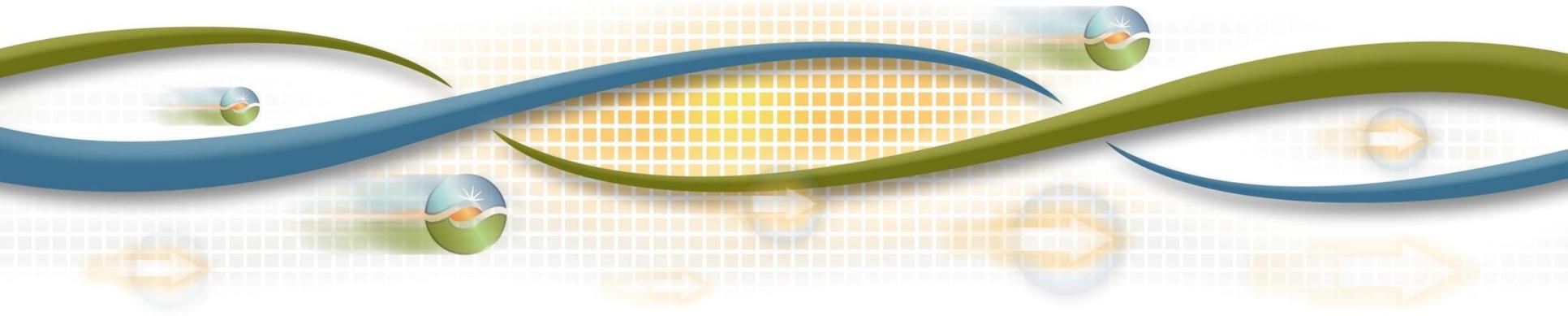
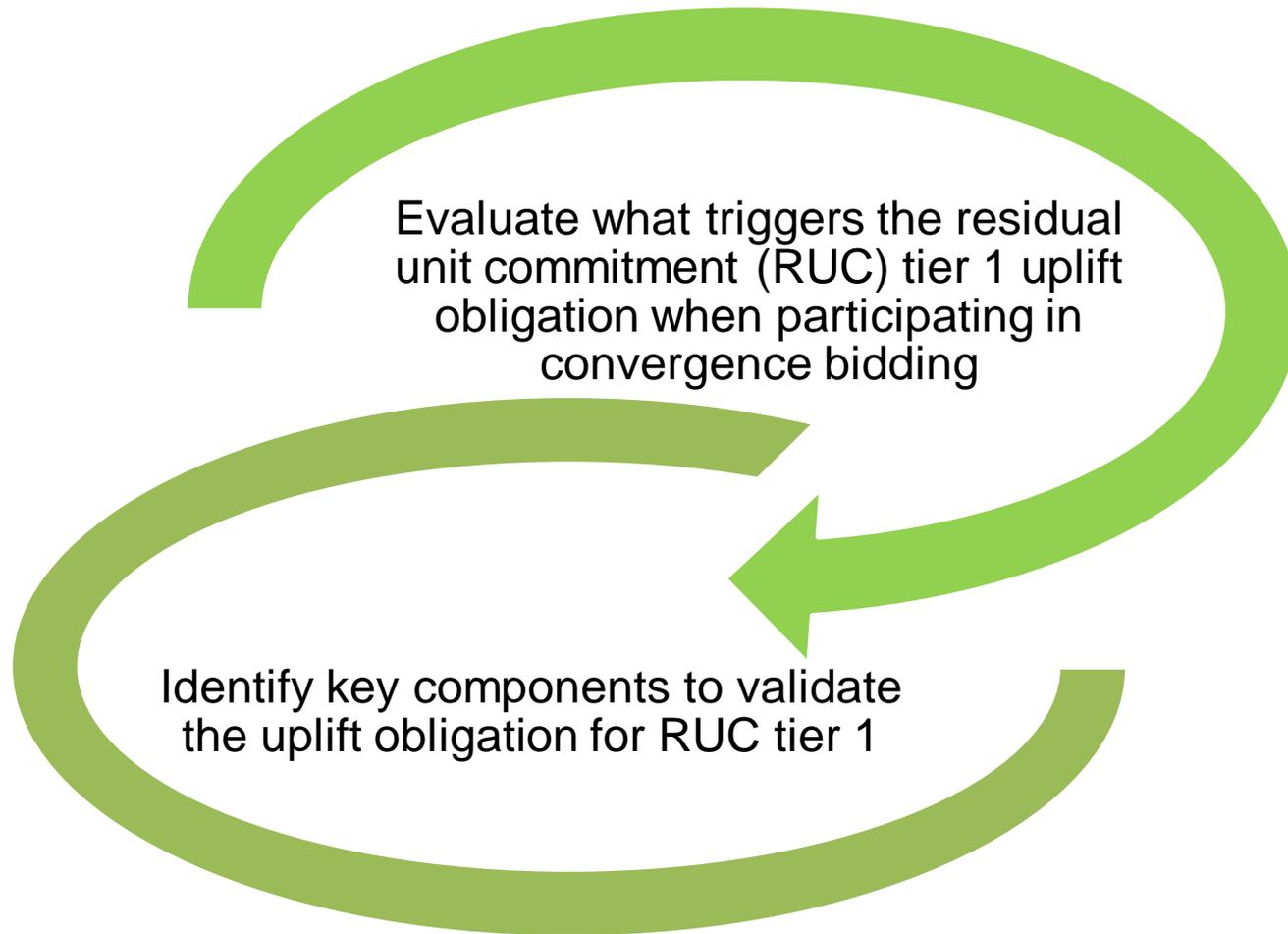


# Convergence bidding

RUC tier 1 obligation uplift



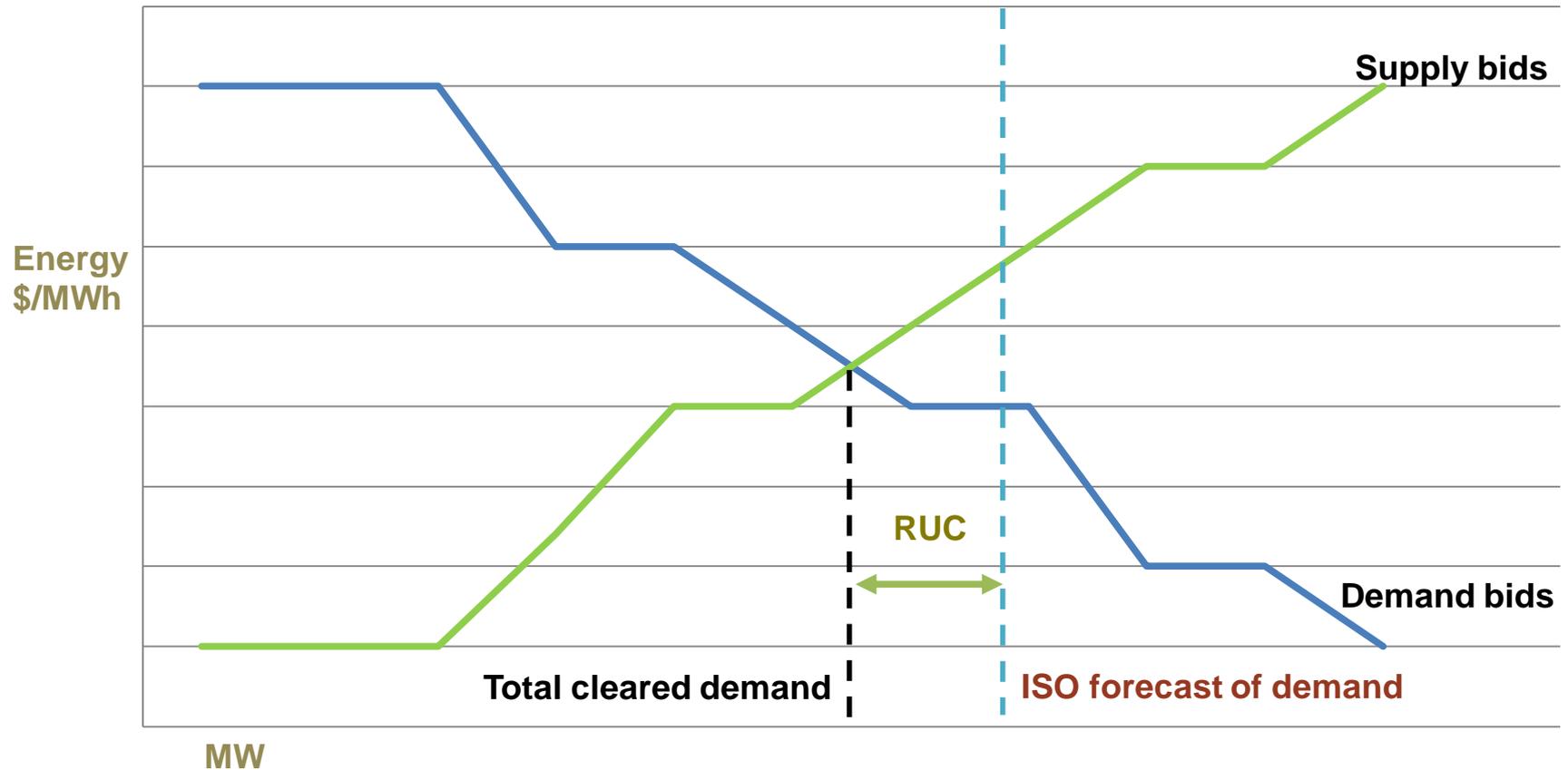
# Module objective



# Purpose of residual unit commitment

- Why do we have residual unit commitment (RUC)?
  - The graph on the following slide indicates the volume (both real and virtual) where supply and demand intersect
    - Market clearing price (MCP) is determined by this intersection point
- If the ISO forecast of ISO demand is greater than the volume that cleared economically through the markets, the ISO will need to procure additional online capacity in the RUC process to make up for the gap between what has been procured and what the ISO needs to run the system.

# Residual unit commitment determination



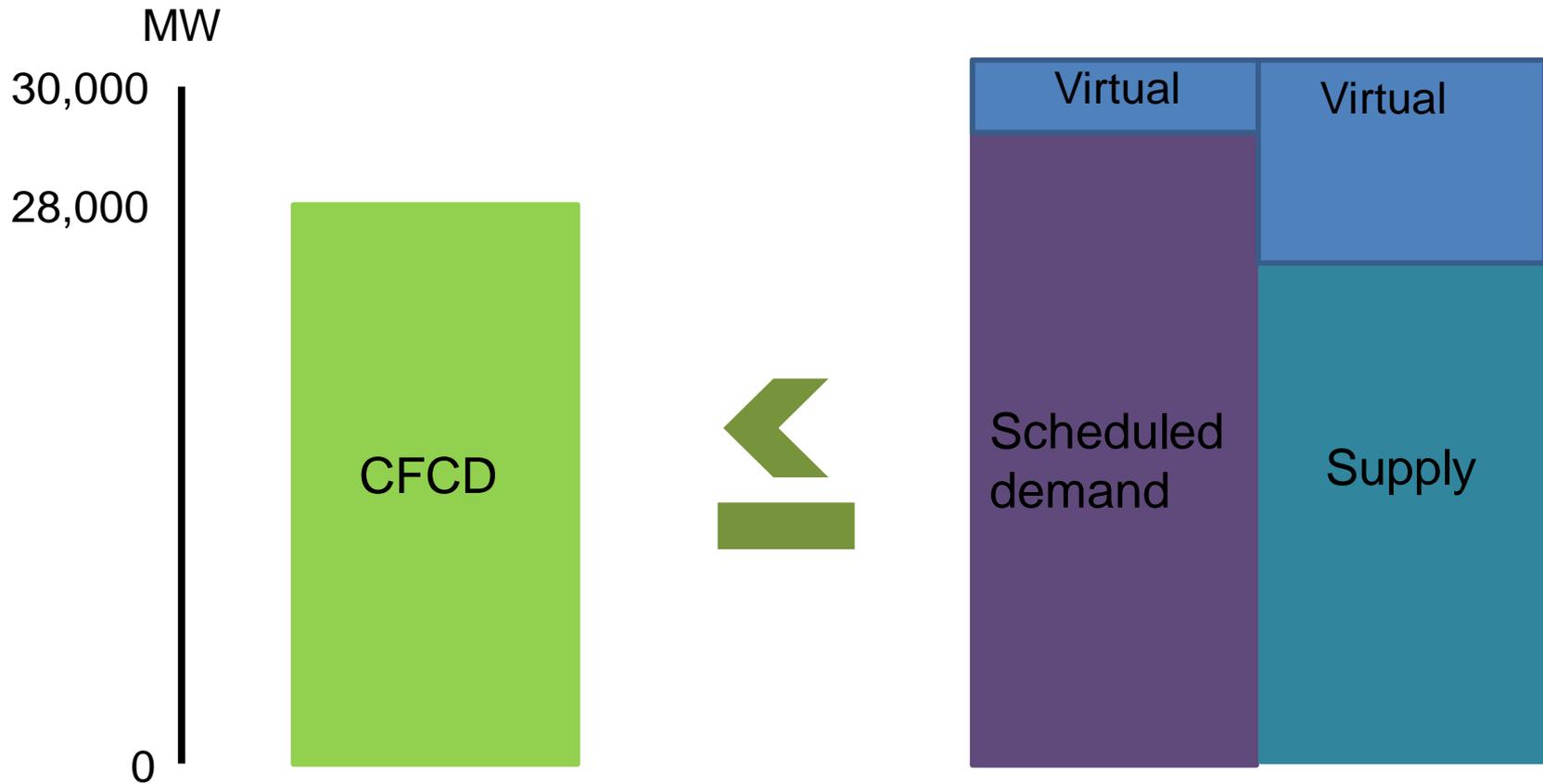
# Convergence bidding – RUC tier 1 uplift obligation

- Allocate RUC tier 1 uplift obligation to virtual supply . . . when system-wide net virtual supply is **positive**
- When ISO forecast  $\leq$  scheduled demand . . .

$$\frac{\text{CFCD}}{28,000} \leq \frac{\text{Scheduled demand}}{30,000}$$

- RUC Tier 1 uplift will be allocated by positive net virtual supply and net negative ISO demand deviation
- ISO will procure RUC up to 28,000 MW

# Convergence bidding - RUC tier 1 uplift obligation



# Obligation for virtual supply to pay RUC tier 1 uplift

- When ISO forecast > scheduled demand . . .

$$\frac{\text{CFCD}}{32,000} > \frac{\text{Scheduled demand}}{30,000}$$

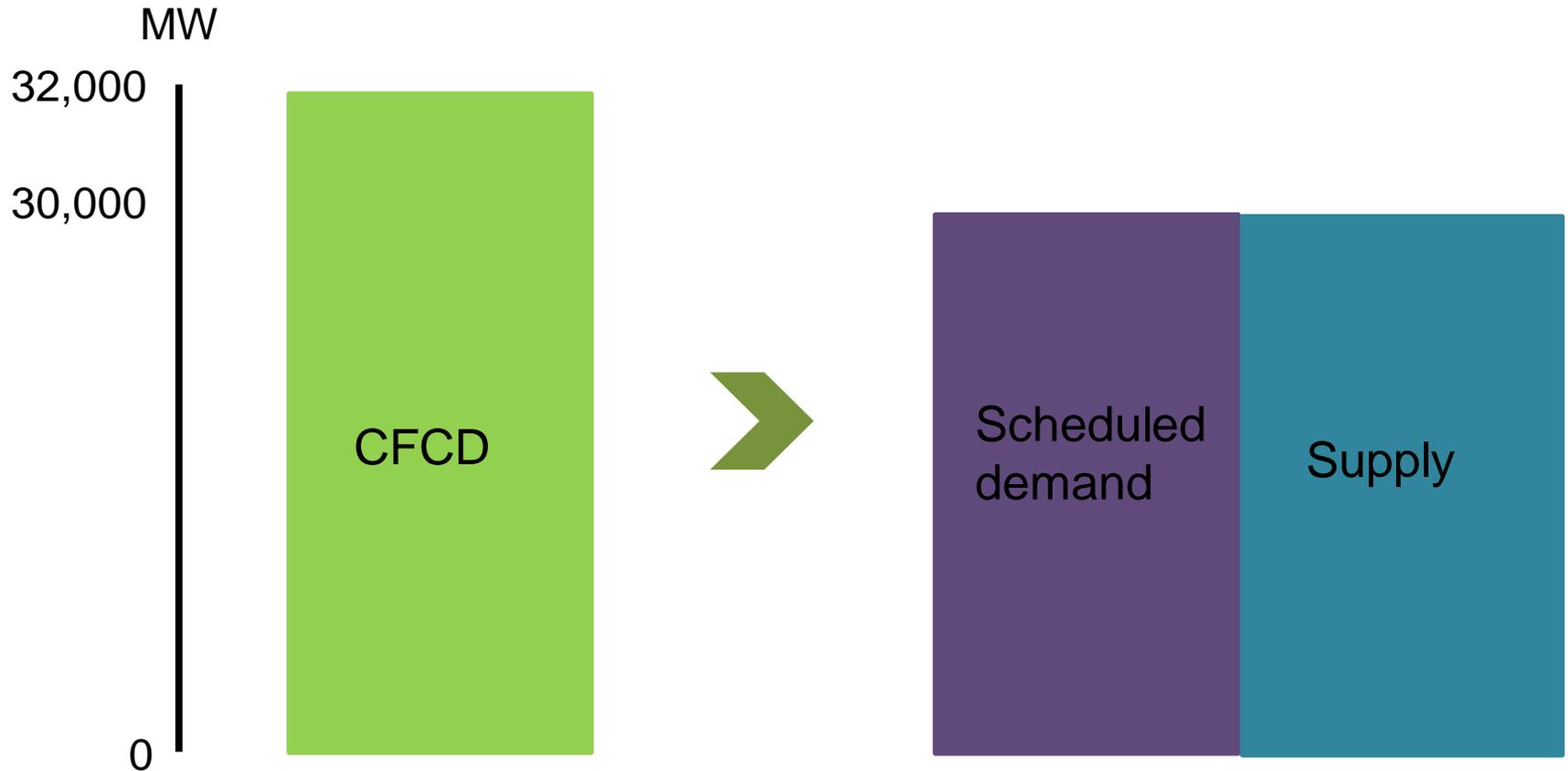
- RUC tier 1 will be allocated to measured demand by ratio share

RUC tier 1 charge =

RUC tier 1 obligation quantity \* RUC tier 1 base rate

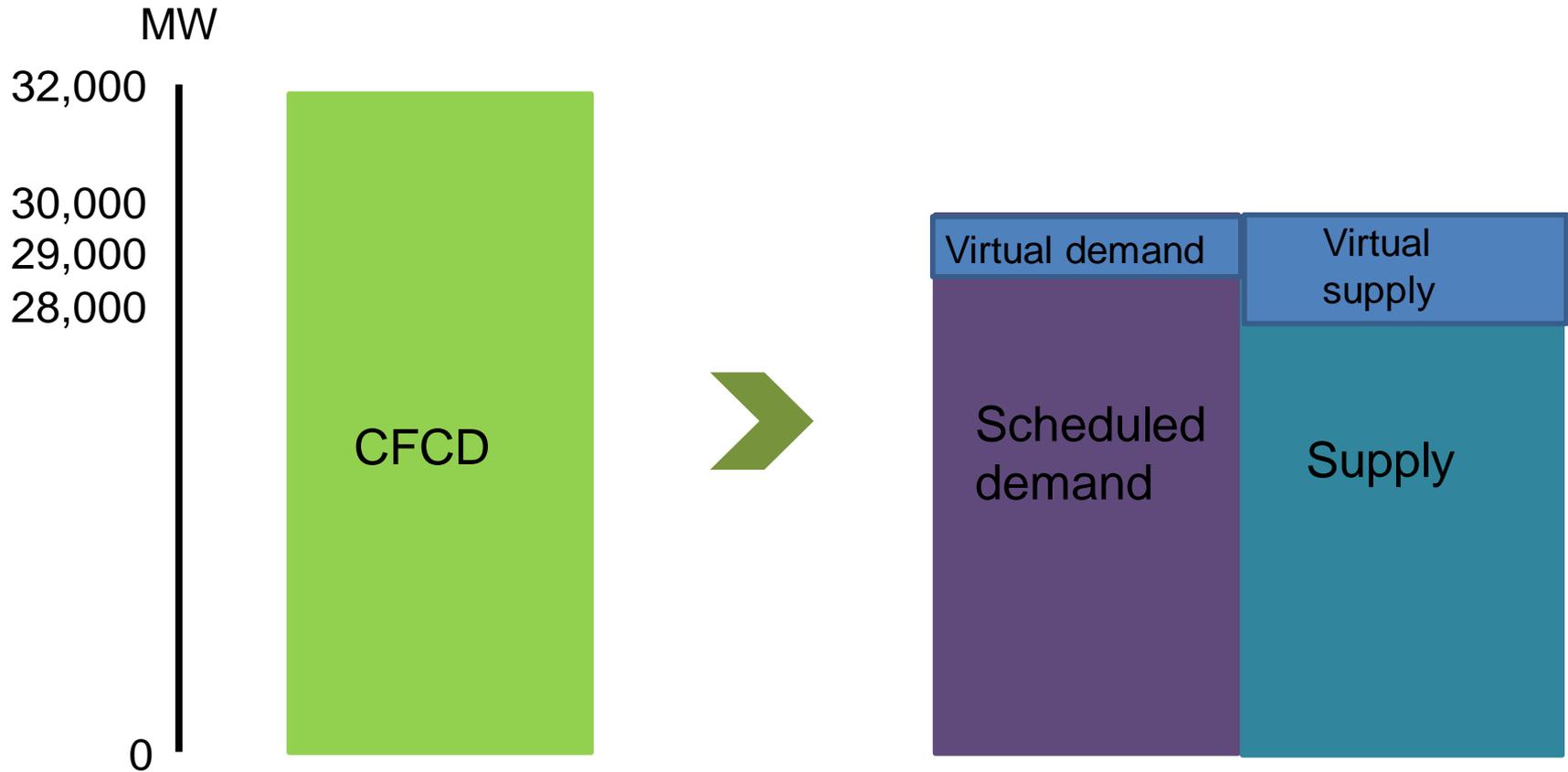
# Convergence bidding - RUC tier 1 uplift obligation

When ISO forecast > scheduled demand . . .



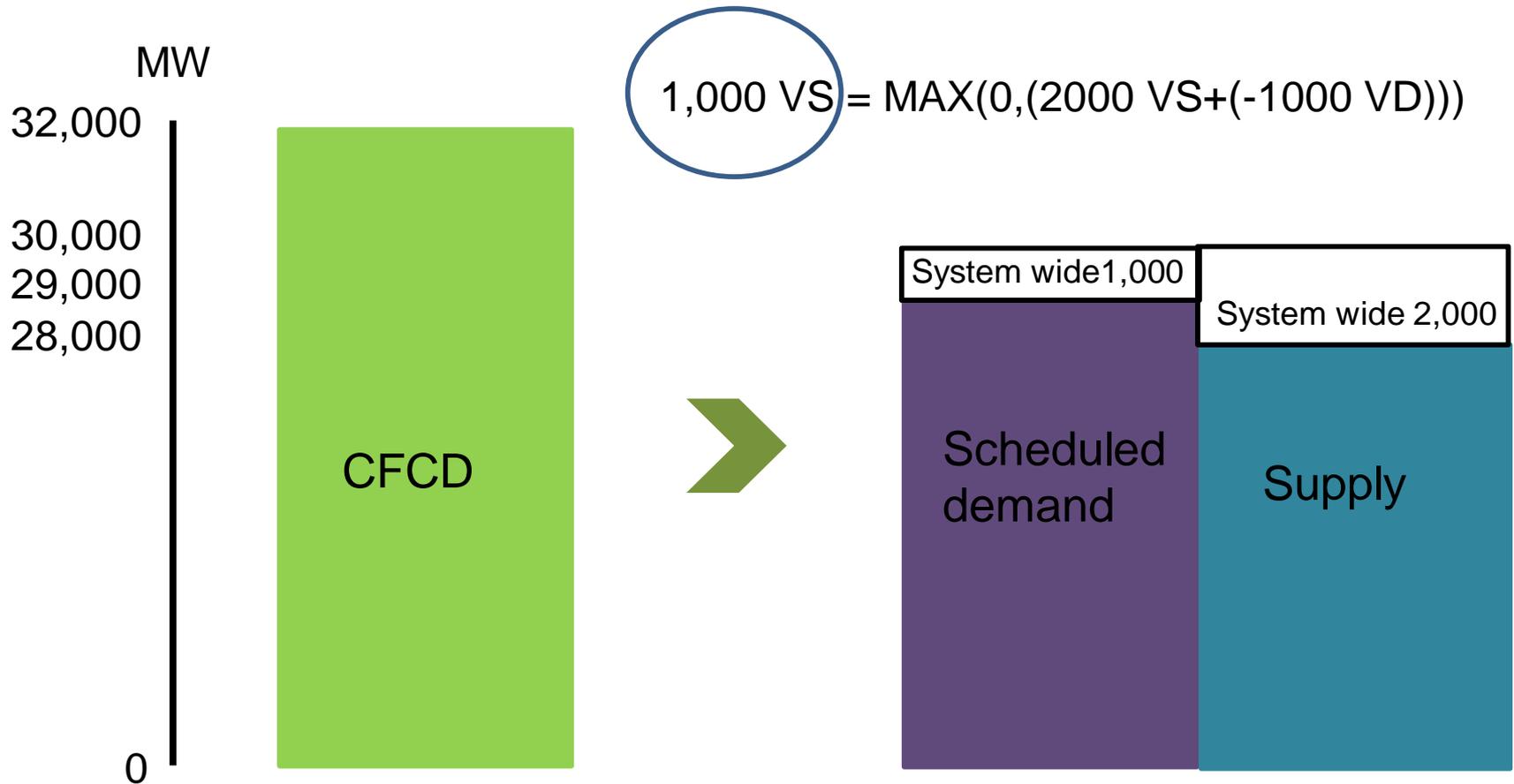
# Convergence bidding - RUC tier 1 uplift obligation

Strip out virtual schedules



# Convergence bidding - RUC tier 1 uplift obligation

Allocate RUC tier 1 uplift obligation to virtual supply . . when system-wide net virtual supply is **positive**



# Obligation for virtual supply to pay RUC tier 1 uplift – quantity

- RUC tier 1 obligation quantity = BA hourly net neg ISO demand deviation (-TORs) + BA hourly virtual supply award obligation
- Where BA hourly net neg ISO demand deviation (-TORs) = Max (0, BA hourly net neg ISO demand deviation – hourly real time TOR deviations for RUC allocation)
- Where BA hourly virtual supply award obligation = (BA hourly DA net positive virtual supply award quantity / ISO hourly DA net positive virtual supply award quantity) \* ISO hourly DA system wide net positive virtual supply award quantity

# Obligation for virtual supply to pay RUC tier 1 uplift – rate

- RUC tier 1 base rate
  - RUC tier 1 base rate used will be the minimum of two other rate calculations
    - ISO hourly RUC tier 1 uplift to meet measured demand rate (ISO hourly RUC tier 1 uplift to meet measured demand rate)
    - ISO hourly RUC tier 1 capacity rate (ISO hourly RUC tier 1 capacity rate)

## Actual formula

RUC tier 1 base rate = Min (ISO hourly RUC tier 1 uplift to meet measured demand rate, ISO hourly RUC tier 1 capacity rate)

# Obligation for virtual supply to pay RUC tier 1 uplift – rate

RUC tier 1 base rate =

ISO hourly total RUC compensation costs to meet measured demand amount  
ISO hrly total RUC tier 1 demand deviation quantity

ISO hrly total RUC compensation costs to meet measured demand amount = \$114.38

ISO hrly total RUC tier 1 demand deviation quantity = 1,141

$$\text{RUC tier 1 base rate}_1 = \frac{\$114.38}{1,141} = 0.10246$$

$$\text{RUC tier 1 base rate} = 0.10246$$

*<sub>1</sub>ISOHourlyRUCTier1UpliftToMeetMeasuredDemandRate*

# Obligation for virtual supply to pay RUC tier 1 uplift - Calculation concept

RUC tier 1 obligation quantity = BA hourly net neg ISO demand deviation (-TORs) + BA hourly virtual supply award obligation

| SCID | Virtual Demand | Virtual Supply | Net VS | RUC Tier 1 Oblig |
|------|----------------|----------------|--------|------------------|
| SC1  | 0              | 20             | 20     |                  |
| SC2  | 0              | 47.8           | 47.8   |                  |
| SC3  | 25             | 100            | 75     | <b>37.44</b>     |
| SC4  | 13             | 5              | -8     | <b>52.04</b>     |
| SC5  | 250            | 343            | 93     | <b>140.41</b>    |

**174.11**

- Where BA hourly net neg ISO demand deviation (-TORs) = Net neg ISO demand deviation – RT TOR deviation for RUC allocation +
- Where BA hourly virtual supply award obligation = (BA hourly DA net positive virtual supply award quantity / ISO hourly DA net positive virtual supply award quantity<sub>1</sub>)\* ISO hourly DA system wide virtual supply award quantity<sub>2</sub>

*<sub>1</sub>ISO hourly DA net positive virtual supply award quantity = 955.12*

*<sub>2</sub>ISO hourly DA system wide virtual supply award quantity = 1,788.12*

# Obligation for virtual supply to pay RUC tier 1 uplift -

- Allocated to SCs with a *positive* net virtual supply position
- RUC tier 1 base rate = 0.100246

| SCID | Virtual Demand | Virtual Supply | Net VS | RUC Tier 1 Oblig | RUC BCR Uplit \$ |
|------|----------------|----------------|--------|------------------|------------------|
| SC1  | 0              | 20             | 20     | 37.44            | \$ 3.75          |
| SC2  | 0              | 47.8           | 47.8   | 52.04            | \$ 5.21          |
| SC3  | 25             | 100            | 75     | 140.41           | \$ 14.07         |
| SC4  | 13             | 5              | -8     |                  |                  |
| SC5  | 250            | 343            | 93     | 174.11           | \$17.45          |

- RUC tier 1 charge = RUC tier 1 obligation qty. \* RUC tier 1 base rate

## Module summary

- RUC tier 1 uplift obligation is allocated when system-wide net virtual supply is positive
- Virtual supply obligation to pay RUC tier 1 uplift would be based on pro-rata share of the total obligation as determined by their total net virtual supply awards

## Module summary

- Virtual bids are only used in the IFM process
- IFM process clears bid in supply and bid in demand, regardless of whether the bids are virtual or physical
- For each bidding location, all virtual bids submitted for that location are aggregated together to be used in the day-ahead market
- One multi-segment virtual supply bid / one multi-segment virtual demand bid will be created for each node

## Module summary

- Virtual awards are liquidated at the real-time price, the simple average of the twelve 5-minute interval prices
- Virtual awards at the interties are liquidated at the HASP price