



Day-Ahead Market Overview

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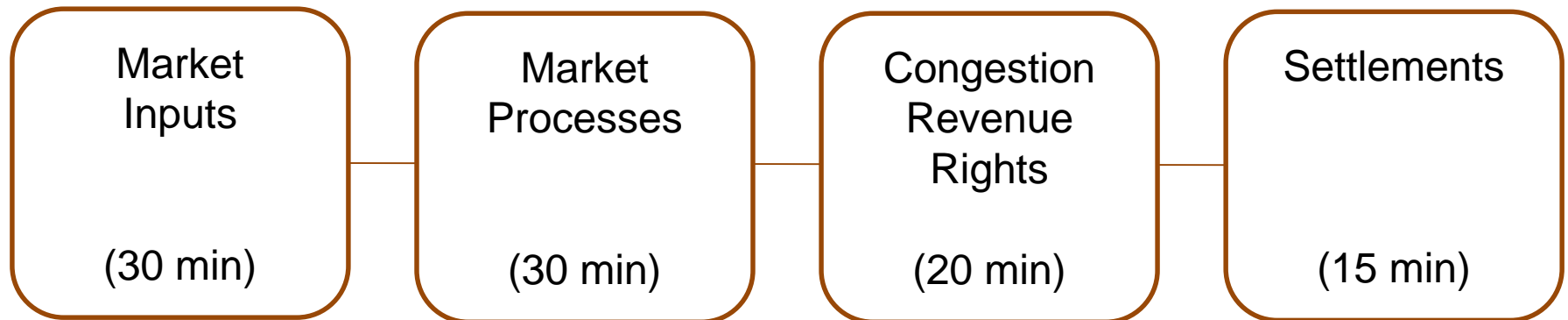
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The Purpose of Today's Session

To educate stakeholders on the features of the current day-ahead market, setting a foundation for the extended day-ahead market (EDAM) stakeholder process.

In today's session we'll cover:



A full day's operations are covered by two markets

**Day-ahead
market**



**Real-time
market**

Day-ahead markets accomplish two main goals

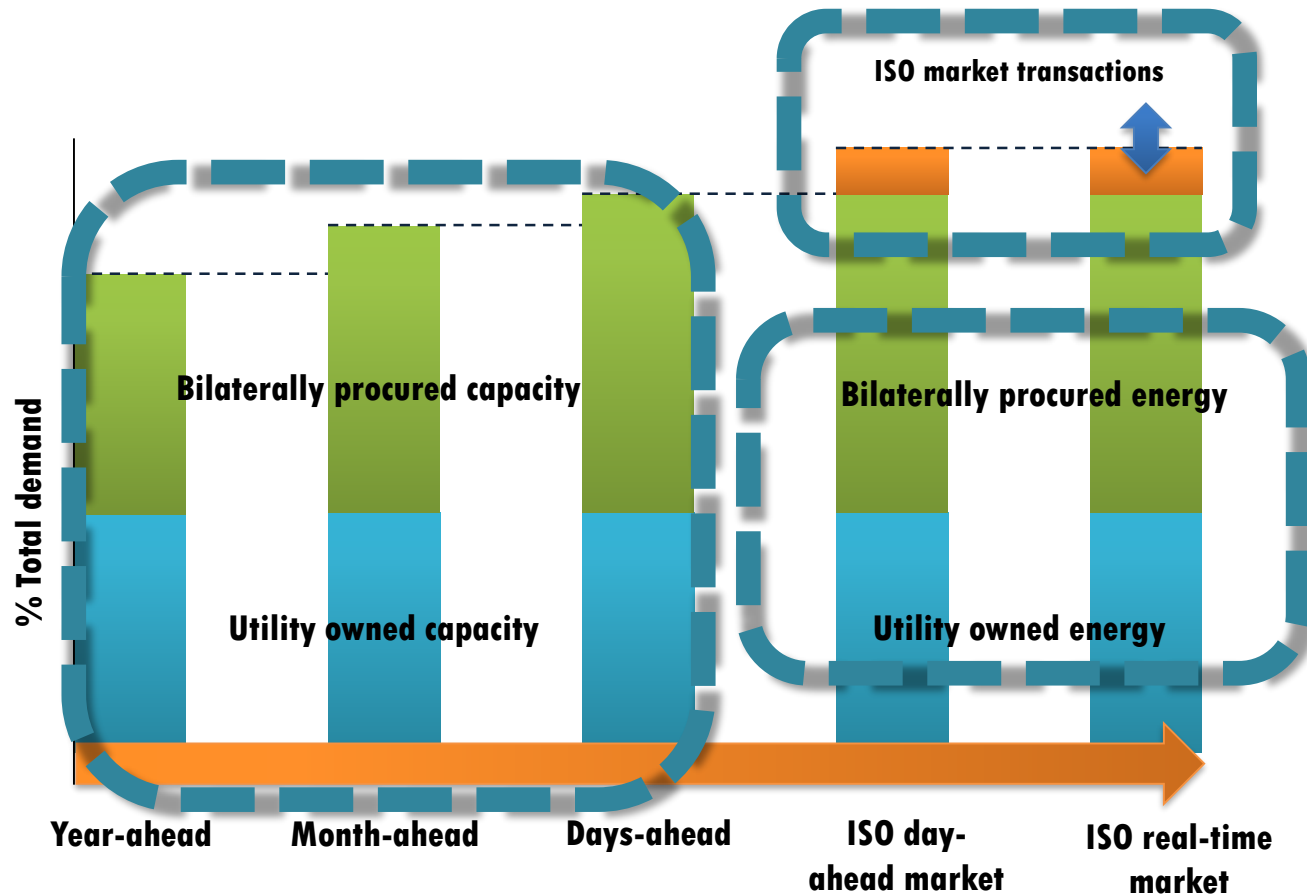
Reliability

- Assurance, a day in advance, that System Operators have adequate resources available in real-time

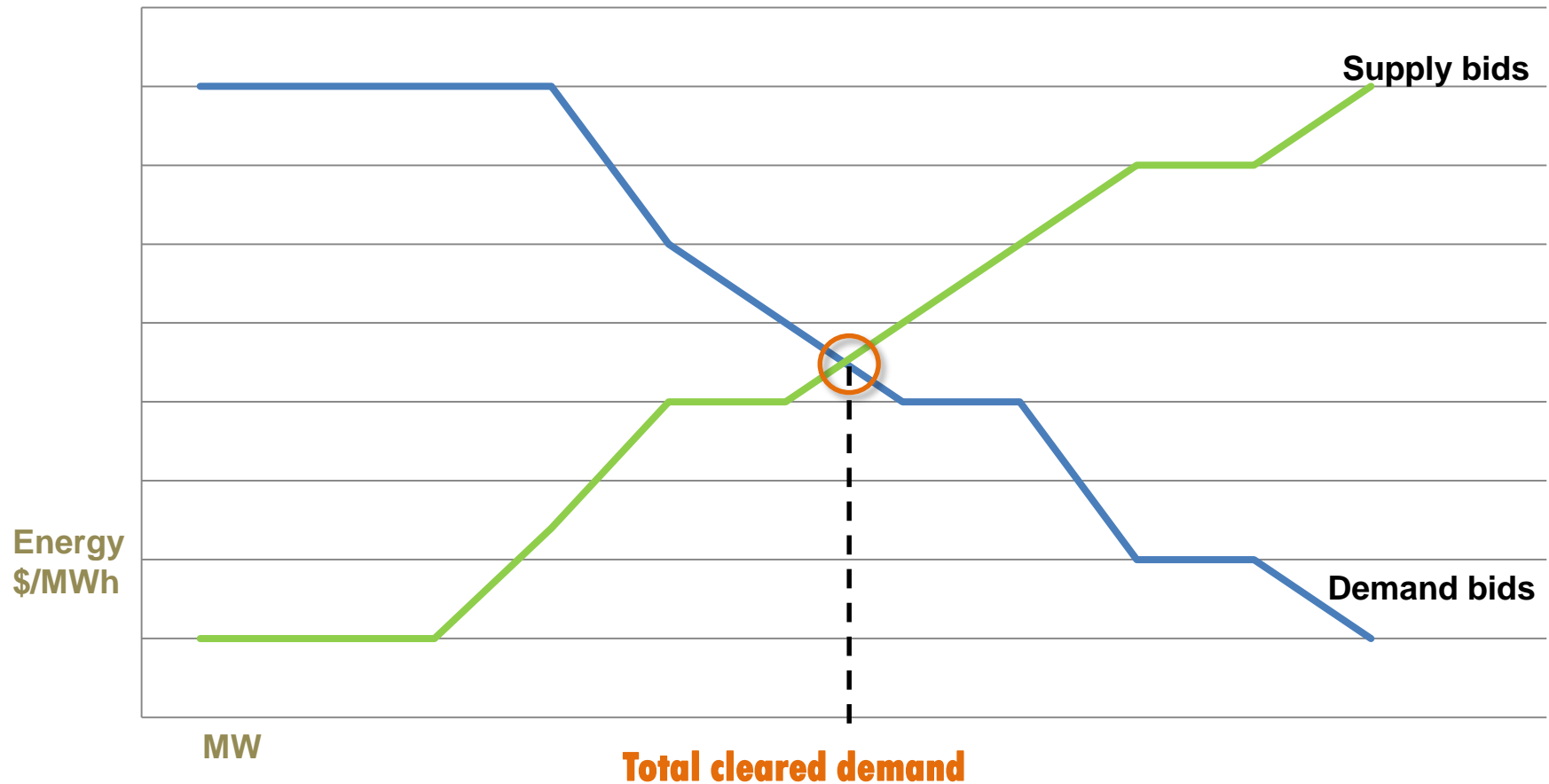
Pricing

- Allows participants to sell/purchase energy and capacity in advance of real-time conditions

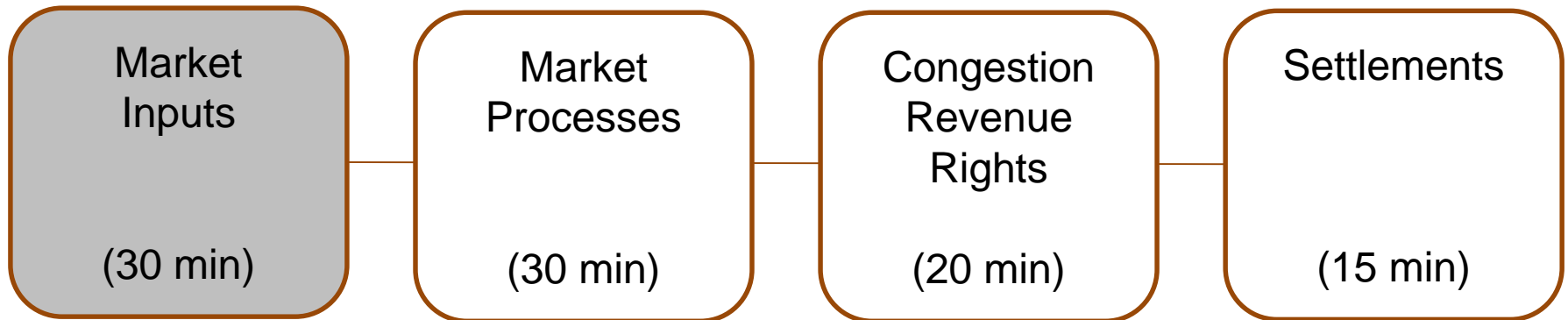
Utilities line up most of their supply needs in advance of the operating day



The day-ahead market clears the supply against the demand for each hour of the day.



In today's session we'll cover:



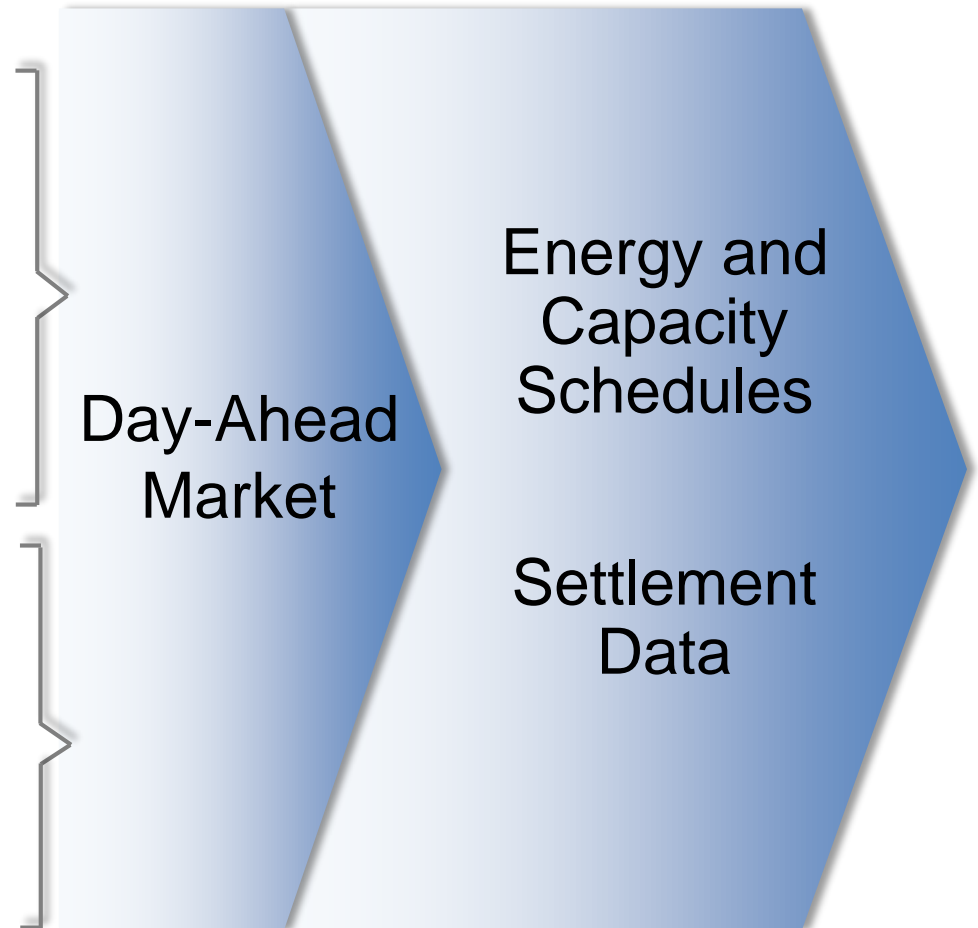
Inputs and outputs of the **day-ahead** market

Data:

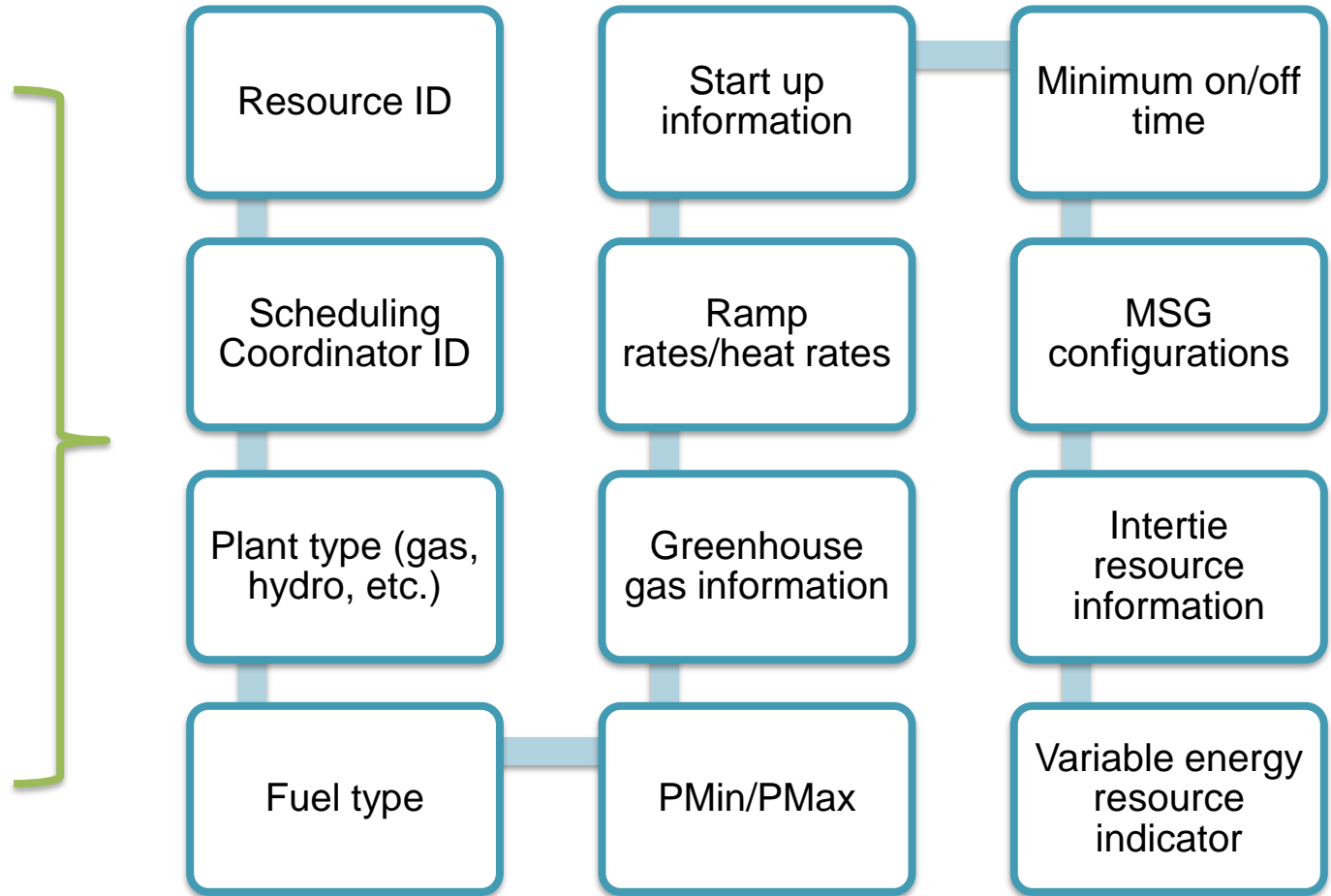
- System parameters
- Resource parameters
- Outage information
- Bid information
- ISO forecast of demand
- Transmission interface limits

Requirements:

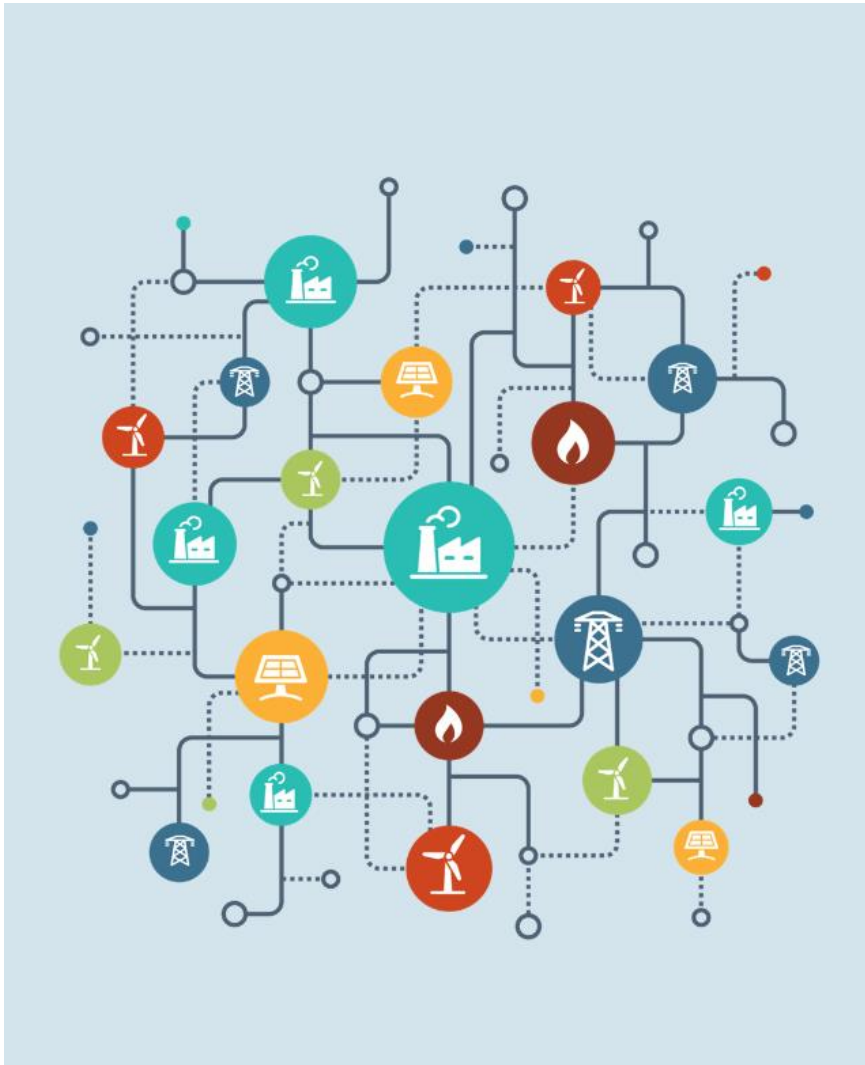
- Reserves
- Residual unit commitment
- Energy to serve demand



Master File contains characteristics of each resource

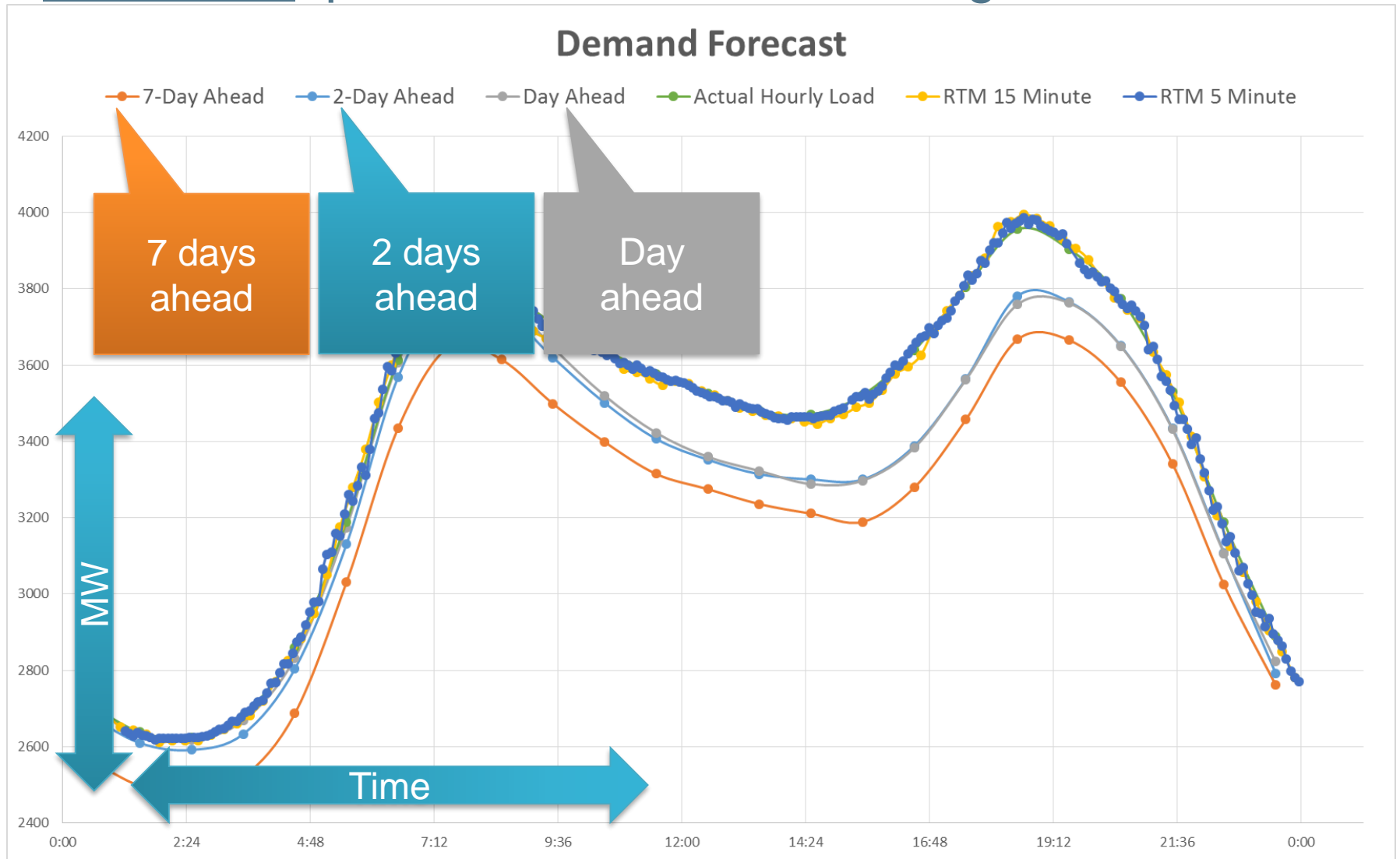


Full network model of the physical power system



- Computer-based model that maps out the entire RC West network
- Contains three major types of information:
 - Physical model
 - Market model
 - Resource model

Forecasts updated to account for changes



Bid features

Physical resource bid features

- Maximum of 10 segments
- Bids must be submitted by 10:00am on the day prior to the trade date
- Supply bids (\$/MWh) have a monotonically increasing bid curve
- Demand bids (\$/MWh) have a monotonically decreasing bid curve
- Subject to energy soft bid cap of \$1000/hard cap of \$2000 and floor of -\$150

See Tariff section 39.6 for more bidding rules

Features unique to virtual bids

- Only energy bids (no AS)
- No start up and minimum load
- Bid curve begins at zero (0)
- Minimum bid volume is 1 MW
- Must have price and quantity, no self-schedules

Features unique to RUC and AS bids

- Bid cap of \$250 and floor of \$0

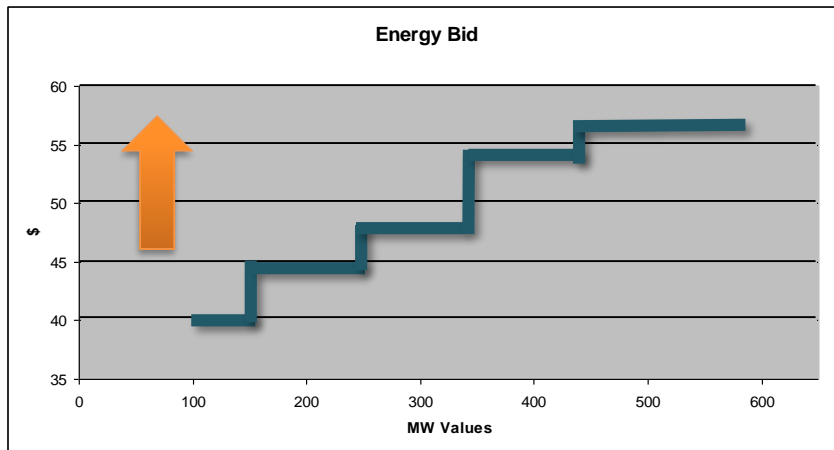


Bid cap not
price cap!

Energy bids provide an economic signal indicating a participant's willingness to supply or purchase energy

SUPPLY

Up to 10 segments, monotonically increasing

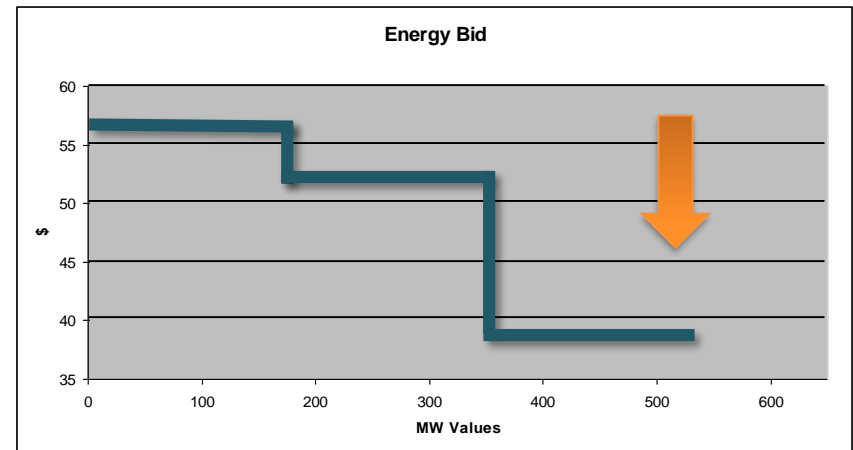


generators and imports

The **higher** the price, the more they will **supply**

DEMAND

Up to 10 segments, monotonically decreasing



loads and exports

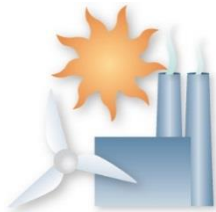
The **lower** the price, the more they will **buy**

Self-schedules (AKA price takers) submit bids for MW without prices

Self schedules are also known as “price takers”

SUPPLY SELF SCHEDULE

Informs the ISO that the SC is willing to run its generator regardless of the price



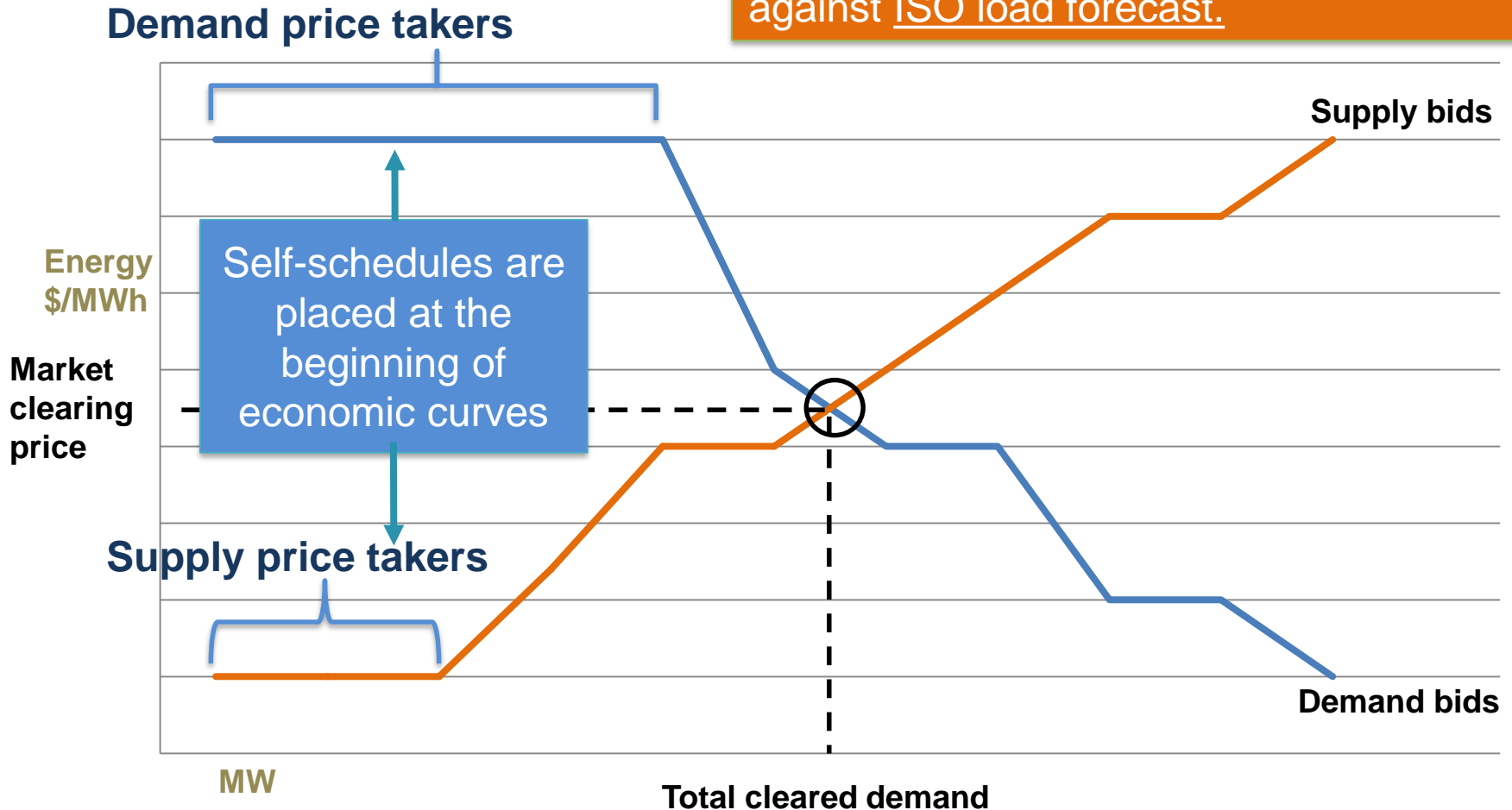
DEMAND SELF SCHEDULE

Informs the ISO that the SC is willing to buy a certain quantity of supply, regardless of the price, to serve its load

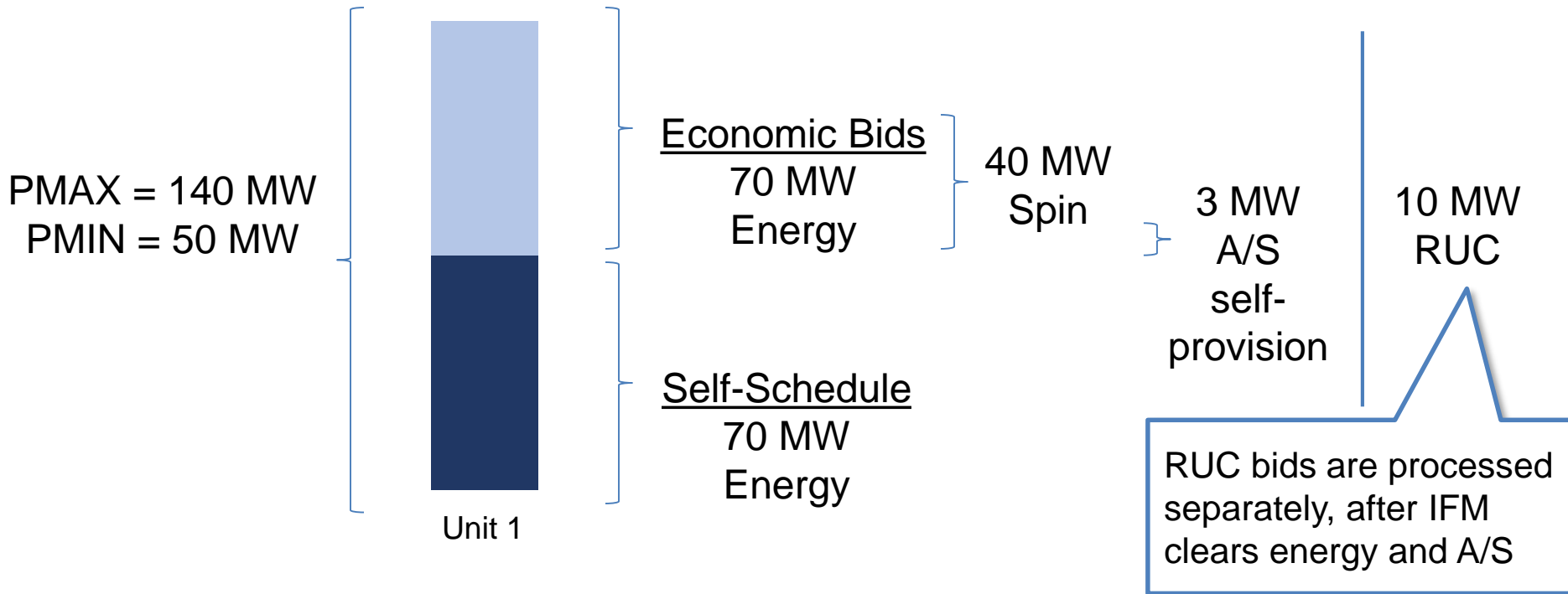


Self schedules and bids

Day-ahead clears supply bids against demand bids; real-time clears supply against ISO load forecast.



Day-ahead bidding activity



- The same MWs are being offered to the market across a variety of products
- The market co-optimizes the offers for **energy** and **ancillary services** along with those from all of the other resources to determine the optimal solution across the entire day

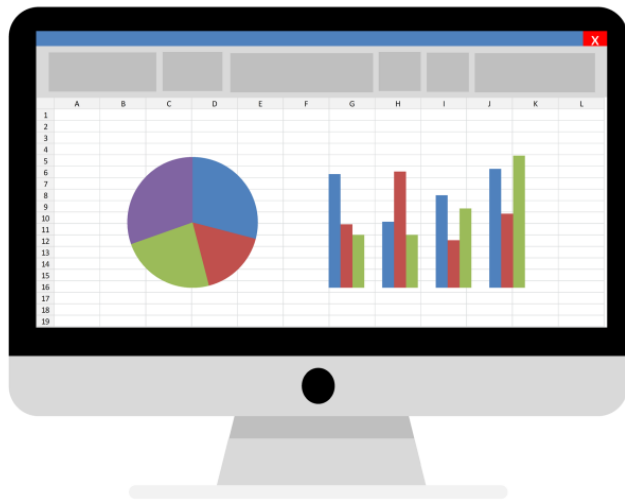
Resource bidding: **financial** and **physical** participation in the market

Physical

- **Supply:** generators, imports
- **Demand:** load, exports

Financial

- **Supply:** supply nodes, demand nodes, trading hubs
- **Demand:** supply nodes, demand nodes, trading hubs



Does convergence bidding affect the physical market?

- With virtual bids:
 - No physical energy is delivered or consumed
 - Not backed by physical assets
- For SCs who submit both virtual and physical bids, there is no link between the two types of bids
- Impacts
 - Pricing (can set the clearing price)
 - Congestion
 - RUC procurement target



Three reasons why all ISOs have convergence bidding.

Drives convergence of day-ahead and real-time prices

Leads to more efficient market outcomes

Eliminates the need for scheduling penalties

Convergence bidding: **financial** participation in the market

Virtual demand



- ✓ A bidder submits a bid to buy MW in the day-ahead market
- ✓ Assuming the bid clears, the bidder will pay the day-ahead price for the MW
- ✓ The real-time market automatically sells the MW and the bidder will be paid at the real-time price

Virtual supply



- ✓ A bidder submits a bid to sell MW in the day-ahead market
- ✓ Assuming the bid clears, the bidder will be paid the day-ahead price for the MW
- ✓ The real-time market automatically buys the MW and the bidder will pay the real-time price

Why does convergence bidding exist and what are the benefits?

From the **market** perspective:

- Increases market liquidity
- Lower costs and improved grid operations due to more efficient day-ahead commitment
- Minimize differences between day-ahead & fifteen-minute prices
- Incentivizes load to participate in the day-ahead market

From the **participant** perspective:

- Mitigate the risk impact of an outage that happens after the close of the day-ahead market
- Hedge against exposure to fifteen-minute market pricing for load
- Earn revenues or risk losses between the day-ahead and fifteen-minute prices



Convergence Bidding: Dynamic Credit Check

- For virtual bidding, a **dynamic credit check** is performed at bid submission:



**Total value of
submitted bids**

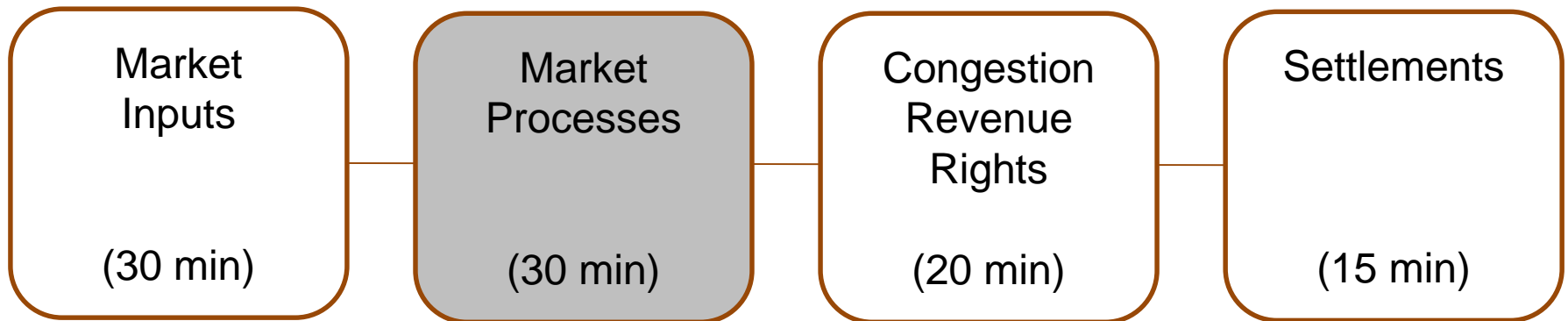


**Available credit
limit**

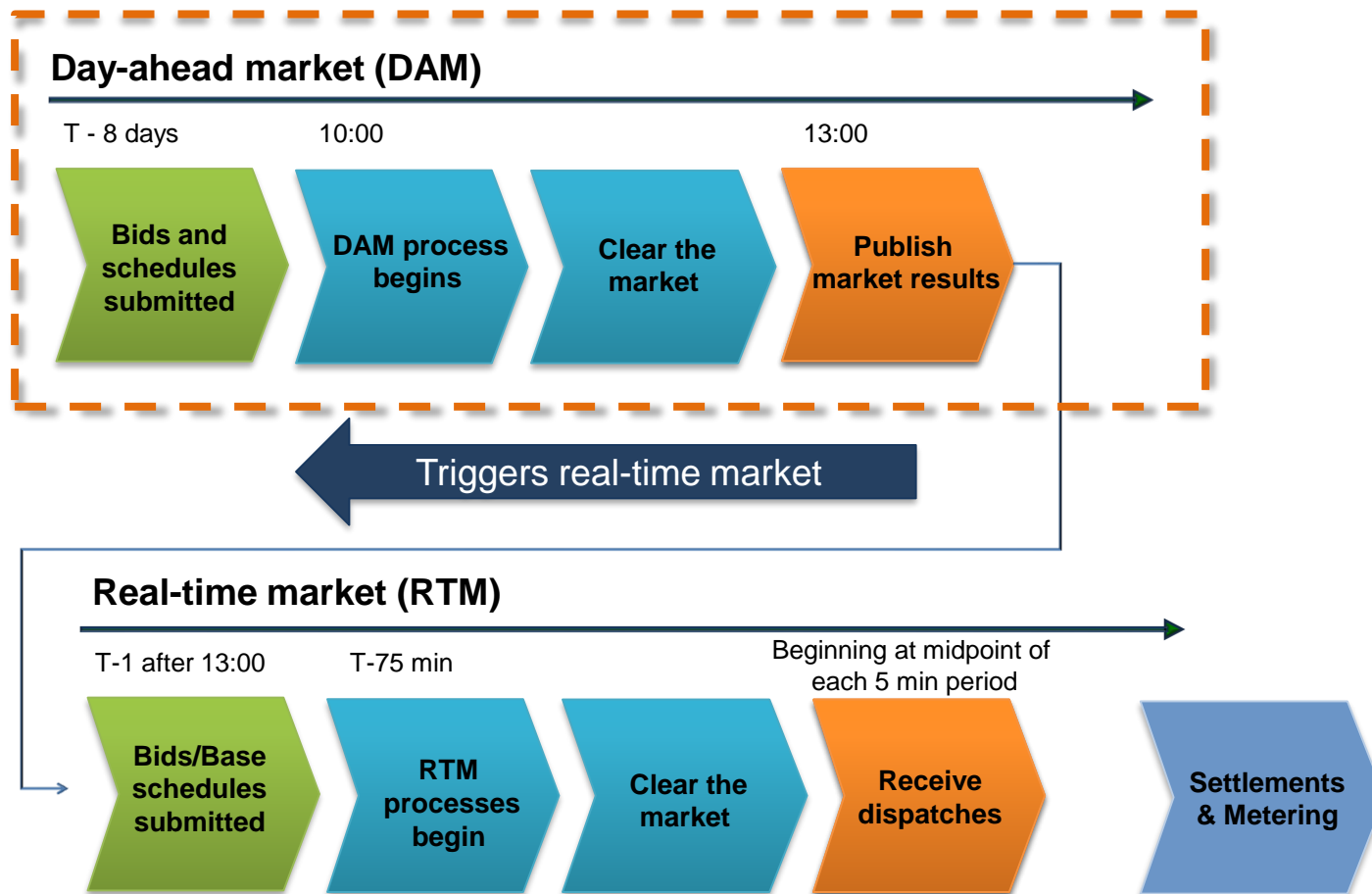
- Available credit limit =
(aggregate credit limit) – (estimated aggregated liability)

Q&A

In today's session we'll cover:

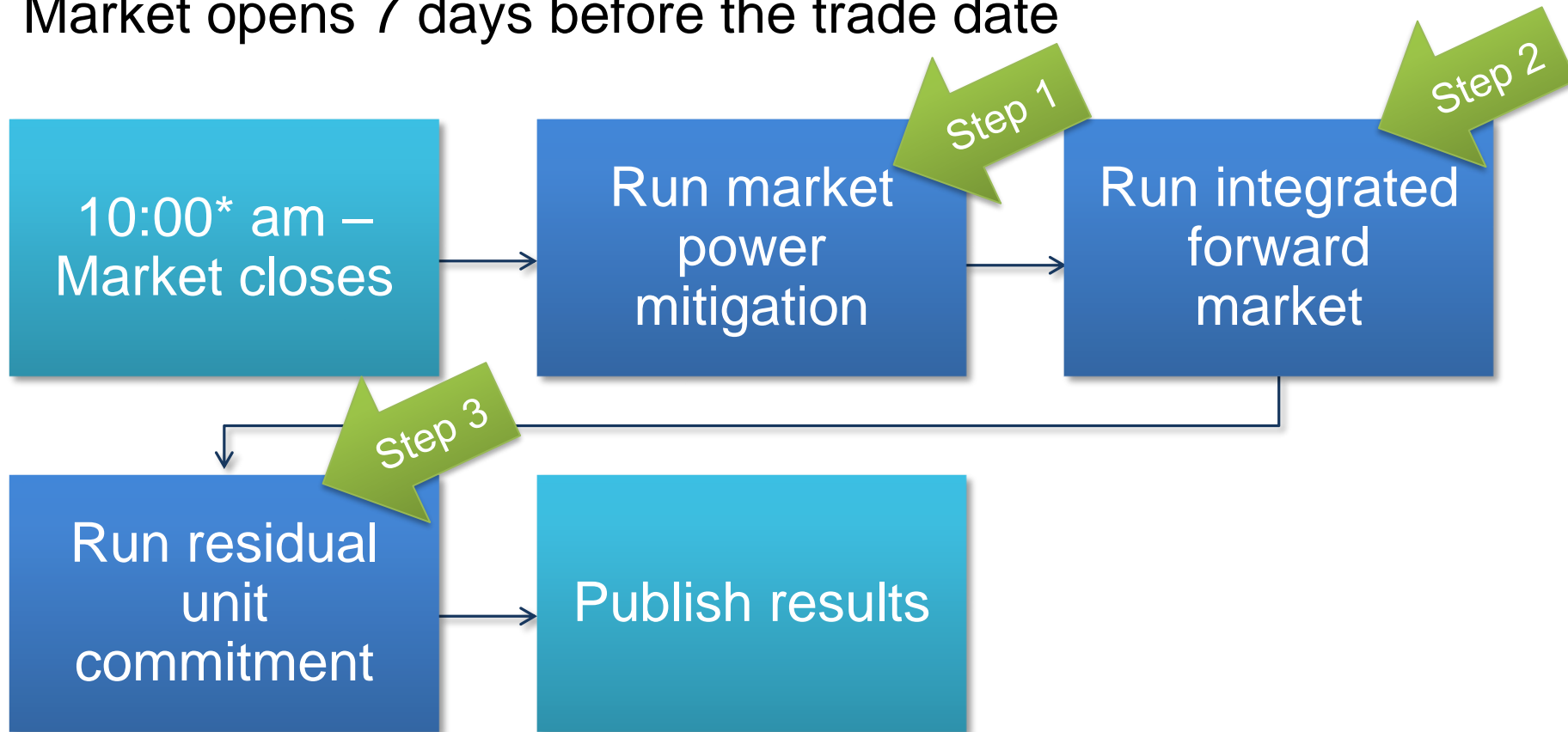


Market process timelines



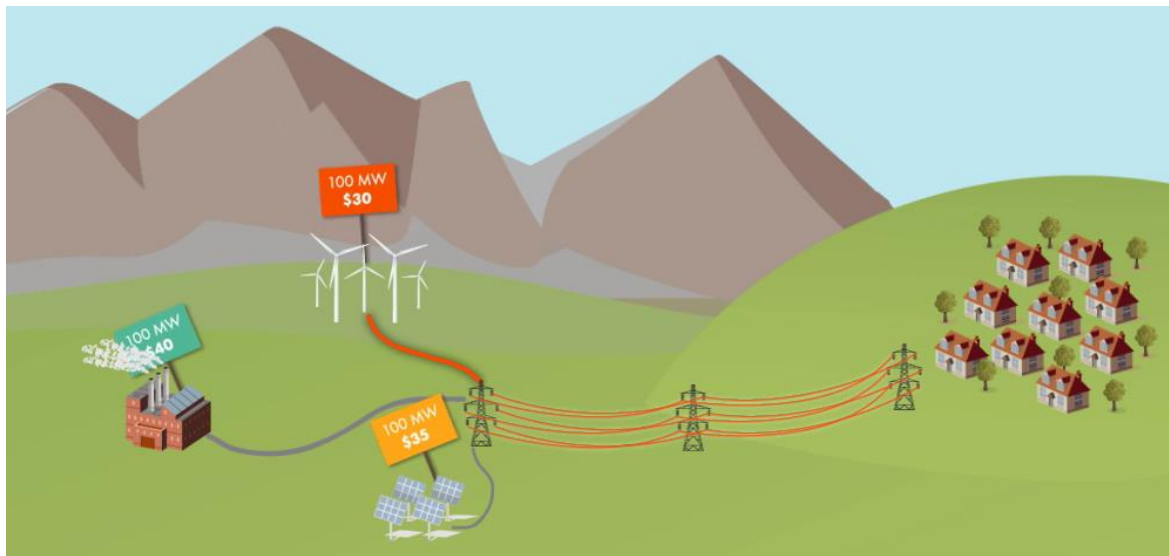
Day-ahead market process

Market opens 7 days before the trade date



* Pacific Prevailing Time

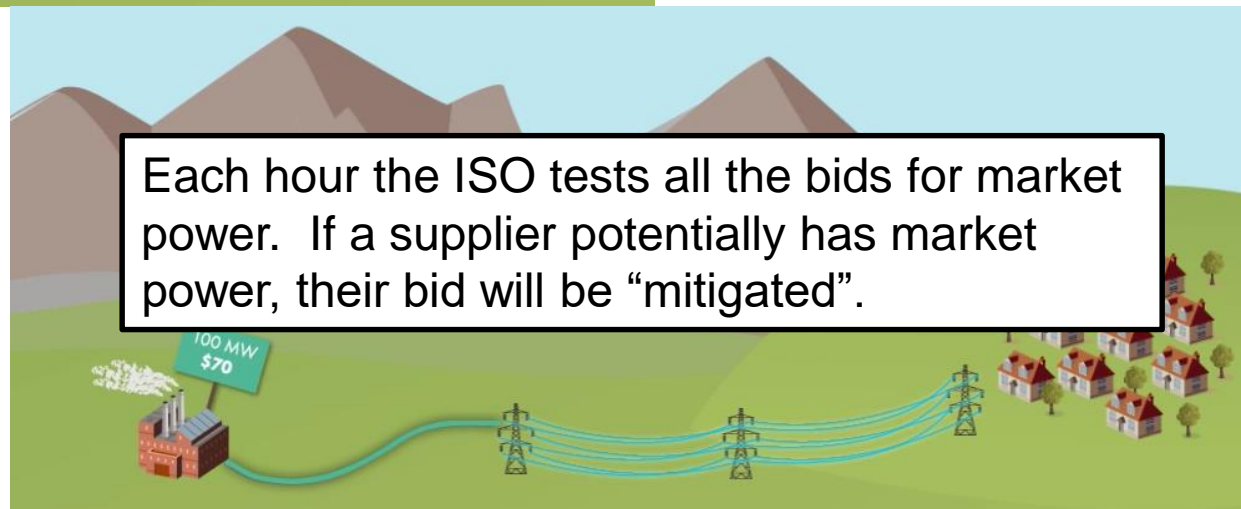
Market Power



Competition among suppliers to serve the load

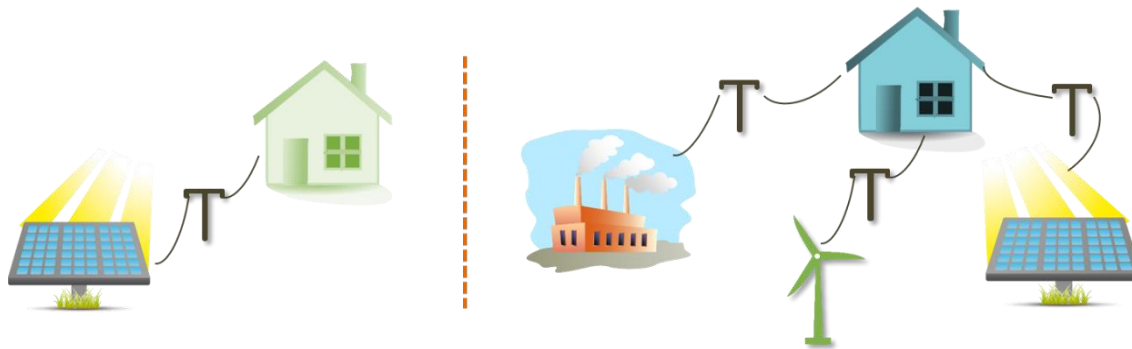


No competition = Market power



Step 1: Market power mitigation (MPM)

- Ensure units cannot exercise market power by nature of where they reside
- NOTHING is scheduled or dispatched as a result of this process
- May result in mitigated bids based on predetermined calculations



What do we do if market power is determined?

ISO replaces bid with the higher of their default energy bid or the competitive LMP

For generating resources and participating loads

Four methodologies for calculation

Variable Cost Option (ISO Tariff Section 39.7.1.1)

LMP Option (ISO Tariff Section 39.7.1.2)

Negotiated Rate Option (ISO Tariff Section 39.7.1.3)

Variable Cost Option plus Bid Adder (ISO Tariff Section 39.7.1.4)

Step 2: Integrated forward market

Clears bid-in supply against bid-in demand

Day-ahead schedules

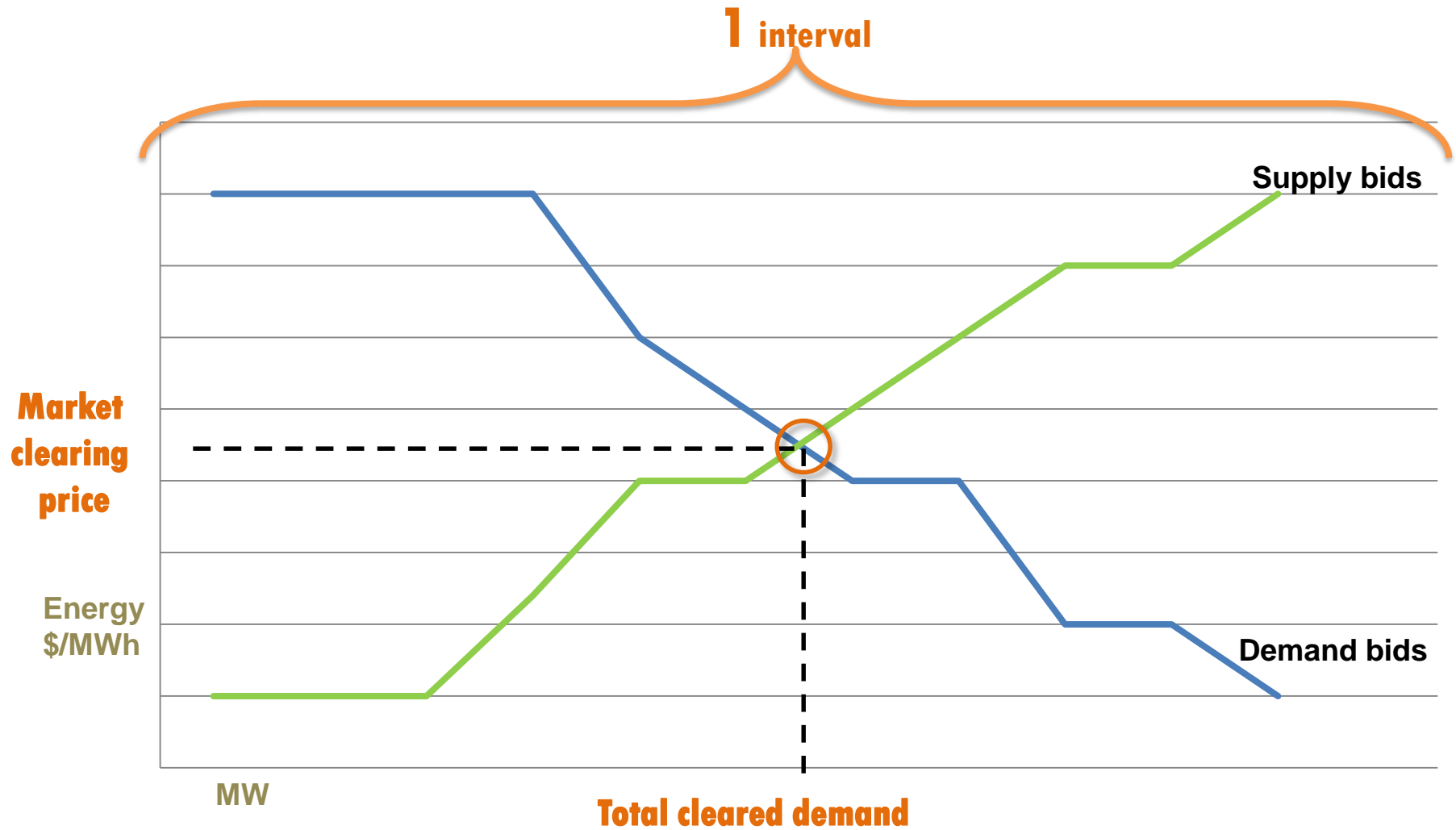
Virtual awards

Procures 100% ancillary services

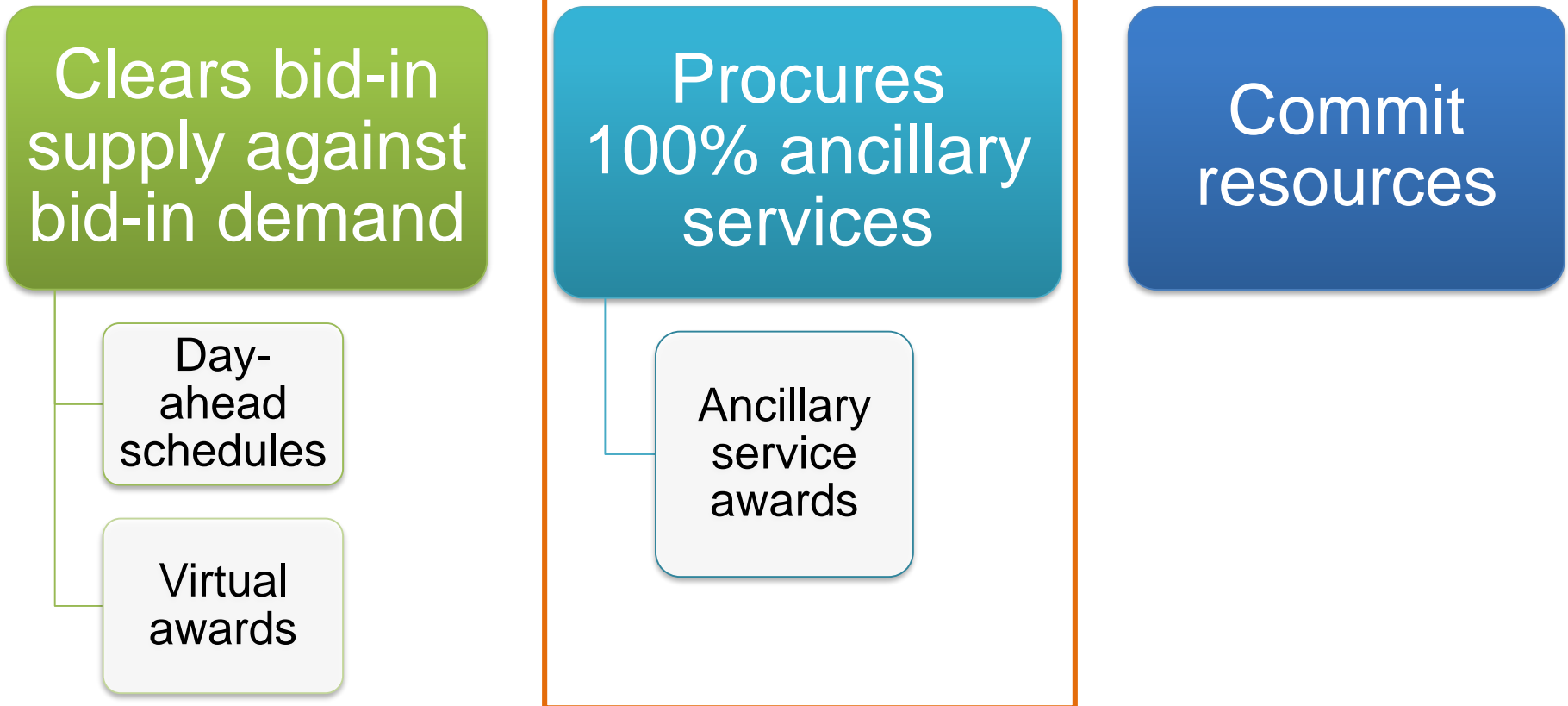
Ancillary service awards

Commit resources

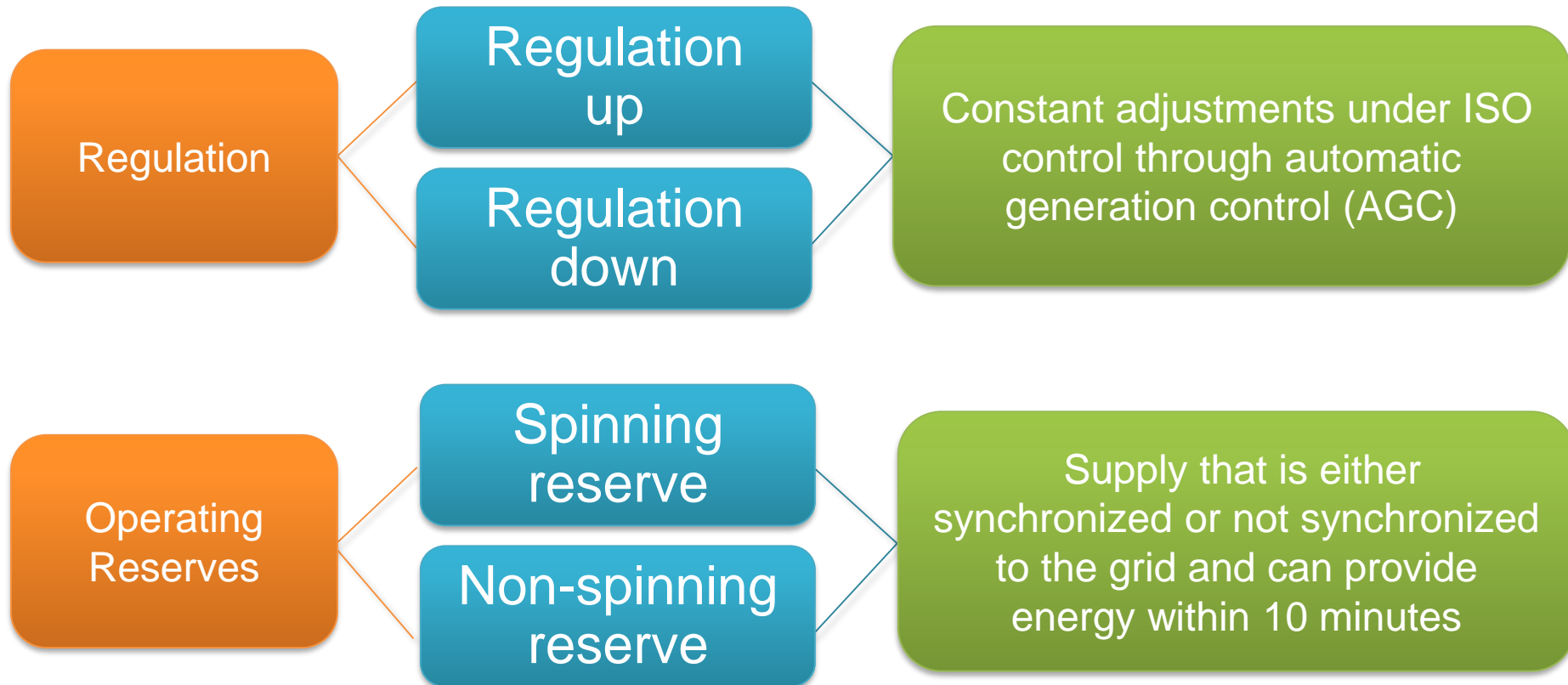
Step 2: What clears in the integrated forward market?



Day-ahead market (**step 2**): Integrated forward market



Step 2: Ancillary services ensure reliability as electricity is moved from generating sources to customers

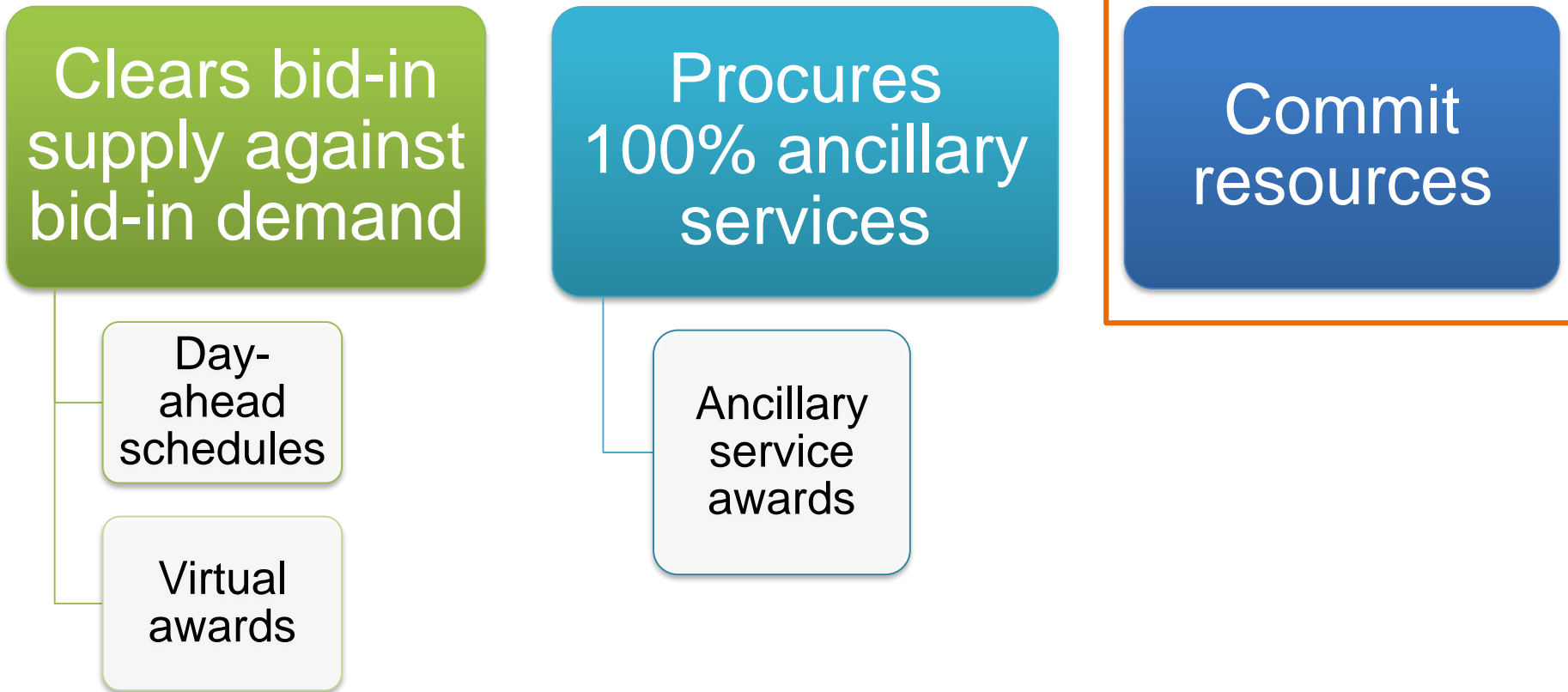


Capacity procurement target requirements

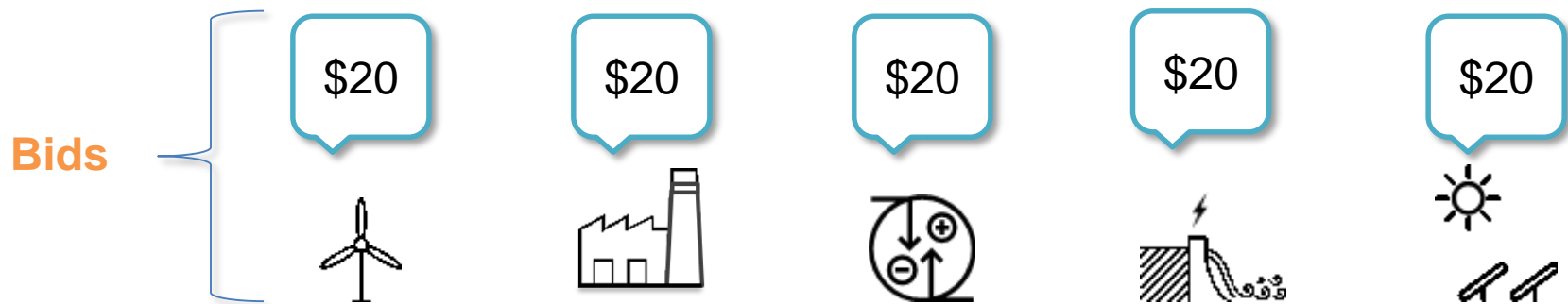
- Regulatory requirements ensure that adequate ancillary services are procured in the ISO BAA
- The ISO procures:
 - regulating reserves based on procurement targets set by ISO to meet WECC standards
 - contingency reserves based on procurement targets set by WECC
 - RUC based on forecasted demand for the entire system as well as for specific areas that may have local or regional requirements



Day-ahead market (**step 2**): Integrated forward market



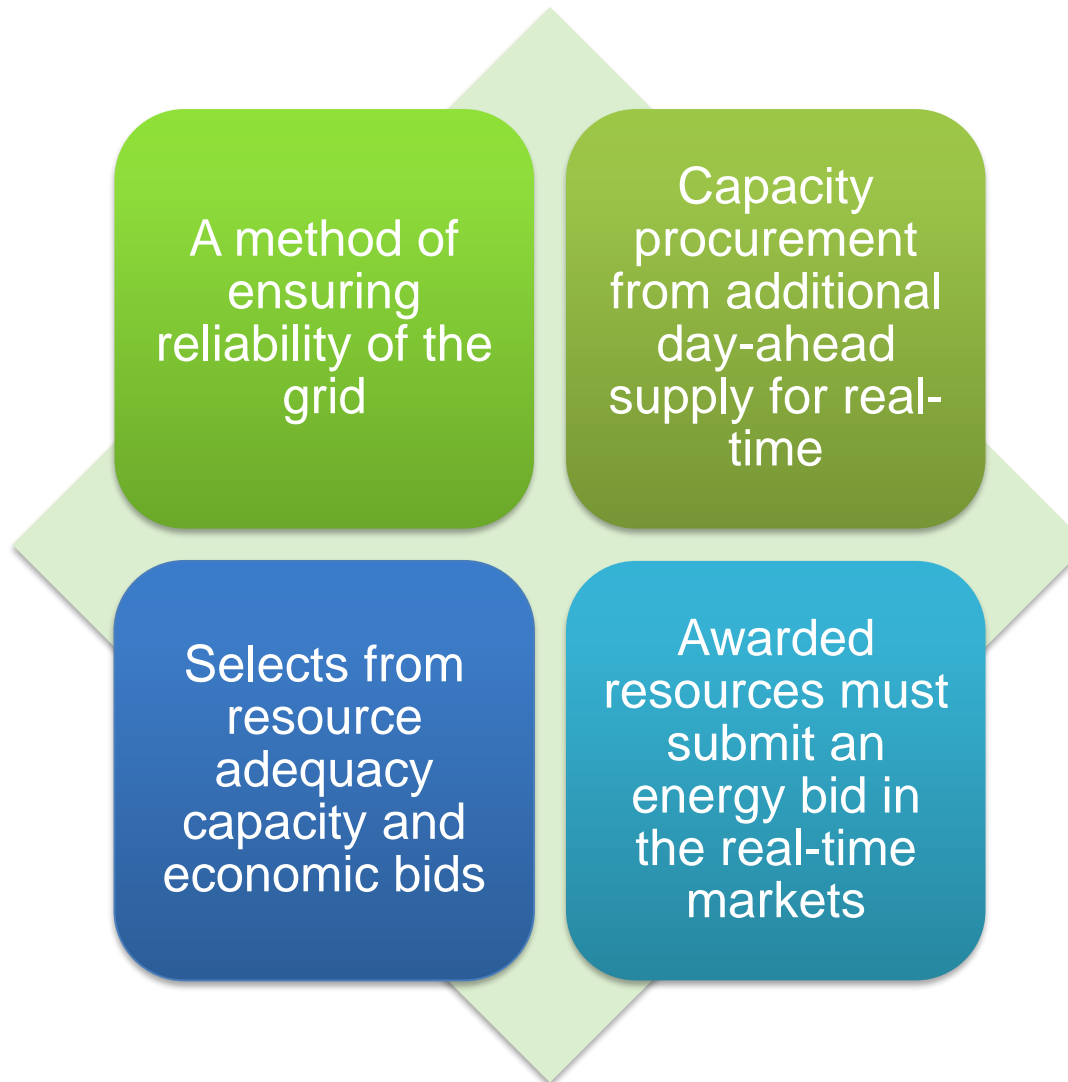
How does the market decide which resources to commit?



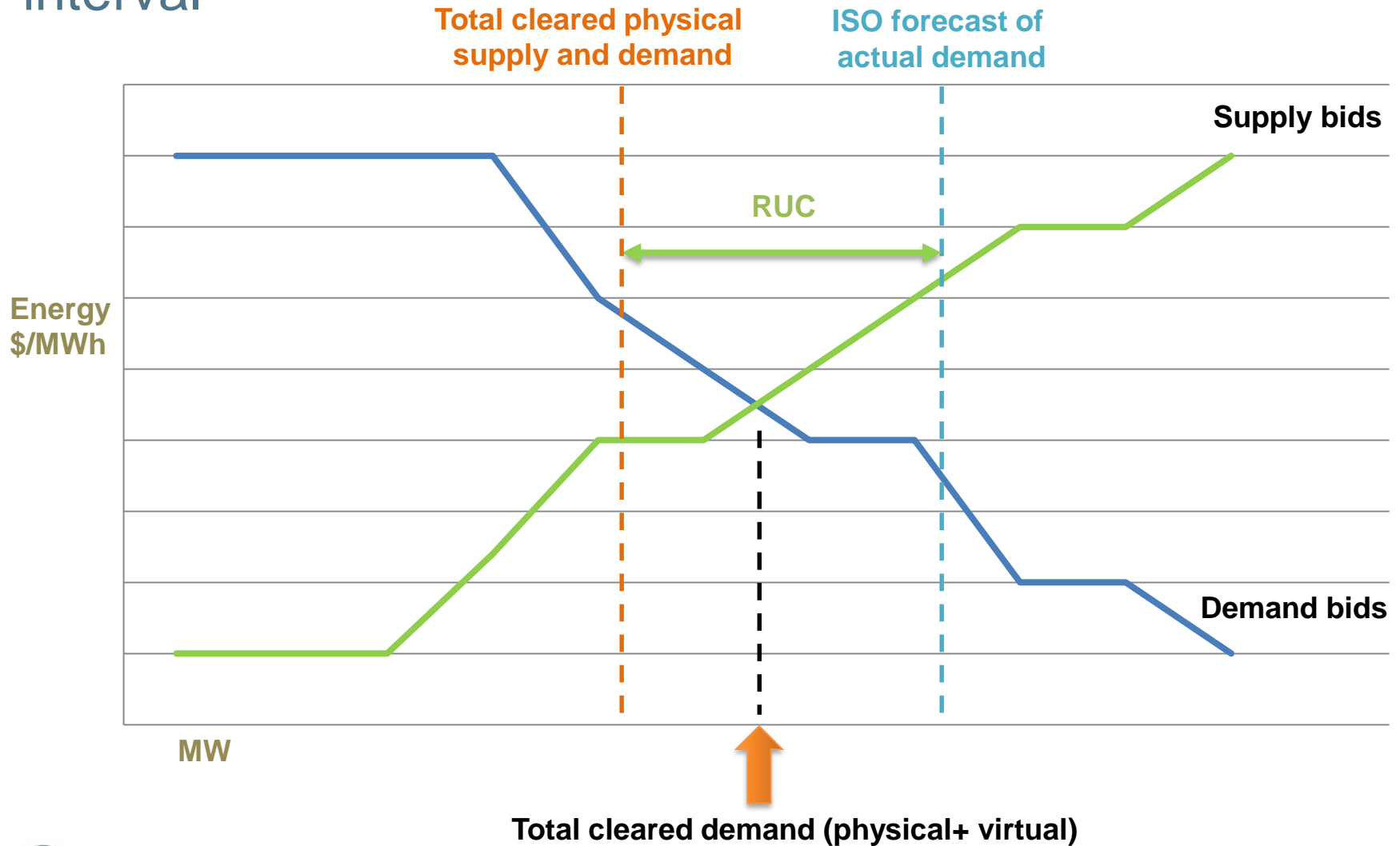
Three-part energy bid includes:

- Start-up cost (one time)
- minimum load cost (hourly)
- Energy bid curve above minimum load (\$/MWh)

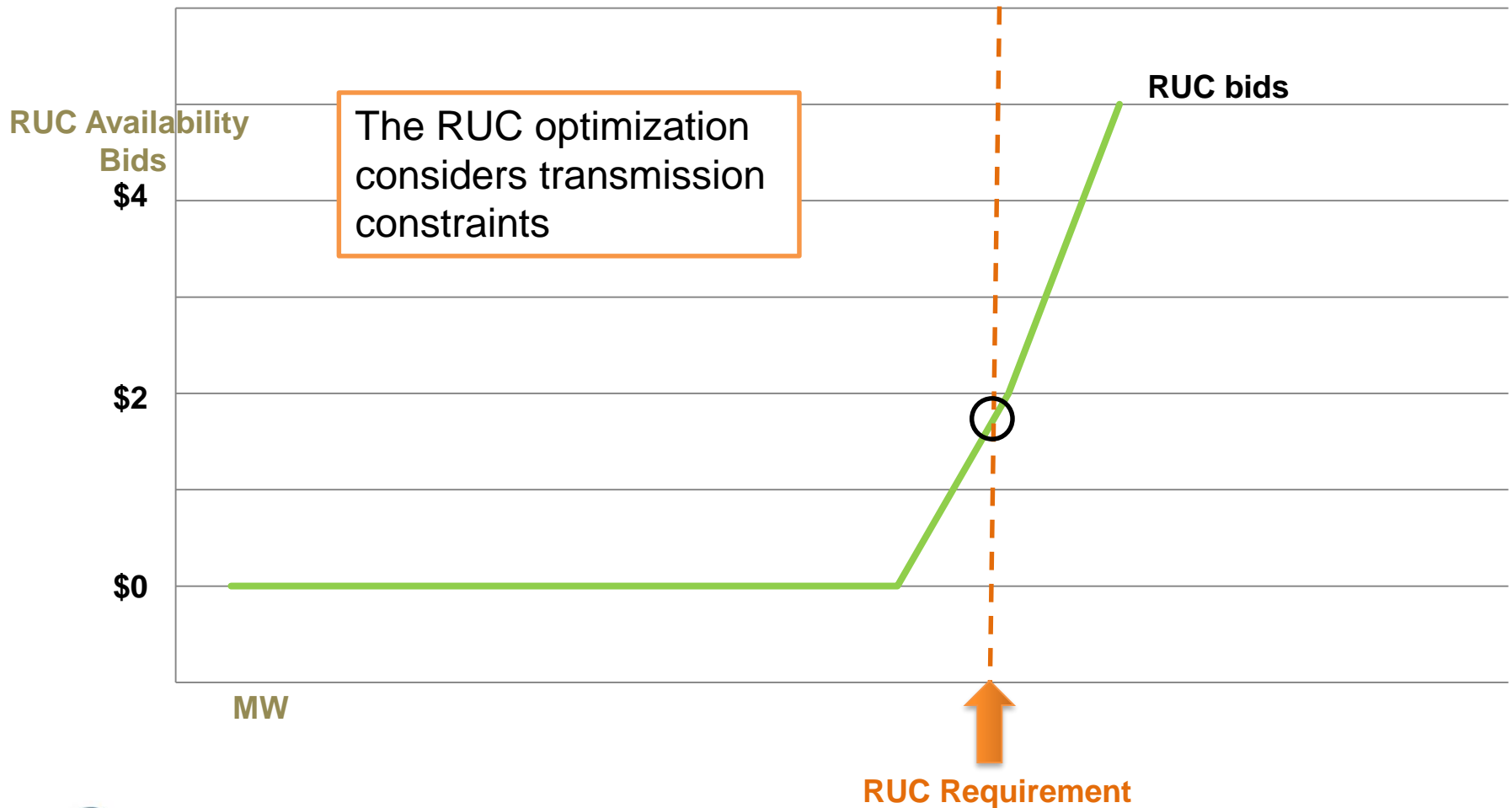
Step 3: Residual unit commitment



Residual unit commitment is determined for each interval



Residual unit commitment capacity bidding and procurement



RUC looks out further than the next trade date

Extremely long-start commitment (ELC) process applies to:

- Resources with start times >18 hours
- Contractual intertie resources that must receive commitment instructions by 0600 hours one day ahead

Commitments are generated by RUC or manually notified by the ISO operator and the process considers bids in the day-ahead market up to two days out.



MOVING FROM DAY-AHEAD TO REAL-TIME

How does the day-ahead award affect a resource's real-time position?

- The day-ahead market is a financial position only
- However, the day-ahead award directly affects the real-time position
- Scheduling Coordinators are expected to deliver their day-ahead award in real-time or bid something else
 - If they do nothing, the day-ahead award becomes a self-schedule in real-time
 - Or they can choose to take a different position in the real-time market, and bid accordingly

Ancillary Services Requirements

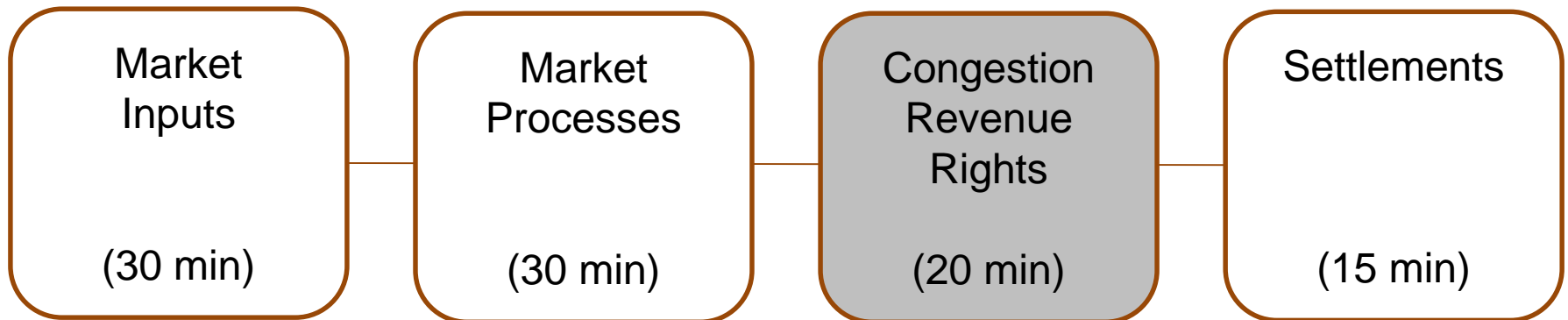
- Resources with awards for ancillary services must submit real-time energy bids for those awards
- Nuances for Regulation:
 - **Regulation Down** must submit a self-schedule in real-time (ISO needs to ensure that the resource is at the top of the Regulation range to bring them down)
 - **Regulation Up** can submit a self-schedule or an economic bid

Residual Unit Commitment Requirements

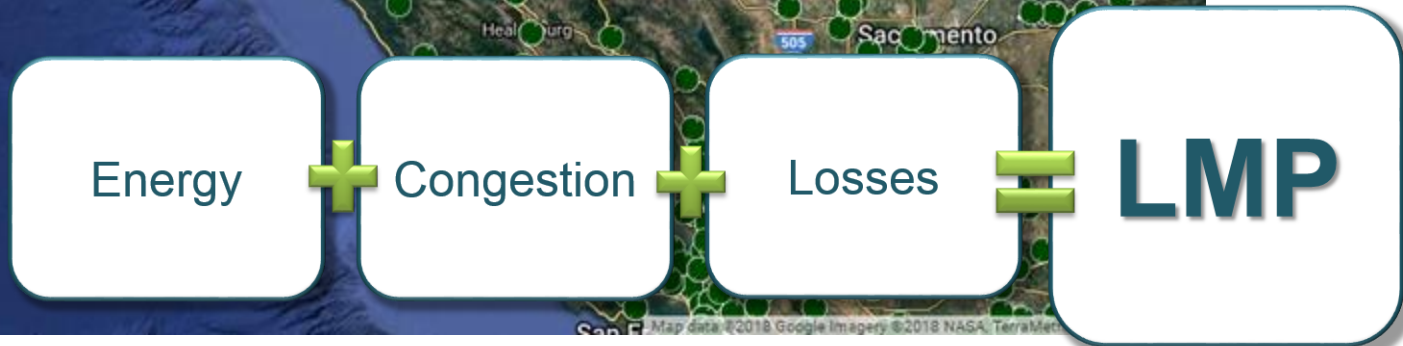
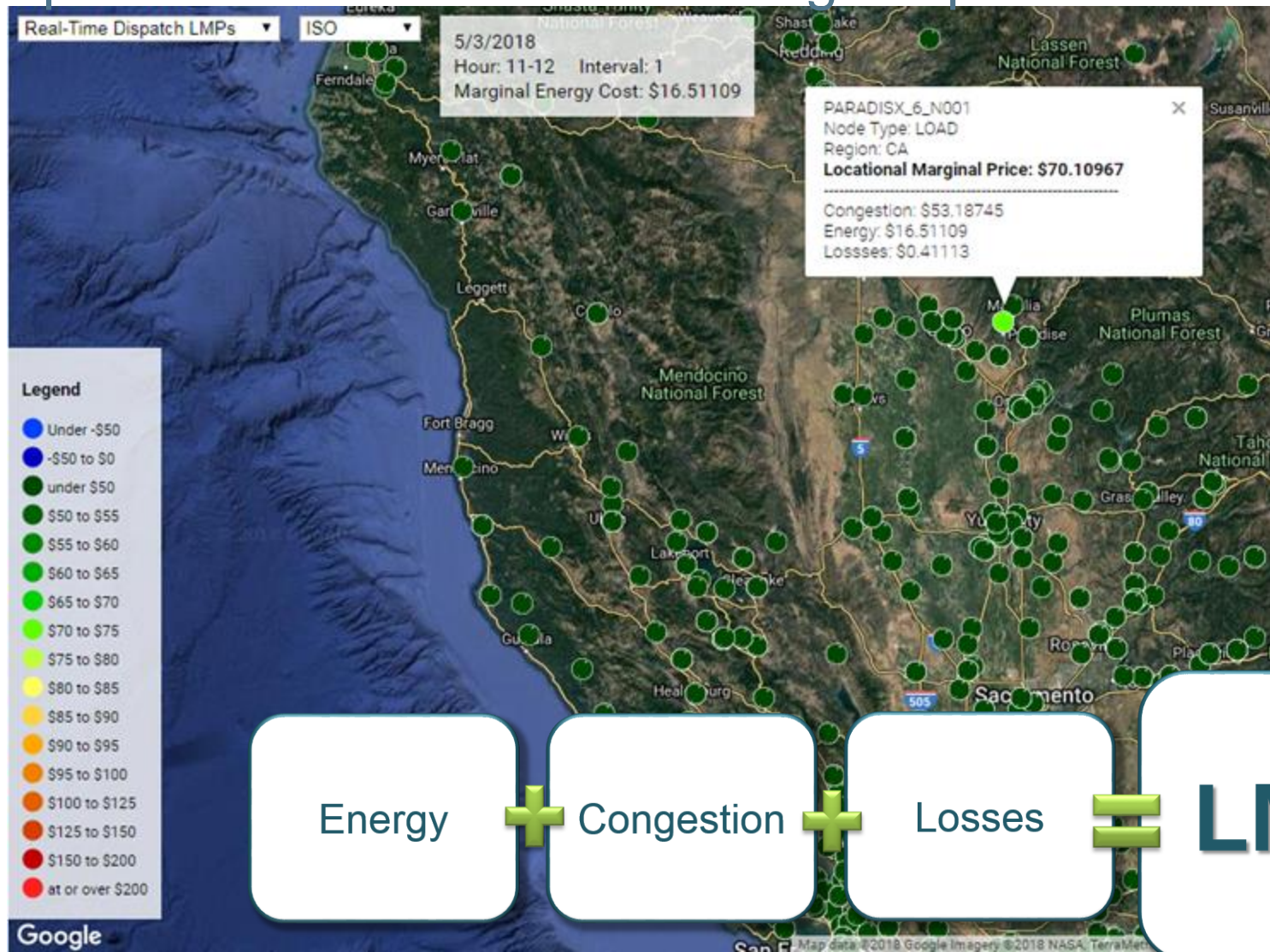
- Resources with a RUC award must submit a real-time economic bid to cover the awarded MWs
- Resource adequacy must-offer obligation is for day-ahead and real-time

Q&A

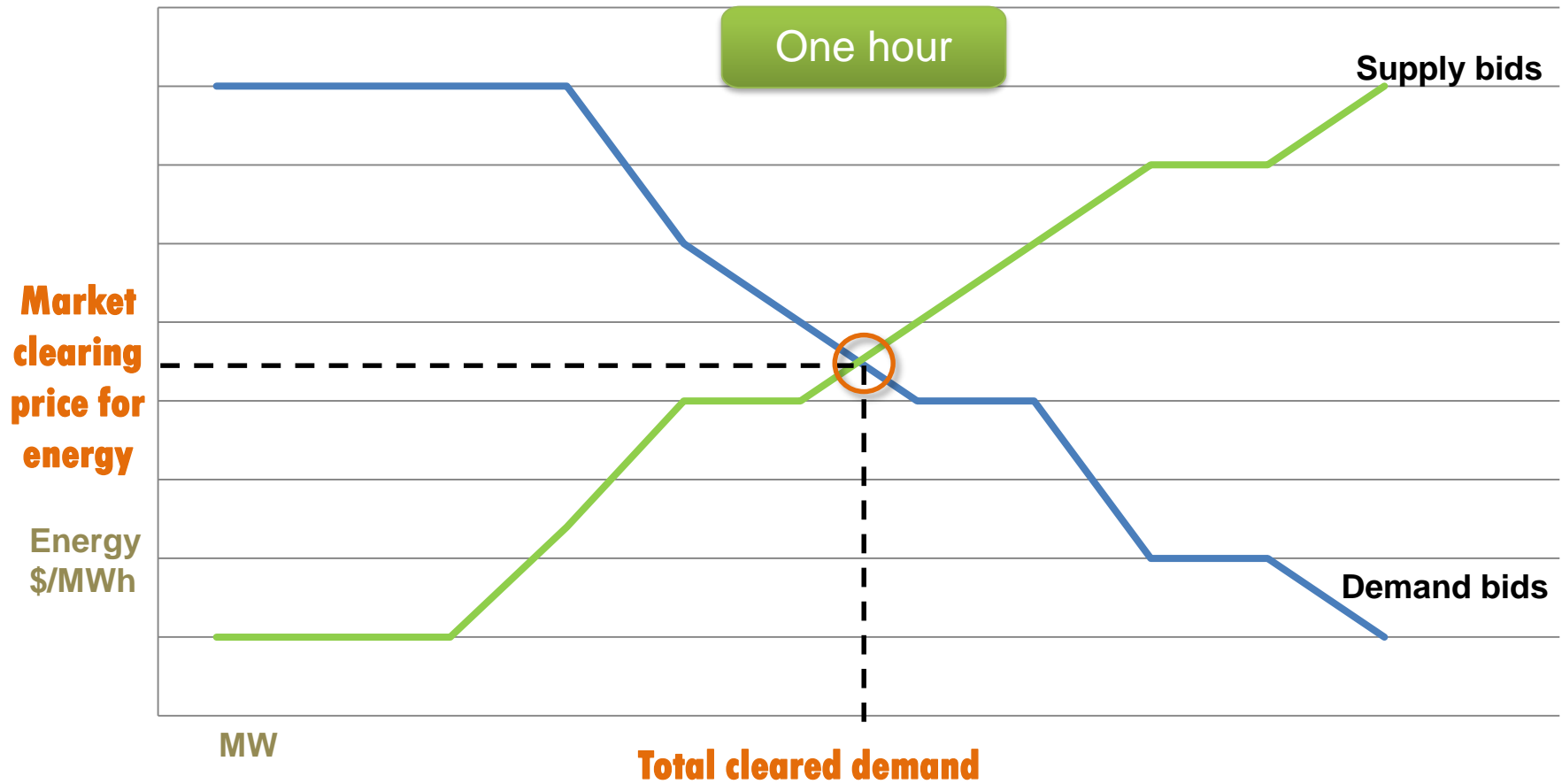
In today's session we'll cover:



Components of the locational marginal price



The day-ahead market clears the energy that will be awarded for each hour.



Loss component



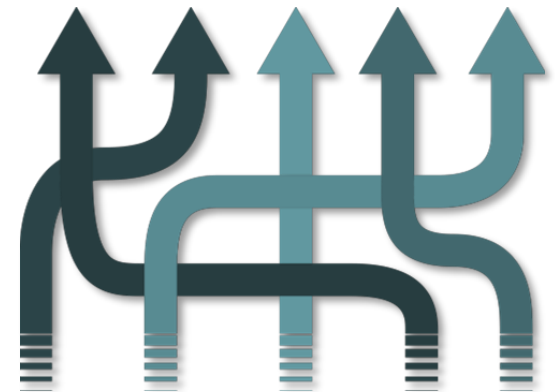
Actual losses use the full network model & the optimal power flow solution

The loss component of the LMP is based on marginal losses

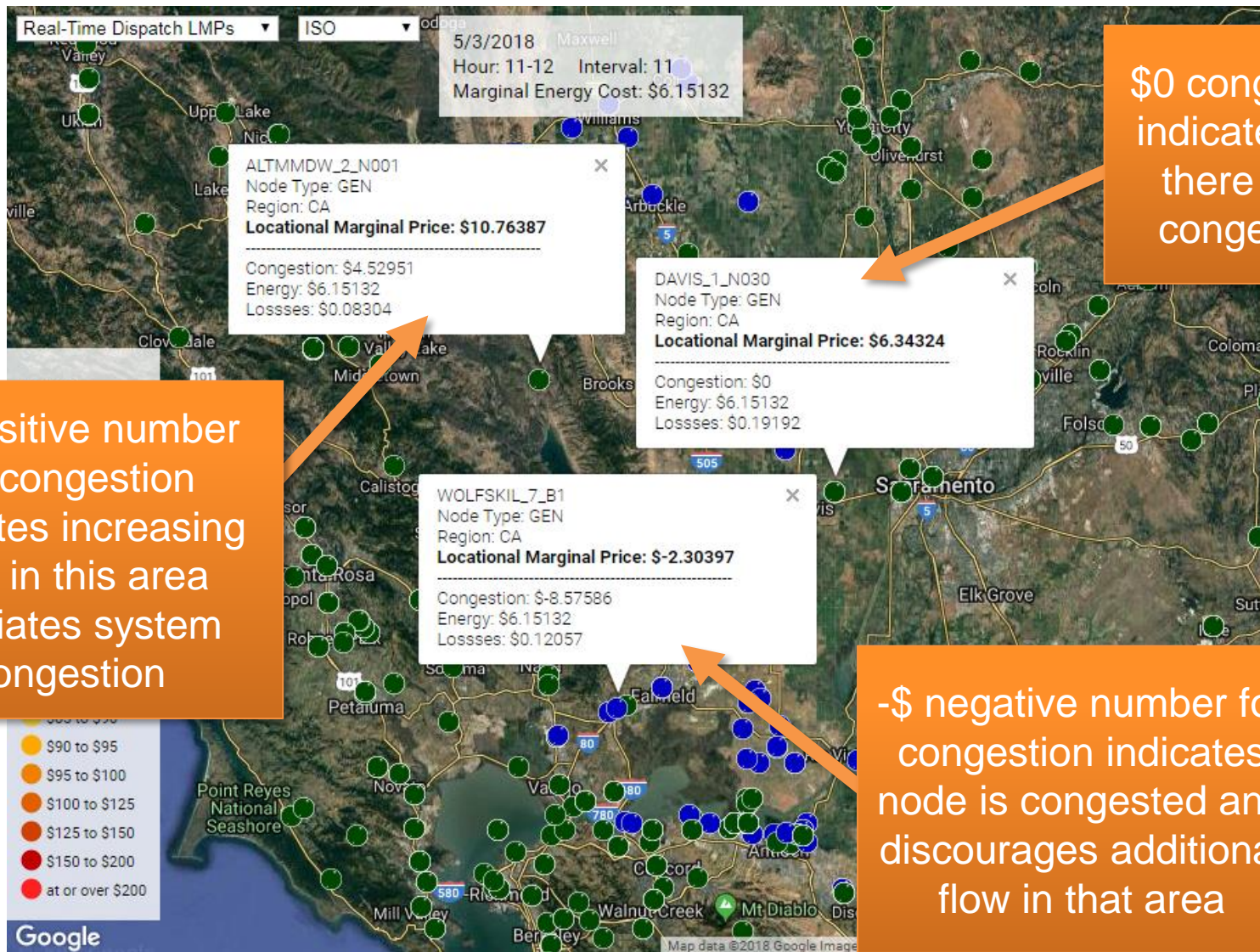
Marginal losses are based on loss sensitivity factors

Congestion

- A condition in which the lowest-priced electricity can't flow freely to a specific area due to heavy use of the transmission system
- Load pays more than generation gets paid resulting in congestion rents
- Potential causes:
 - Lack of transmission capacity
 - Outages



Congestion may result in higher or lower prices



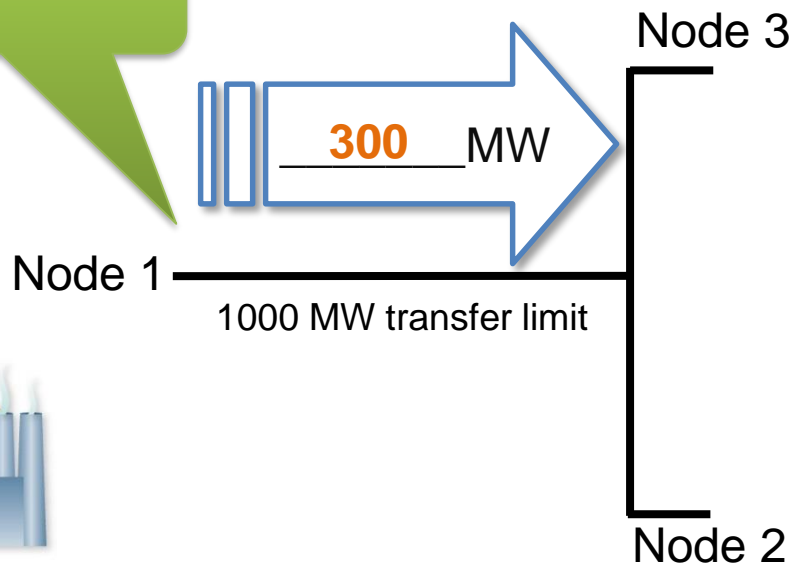
\$0 congestion indicates that there is no congestion

+\$ positive number for congestion indicates increasing flow in this area alleviates system congestion

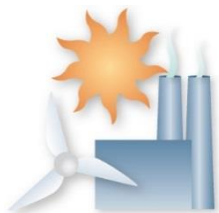
-\$ negative number for congestion indicates node is congested and discourages additional flow in that area

Example 1 – No congestion or losses

No congestion



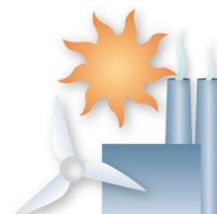
300 MW of load to be served



Generator 1

Bid: 500 MW @ \$40

Energy	\$40
Congestion	0
Loss	0
LMP	\$40



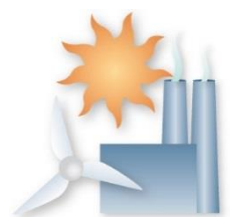
Generator 2

Bid: 500 MW @ \$60

Energy	\$40
Congestion	0
Loss	0
LMP	\$40

Example 2 – Congestion, no losses

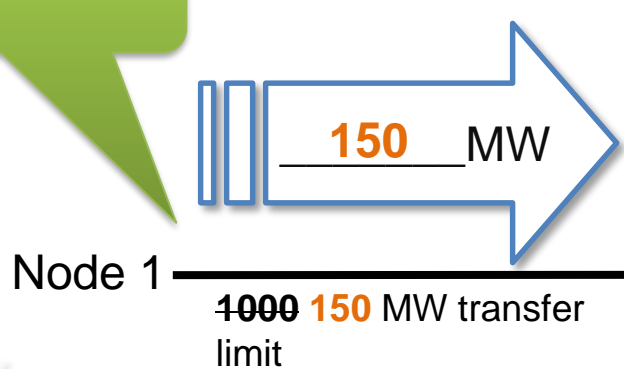
Congestion exists



Generator 1

Bid: 500 MW @ \$40

Energy	\$ 60
Congestion	-20
Loss	0
LMP	\$ 40

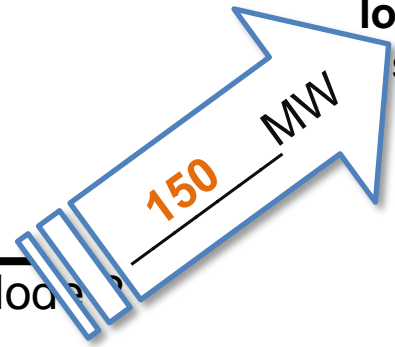


Node 3

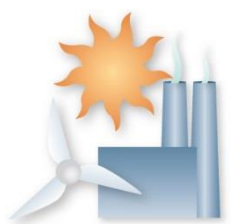


300 MW of load to be served

Node 2



Energy	\$ 60
Congestion	0
Loss	0
LMP	\$ 60

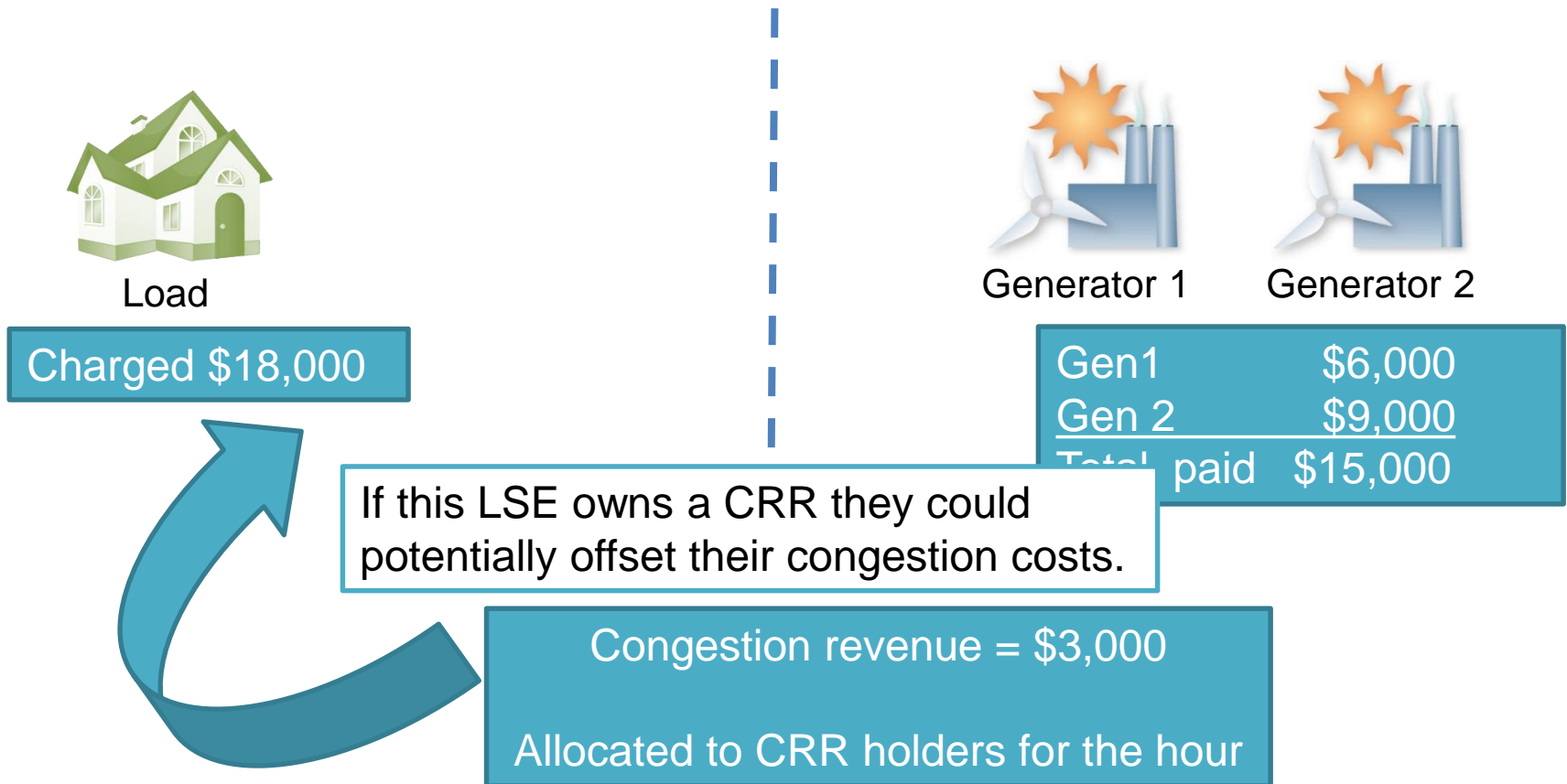


Generator 2

Bid: 500 MW @ \$60

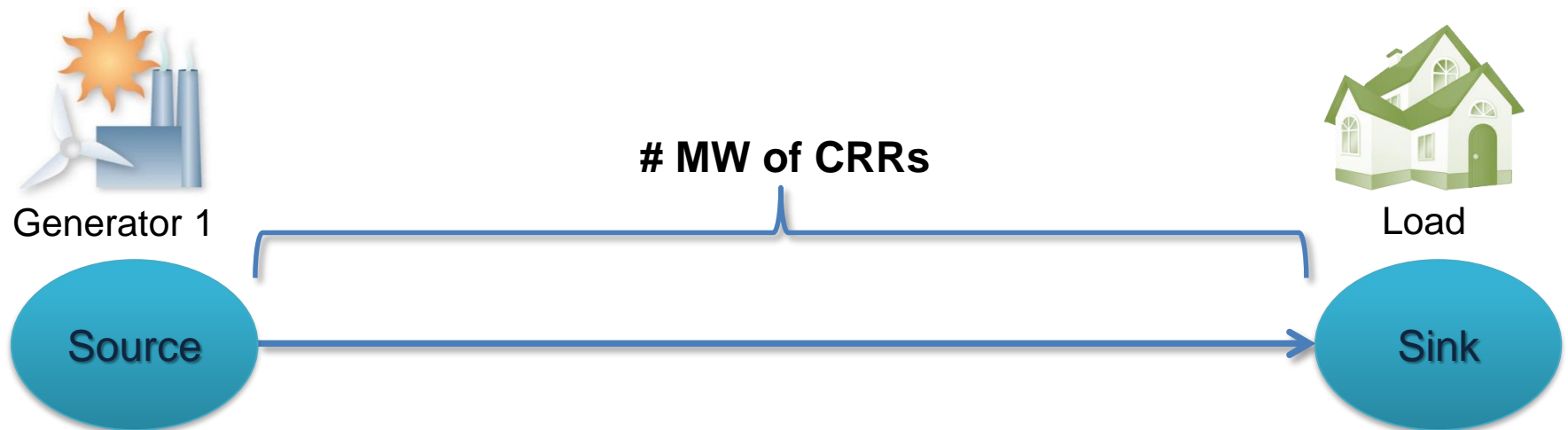
Energy	\$ 60
Congestion	0
Loss	0
LMP	\$ 60

The ISO uses Congestion Revenue Rights to allocate congestion rents



Entities acquire Congestion Revenue Rights (CRRs) to offset day-ahead congestion costs

- Used to manage congestion cost variability based on LMPs
- Offsets congestion costs based on each entity's congestion exposure
- Available through allocation and auction processes



CRRs and the day-ahead market – key points

An SC is not required to own a CRR to bid into the day-ahead market

A CRR holder is not required to bid into the day-ahead market

An SC with a CRR is not required to bid consistent with the terms of their CRR (i.e. they do not need to bid at the source and sink of their CRR, or MW quantity)

An awarded day-ahead bid is settled at the LMP

A CRR is settled at the marginal cost of congestion (MCC) of the day-ahead locational marginal price (LMP)

Obtaining CRRs

Allocation

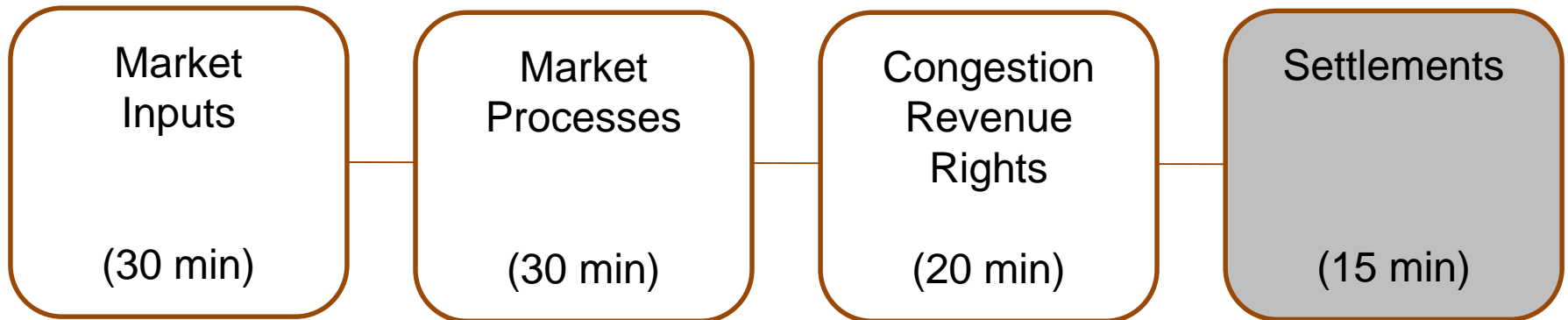
- For entities that provide for the upkeep of the transmission system including :
 - Internal load-serving entities (LSEs)
 - Out of balancing authority area LSEs
 - Project sponsors of merchant transmission facilities

Auction

- Open to entities that are registered as candidate CRR holders
- Subject to creditworthiness requirements

Q&A

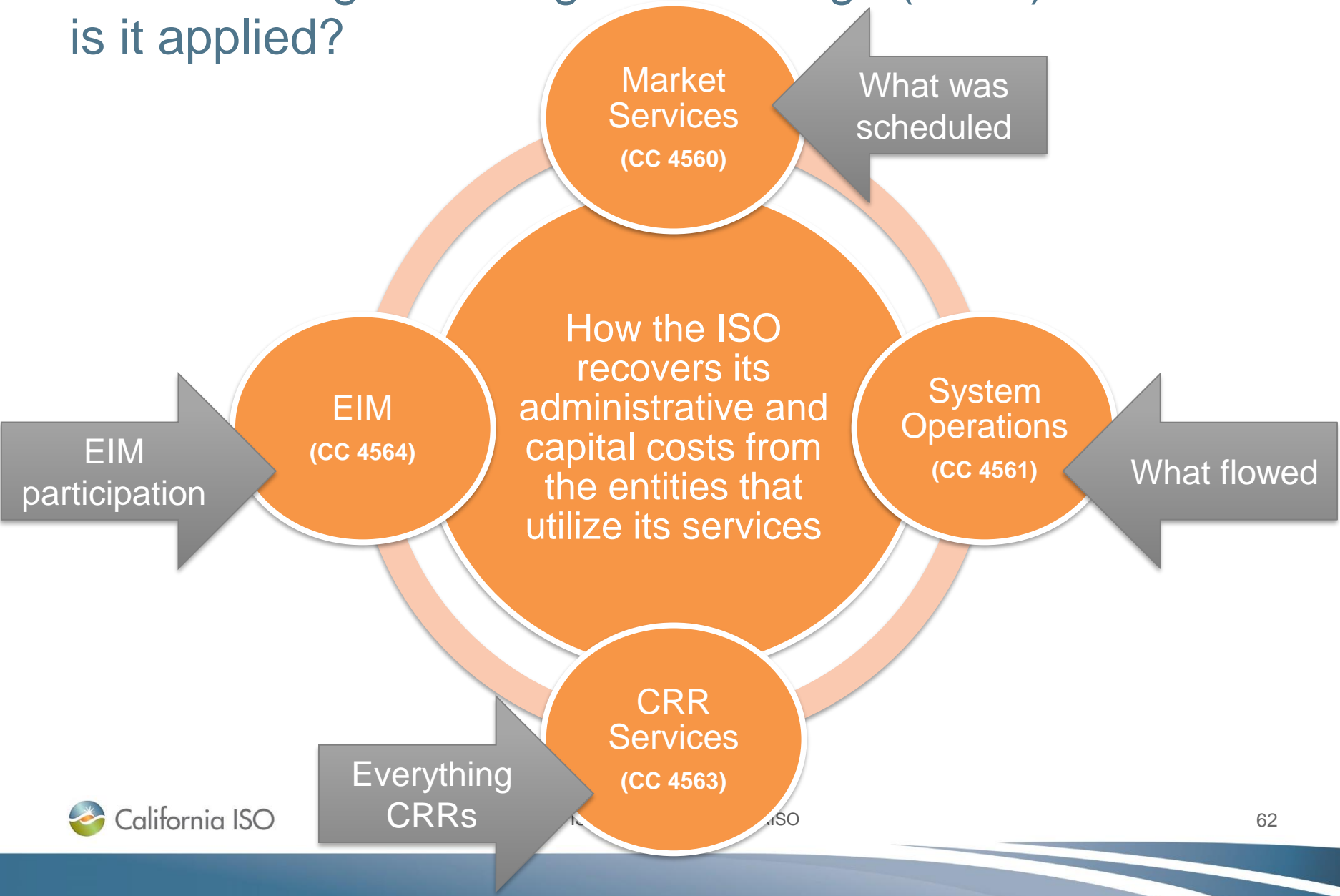
In today's session we'll cover:



Day-ahead market settlements

What is settled?	Covers
Physical Energy	Cleared supply and/or demand
Virtual Energy	Cleared supply and/or demand
Ancillary Services	Awarded regulation or contingency reserves
Residual Unit Commitment	Awarded capacity
Bid Cost Recovery	Costs that exceed revenues for ISO committed resources
Grid Management Charges & Fees	ISO costs

What is the grid management charge (GMC) and how is it applied?



GMC administrative and transaction fees

Bid segment fee

- \$.005 applied to all submitted bid segments
- Physical bids and virtual bids

SCID fee

- \$1,000 per SCID that have settlements activity within a trade month
- Calculated monthly

Forecasting service fee

- \$.10 per MWh based on actual metered energy for eligible intermittent resources*
- Calculated monthly

* Does not apply to external EIRs that use their own forecast. All other EIRs are subject to this charge.

Q&A



Thank you for your participation!

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