

ercot

Reliability Unit Commitment


Greetings and Introductions

- Attendance
- Questions
- Presentation materials
- Recording for internal purposes

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:

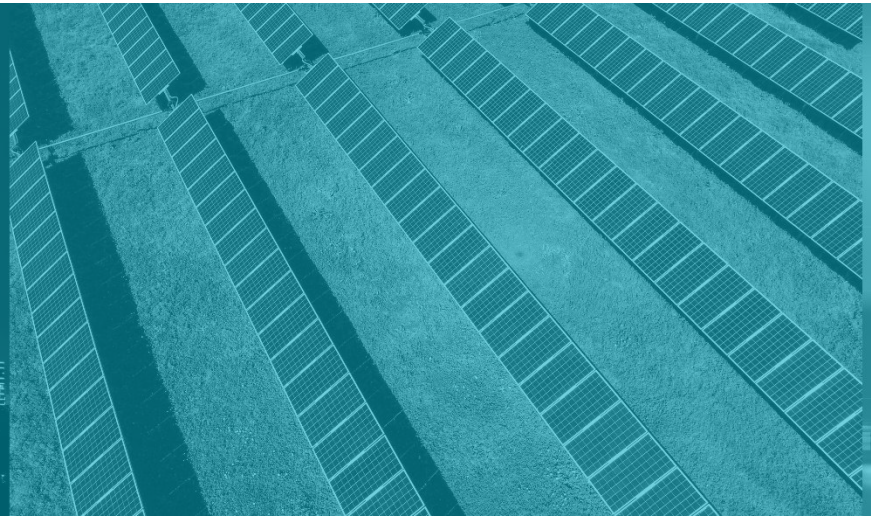
http://www.ercot.com/mktrules/nprotocols/

Format	Title
WBT	Wholesale Markets Overview

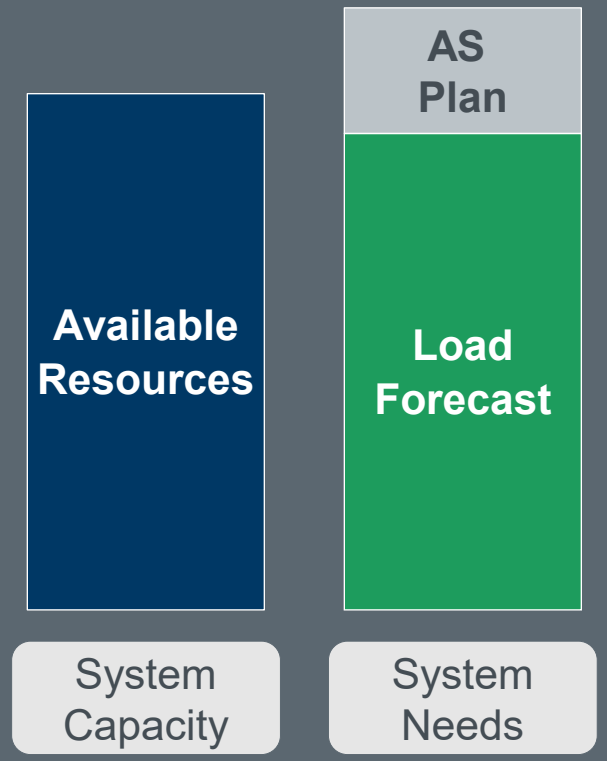
Format	Title	Topic
ILT	Day-Ahead Market Operations	Inputs
		Market Clearing
		Financial Impacts
	Reliability Unit Commitment	Overview
		Process
		Financial Impacts
	Real-Time Market Operations	Security Constrained Economic Dispatch
		Load Frequency Control
		Financial Impacts



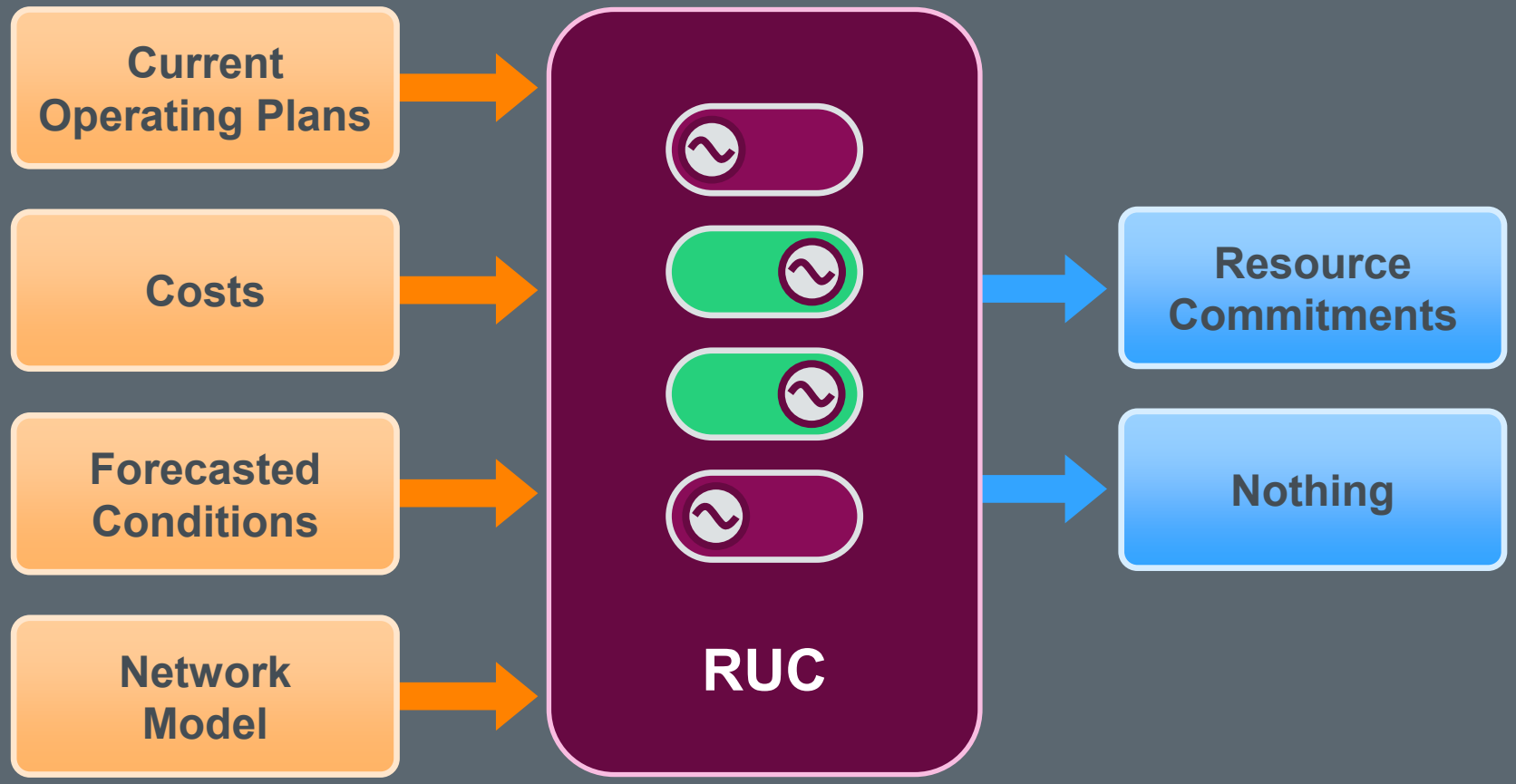
Overview

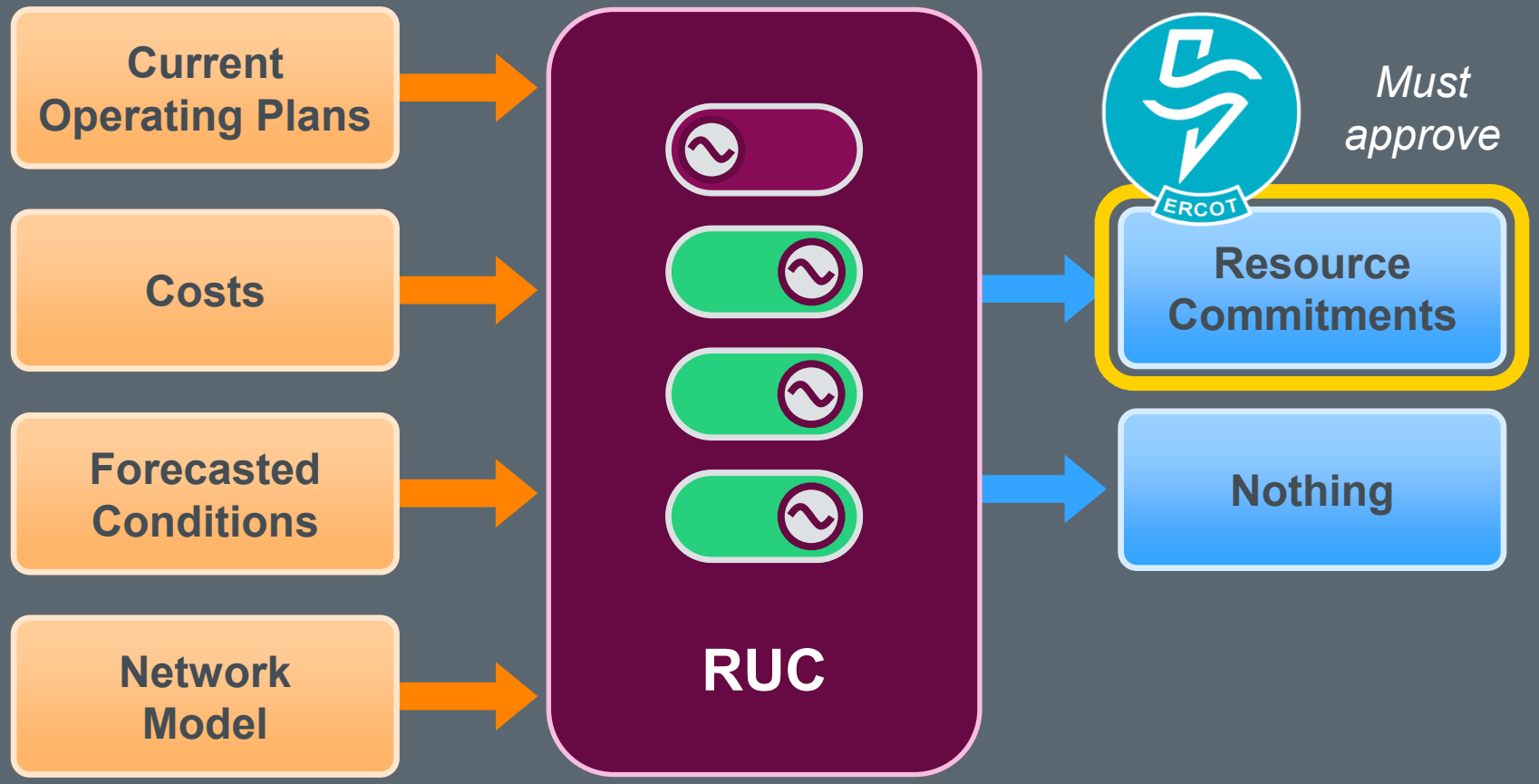




It's 11:00. For hours ending 14:00-18:00, the Load Forecast and AS Plan exceed the committed Resource Capacity by 400 MW.

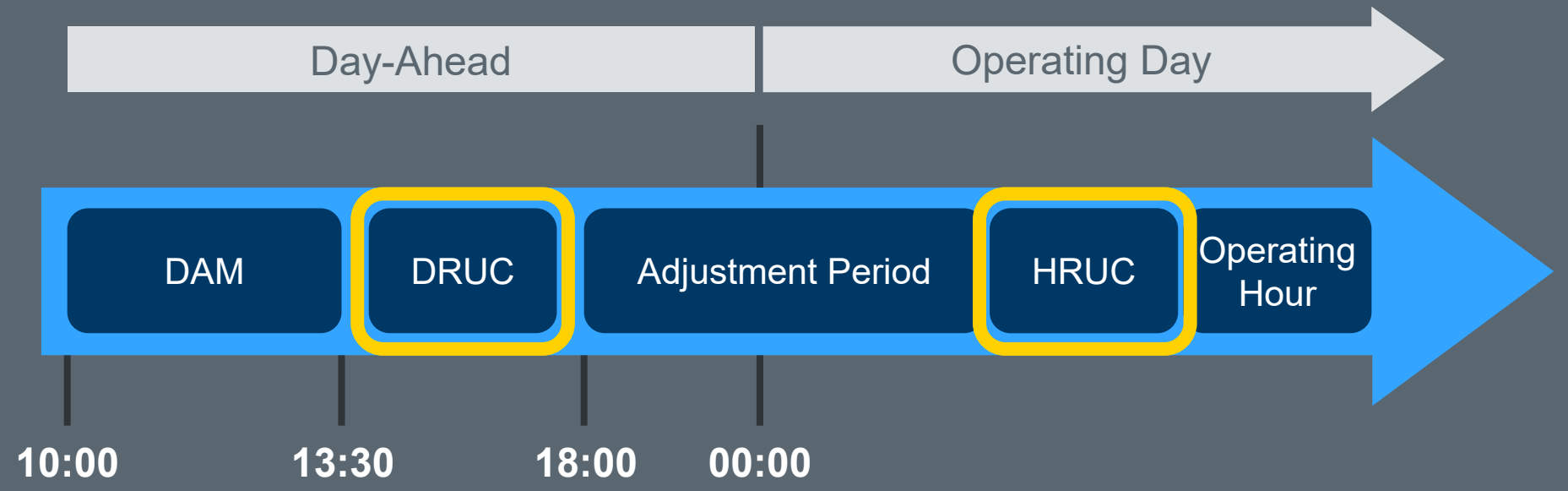


1. What options does ERCOT have?
2. How do the ERCOT operators choose?


Current Operating Plans
Costs
Forecasted Conditions
Network Model
RUC
Resource Commitments
Nothing


Current Operating Plans
Costs
Forecasted Conditions
Network Model
RUC
ERCOT
Must approve
Resource Commitments
Nothing

Reliability Unit Commitment Timing

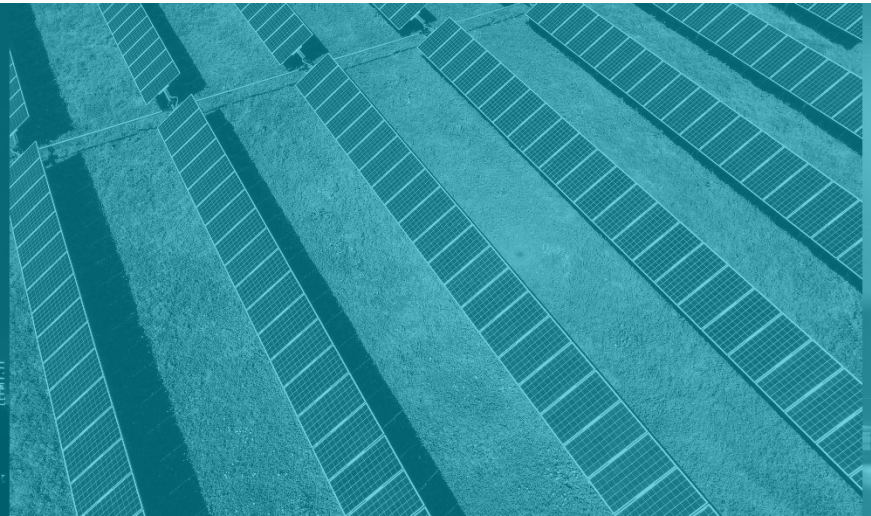


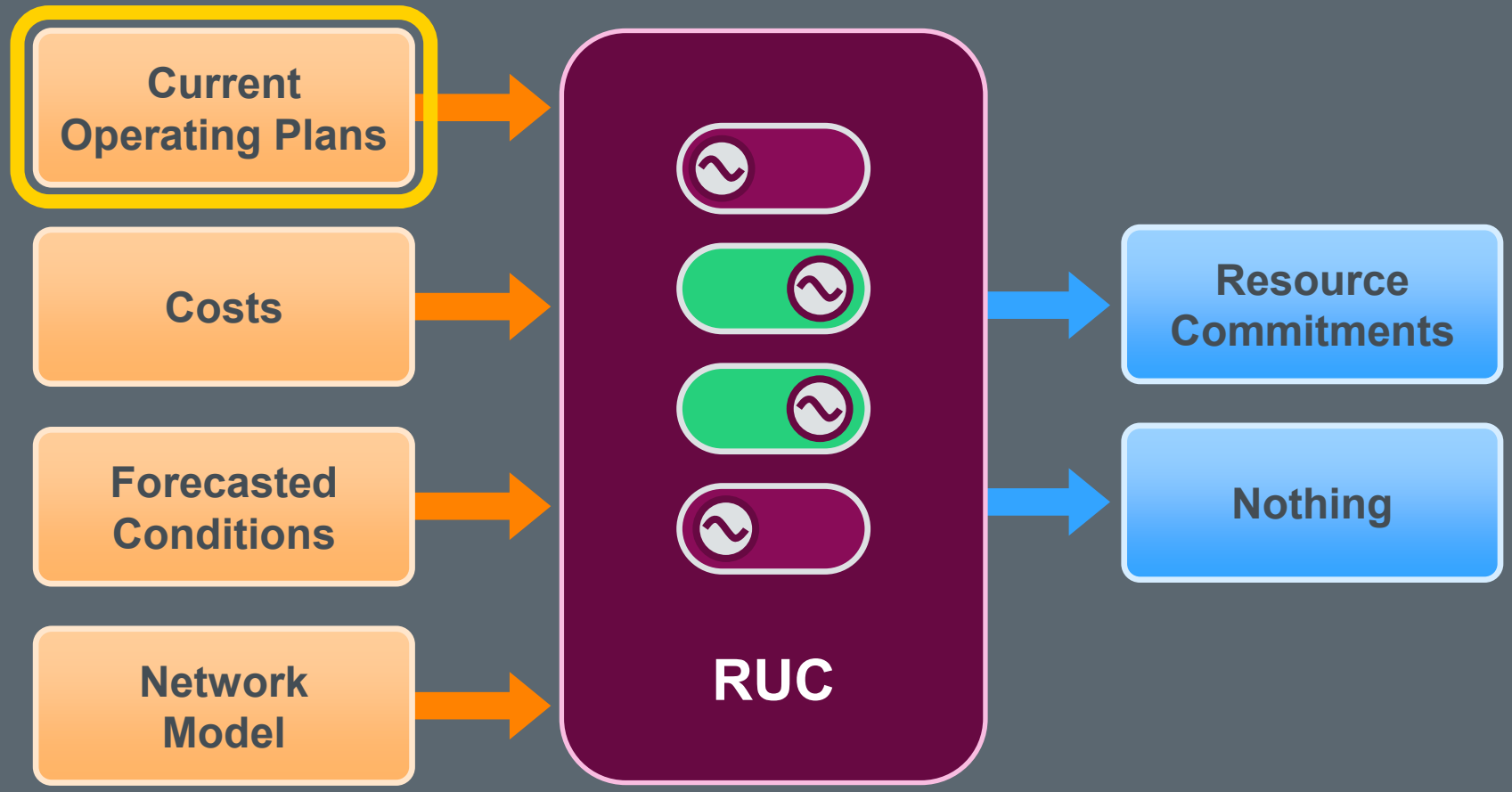
DRUC = Day-Ahead Reliability Unit Commitment

HRUC = Hourly Reliability Unit Commitment



Process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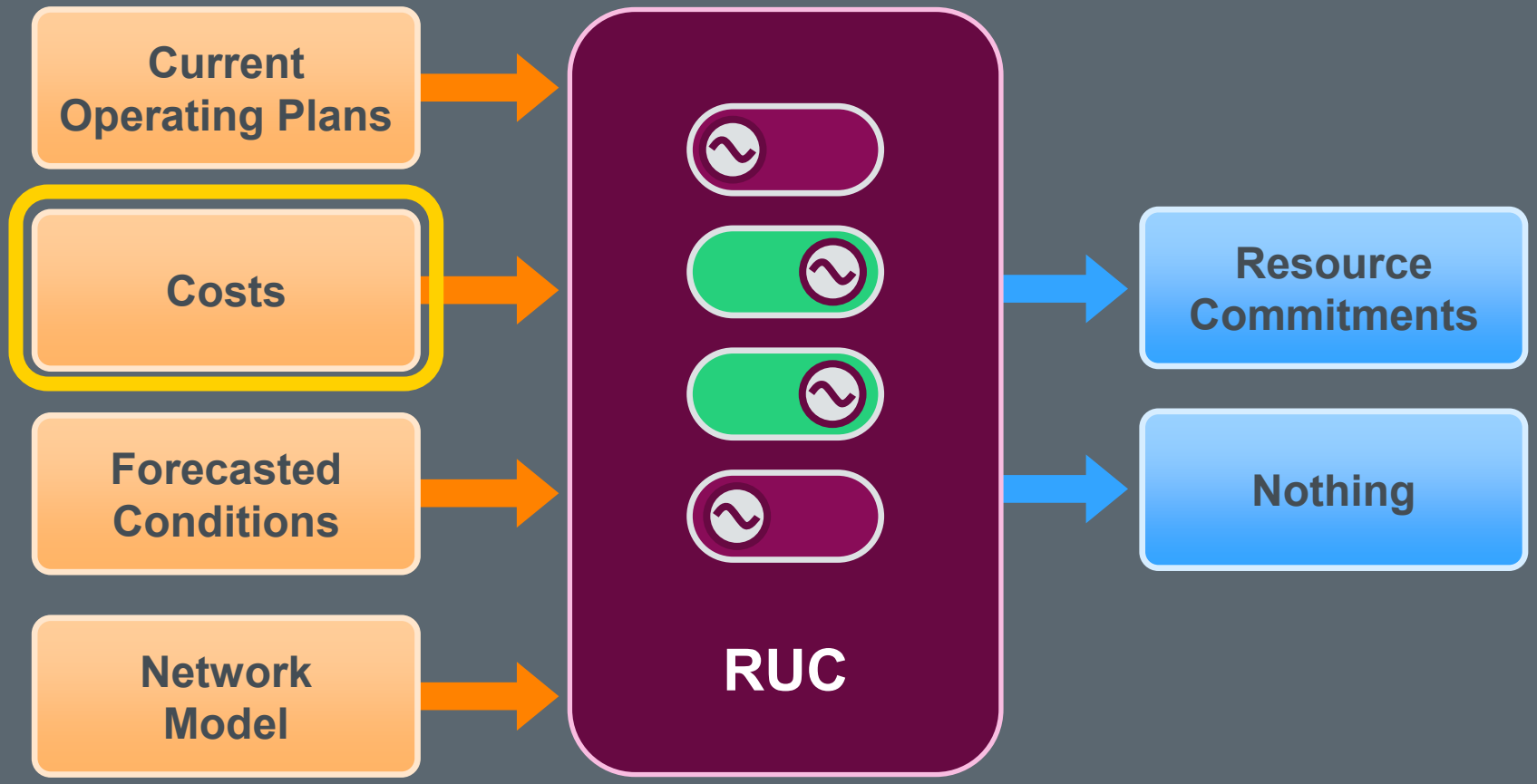
Network Model
RUC
Resource Commitments
Nothing

Provides critical information to RUC

Current Operating Plan											
Resource Name	Resource Status	Resource Limits		ESR SOC Limits			Ancillary Service Capabilities				
		HSL	LSL	Min	Max	Hour Beginning	Reg-Up	Reg-Dn	Responsive	ECRS	NSRS
GEN1	ON	600	120	-	-	-	20	20	40	40	120
GEN2	OUT	100	25	-	-	-	0	0	0	0	0
ESR3	ON	40	-40	0	40	40	0	0	40	40	10
GEN3	OFF	450	100	-	-	-	0	0	0	0	0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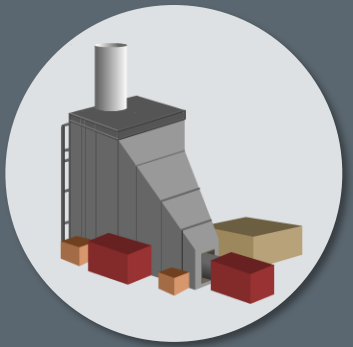
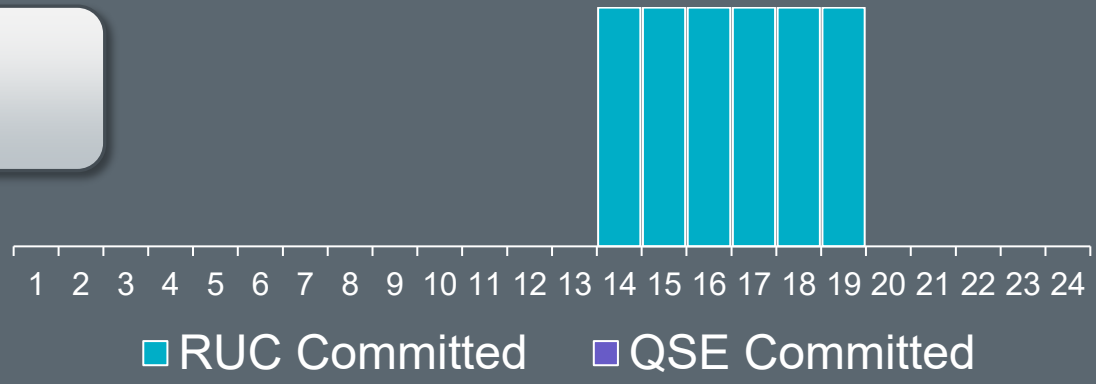
Based on Three Part Supply Offers



Startup Cost Considered?

- No QSE Commitments
- RUC initially commits

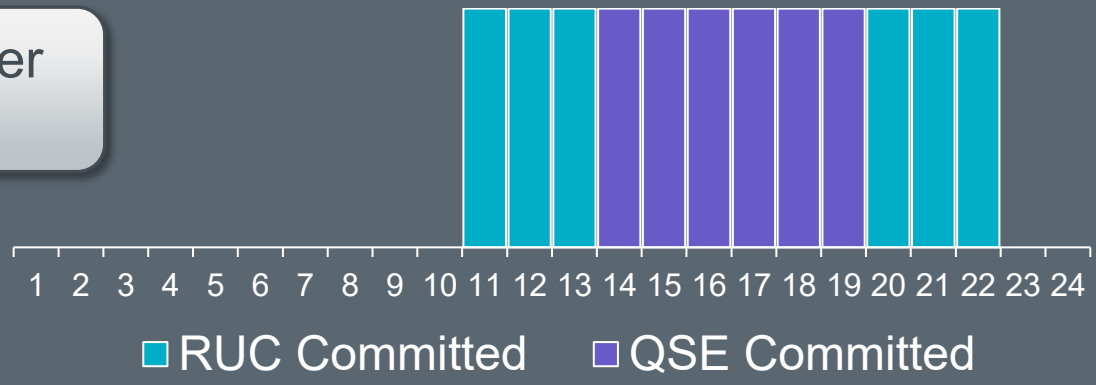
RUC will consider Startup Costs

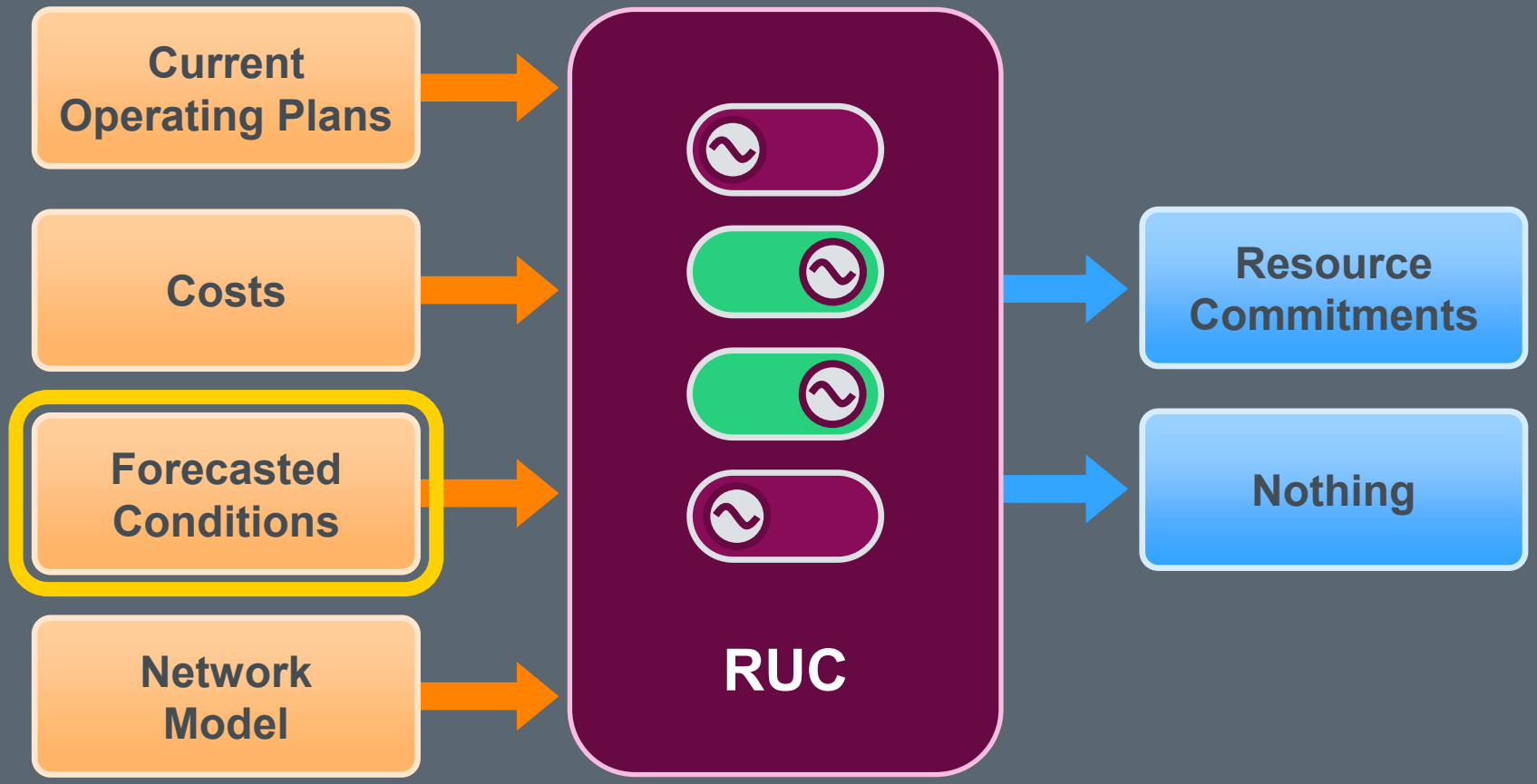


Startup Cost Considered?

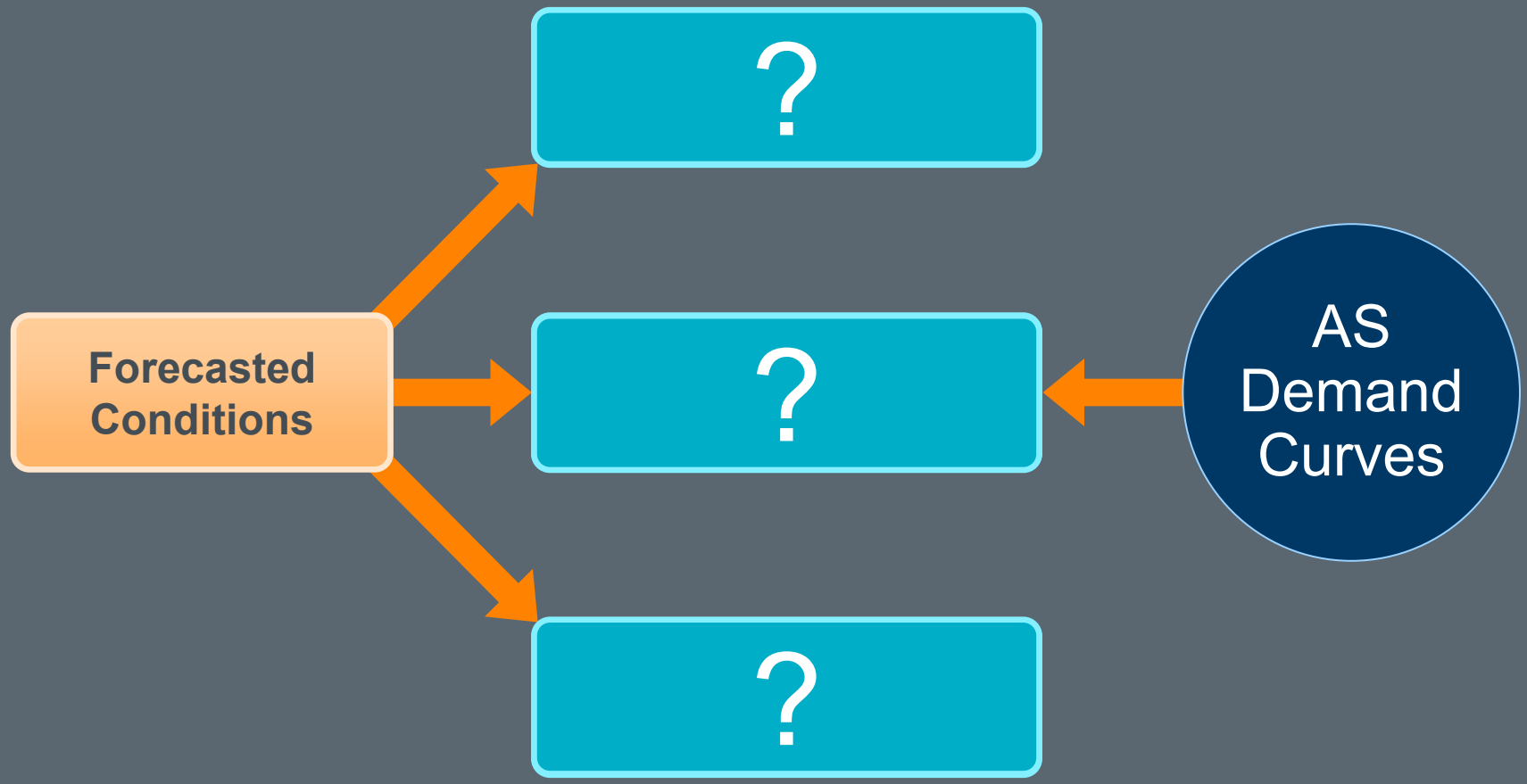
- QSE initially commits
- RUC extends commitment

RUC will not consider Startup Costs

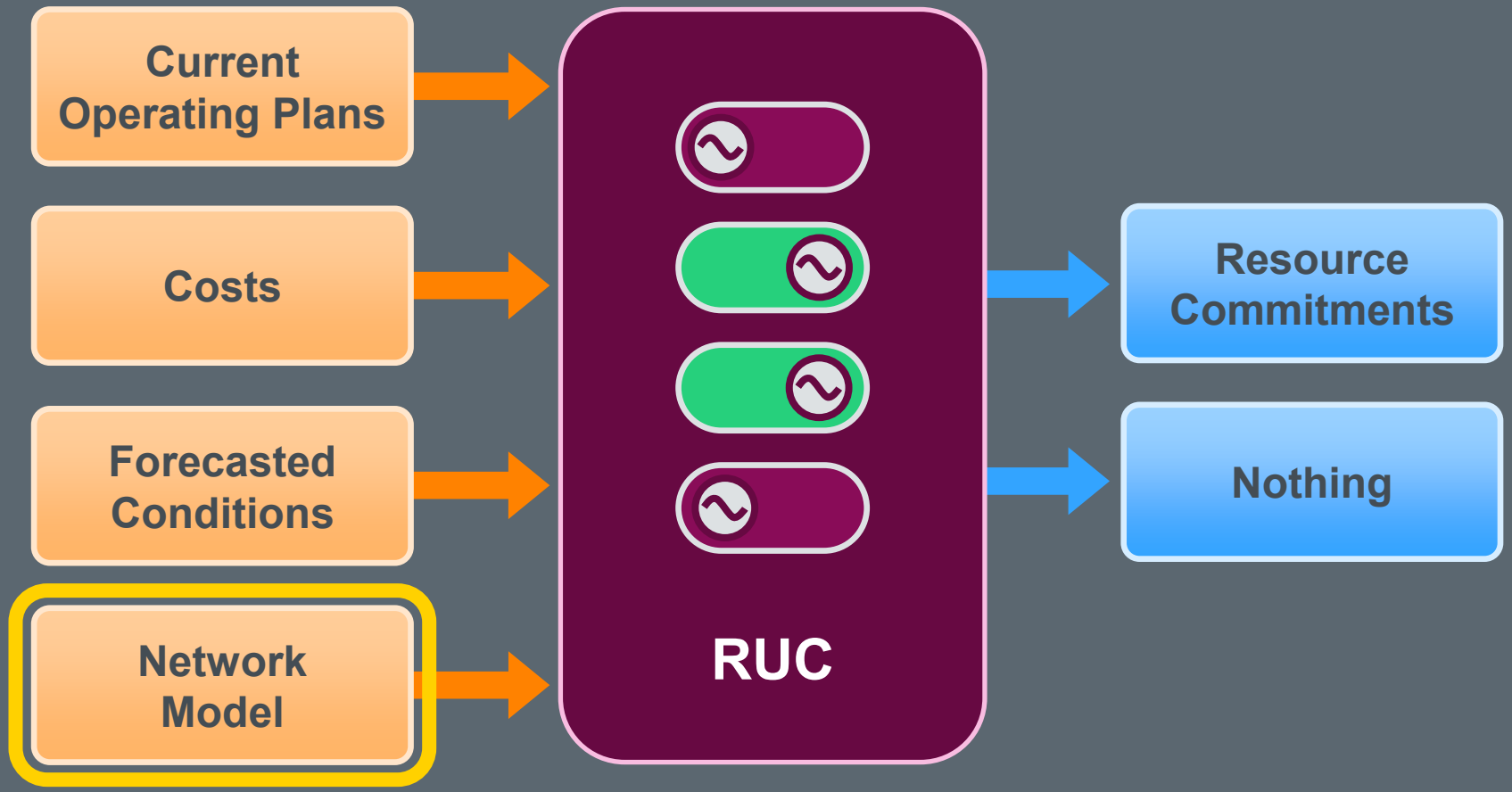


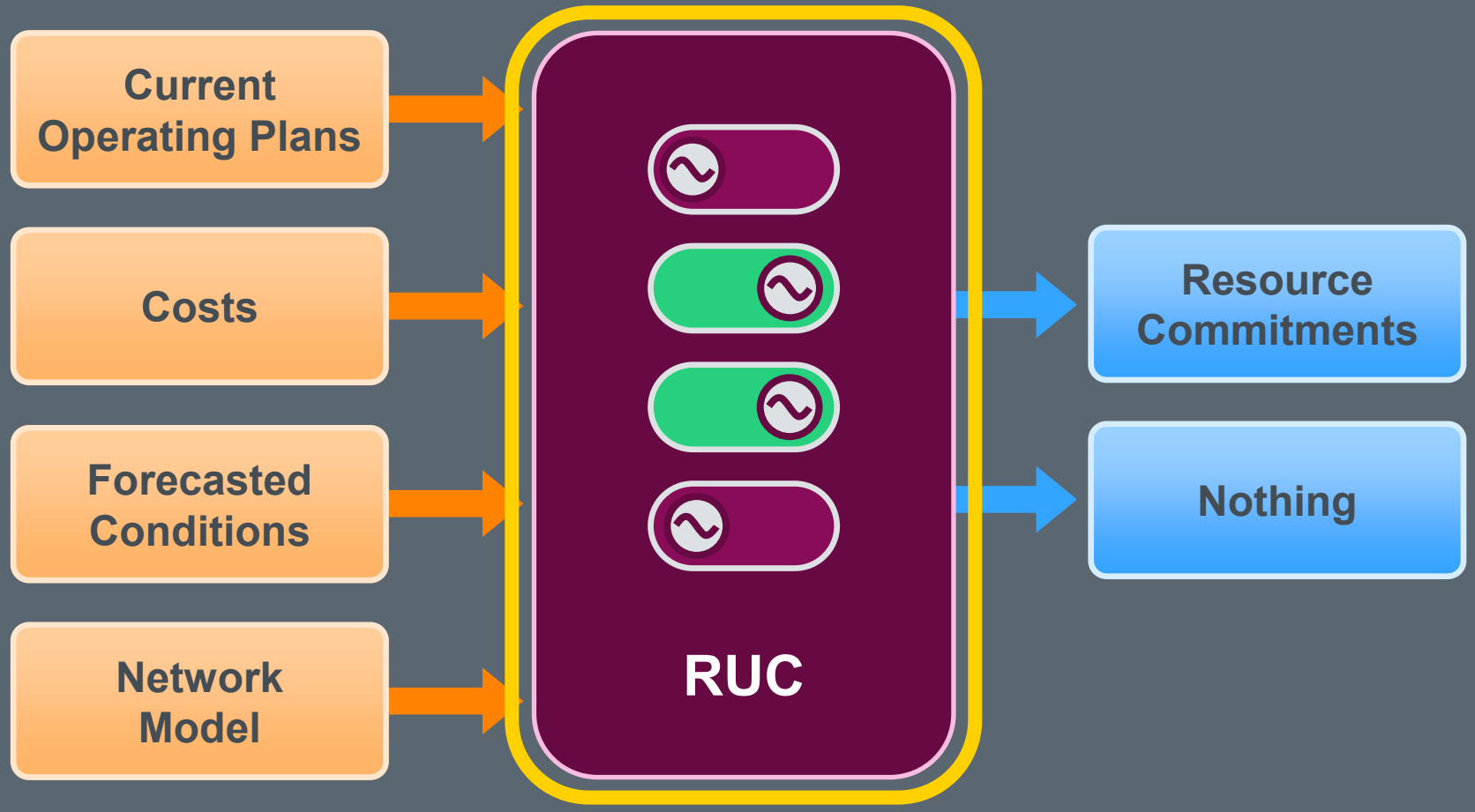

Current Operating Plans
Costs
Forecasted Conditions
Network Model
RUC
Resource Commitments
Nothing

Discussion: What forecast information does RUC need?



Uses expected network topology for each hour




Current Operating Plans
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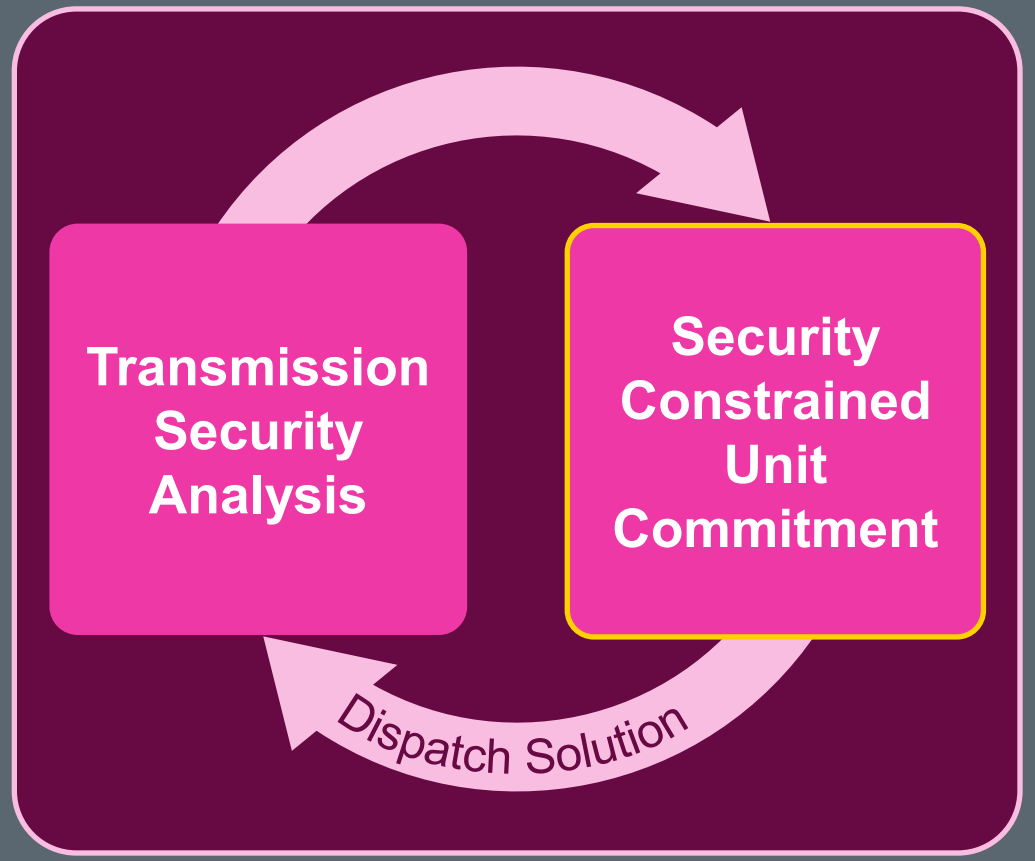
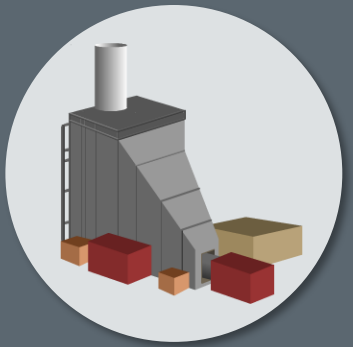
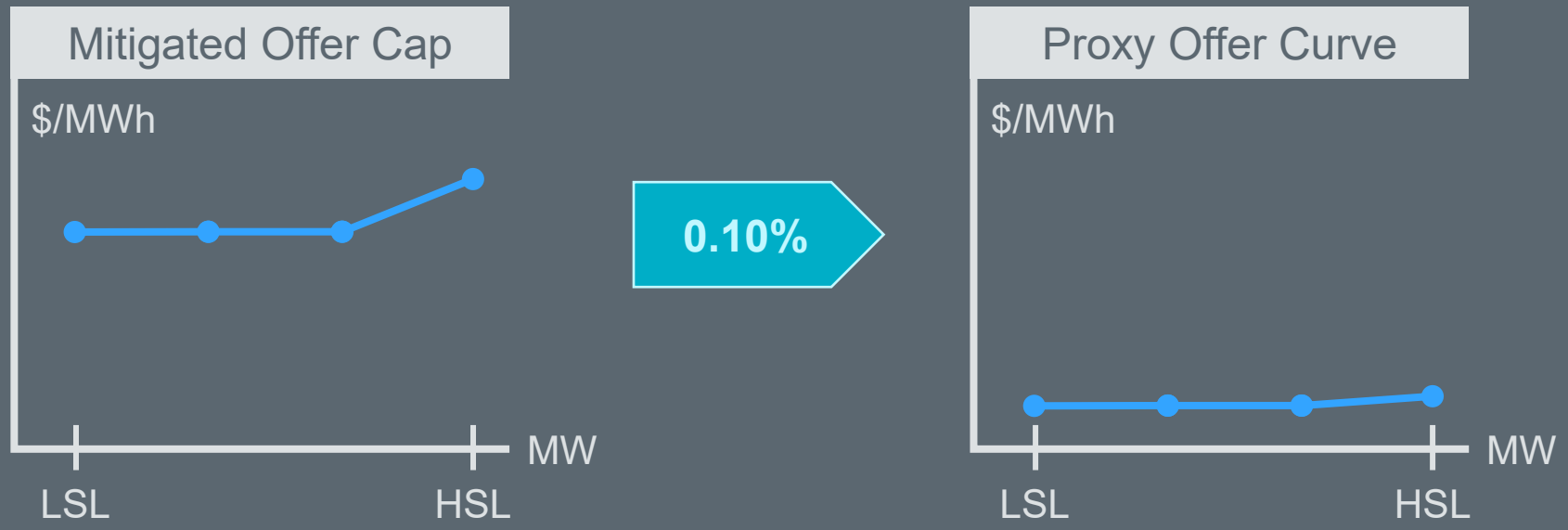
Begins with Initial Unit Commitment for each hour

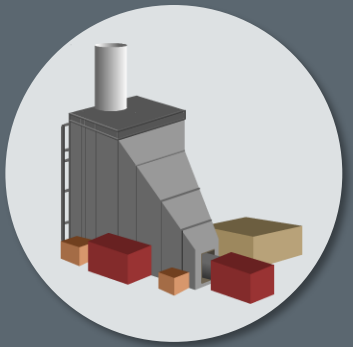


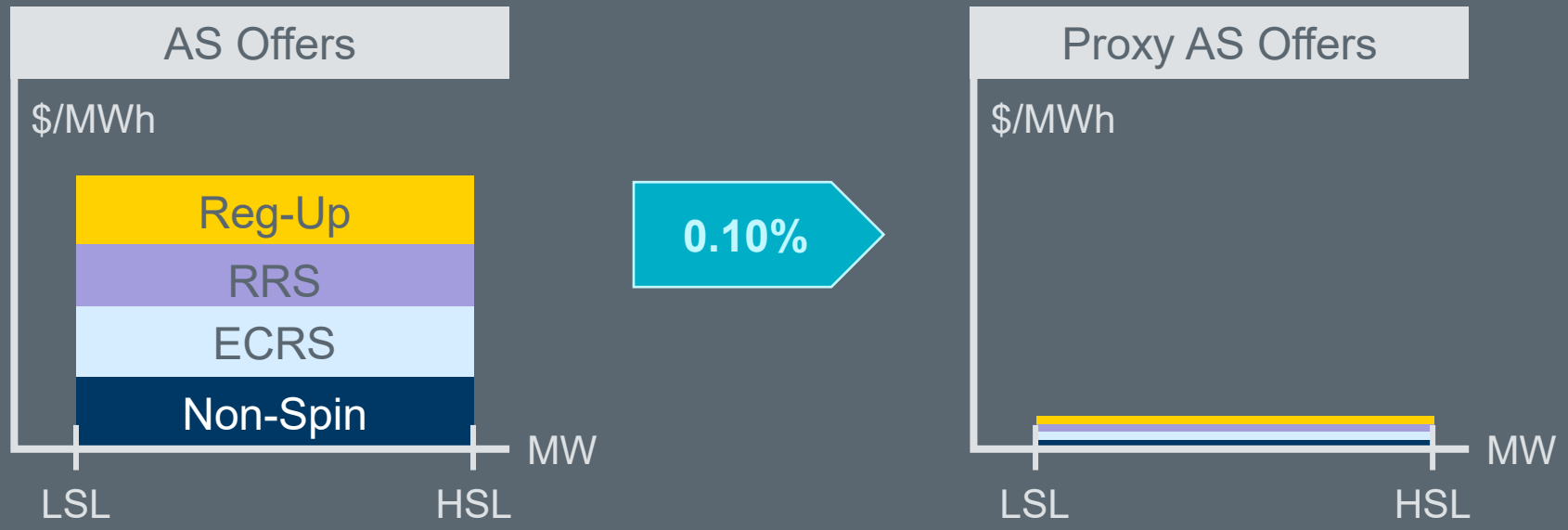
To project possible dispatch solutions





To project possible Ancillary Awards





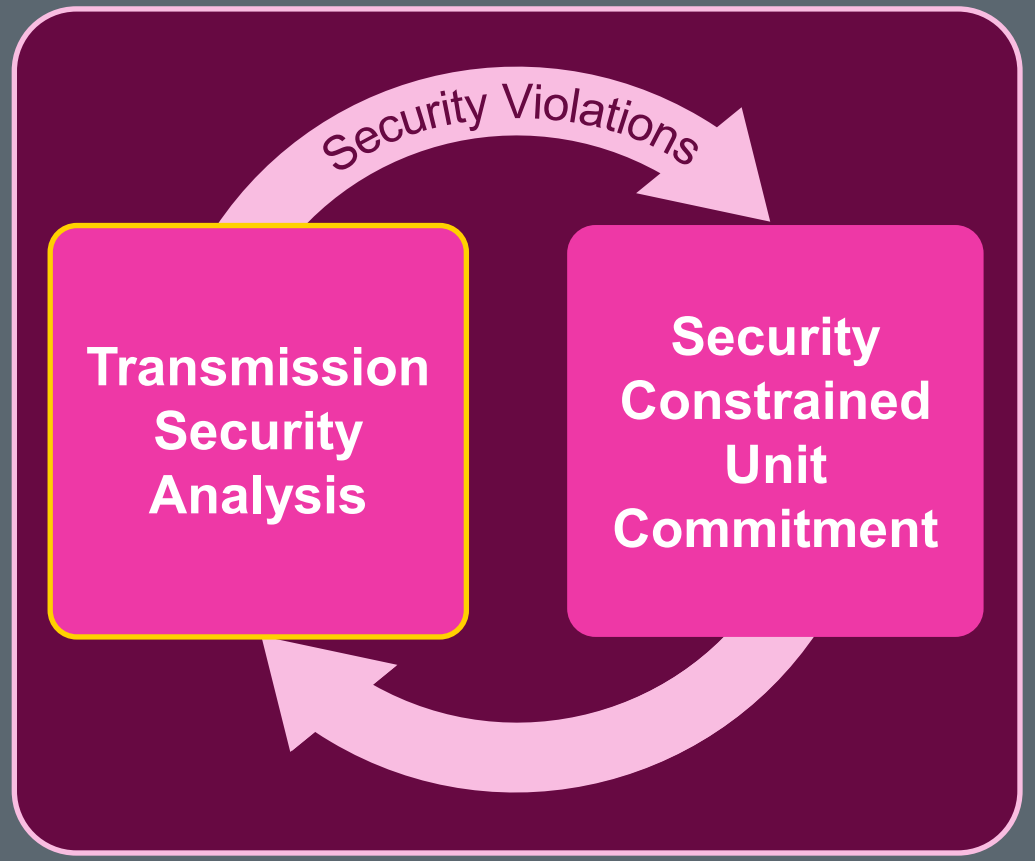
Discussion: RUC and Energy Storage Resources

Current Operating Plan											
Hour	Resource Name	Resource Limits		ESR SOC Limits			Ancillary Service Capabilities				
		HSL	LSL	Min	Max	Hour Beginning	Reg-Up	Reg-Dn	Responsive	ECRS	NSRS
15	ESR3	40	-40	0	40	30	0	0	0	30	0
16	ESR3	40	-40	0	40	40	0	0	0	20	0
17	ESR3	40	-40	0	40	20	0	0	0	10	0
18	ESR3	40	-40	0	40	10	0	0	0	10	0

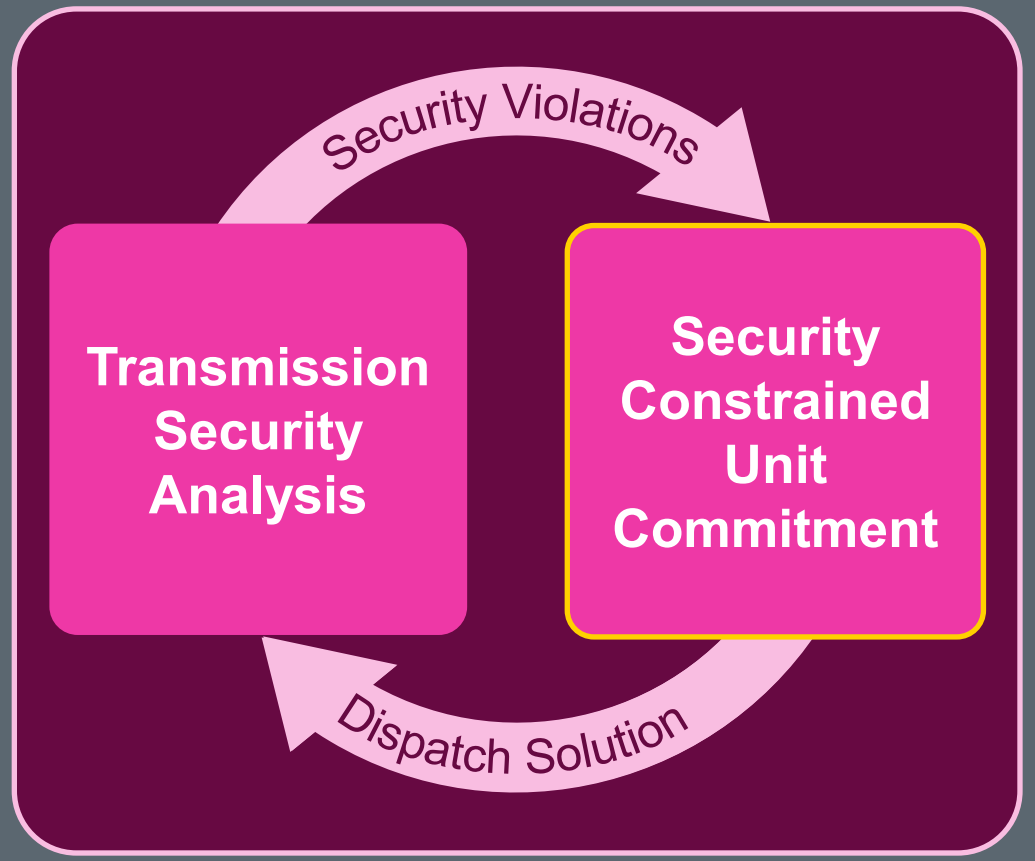
Projects dispatch that aligns with Hourly SOC changes

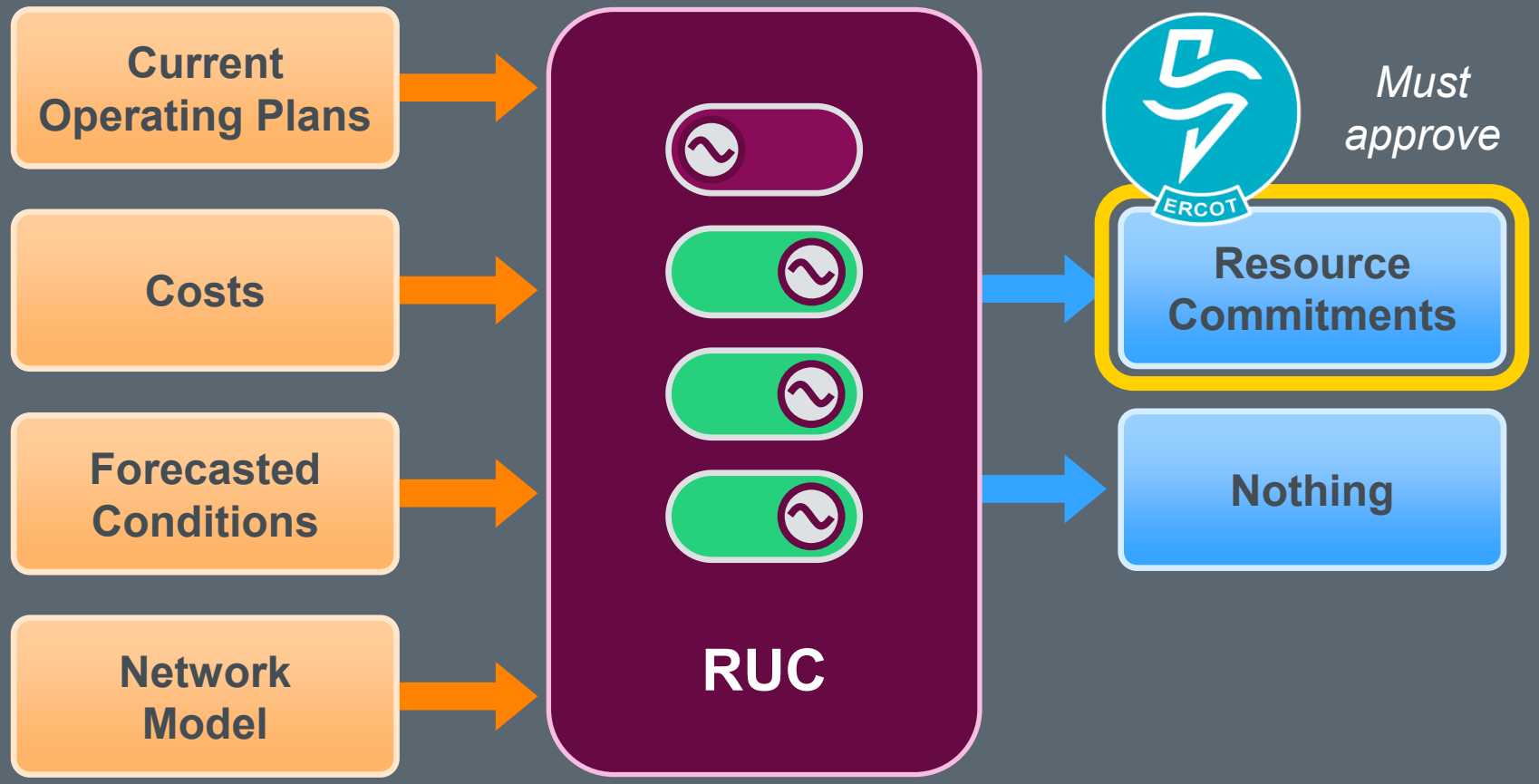
Checks feasibility based on Deployment Factors

Is solution secure with all Ancillary Services awarded?



Revise Unit Commitment if needed




Current Operating Plans
Costs
Forecasted Conditions
Network Model
RUC
ERCOT
Must approve
Resource Commitments
Nothing

Start hour and duration sent to QSEs

XML = Extensible Mark-Up Language
VDI = Verbal Dispatch Instruction

QSE must update COP within 60 minutes

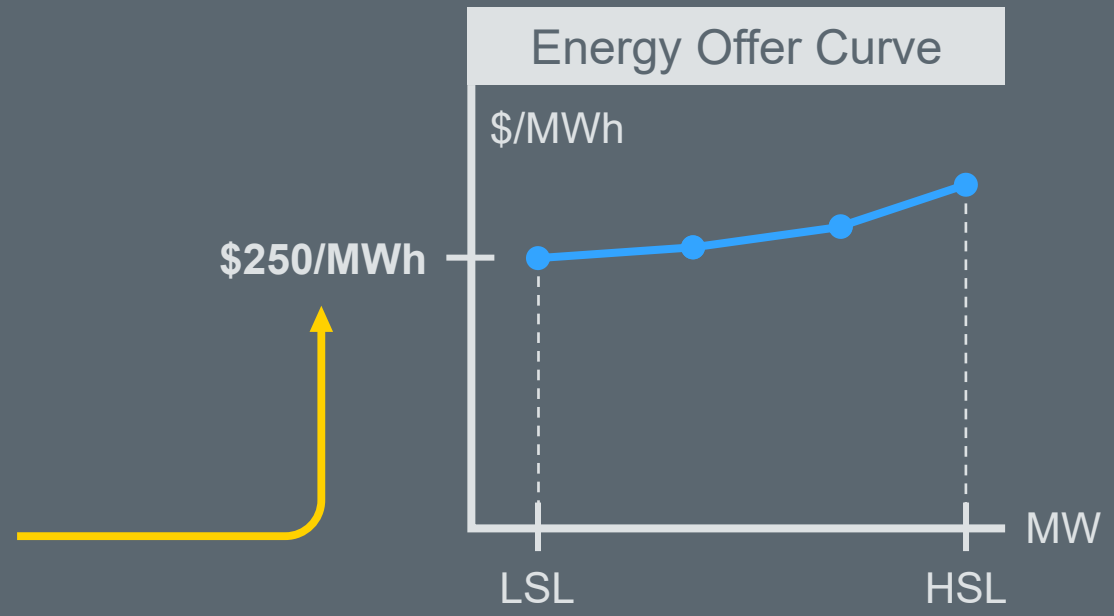
Current Operating Plan											
Resource Name	Resource Status	Resource Limits		ESR SOC Limits			Ancillary Service Capabilities				
		HSL	LSL	Min	Max	Hour Beginning	Reg-Up	Reg-Dn	Responsive	ECRS	NSRS
GEN1	ON	600	120	-	-	-	20	20	40	40	120
GEN2	OUT	100	25	-	-	-	0	0	0	0	0
ESR3	ON	40	-40	0	40	40	0	0	40	40	10
GEN3	OFF ▼	450	100	-	-	-	0	0	0	0	0

ONRUC
ONOPTOUT

Resource Financial Impacts

- **Floor price**
- **RUC Settlement**
  - Make-Whole
  - Clawback

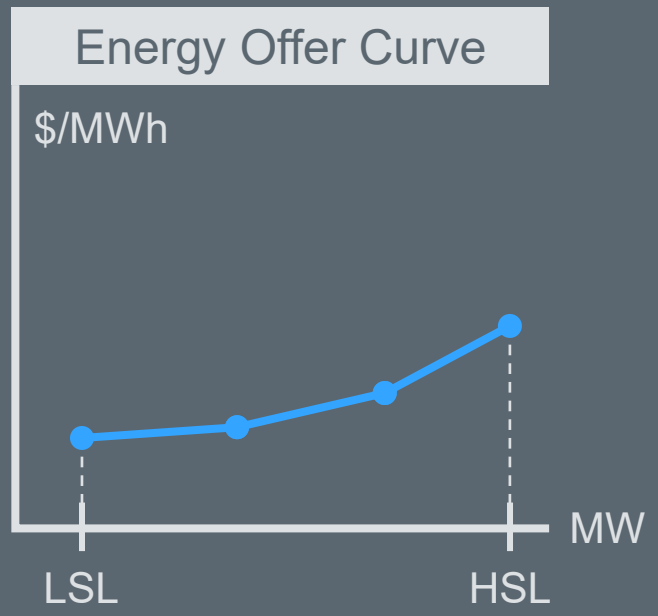
ERCOT adjusts if QSE does not



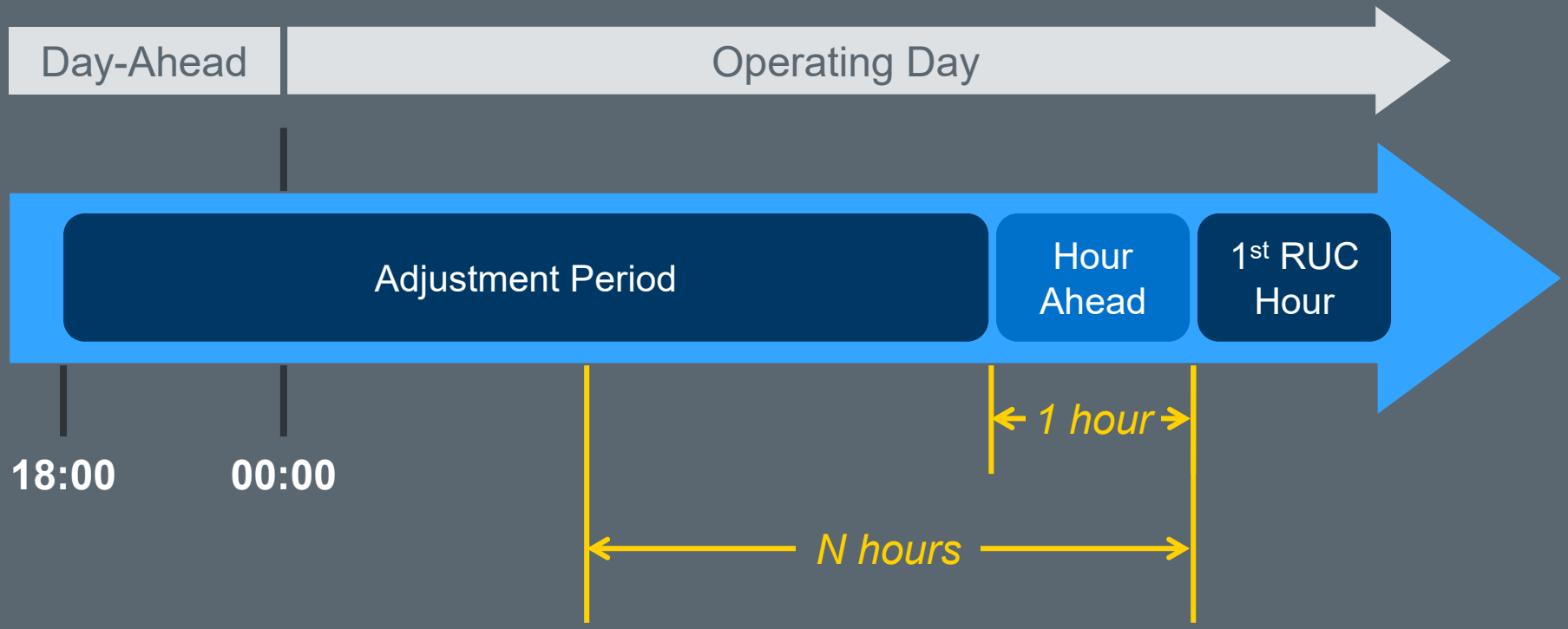
Resource Financial Impacts

- **No floor price**
- **No RUC Settlement**

QSE must update COP prior to Opt Out Snapshot



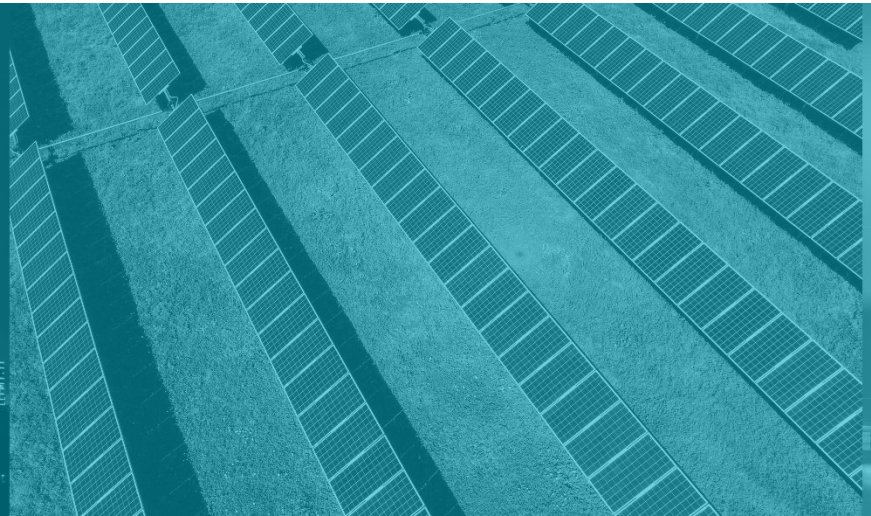
Taken at the earlier of:

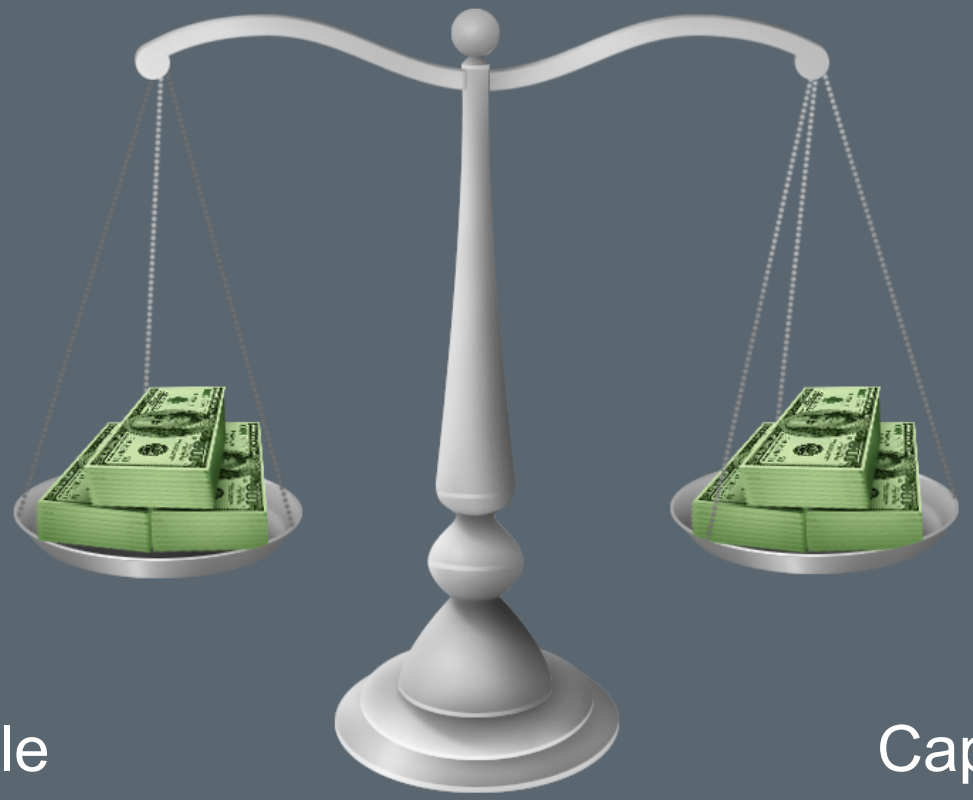


Where N is Start Time



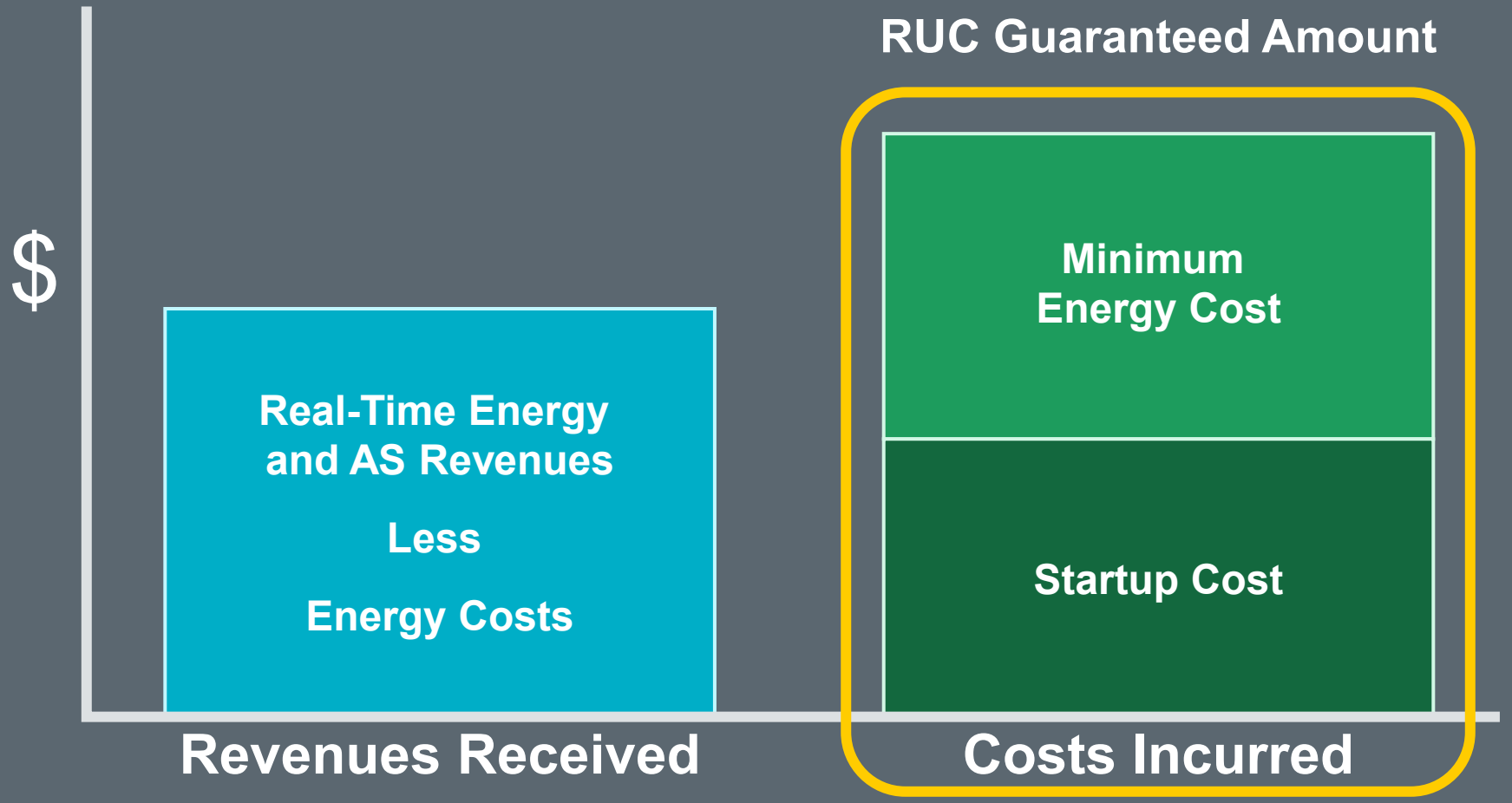
Financial Impacts

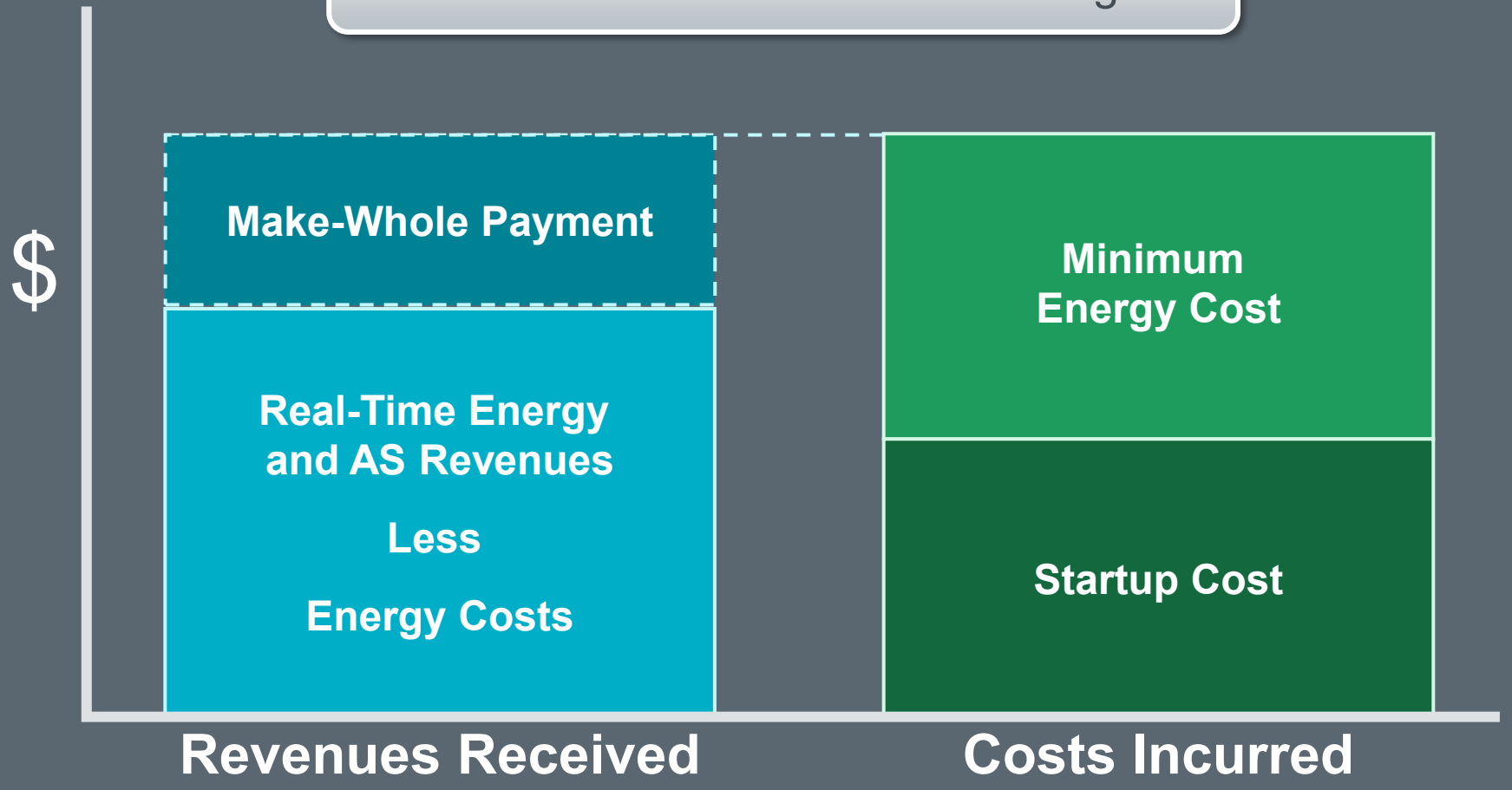



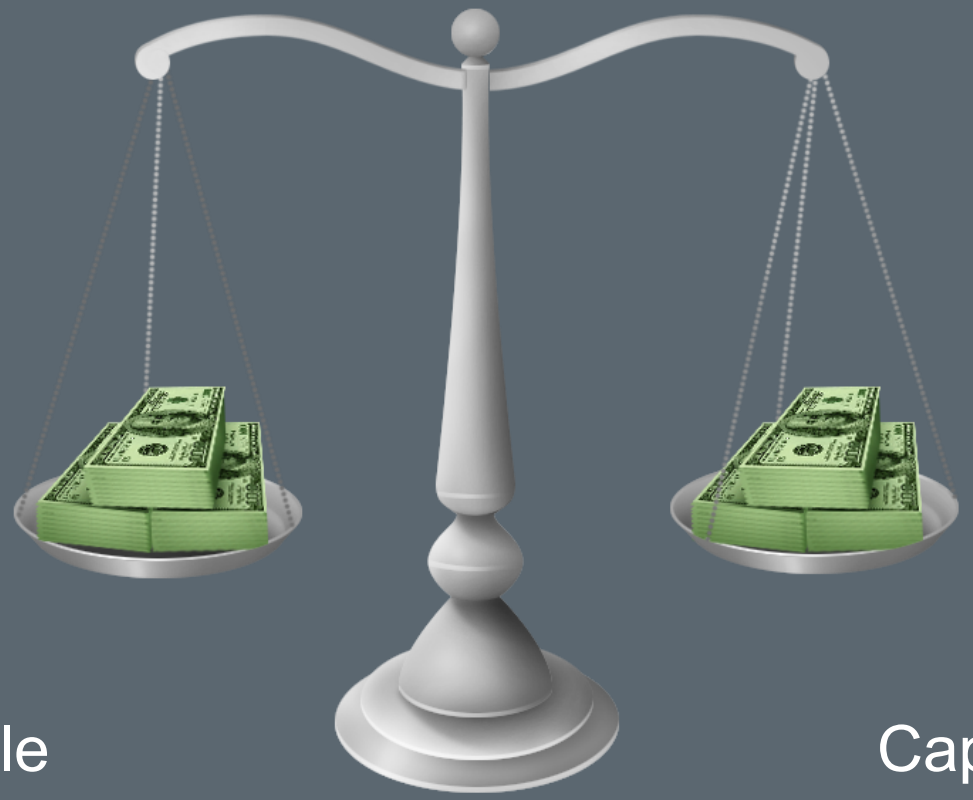
RUC
Make-Whole
Payments

RUC
Capacity Short
Charges


RUC Guaranteed Amount
$
Real-Time Energy and AS Revenues
Less
Energy Costs
Minimum Energy Cost
Startup Cost
Revenues Received
Costs Incurred

Resource must incur costs to be eligible

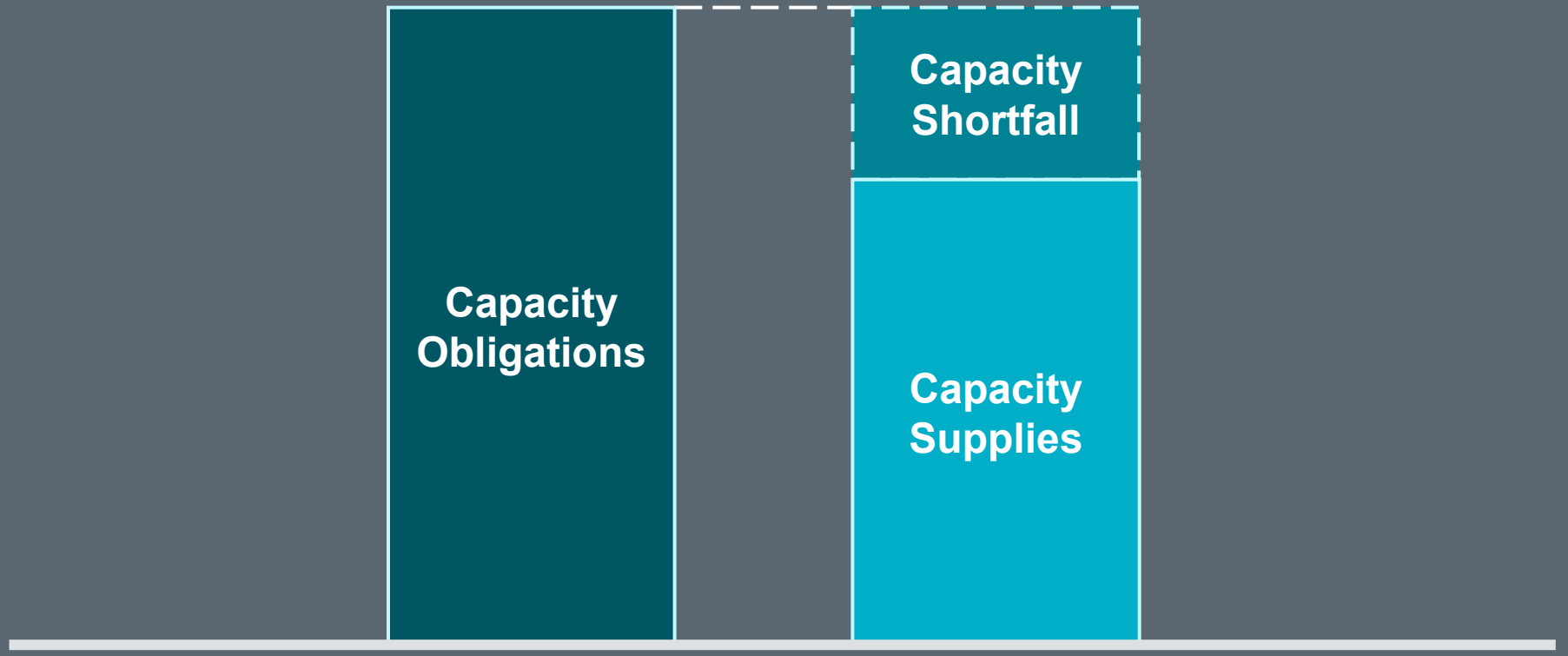




RUC
Make-Whole
Payments

RUC
Capacity Short
Charges

Assessed to QSEs with Capacity Shortfall



Potential Capacity Obligations for QSE

Capacity Obligations

- Load
- Energy Sales (DAM and Trades)
- On-Line AS Sales (DAM and Trades)
- Self-Arranged AS from DAM
- Planned ESR charging

Potential Capacity Supplies for QSE

Committed Resource Capacity

Energy Purchases (DAM and Trades)

On-Line AS Purchases (DAM and Trades)

AS from Load Resources

Planned ESR discharging & ESR upward AS

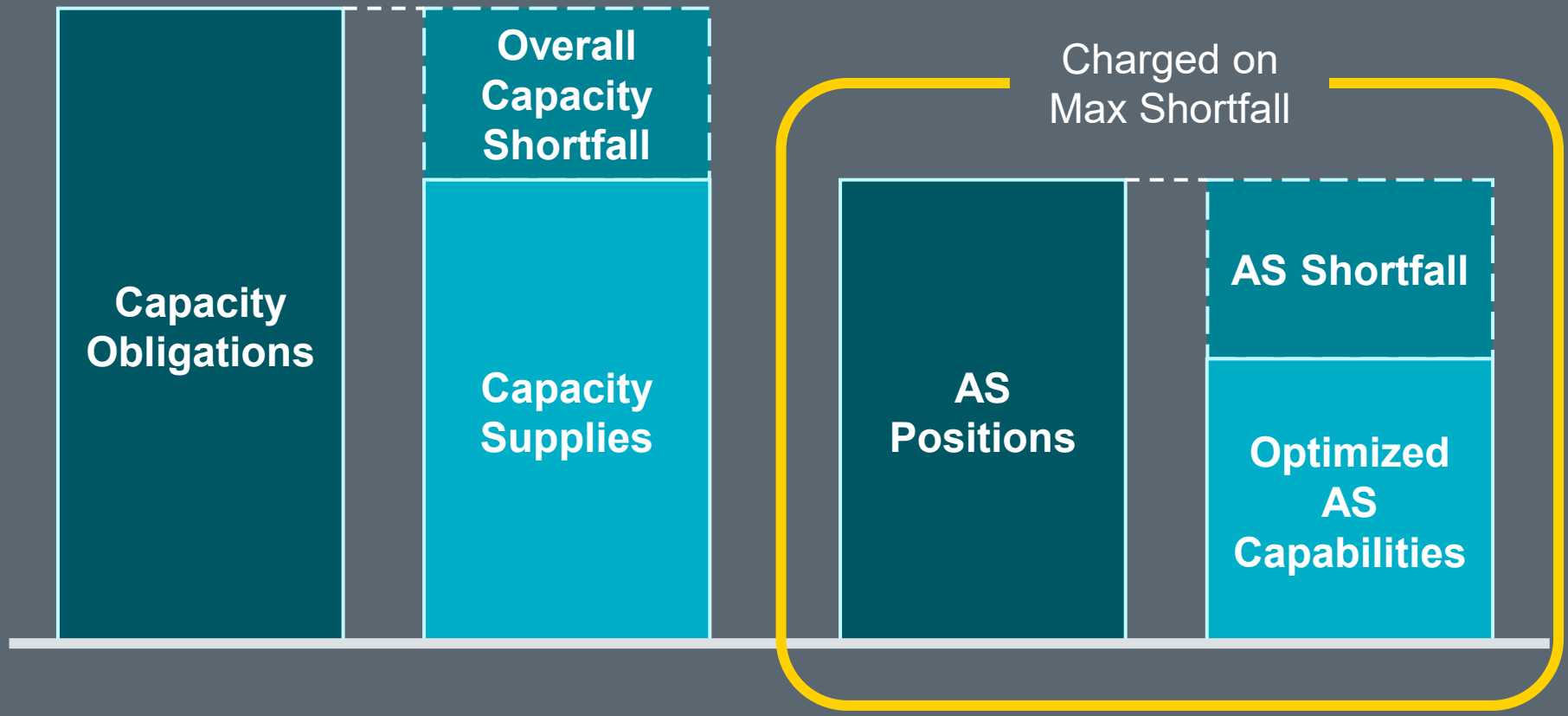
Capacity Supplies

QSE's transactions for Hour 18

- Sold 40 MW Responsive in DAM
- Sold 70 MW ECRS through Trade
- Sold 400 MW Energy in DAM

Current Operating Plan											
Resource Name	Resource Status	Resource Limits		ESR SOC Limits			Ancillary Service Capabilities				
		HSL	LSL	Min	Max	Hour Beginning	Reg-Up	Reg-Dn	Responsive	ECRS	NSRS
GEN1	ON	600	120	-	-	-	0	0	40	40	0
GEN2	OFF	450	100	-	-	-	0	0	20	30	0
ESR3	OUT	40	-40	0	40	40	0	0	40	40	10

Two Ways for QSE to be Capacity Short



Ancillary Service Financial Obligations for QSE

Ancillary Service Positions

DAM Self-Arranged AS

+

DAM AS Awards

+

AS Trade Sales

–

AS Trade Purchases

Ancillary Service Supply for QSE

Capabilities prioritized for AS

Constraints:

- **Resource Limits**
- **SOC (ESRs)**
- **Duration Requirement (ESRs)**
- **Deployment Factors (ESRs)**

Optimized Ancillary Service Capabilities

QSE's transactions for Hour 18

- Sold 40 MW Responsive in DAM
- Sold 70 MW ECRS through Trade
- Sold 400 MW Energy in DAM

Current Operating Plan											
Resource Name	Resource Status	Resource Limits		ESR SOC Limits			Ancillary Service Capabilities				
		HSL	LSL	Min	Max	Hour Beginning	Reg-Up	Reg-Dn	Responsive	ECRS	NSRS
GEN1	ON	600	120	-	-	-	0	0	40	40	0
GEN2	ON	450	100	-	-	-	0	0	20	30	0
ESR3	OUT	40	-40	0	40	40	0	0	40	40	10

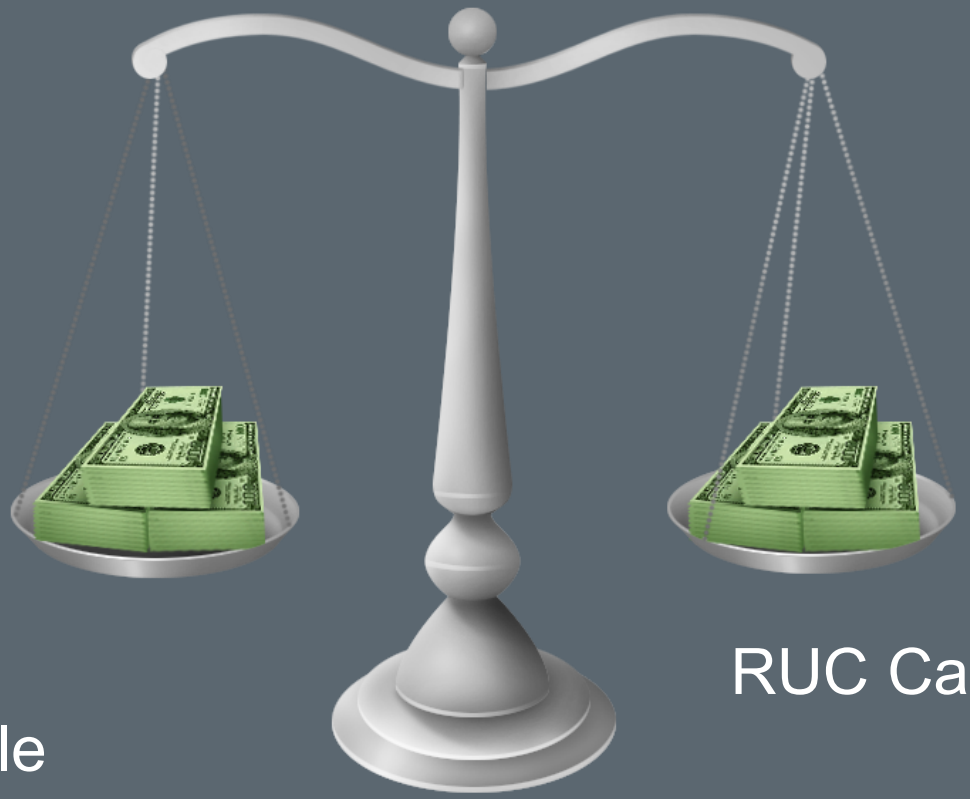
Each QSE with a Capacity Shortfall pays a share of total Make-Whole cost

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

Subject to a cap

$$\text{Charge} = 2 * \left(\text{RUC Capacity Shortfall}\right) * \left(\text{\$/MW cost of RUC Make-Whole}\right)$$

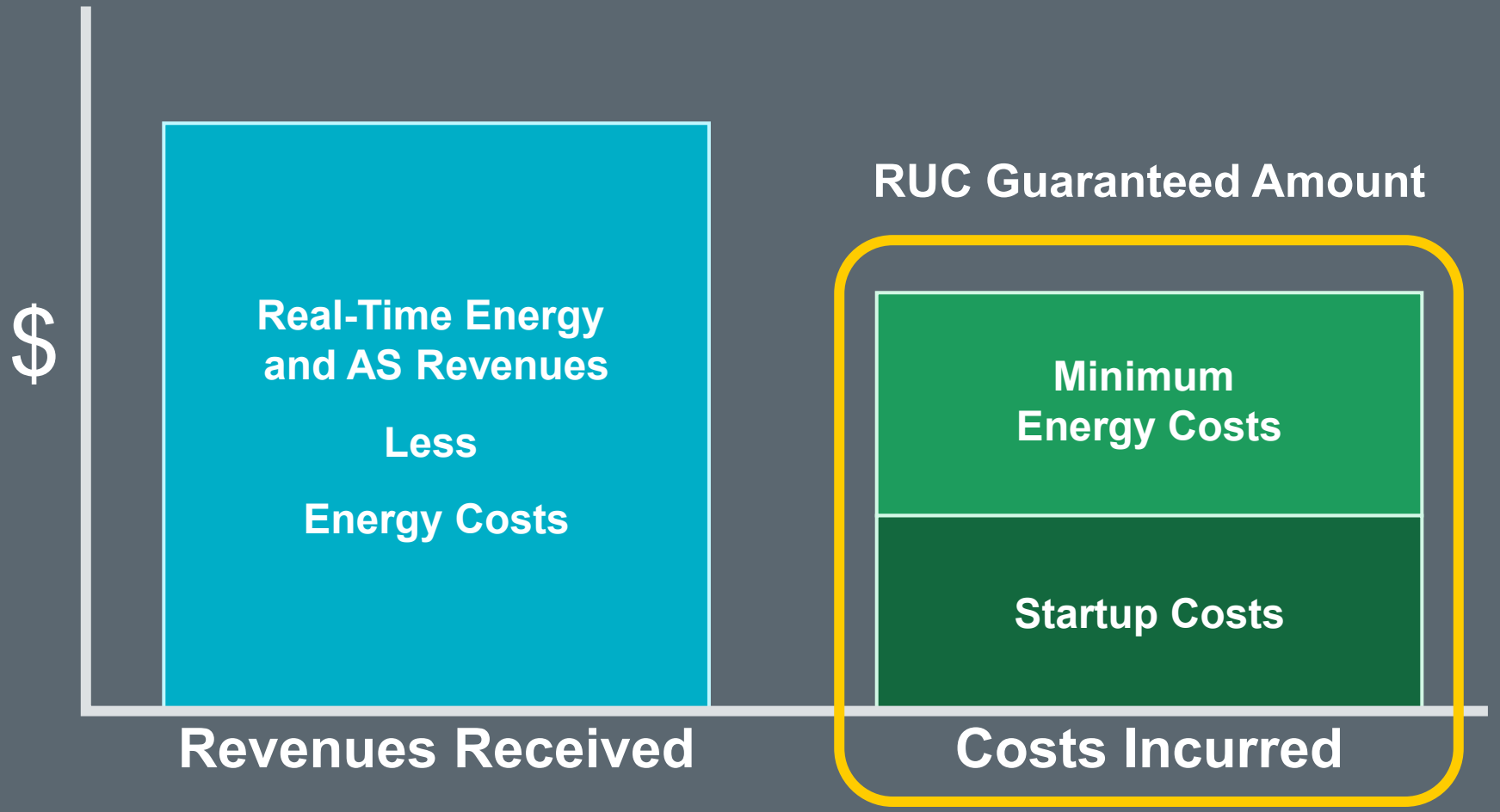
Capacity Short Charges not Enough?



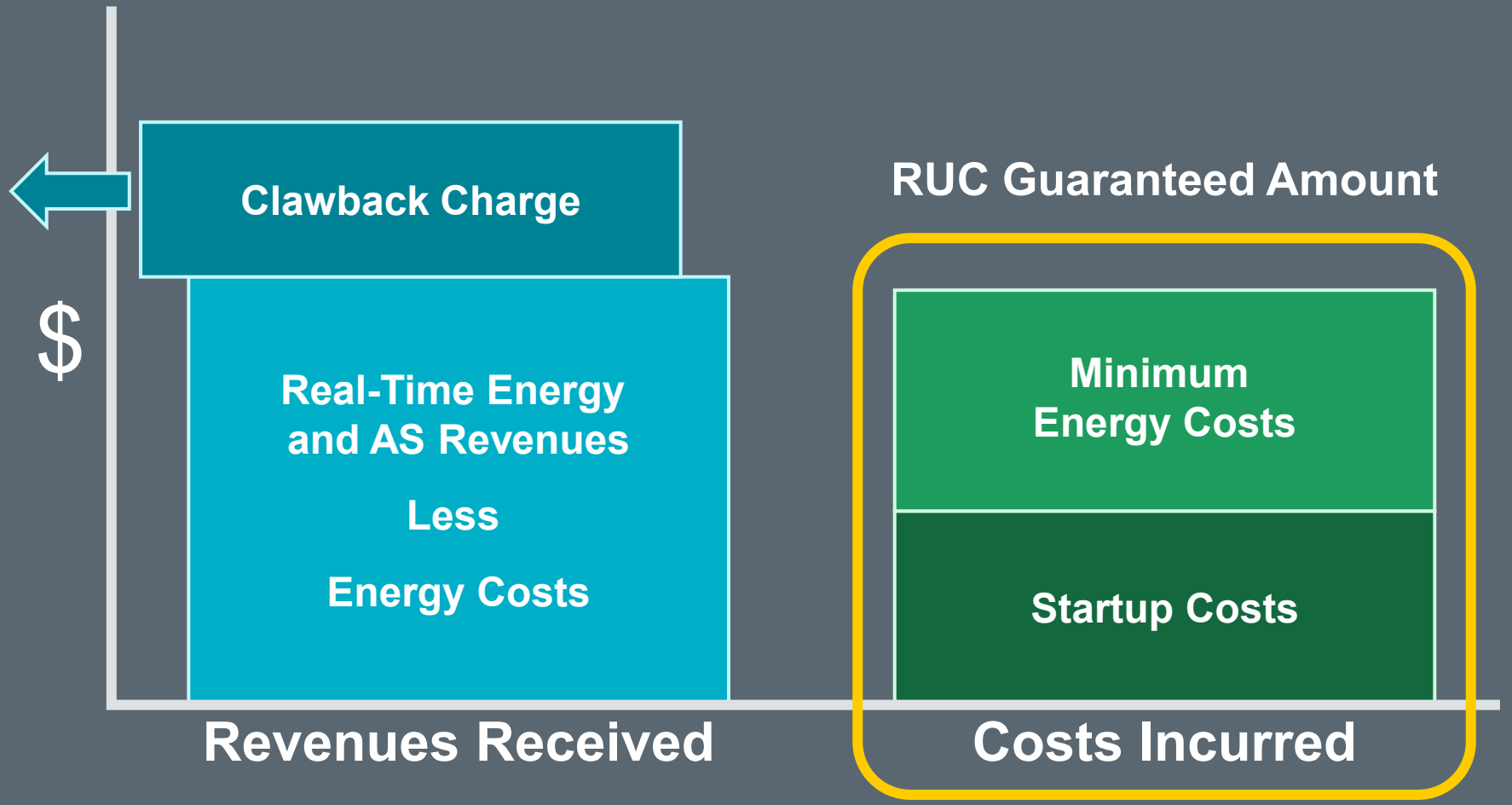
RUC
Make-Whole
Payments

RUC Capacity Short
+
Make-Whole Uplift
Charges

What if revenues are greater than costs?

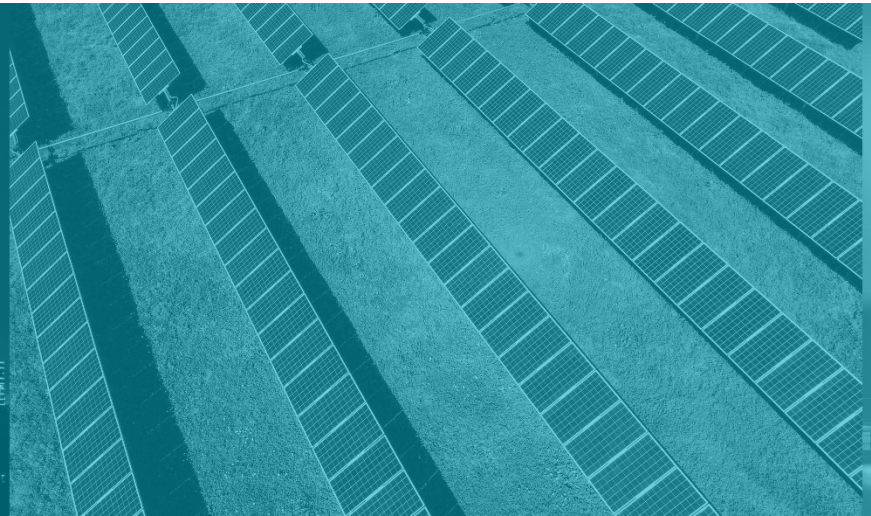


What if revenues are greater than costs?





Course Wrap-Up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ERCOT Training Information
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