Overview: Current Day-Ahead Market

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Customer Readiness

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Agenda

This training will cover the following elements of the ISO's **Day-Ahead Market**:

- Bidding and self-schedules
- Market timeline & processes
- Locational marginal prices
- Congestion revenue rights
- Convergence bidding
- Market outputs (settlements)

The ISO is a grid operator, market operator, and reliability coordinator

Within its balancing authority area, the ISO:

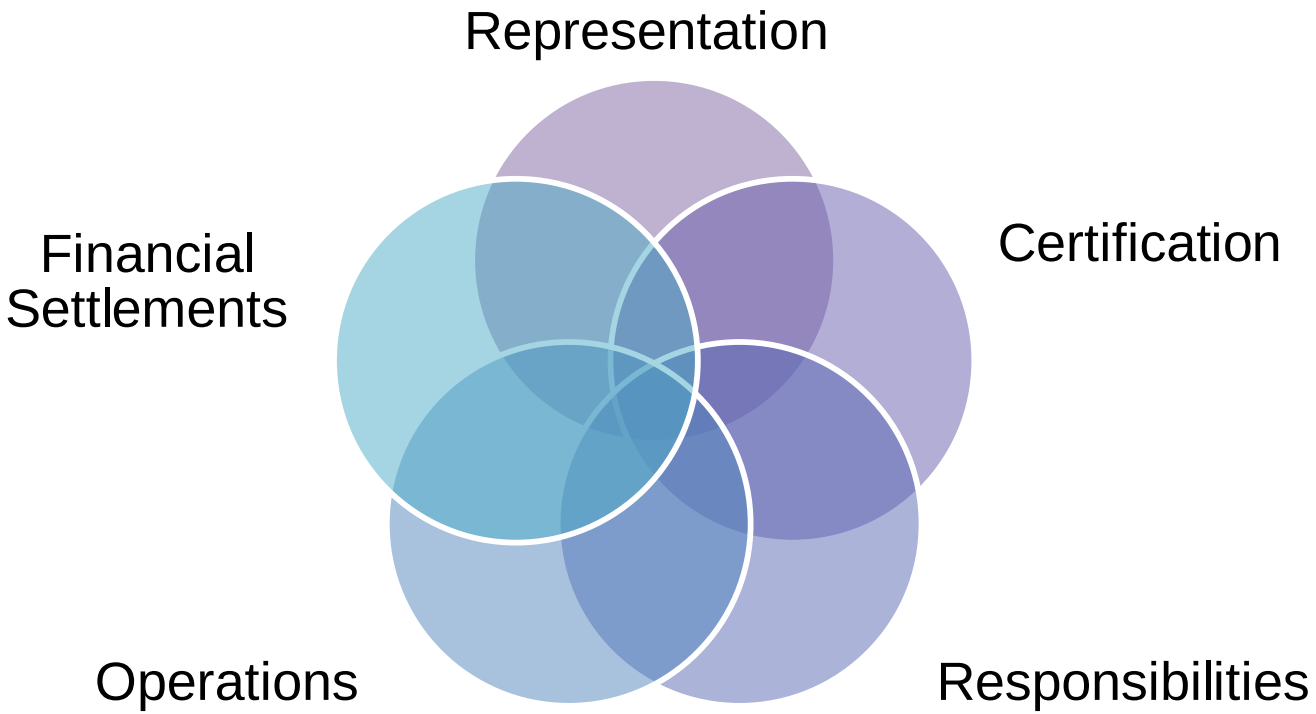
- Maintains reliability of the grid
- Manages the flow of energy
- Oversees the transmission planning process
- Operates the wholesale electric market

For much of the western U.S., the ISO:

- Operates the Western Energy Imbalance Market (WEIM)
- Serves as Reliability Coordinator (RC West)

Focus of today's session

Scheduling Coordinators are entities that are authorized to transact business with the ISO



What does the day-ahead market do?

A full day's operations are covered by two markets:

Day-ahead market

Real-time market

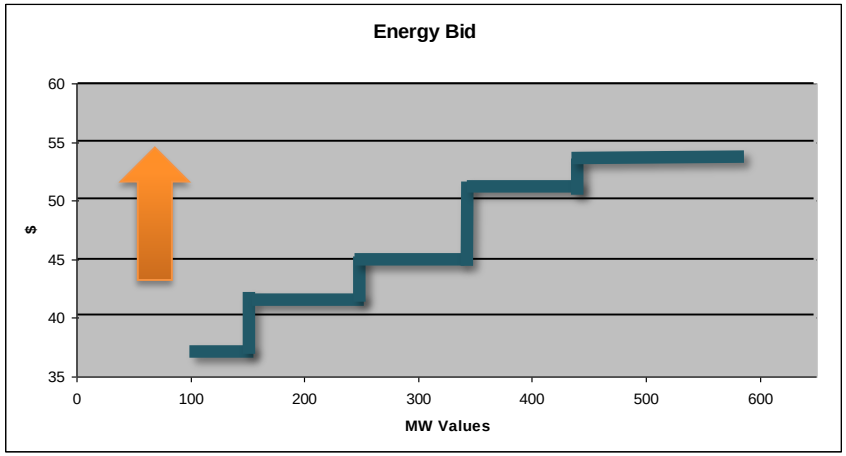
Day-ahead markets procure resources economically to meet reliability needs

Assurance, a day in advance, that there are adequate resources available and deliverable in real-time

ECONOMIC BIDS AND SELF SCHEDULES

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

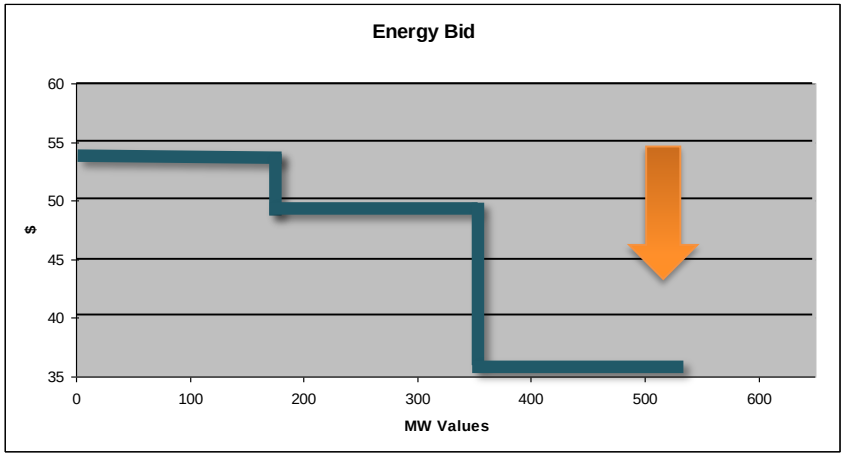
SUPPLY



generators and imports

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

DEMAND



loads and exports

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

Self-schedules are 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

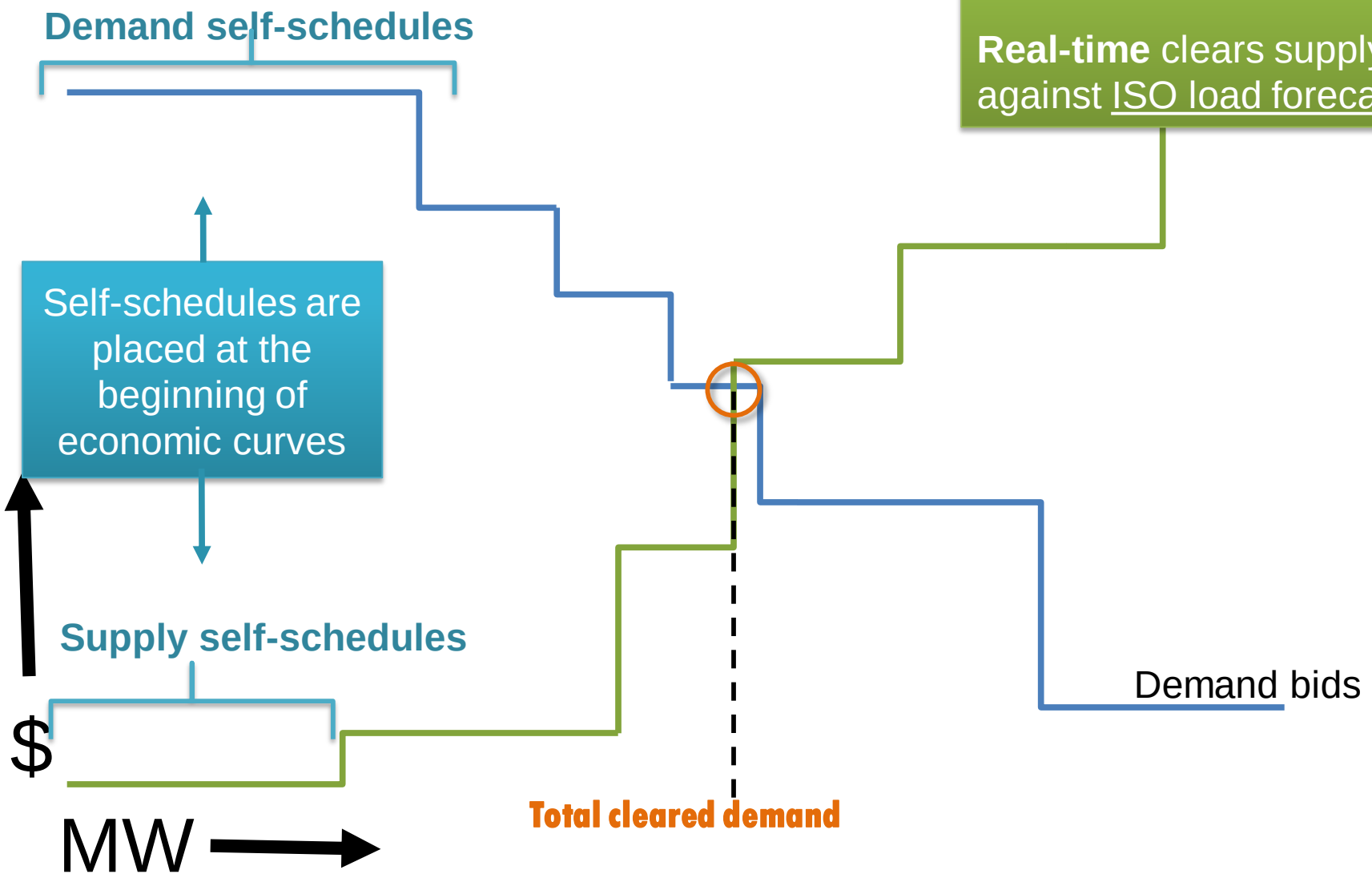
DEMAND SELF SCHEDULE

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

Economic Bids and Self Schedules

Day-ahead clears supply bids against demand bids;

Real-time clears supply against ISO load forecast.



How does the market decide which resources to commit?

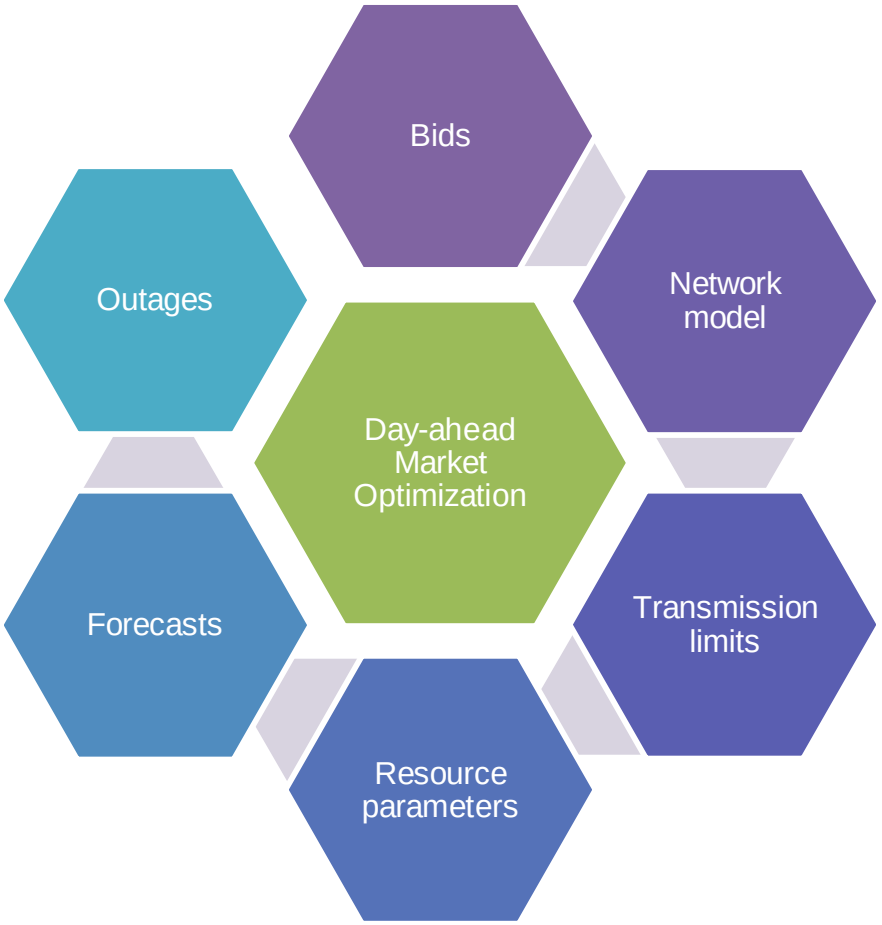
Bids

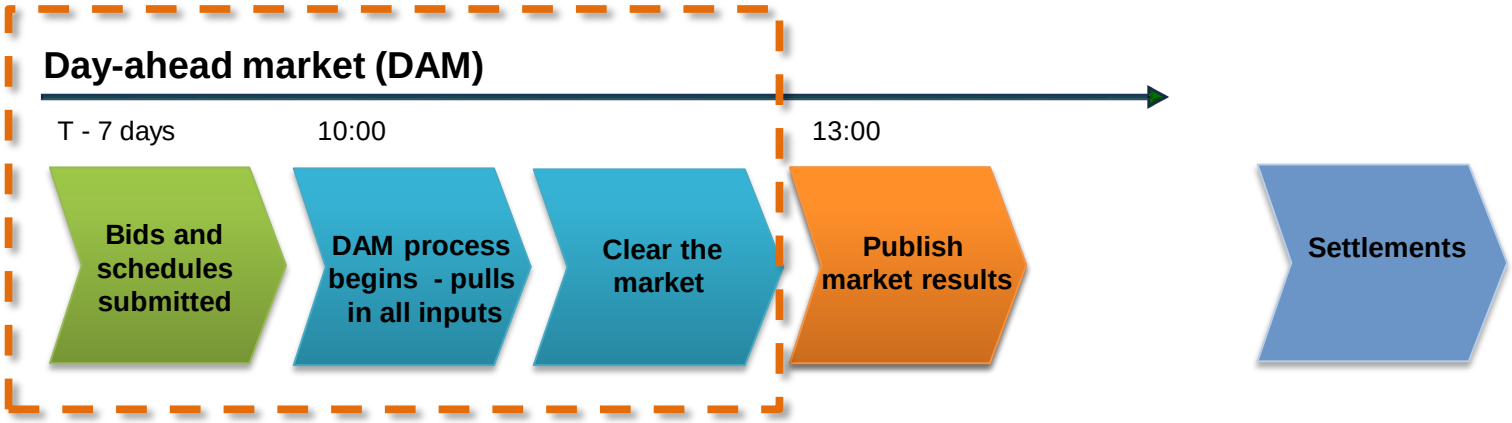
Other costs:

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

Key Point: Bid price is not the only factor considered

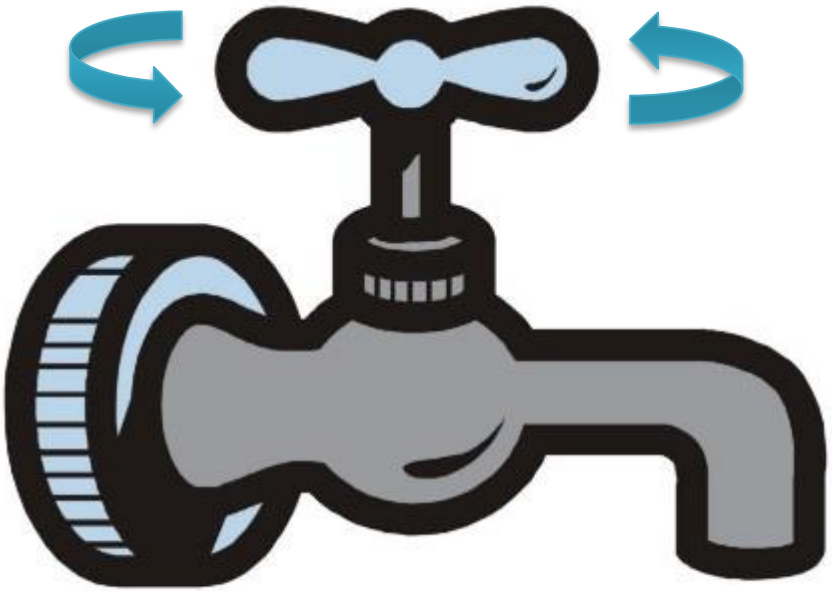
Other inputs of the **day-ahead** market





DAY-AHEAD MARKET TIMELINE & PROCESSES

What do we mean by energy vs. capacity?

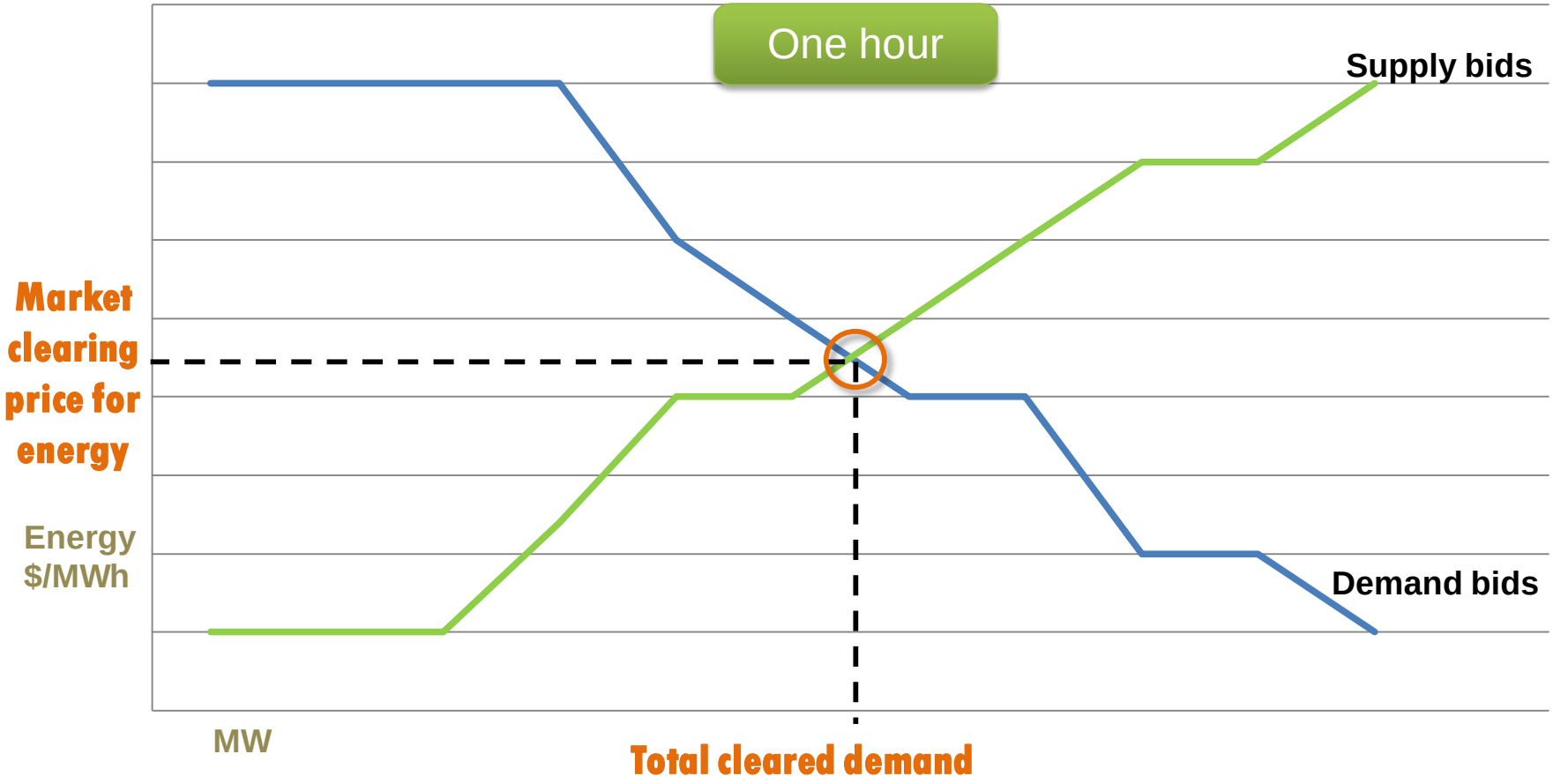


H2O

Capacity

Energy

The day-ahead market determines the amount of energy that will be purchased for each hour



Ancillary services and additional capacity are procured in the ISO BAA to meet reliability requirements

The ISO procures:

Regulating reserves

- based on procurement targets set by ISO to meet WECC standards

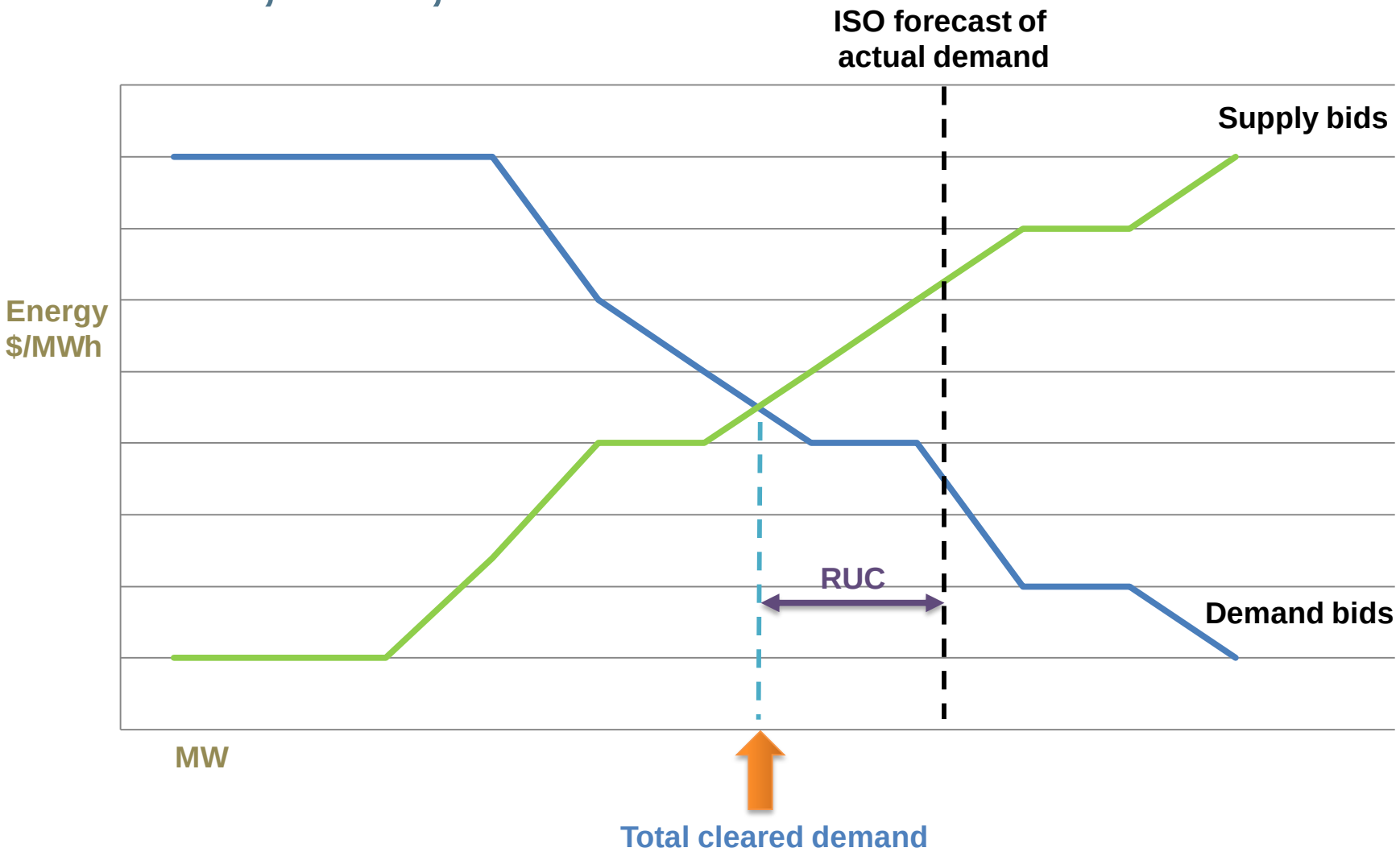
Contingency reserves

- based on procurement targets set by WECC

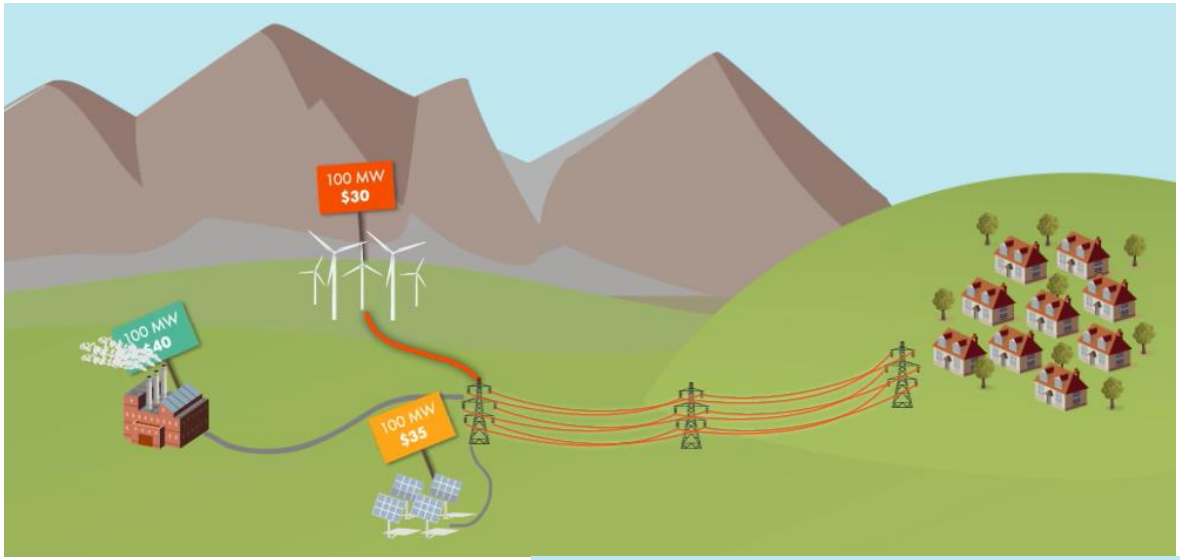
Residual Unit Commitment (RUC)

- to meet the ISO system-wide and regional forecasts

RUC is used to meet the ISO's energy forecast based on: **Need, Price, and Location**



Market Power*



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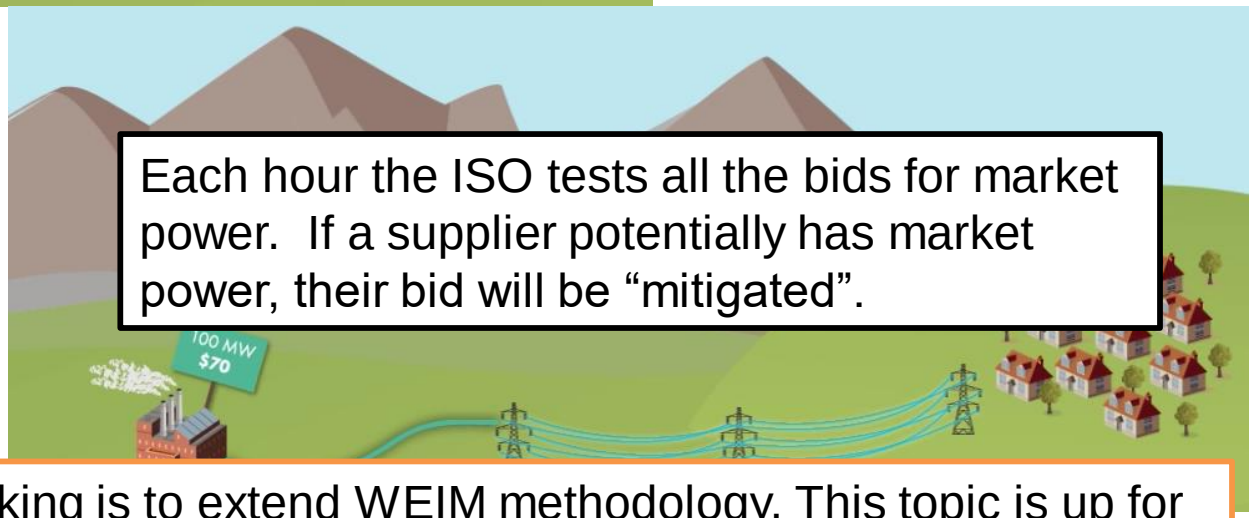
Competition among suppliers to serve the load

X

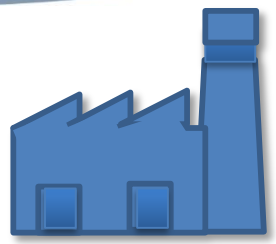
No competition = Market power



Each hour the ISO tests all the bids for market power. If a supplier potentially has market power, their bid will be "mitigated".

*For EDAM: Current thinking is to extend WEIM methodology. This topic is up for discussion and will be finalized/vetted through stakeholder process.

Example: Day-ahead bidding from a supplier's perspective



PMAX = 140 MW

PMIN = 50 MW

Unit 1

Economic Bids
70 MW
Energy

40 MW
Ancillary
Service

Self-Schedule
70 MW
Energy

- Supplier offers resource into applicable products
- Market determines best way to use the resource

Grid operators need a plan for operating the next day to ensure reliability

- The California ISO uses its **day-ahead market** to create that plan. As a result, resources are committed to provide:
  - Supply to meet the demand that cleared in the market
  - Supply to meet the ISO demand forecast
  - Ancillary services to meet the reliability requirements

Components of the LMP

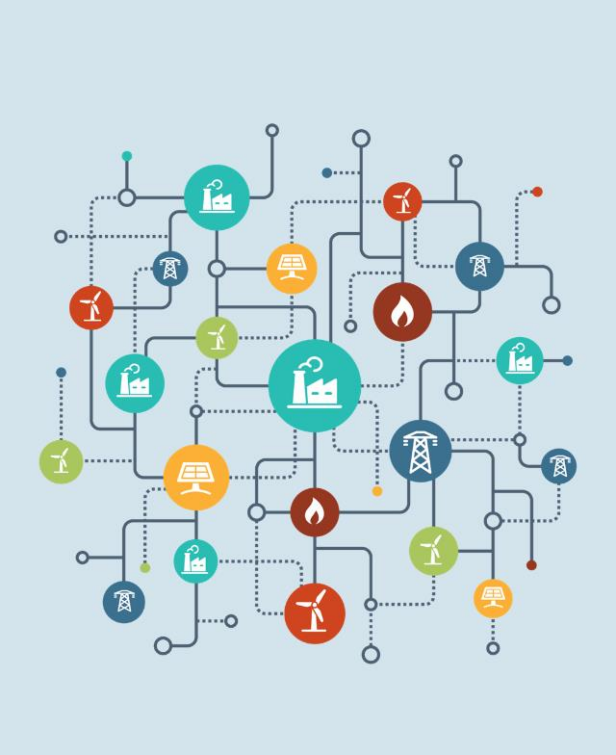
Congestion Revenue Rights

LOCATIONAL MARGINAL PRICING

Locational Marginal Pricing (LMP)

The marginal cost ($/MWh) of serving the next increment of demand at a pricing location that respects:

- Transmission constraints of the system
- Performance characteristics of generating resources



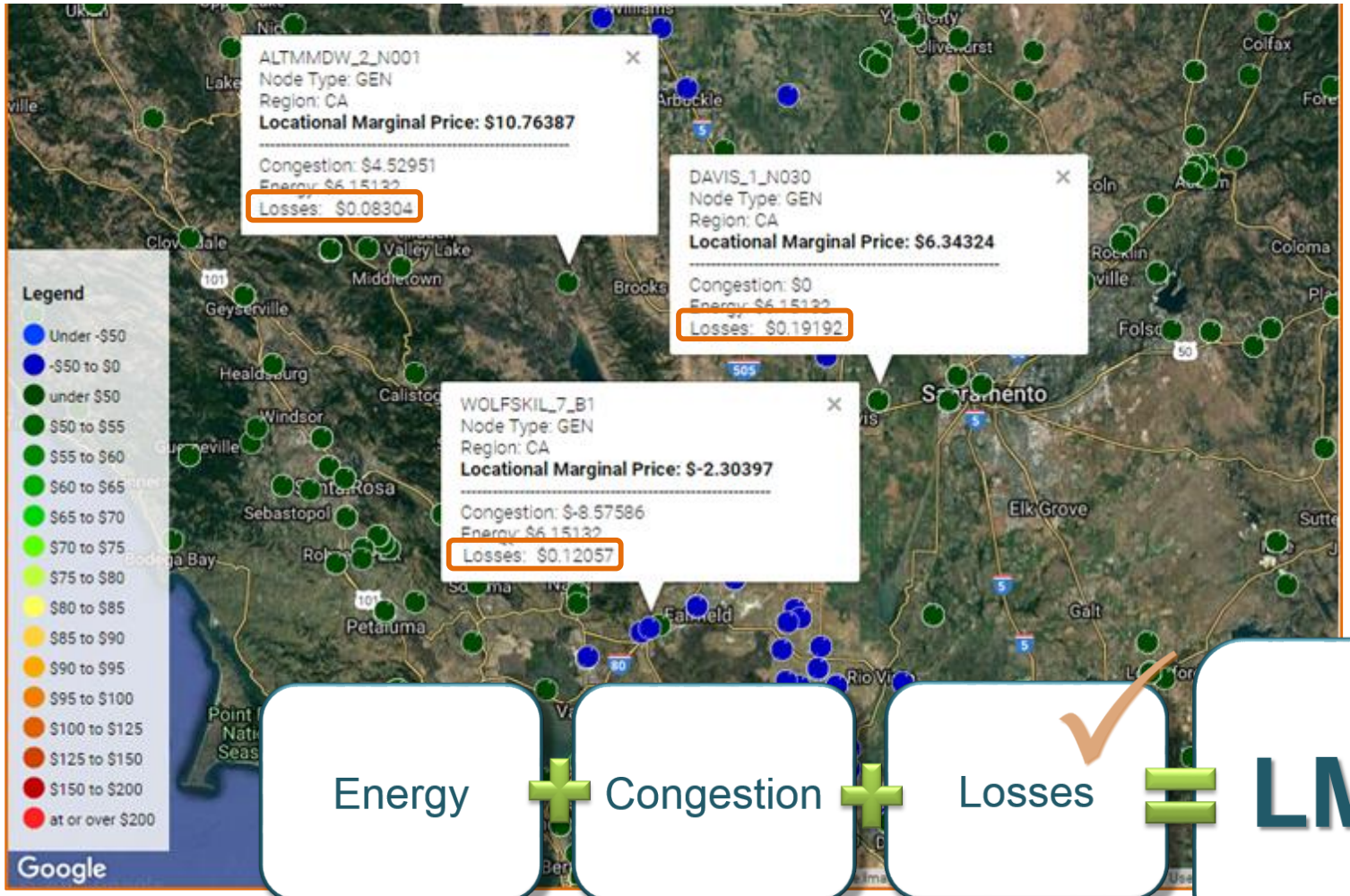
Energy component of the LMP

Losses

The market uses the network model to calculate how electricity will flow through the system

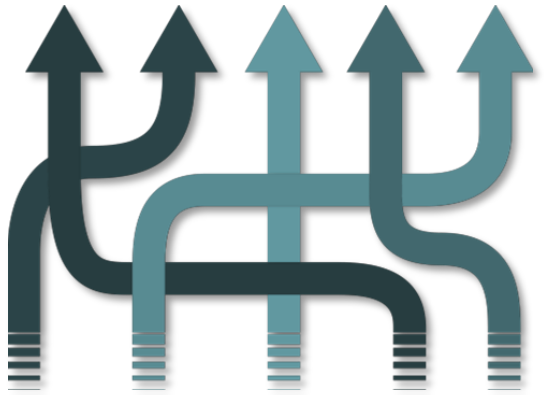
Marginal losses are based on factors such as weather, line material, length of wire, etc.

Loss component of the LMP



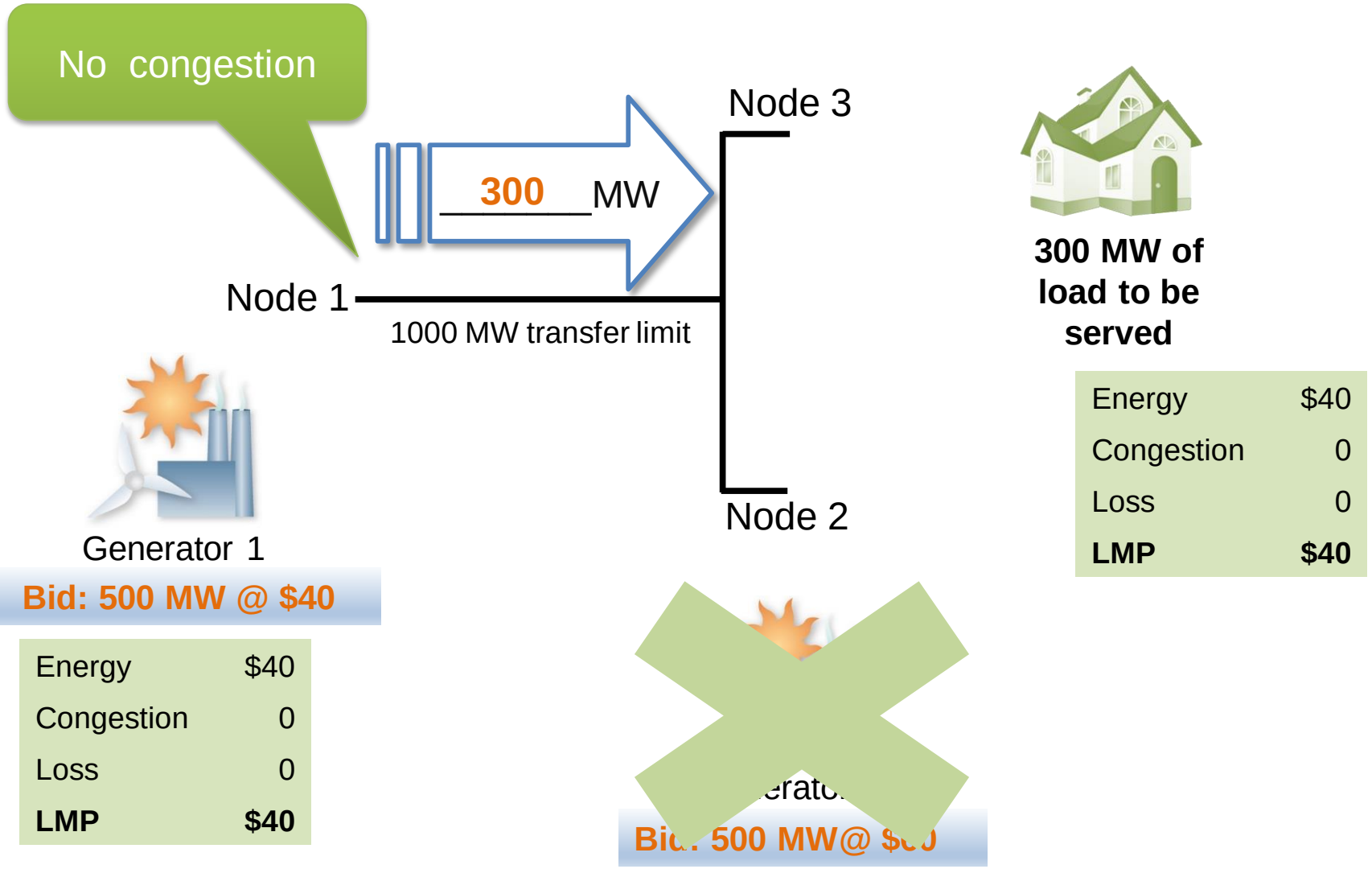
Congestion

- A condition in which the lowest-priced electricity can't flow freely to a specific area due to heavy use of the transmission system
- Congestion prevents energy from low-cost resources from meeting all loads an clearing the market
- Potential causes:
  - Lack of transmission capacity
  - Outages

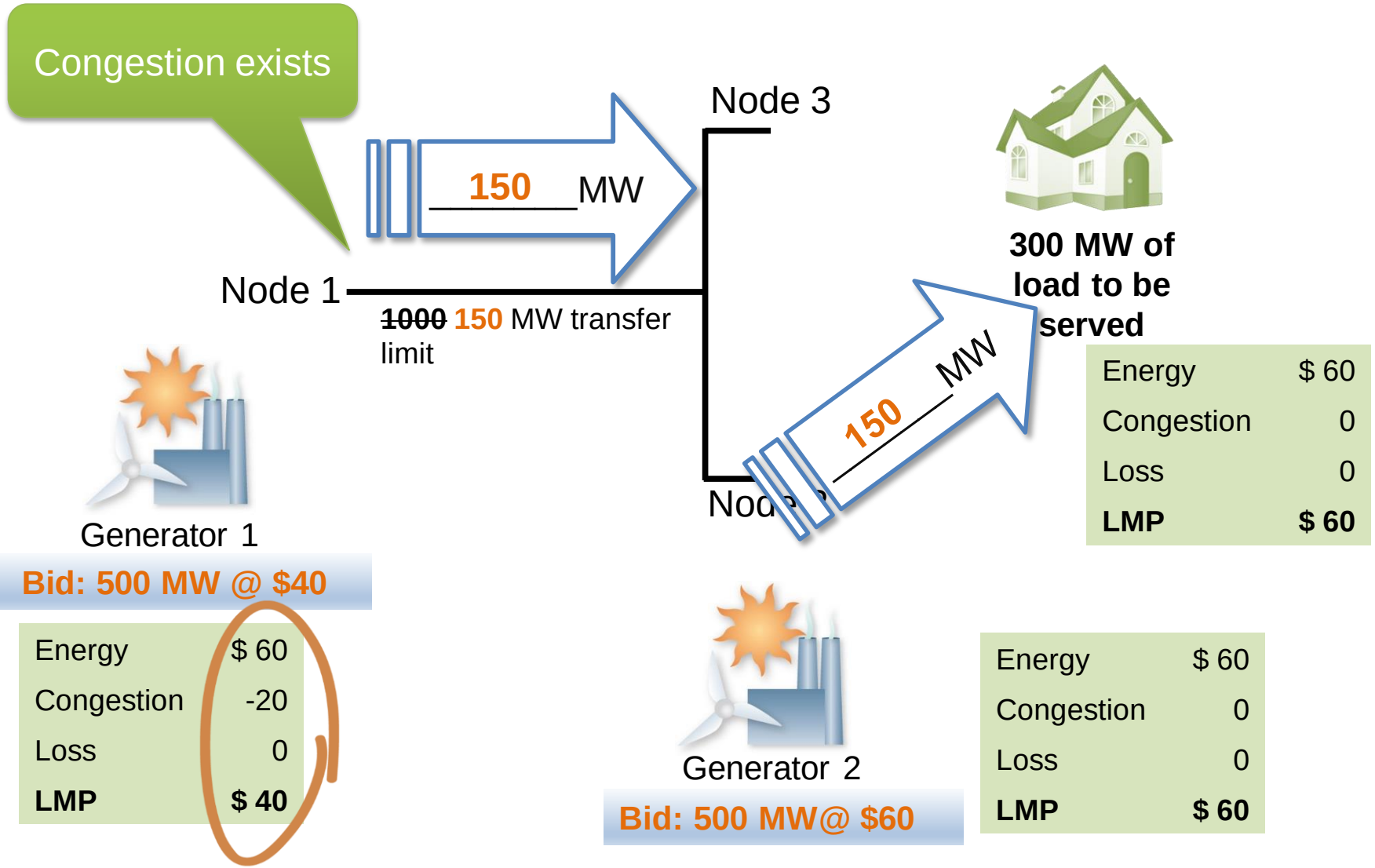


Congestion component of the LMP

Example 1 – No congestion or losses



Example 2 – Congestion, no losses



Example 2 Recap

Congestion exists

Node 3

Node 1

~~1000~~ 150 MW transfer limit

Node 2

Load pays $18,000

300 MW of load to be served

Energy	$ 60
Congestion	0
Loss	0
LMP	**$ 60**

Generator 1

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

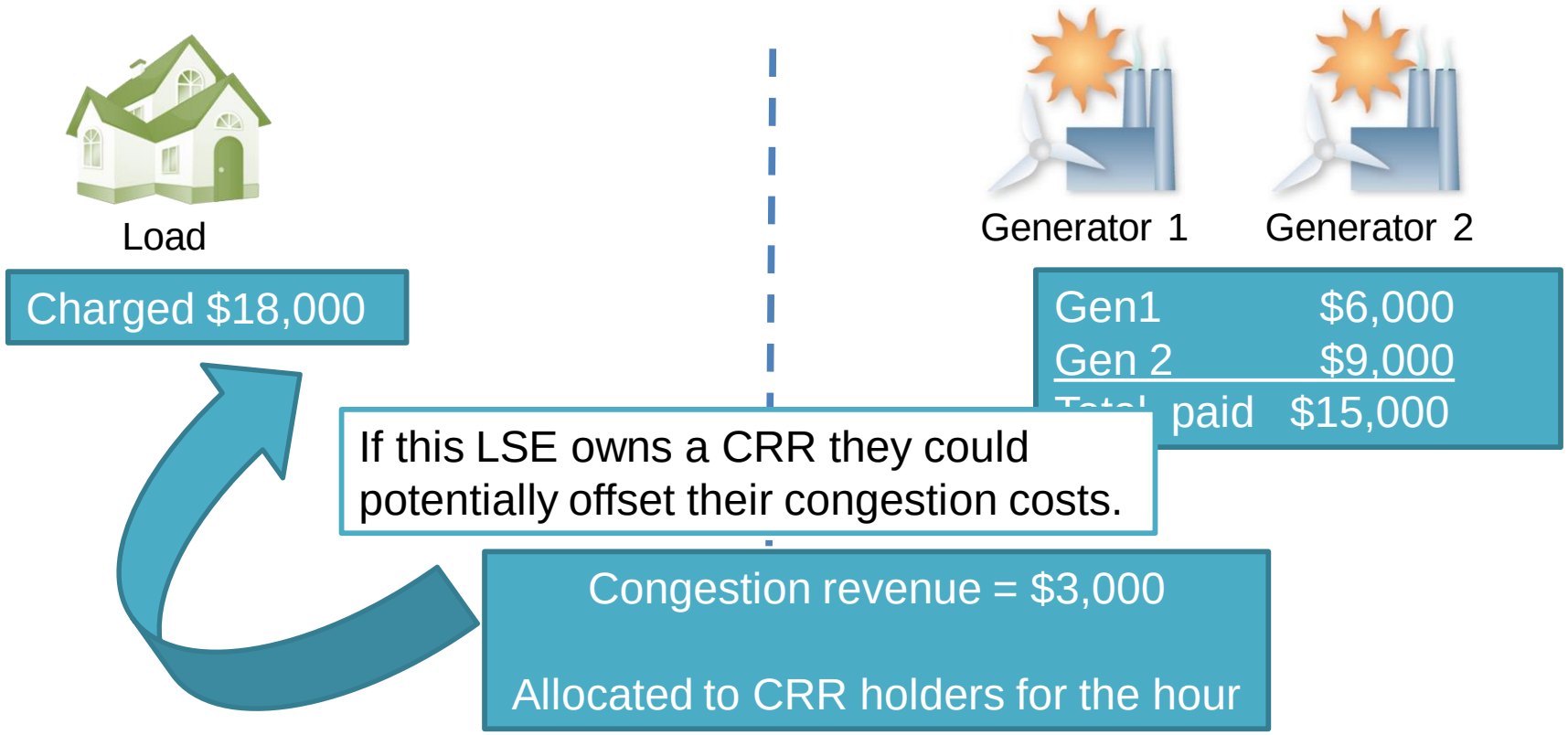
Gen 1 is paid $6,000

Generator 2

Gen 2 is paid $9,000

Energy	$ 60
Congestion	0
Loss	0
LMP	**$ 60**

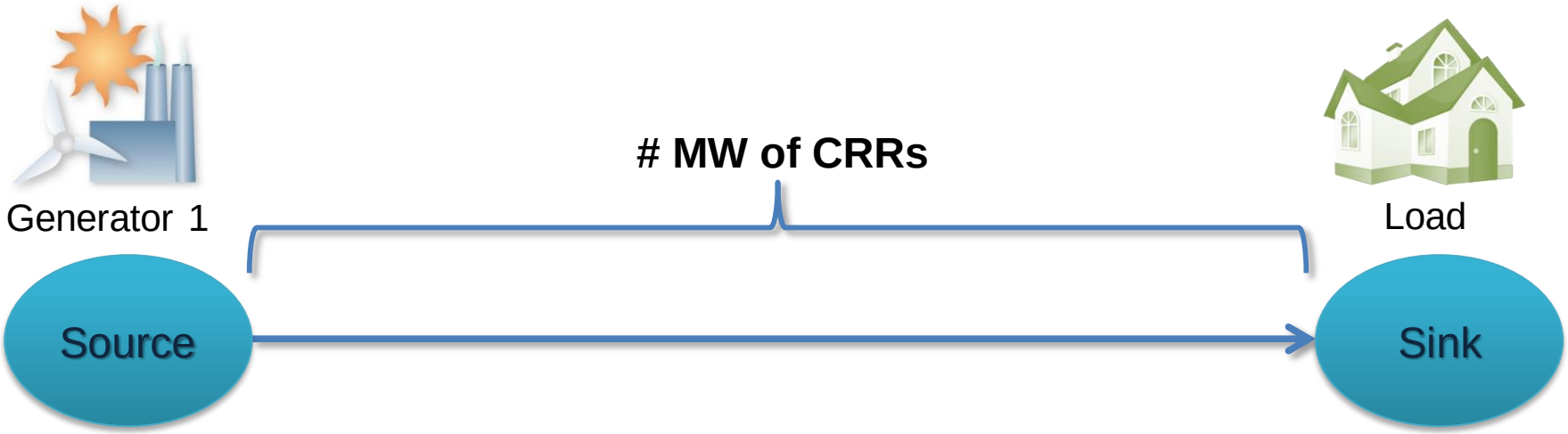
The ISO uses Congestion Revenue Rights to allocate congestion rents*



*Allocation of congestion rents is an item for the EDAM policy team and stakeholders to discuss

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

- Used to manage congestion cost variability based on LMPs
- Available through allocation and auction processes



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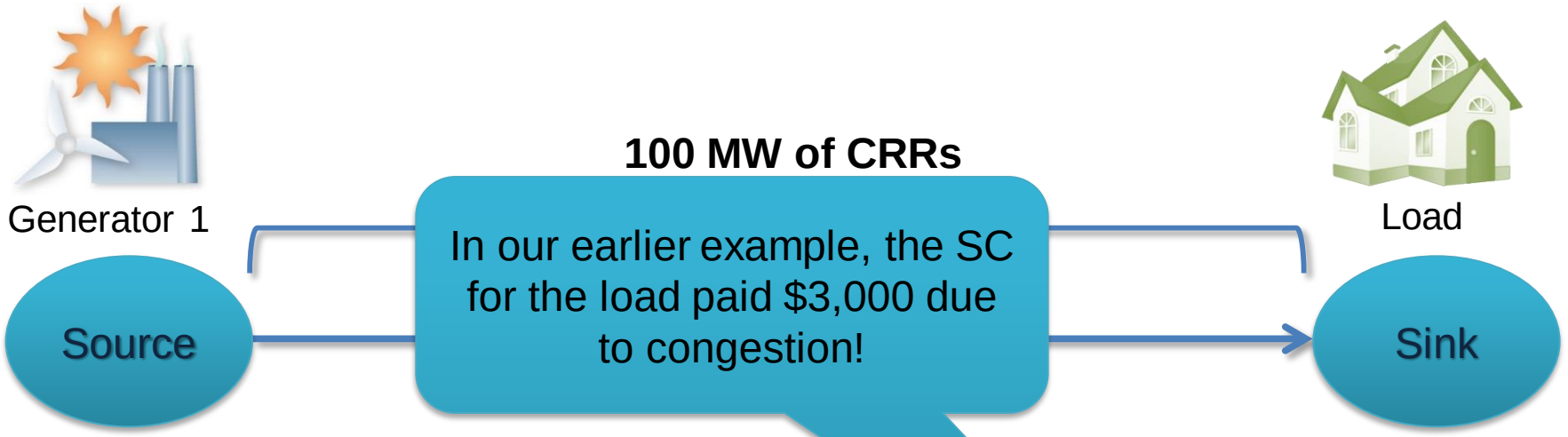
Assume the SC for Load had 100 MW of CRRs on this line



CRR Formula

(MW of CRRs x sink MCC) - (MW of CRRs x source MCC)

(100 MW x $0) - (100 MW x $20) = $2,000 payment

Pricing summary

- Locational Marginal Prices (LMP) are used to settle day-ahead market energy
- LMPs are made up of energy, congestion and losses
- Congestion costs are charged to SCs for load
- Congestion Revenue Rights (CRRs) are allocated to load to offset congestion costs
- There are also opportunities to purchase CRRs through an auction process

CONVERGENCE BIDDING*

*Implementation of convergence bidding is an item for the EDAM policy team and stakeholders to discuss

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

How do convergence bidders participate?

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

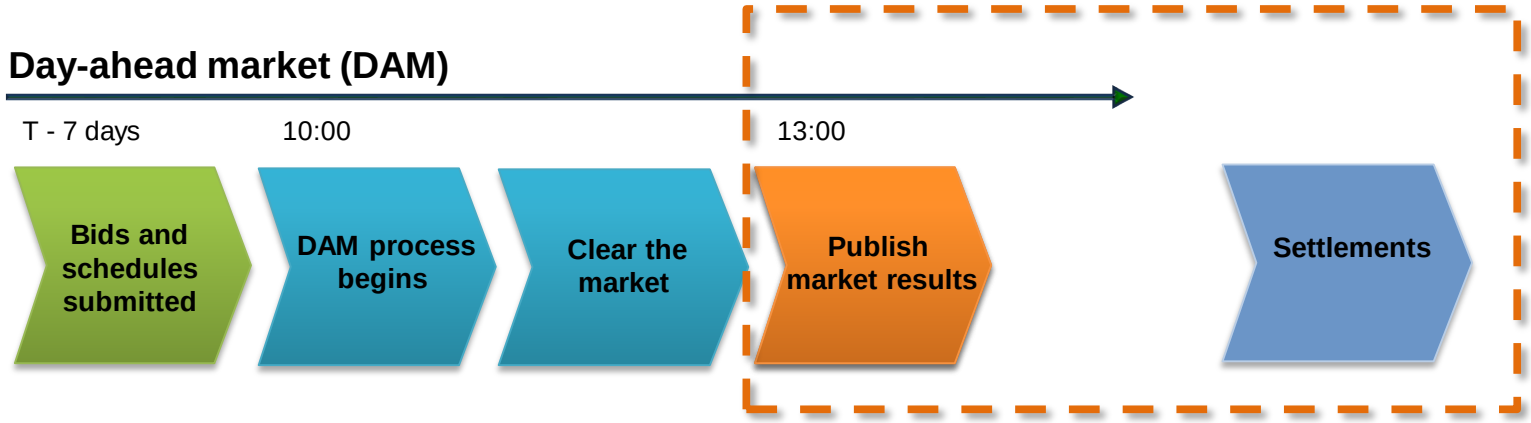
- A bidder submits a bid to sell MW in the day-ahead market
- Assuming the bid clears, the bidder will be paid the day-ahead price for the MW
- The real-time market automatically buys the MW and the bidder will pay the real-time price

Does convergence bidding affect the physical market?

- With virtual bids:
  - No physical energy is delivered or consumed
  - Not backed by physical assets

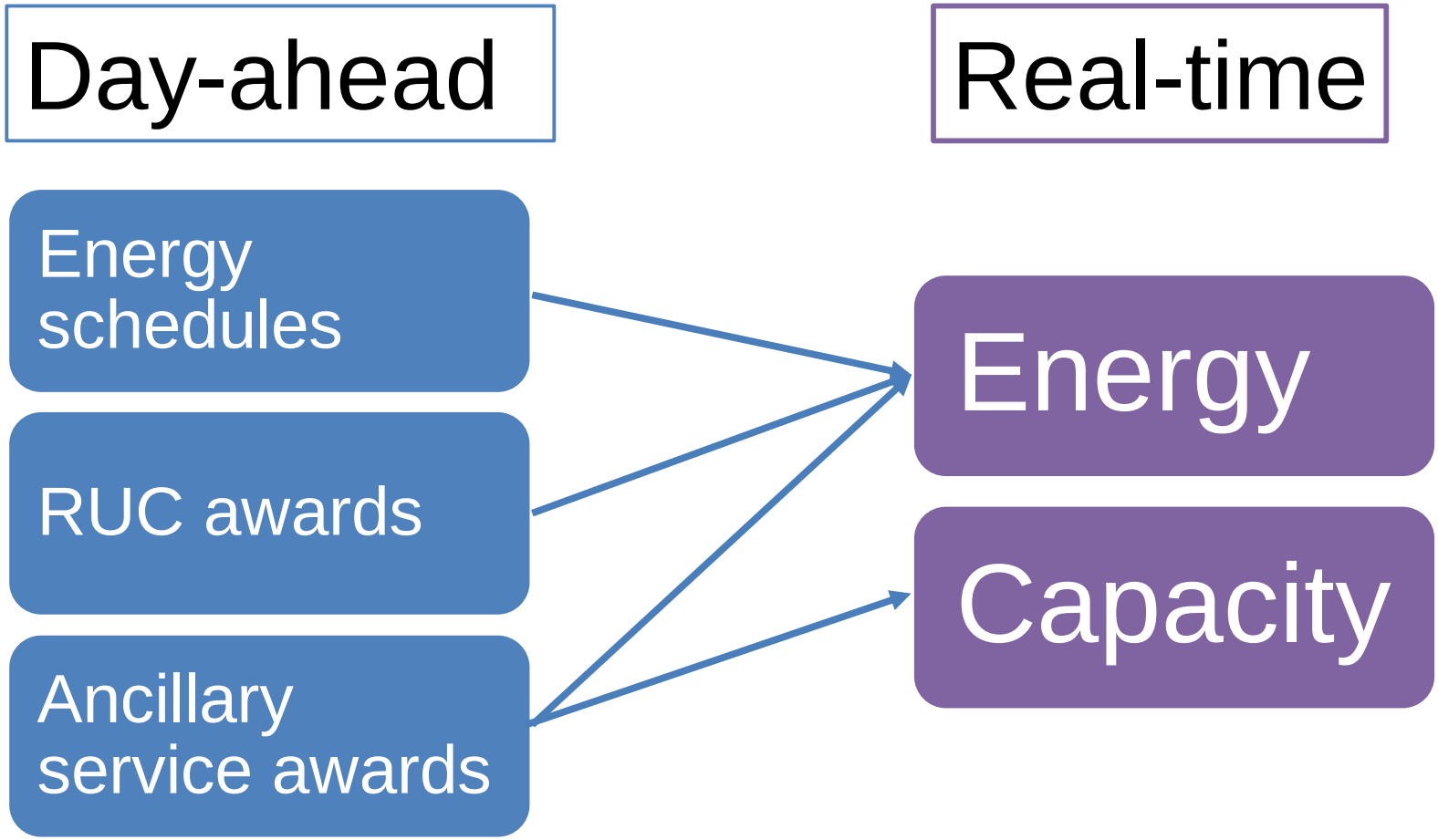
- For SCs who submit both virtual and physical bids, there is no link between the two types of bids

- Impacts
  - Pricing (can set the clearing price)
  - Congestion
  - RUC procurement target



WHAT ARE THE OUTPUTS OF THE DAY-AHEAD MARKET?

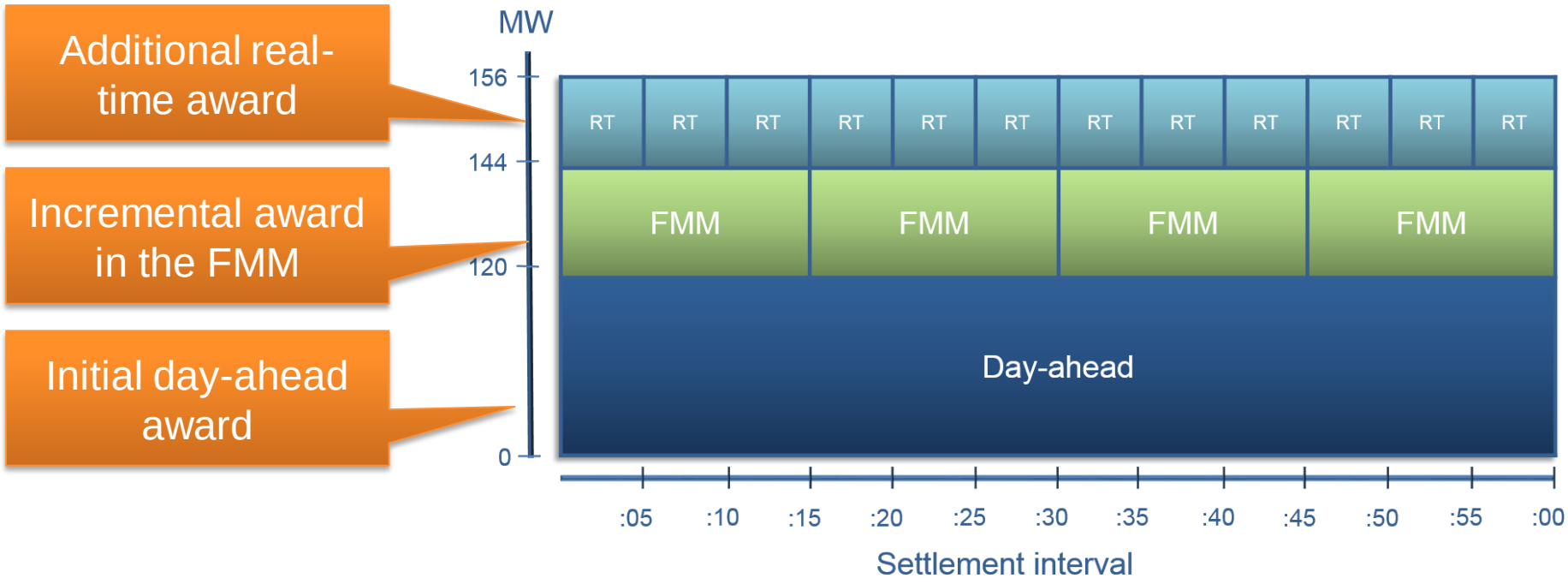
The results of the day-ahead market are a starting point for the real-time market



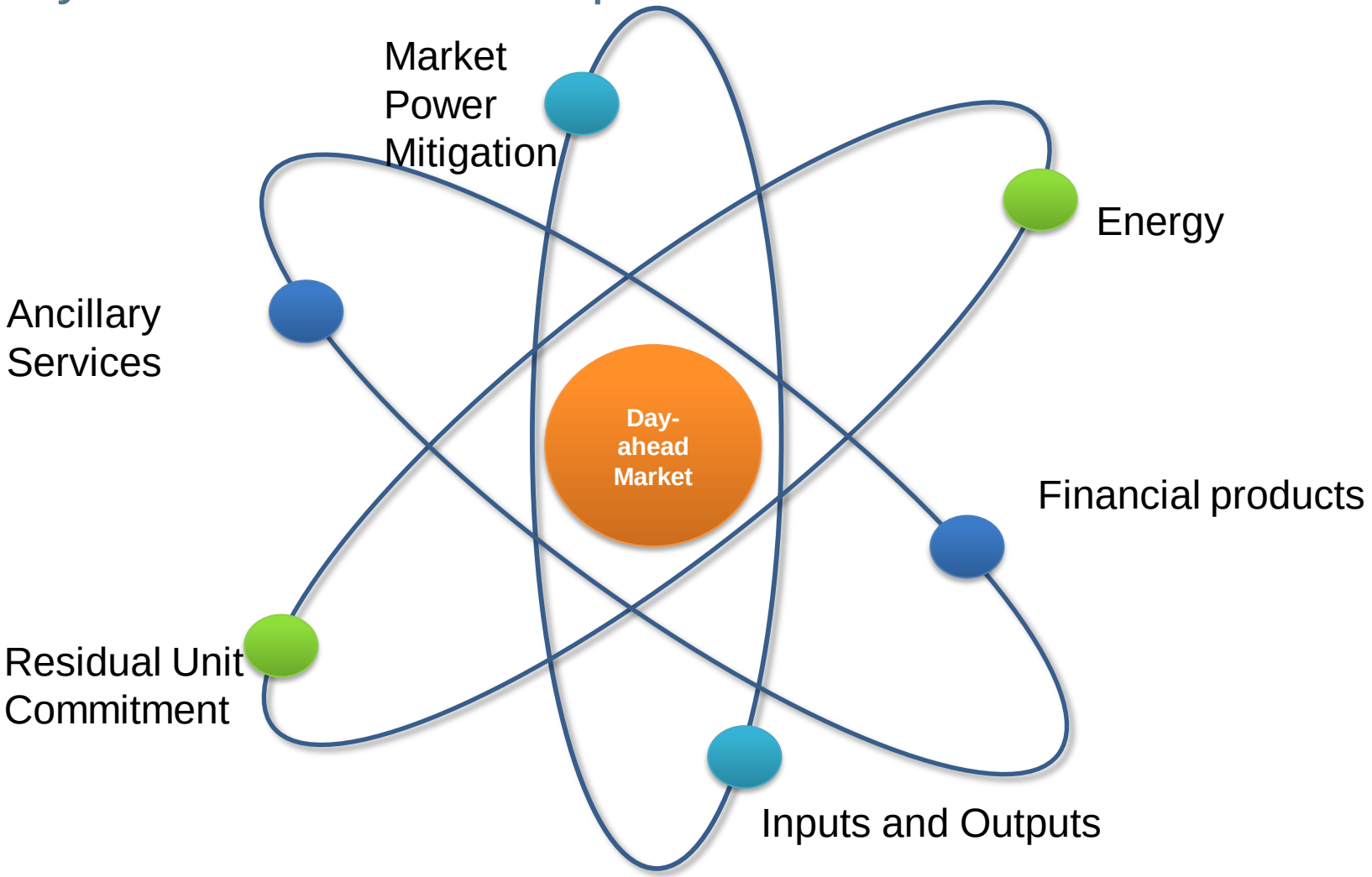
Day-ahead market settlements

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

Energy settlements are broken down by applicable markets



Day-ahead market recap



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