EMR

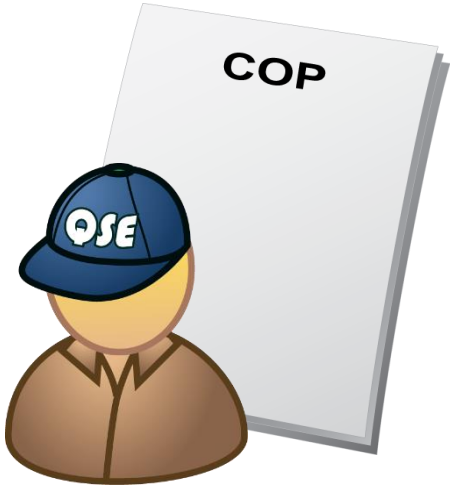
Load Resources

Status	Description
ONRL	Available for Dispatch of Responsive Reserve Service
ONCLR	Controllable Load Resource available for Dispatch by SCED with a Real-Time Market Energy Bid
ONRGL	Controllable Load Resource available for Regulation Service, with any remaining capacity available for Dispatch by SCED with a Real-Time Market Energy Bid
OUTL	Not available

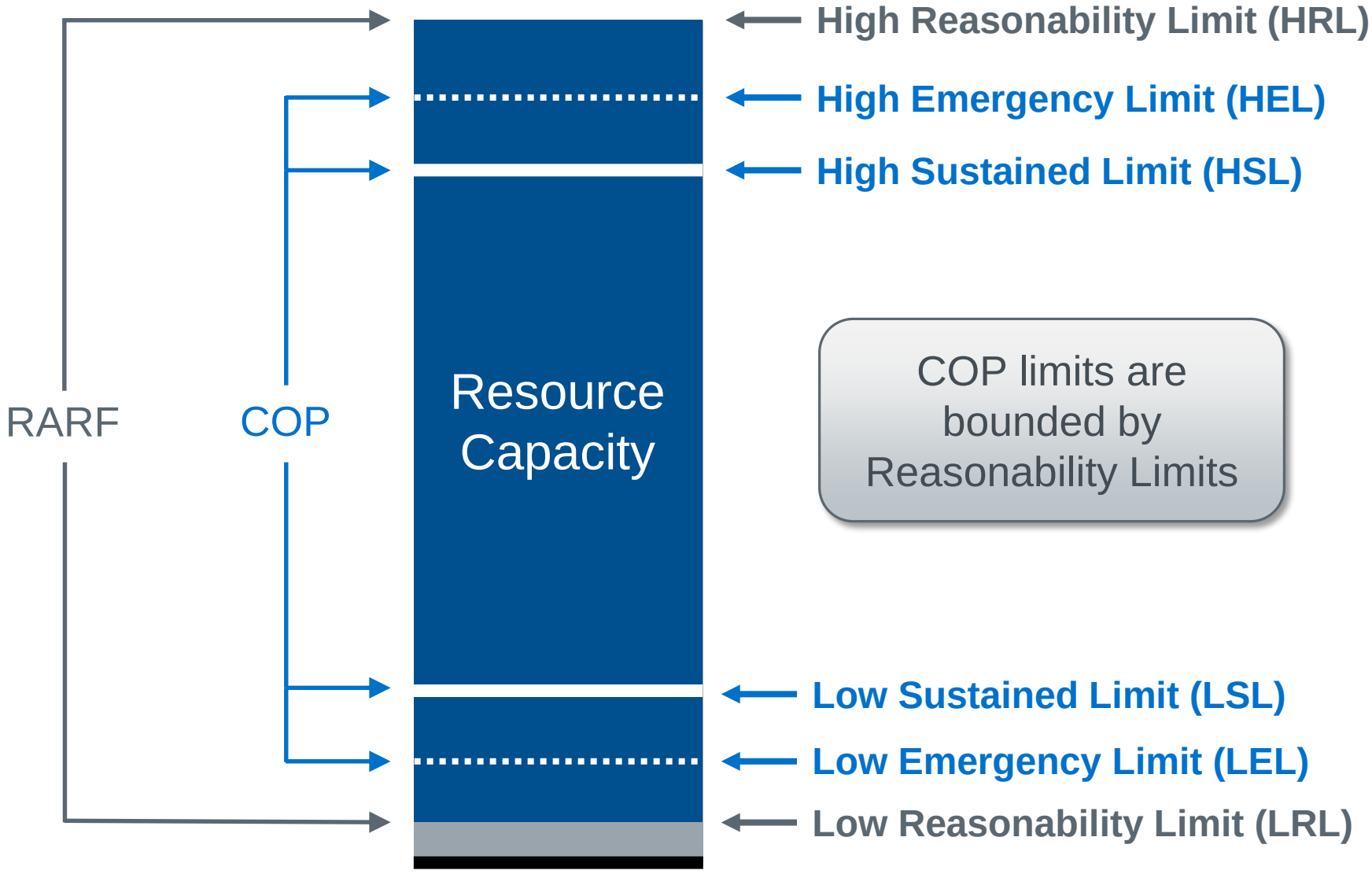
Current Operating Plan – Resource Limits

Resource Name	Hour	Resource Status	Resource Limits				AS Resource Responsibility			
			HEL	HSL	LSL	LEL				
BIGGEN 1	20	ONREG	770	750	50	40				
BIGGEN 2	20	ON	800	750	50	40				
LTLGEN 1	20	OFFNS	110	100	20	15				
BIGLOAD 1	20	ONCLR	80	80	30	30				

QSE must maintain a COP
- For each hour of the next 7 days
- For each Resource they represent



Comparison of Resource Limits



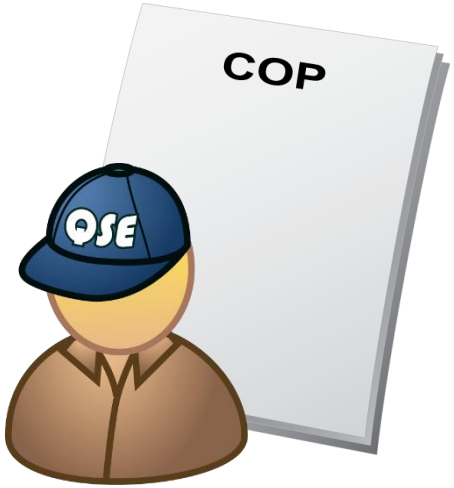
Resource Limit Definitions

Limit	Definition
High Reasonability Limit	A value above which the Resource is not expected to operate under most conceivable conditions.
High Emergency Limit	Maximum temporary production capability of Resource. Achievable for at least 30 minutes.
High Sustained Limit	Maximum sustained production capability of Resource
Low Sustained Limit	Minimum sustained production capability of Resource
Low Emergency Limit	Minimum temporary production capability of Resource. Achievable for at least 30 minutes.
Low Reasonability Limit	A value below which the Resource is not expected to operate under most conceivable conditions.

Current Operating Plan – AS Resource Responsibility

Resource Name	Hour	Resource Status	Resource Limits				AS Resource Responsibility			
			HEL	HSL	LSL	LEL	Reg-up	Reg-Down	Responsive	Non-Spin
BIGGEN 1	20	ONREG	770	750	50	40	10	10	150	0
BIGGEN 2	20	ON	800	750	50	40	0	0	100	0
LTLGEN 1	20	OFFNS	110	100	20	15	0	0	0	100
BIGLOAD 1	20	ONCLR	80	80	30	30	0	0	0	0

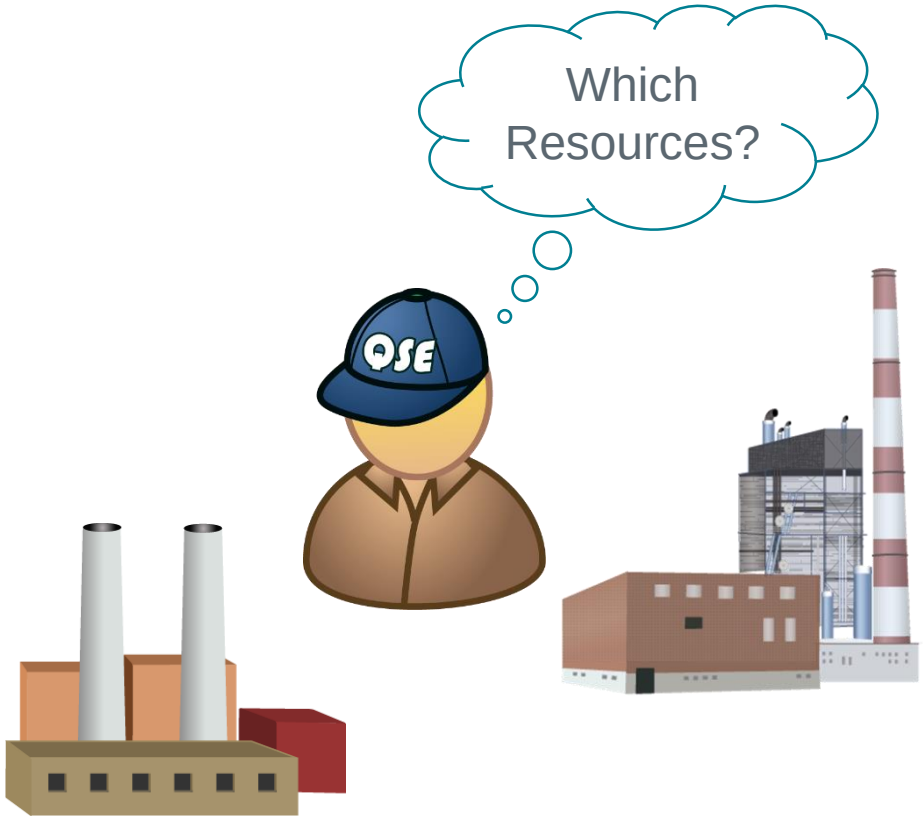
QSE must maintain a COP
- For each hour of the next 7 days
- For each Resource they represent



AS Resource Responsibility indicates the amount of each Ancillary Service the QSE plans to carry on each Resource

Reflects:

- Self-Arranged Quantities
- Ancillary Service Trades
- Ancillary Services awarded in Day-Ahead Market

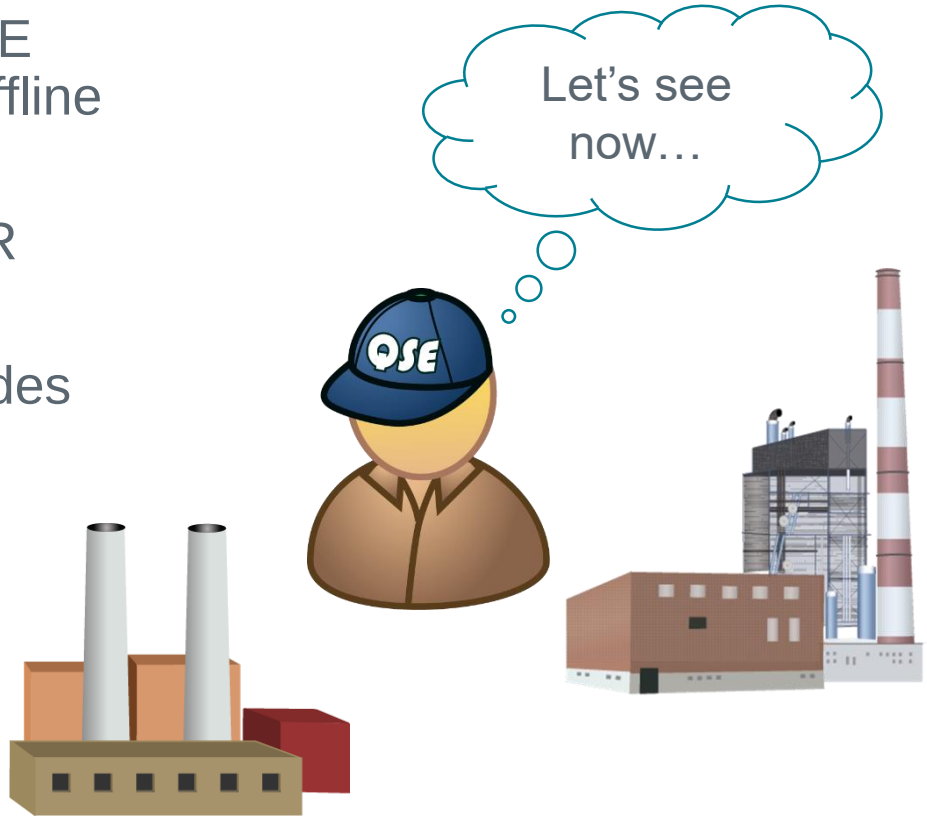


Scenario 1

A QSE intends to commit their Resources for an Operating Hour as follows:

- Generation Resource IMXPNSVE provides its entire capacity as Offline Non-Spin
- Generation Resource IMCHEIPR provides 30 MW of Reg-Up
- Load Resource WGTMKR provides 50MW of Responsive Reserve

Complete the QSE's Current Operating Plan on the next slide

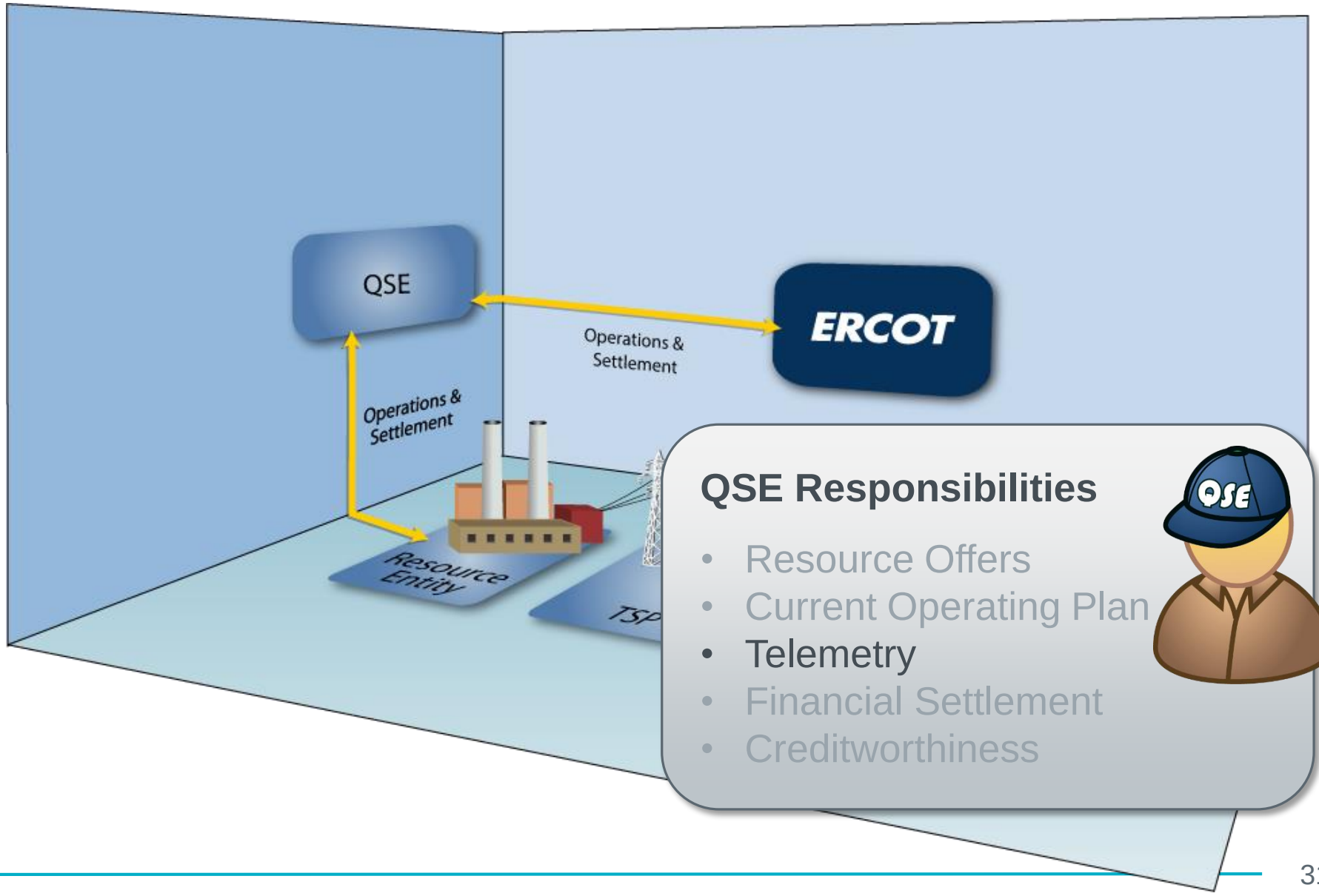


Scenario 1

A QSE intends to commit their Resources for an Operating Hour as follows:

Resource Name	Hour	Resource Status	Resource Limits				AS Resource Responsibility			
			HEL	HSL	LSL	LEL	Reg-up	Reg-Down	Responsive	Non-Spin
IMXPNSVE	18		108	100	20	17				
IMCHEIPR	18		620	600	50	40				
WGTMKR	18		75	75	25	25				

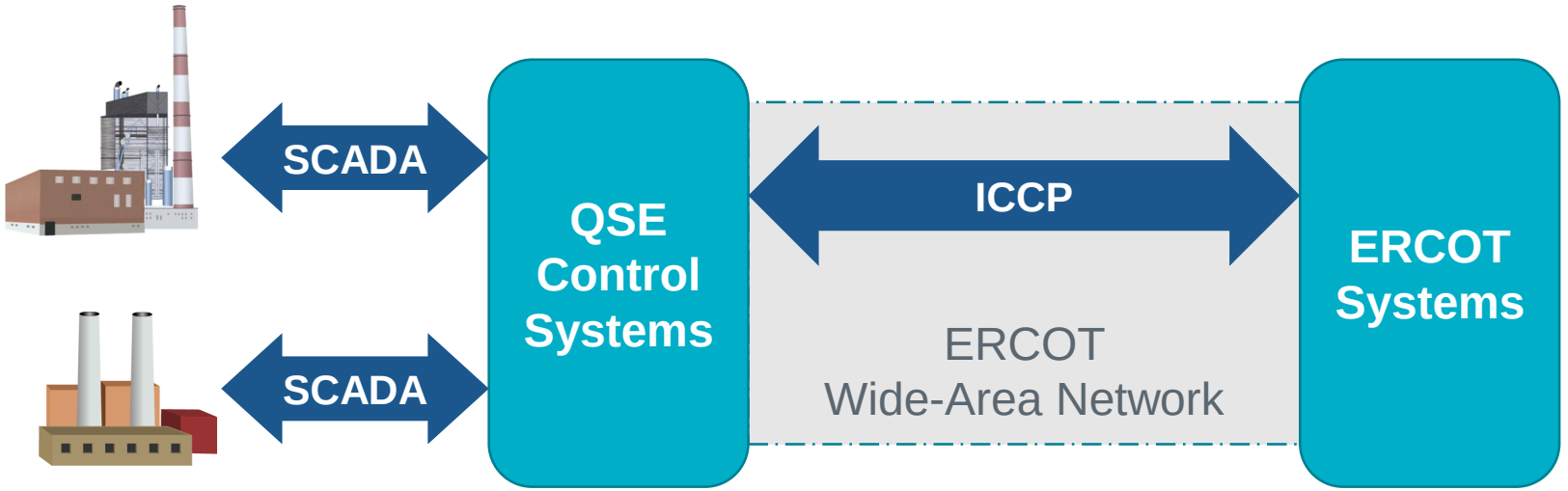
Qualified Scheduling Entity (QSE) – Telemetry



QSE Responsibilities

- Resource Offers
- Current Operating Plan
- Telemetry
- Financial Settlement
- Creditworthiness

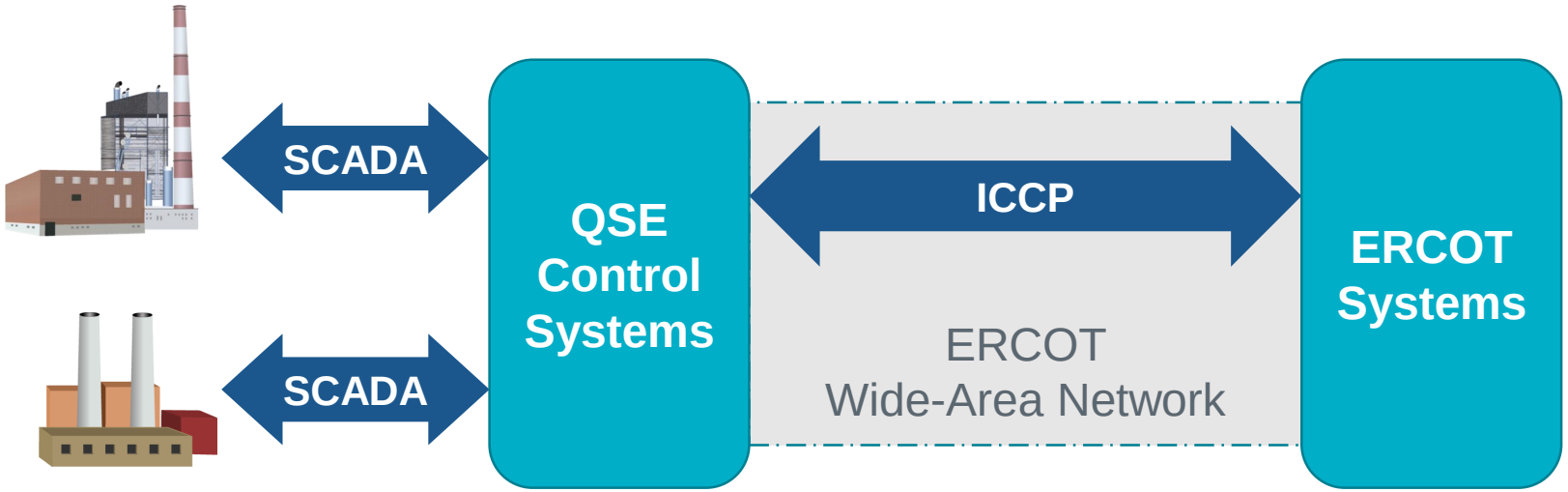
Resource Real-Time communications



QSEs communicate with ERCOT through Inter-Control Center Communications Protocol (ICCP)

- SCADA telemetry from Resources
- ERCOT instructions to Resources

ICCP Data Quality Codes



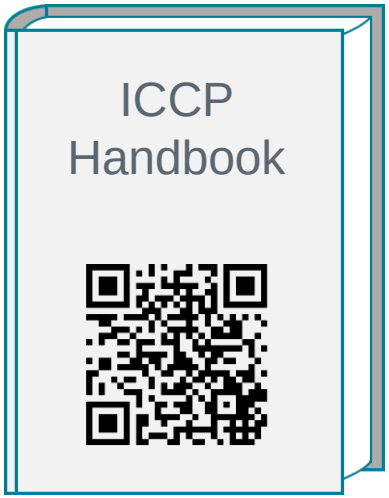
Requirements vary by circumstance

- Data Type
- QSE to ERCOT
- ERCOT to QSE

- Validity
- Current Source
- Normal Value

For status indications only

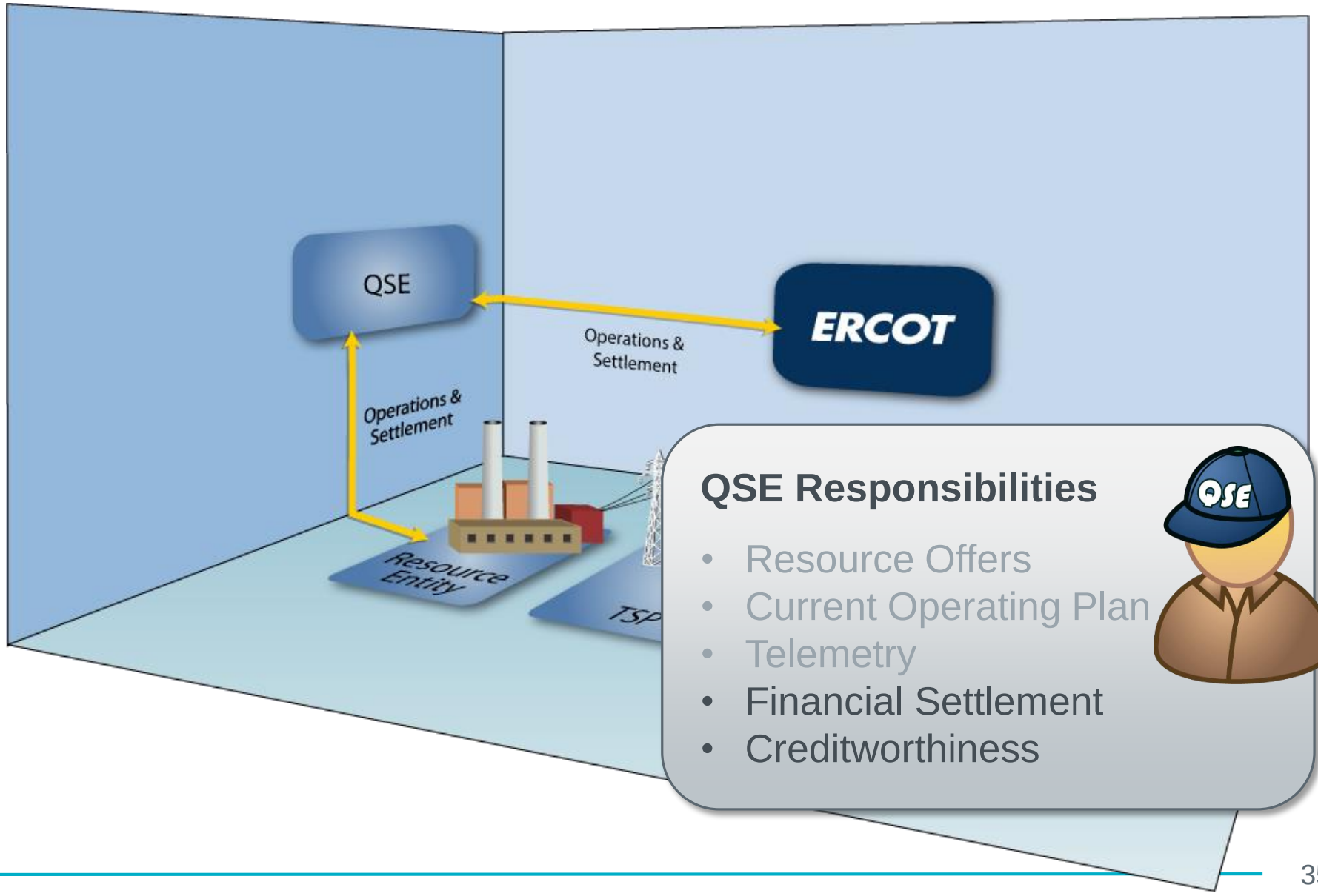
ICCP Data Quality Codes



Details in ERCOT ICCP Handbook

Category	General Values
Validity	VALID
	HELD
	SUSPECT
	NOT_VALID
Current Source	TELEMETERED
	CALCULATED
	MANUAL
	ESTIMATED
Normal Value	Current state is NORMAL
	Current state is ABNORMAL

Qualified Scheduling Entity (QSE) – Settlement and Credit

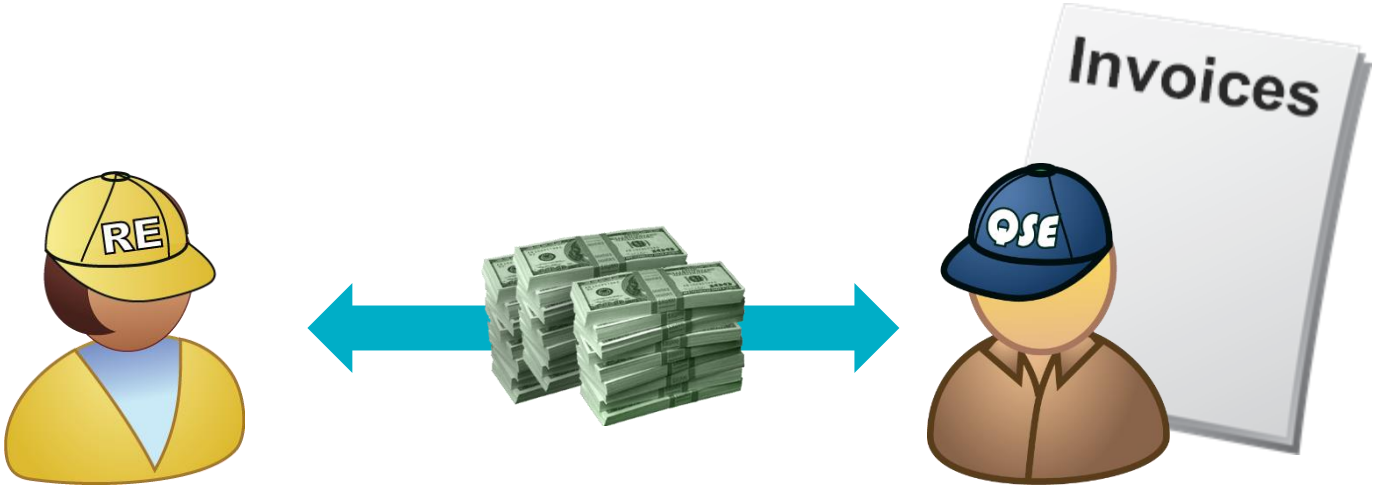


QSE Responsibilities

- Resource Offers
- Current Operating Plan
- Telemetry
- Financial Settlement
- Creditworthiness

QSE Settles with ERCOT and Resource Entity

- ERCOT settles with QSE
- QSE settles with Resource Entity
- QSE responsible for any Creditworthiness impacts with ERCOT



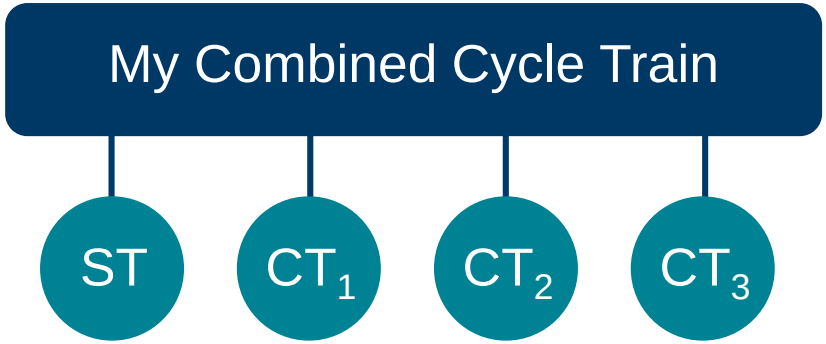
Special Resource Requirements

Topics in this Section Include

1. Combined Cycle Generation Resources
2. Split Generation Resources
3. Quick Start Generation Resources

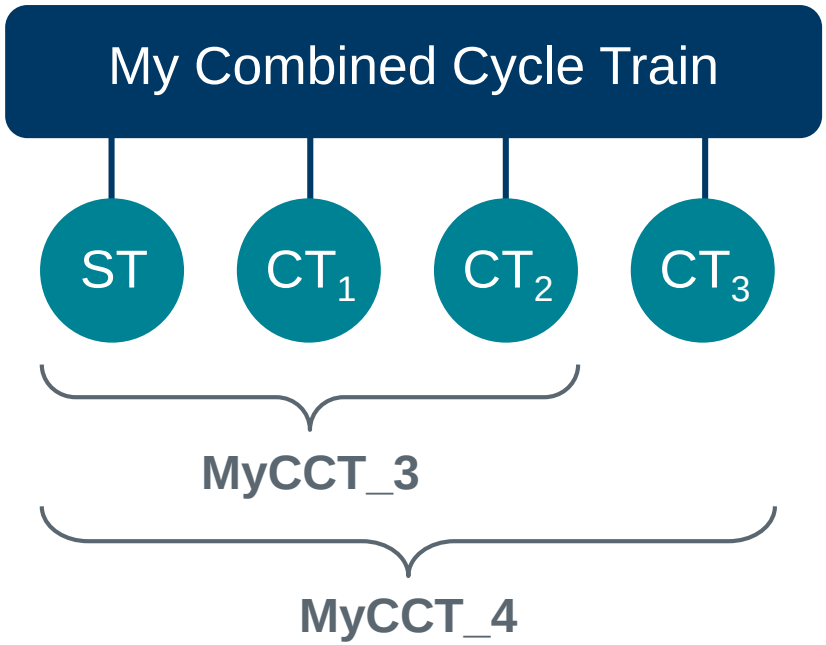
Combined Cycle Train (CCT)

- Combination of Combustion Turbines (CT) with heat recovery Steam Turbines (ST)
- Operates in one or more configurations



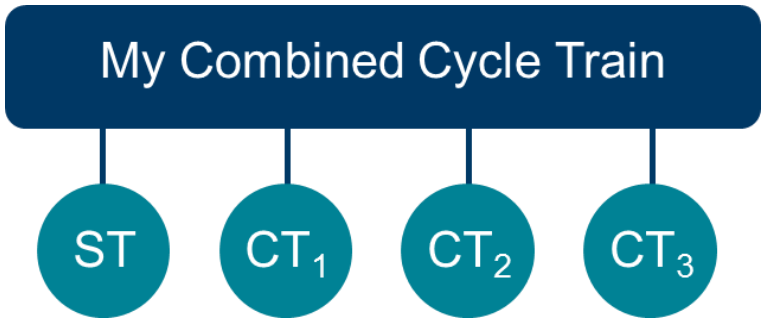
Combined Cycle Generation Resource (CCGR)

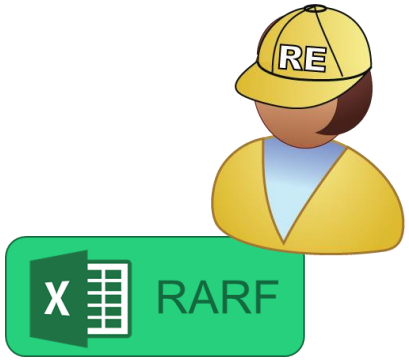
- A registered configuration of a Combined Cycle Train
- Treated as a single Resource
  - Offers
  - Commitment
  - Dispatch
  - Settlement



Resource Entity registers all desired configurations

Configurations		Configuration Codes			
		MyCCT_1	MyCCT_2	MyCCT_3	MyCCT_4
Units Included	CT_1	X	X	X	X
	CT_2	Alt	Alt	X	X
	CT_3	Alt	Alt	Alt	X
	ST		X	X	X





Resource Entity must also provide Transition Matrix

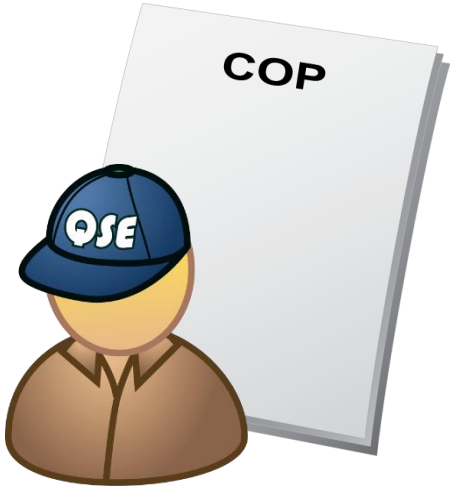
Allowable Transitions		To Configuration				
		Offline	MyCCT_1	MyCCT_2	MyCCT_3	MyCCT_4
From Configuration	Offline		X	X		
	MyCCT_1	X		X	X	
	MyCCT_2	X	X		X	X
	MyCCT_3		X	X		X
	MyCCT_4			X	X	

ERCOT is only allowed to use one transition per hour

QSE submits COP for each registered CCGR

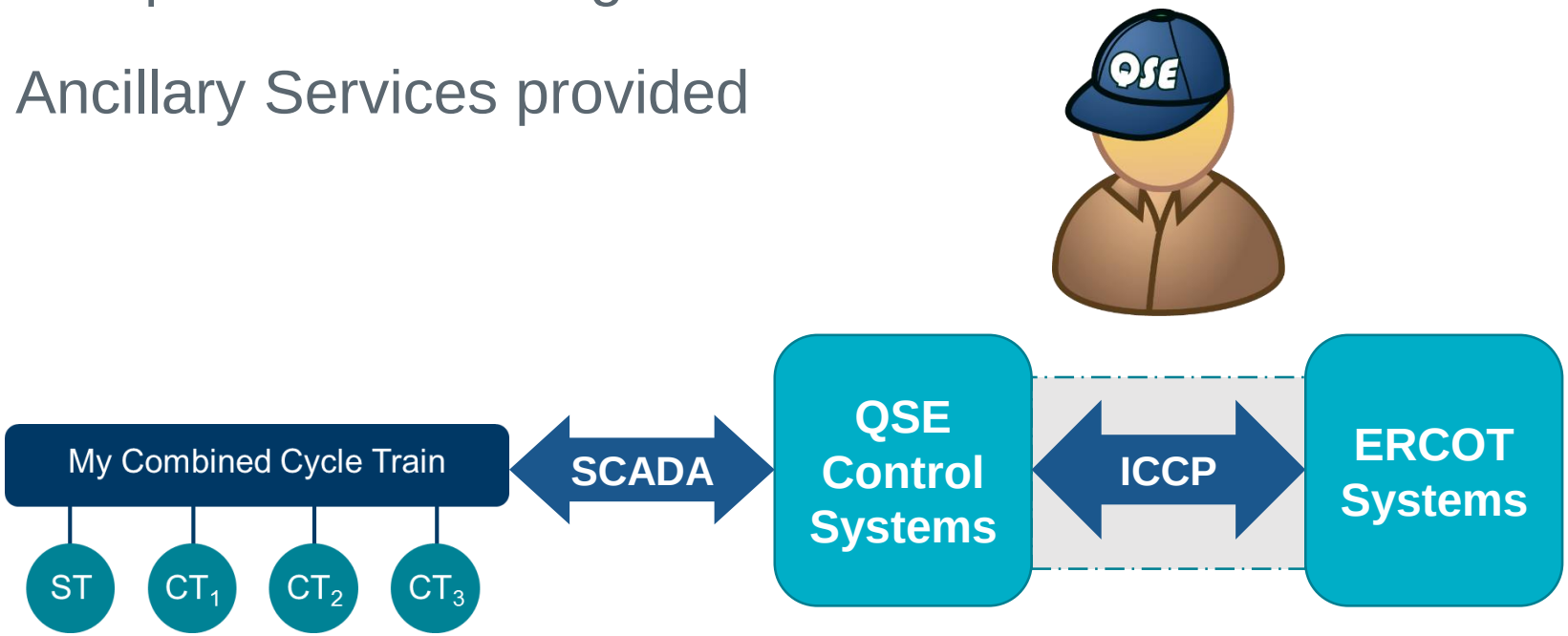
Resource Name	Hour	Resource Status	Resource Limits				AS Resource Responsibility			
			HEL	HSL	LSL	LEL	Reg-up	Reg-Down	Responsive	Non-Spin
MyCCT_1	20	OFF	110	100	50	50	0	0	0	0
MyCCT_2	20	ON	165	150	75	75	0	0	0	0
MyCCT_3	20	OFF	330	300	150	150	0	0	0	0
MyCCT_4	20	OFF	495	450	225	225	0	0	0	0

Only one CCGR from a Combined Cycle Train may be shown as on-line during a given hour



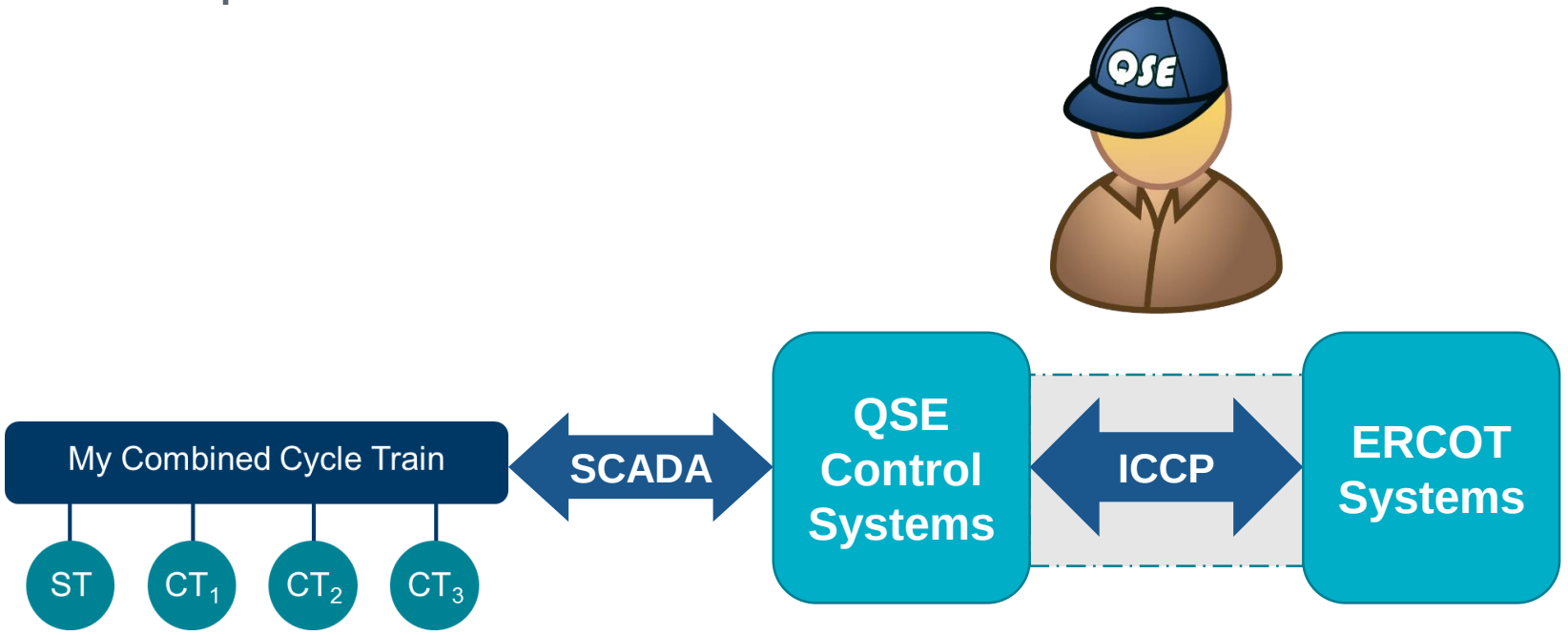
QSE provides telemetry at the Train level

- Configuration Number (1, 2, 3, 4, etc)
- Resource Limits for configuration
- Ramp Rates for configuration
- Ancillary Services provided



… and also at the individual turbine level

- Power output (MW and MVAR)
- Resource breaker and switch status
- Other operational data*



* See Protocol 6.5.5.2 for details

Scenario 2

The "Dream Steam" Combined Cycle Train is registered as follows:

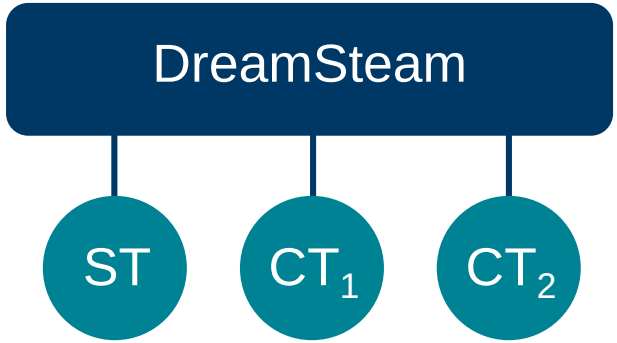
Configurations		Configuration Codes		
		MyCCT_1	MyCCT_2	MyCCT_3
Units Included	CT_1	X	X	X
	CT_2	Alt	Alt	X
	ST		X	X

Allowable Transitions		To Configuration			
		Offline	MyCCT_1	MyCCT_2	MyCCT_3
From Configuration	Offline		X		
	MyCCT_1	X		X	
	MyCCT_2		X		X
	MyCCT_3			X	

Scenario 2

DreamSteam's QSE plans to start the Resource at 0900

If DreamSteam is running only the CT_1 unit, can ERCOT instruct DreamSteam to simultaneously start both the CT_2 and ST units?



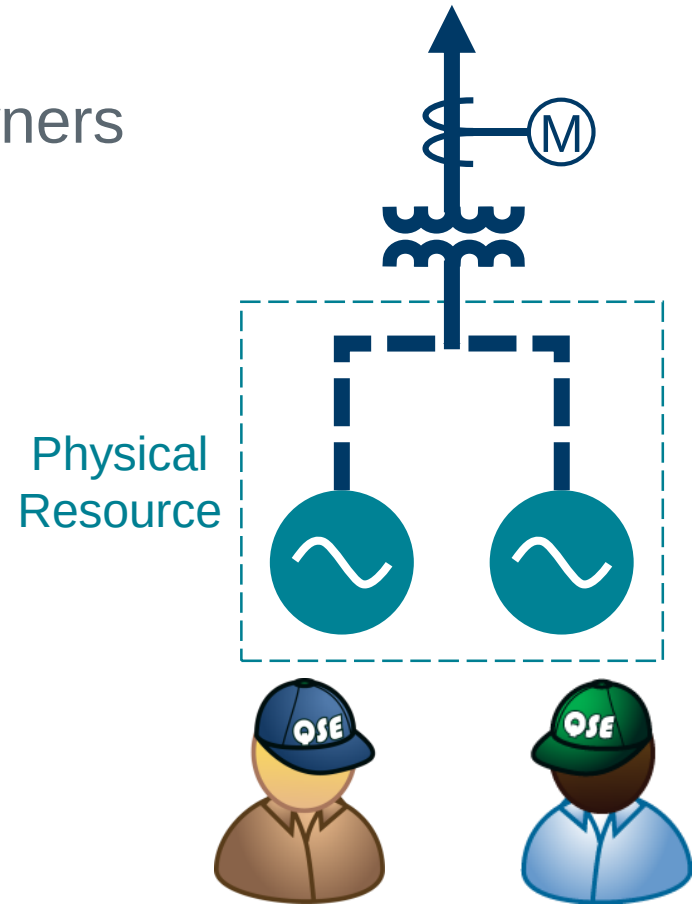
Can ERCOT instruct DreamSteam to simultaneously start the CT_1, CT_2 and ST units at 0700?

Topics in this Section Include

1. Combined Cycle Generation Resources
2. Split Generation Resources
3. Quick Start Generation Resources

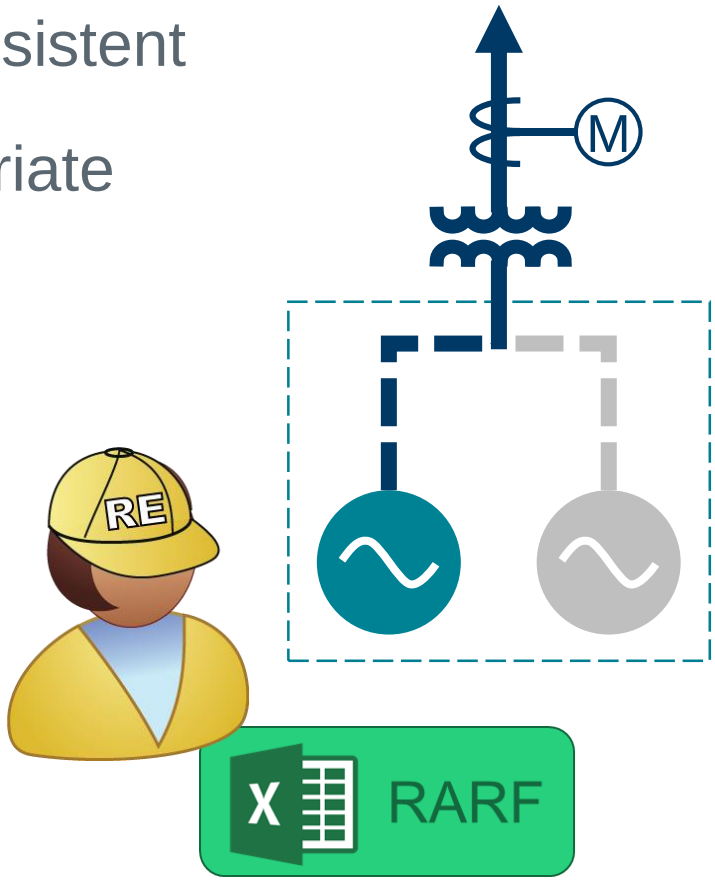
What is a Split Generation Resource?

- Single physical Resource that is not a Combined Cycle Train
- Meter output split across multiple owners
- Each split modeled as a separate Resource
- Each owner may have separate QSE



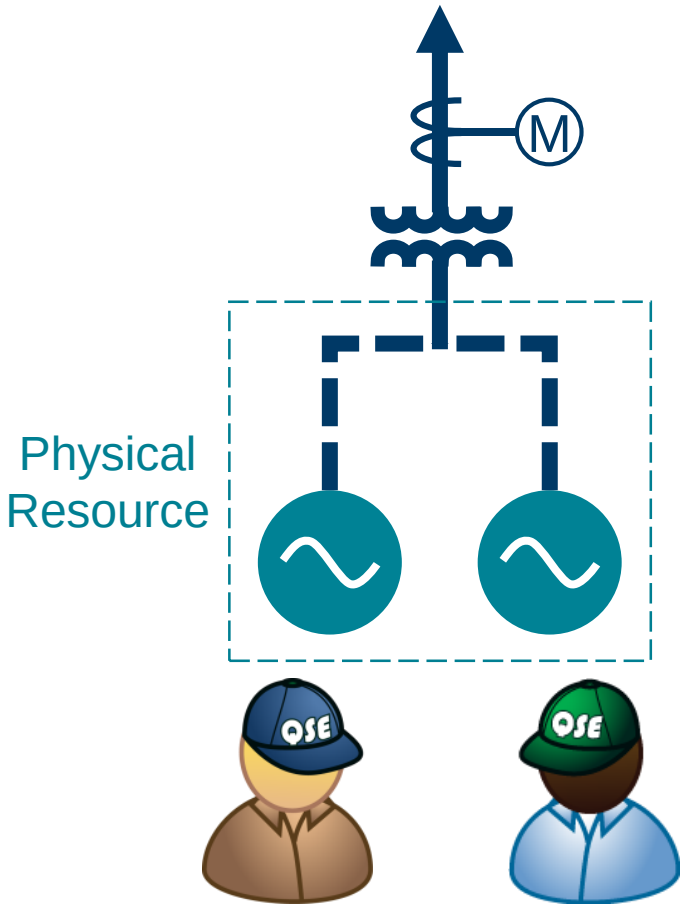
Setting up a Split Generation Resource

- Each Resource Entity registers their portion
- Resource Parameters must be consistent
  - Limits and Ramp Rates appropriate for each split
  - Temporal values identical across all splits



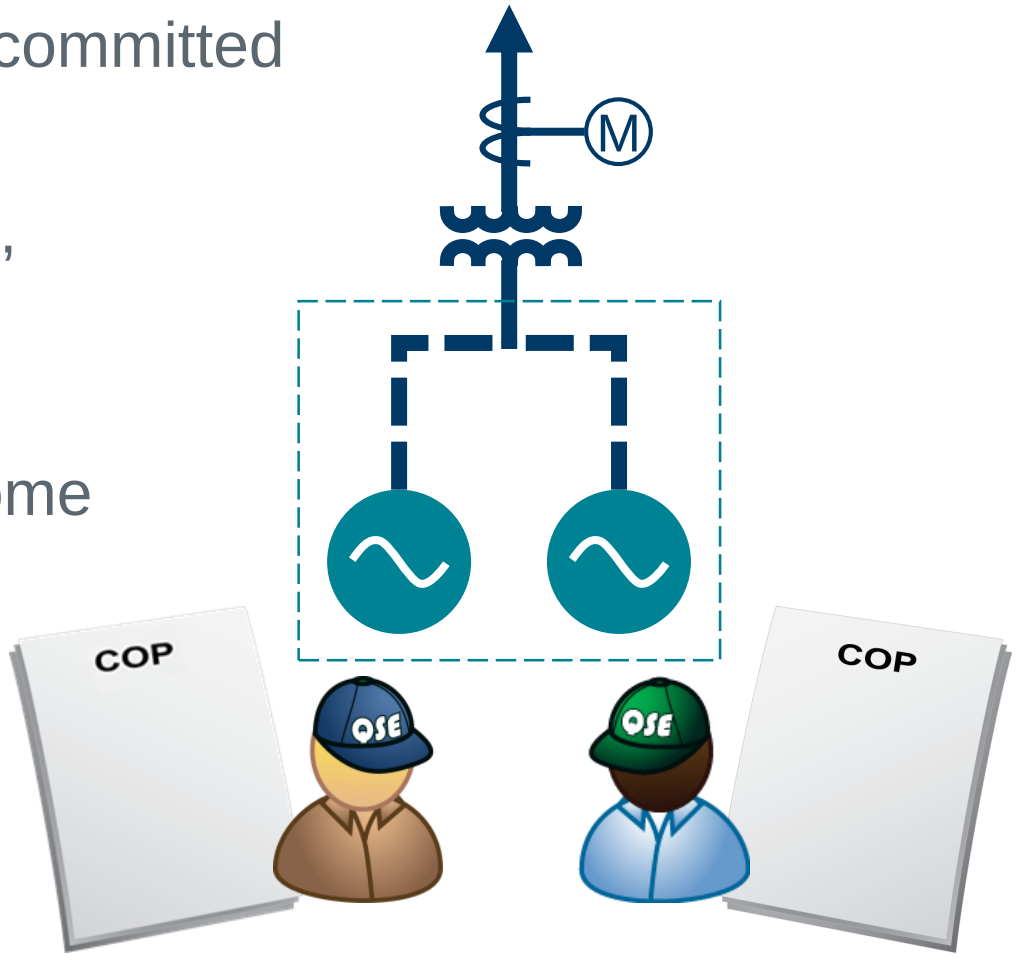
Resource Entities shall designate a Master QSE

- Serves as the Single Point of Contact
- Provides real-time telemetry for total physical Resource
- May or may not be one of the controlling QSEs

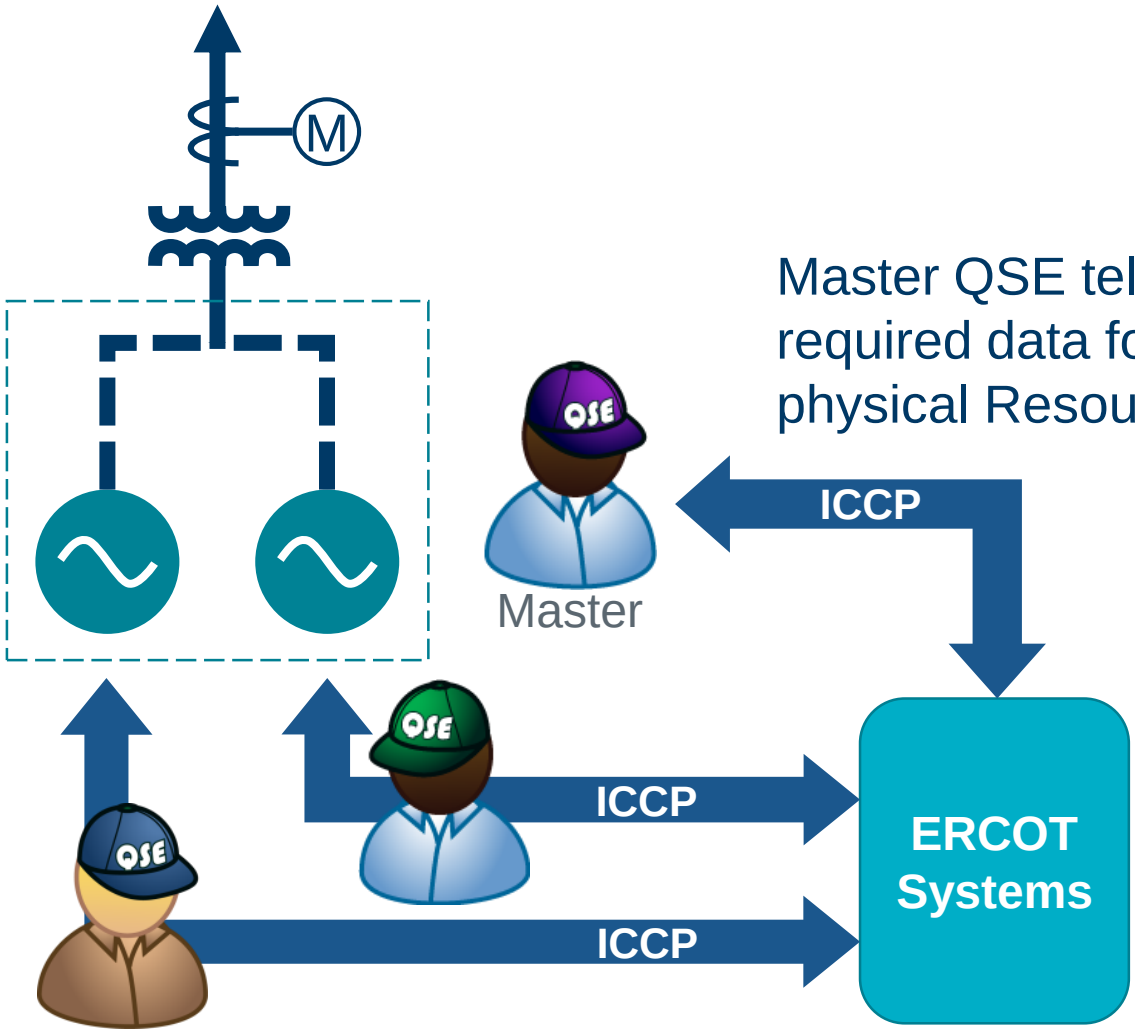


Each QSE maintains COP for their split

- All related Split Generation Resources must be committed or decommitted together
- In case of status conflicts,
  - If one SGR is “OUT,” all are “OUT”
  - Else, if one SGR is some form of “ON,” then all are “ON”



Each QSE telemeters required data for their split



Master QSE telemeters required data for total physical Resource

ERCOT checks for consistency and notifies QSEs of any errors

Topics in this Section Include

1. Combined Cycle Generation Resources
2. Split Generation Resources
3. Quick Start Generation Resources

Quick Start Generation Resource (QSGR)

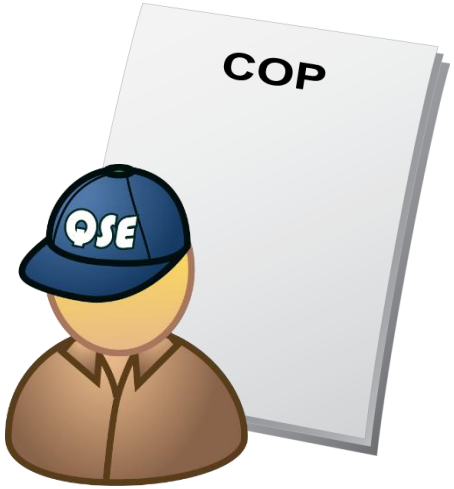
- A Generation Resource that can come online from a cold state within ten minutes
- Must qualify by test
  - Receive deployment instruction from ERCOT
  - Qualified MW is observed output 10 minutes after instruction

QSE submits COP for QSGR

Resource Name	Hour	Resource Status	Resource Limits				AS Resource Responsibility			
			HEL	HSL	LSL	LEL	Reg-up	Reg-Down	Responsive	Non-Spin
QSGR1	20	OFFQS	55	50	20	20	0	0	0	0
QSGR2	20	OFFQS	55	50	20	20	0	0	0	30
QSGR3	20	OFFQS	85	80	25	20	0	0	0	80

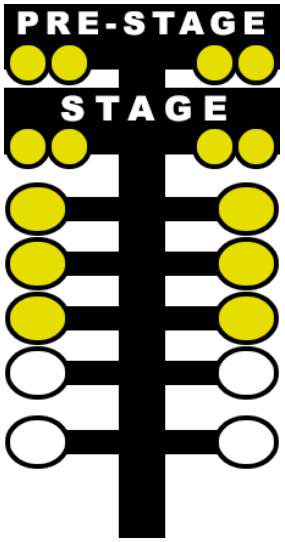
With Status of “OFFQS,”
Resource will remain offline until

- Dispatched by SCED
- Started by QSE



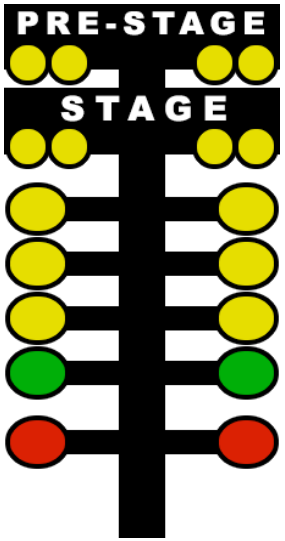
Waiting for Dispatch by SCED

- Resource Status of OFFQS
- Breaker Status of Open
- Ramp Rate = (Qualified 10 min MW) / 5 min
- LSL = 0



After Dispatch by SCED

- Resource Status of ON
- Breaker Status of Closed
- LSL less than actual output until reaching actual LSL



Decommitment Process

- Once SCED brings QSGR Basepoint back to LSL
  - Set LSL=0
  - Ramp Rate must allow dispatch to zero in 5 min
- Non-zero Basepoint
  - QSGR is still needed
  - Resume normal LSL

QSE may test no more than two non-consecutive SCED executions in an Operating Hour

Decommitment Process

- Once SCED brings QSGR Basepoint back to LSL
  - Set LSL=0
  - Ramp Rate must allow dispatch to zero in 5 min
- Zero Basepoint
  - QSGR no longer needed
  - May shut down normally

You've learned about ...

- Resource Entity Responsibilities
- QSE Responsibilities
- Special Resource Requirements
- Resource Nodes

Module Conclusion