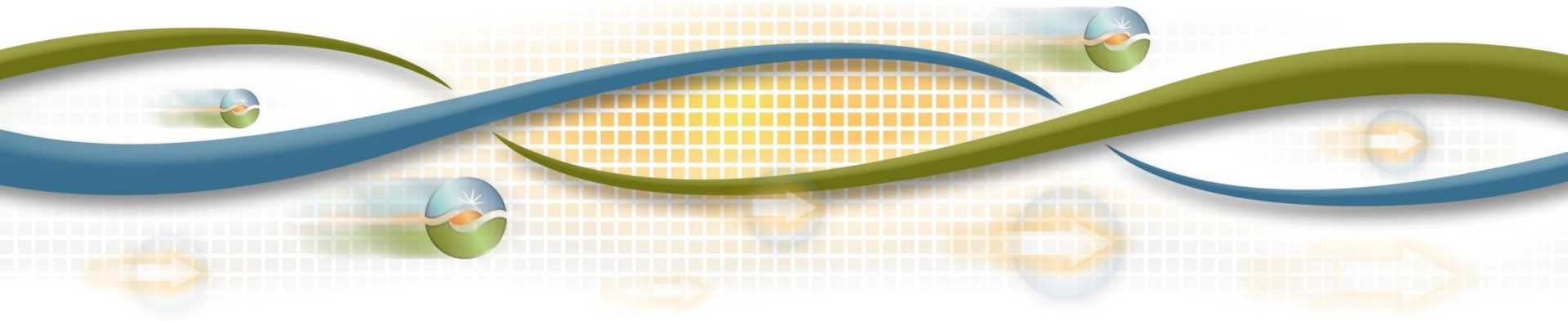
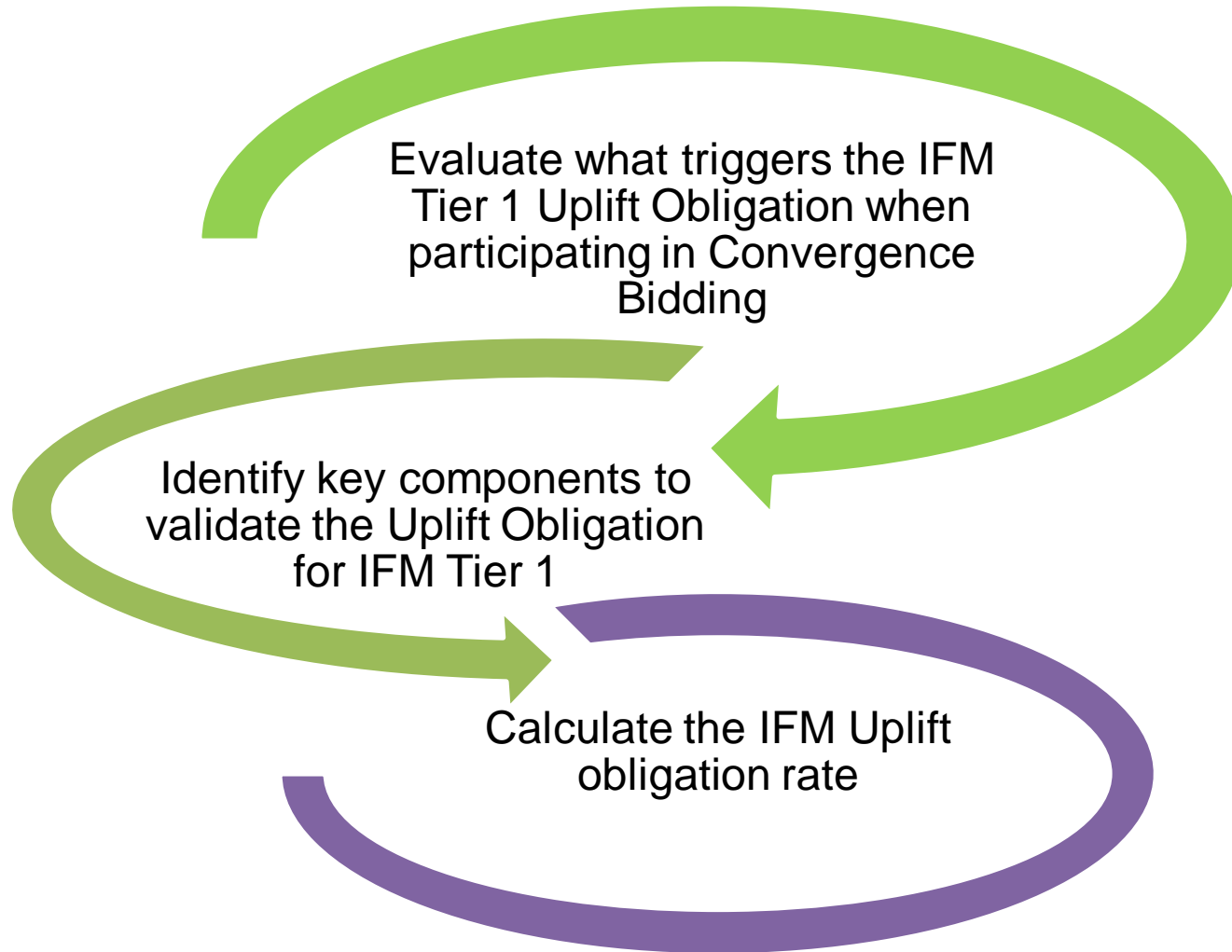


Convergence bidding

IFM tier 1 uplift obligation



Module Objectives



Convergence Bids - financial positions taken in the day-ahead market and liquidated in FMM

Virtual Demand

- Bid to buy at day-ahead price/sell at real-time price
- Looks like price sensitive demand

Virtual Supply

- Bid to sell at day-ahead price/buy at real-time price
- Looks like a dispatchable supply resource

Defining convergence (virtual) bids - review

- Supported in day-ahead market only
- Bid to buy (virtual demand) is charged the day-ahead LMP and is considered a “long” position
- Bid to sell (virtual supply) is paid the day-ahead LMP and is considered a “short” position
- Virtual supply offers and virtual demand bids may be submitted at any eligible pricing node in CAISO system
- Does not require any physical generation or load
- Virtual bids can set the price

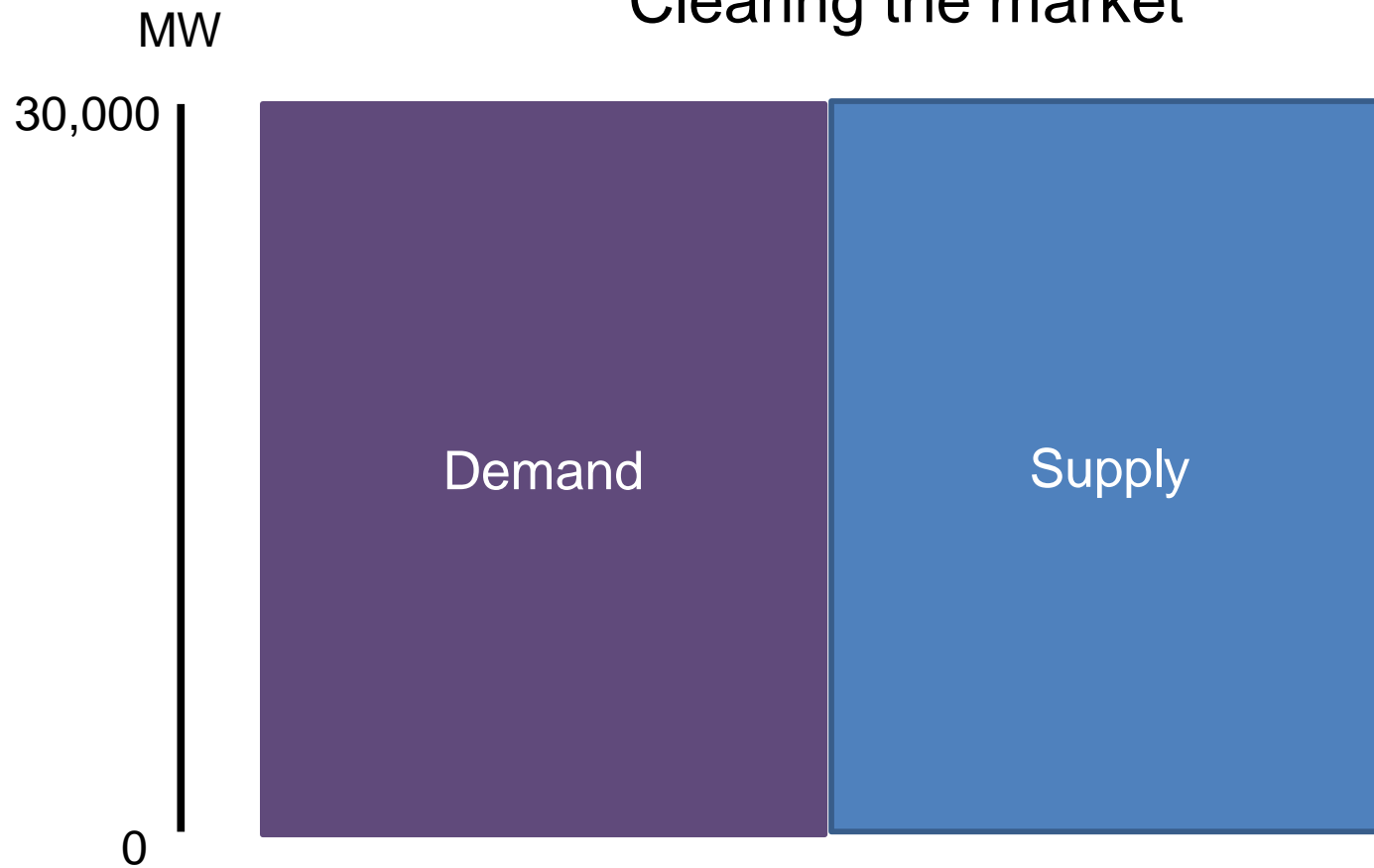
Convergence bidding - IFM tier 1 uplift obligation

- When system-wide net virtual demand is **positive**..... IFM Tier 1 Uplift Obligation will apply.
- Obligation uplift for virtual demand is based on how much *additional* unit commitment was driven by net virtual demand that resulted in IFM clearing above what was needed to satisfy measured demand.

$$\text{IFM Tier 1 Uplift Charge} = \text{IFM Tier 1 Uplift Obligation} * \text{IFM Tier 1 Uplift Rate}$$

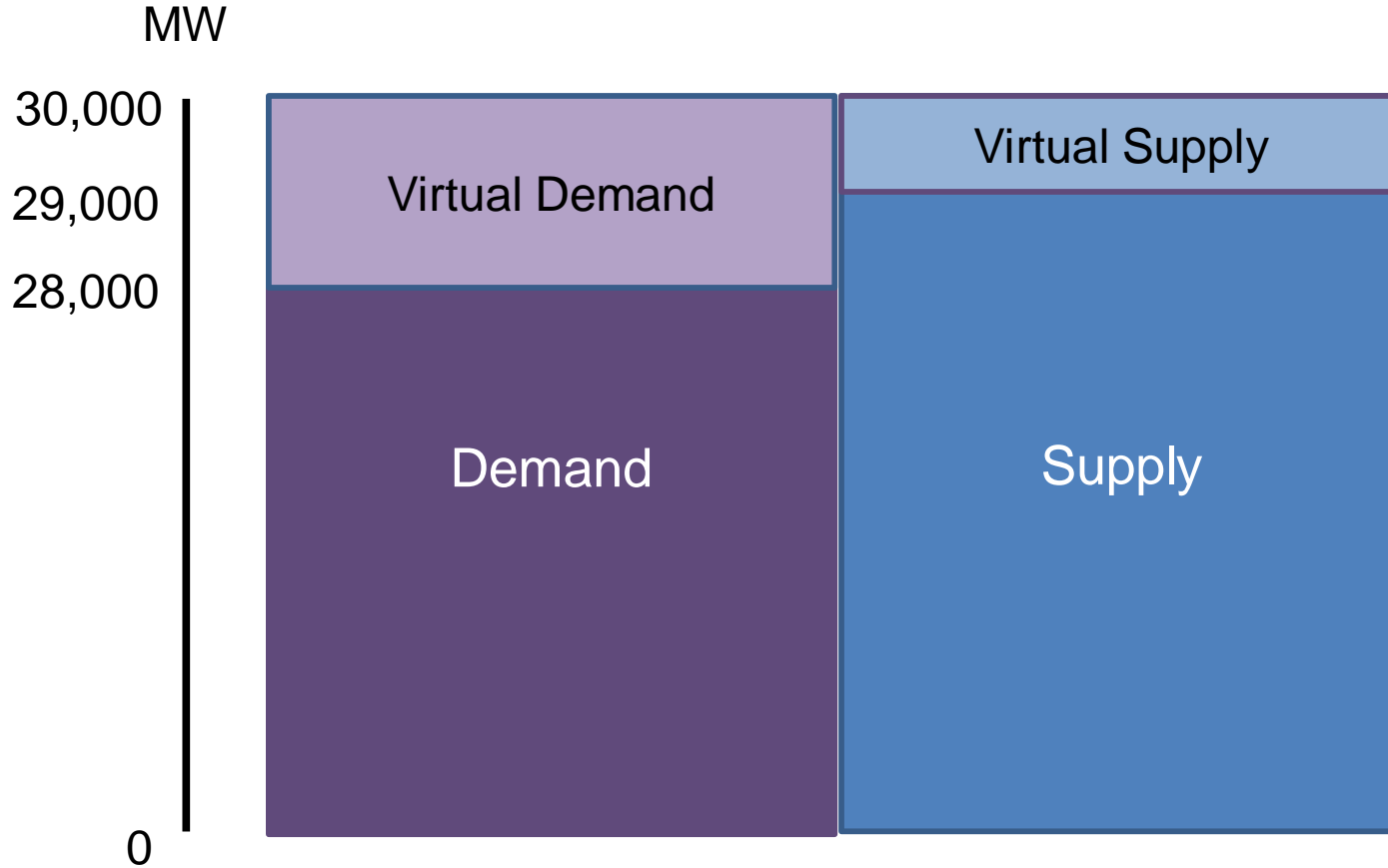
Convergence bidding - IFM tier 1 uplift obligation

Clearing the market

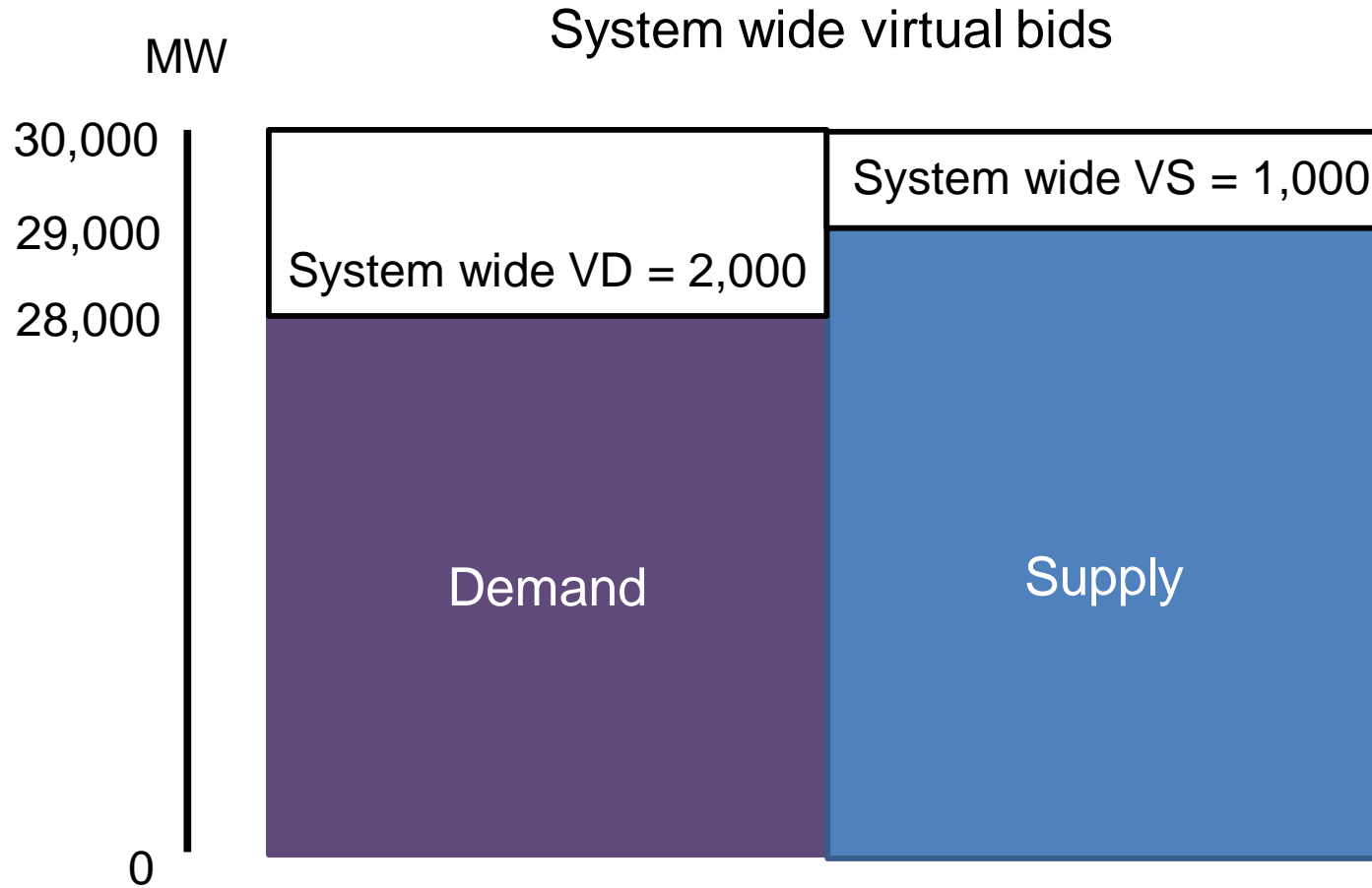


Convergence bidding - IFM tier 1 uplift obligation

Physical vs Virtual

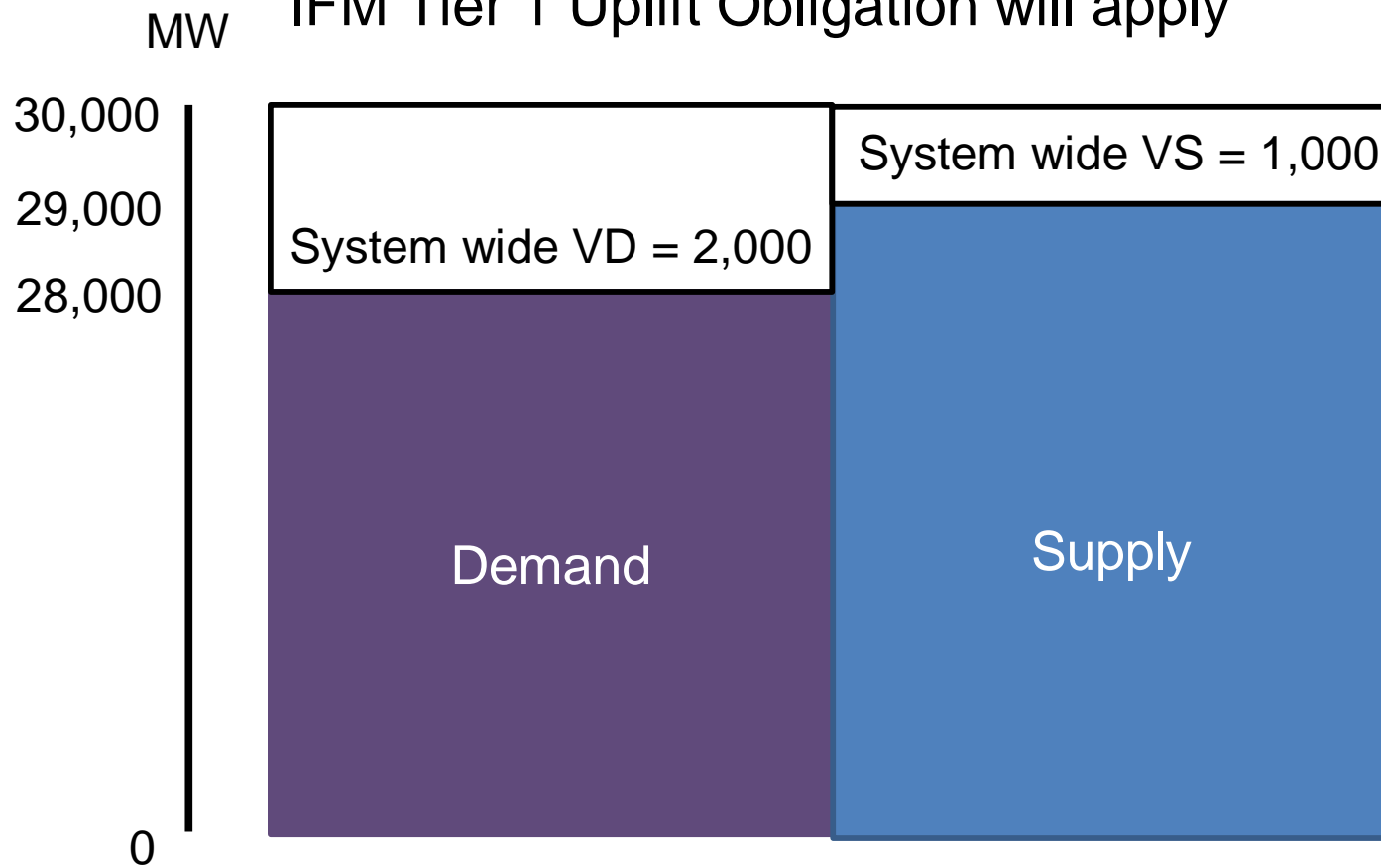


Convergence bidding - IFM tier 1 uplift obligation



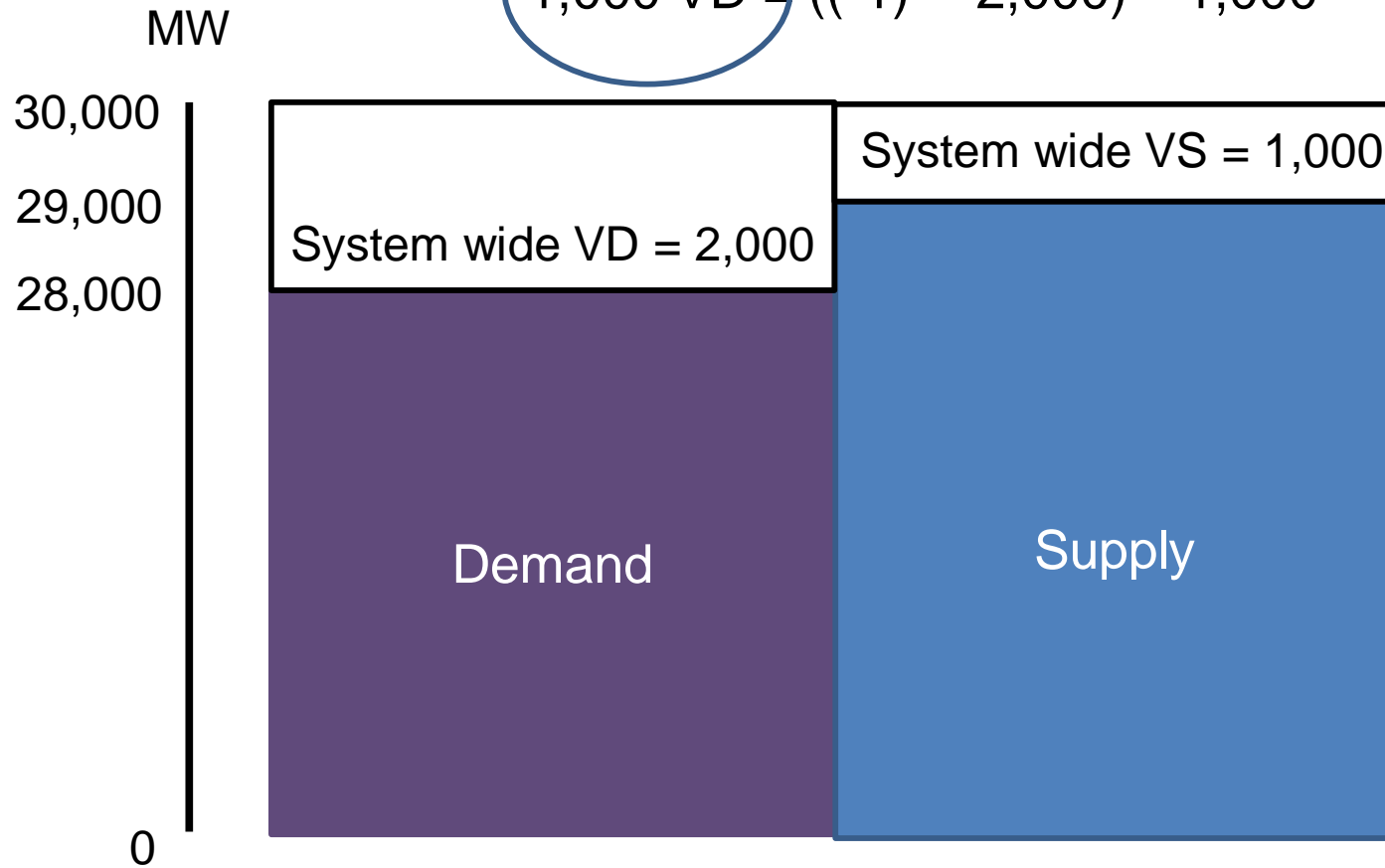
Convergence bidding - IFM tier 1 uplift obligation

When system-wide net virtual demand is **positive**.....
IFM Tier 1 Uplift Obligation will apply



Convergence bidding - IFM tier 1 uplift obligation

$$1,000 \text{ VD} = ((-1) * -2,000) - 1,000$$



Convergence bidding - IFM tier 1 uplift obligation

IFM Tier 1 Uplift Obligation =
IFM Load Uplift Obligation +
IFM VD Award Uplift Obligation

Where IFM Load Uplift Oblig =
Physical Demand – Physical Supply

Where IFM VD Award Uplift Oblig. =
(BAHourlyDANetPositiveVirtualDemand/CAISOHourly
DANet Positive VirtualDemandAwardQuantity)*
IFMSystemWideVirtualDemandAwardUpliftObligation

Convergence bidding - IFM tier 1 uplift obligation

- Rate
 - IFM Tier1Uplift Rate used will be the minimum of two rate calculations
 - IFM Physical Load Rate (IFMPhysicalLoadRate)
 - IFM Obligation Rate (IFMObligationRate)

Actual Formula

$$\text{IFMTIER1UPLIFTRate} = \text{Min}(\text{IFMPhysicalLoadRate}, \text{IFMObligationRate})$$

Convergence bidding - IFM tier 1 uplift obligation

- IFM Obligation Rate (IFMObligationRate)
 - This rate is based on CAISO Hrly Total IFM Uplift amount / CAISO total IFM Load and Virtual Demand obligation
- IFM Physical Load Rate(IFMPhysicalLoadRate)
 - This rate is based on CAISO Hrly Total IFM Uplift amount / maximum of the CAISO total IFM Load Uplift Obligation or Total IFM Capacity
- CAISO Hourly Total IFM Uplift amount
 - Common to both rates...the denominator of the two is the difference

IFM tier 1 uplift obligation example – IFM Obligation Rate

$$\text{IFM Obligation Rate} = \frac{\text{CAISO Hrly Total IFM Uplift Amount}}{\text{CAISO Total IFM Load and Virtual Demand Obligation}}$$

CAISO Hrly Total IFM Uplift Amount (Pre-Calc of BCR) = \$19,430

CAISO Total IFM Load and Virtual Demand Obligation = 6,047

$$\text{IFM Obligation Rate} = \frac{\$19,430}{6,047} = 3.213$$

IFM Tier 1 Uplift Rate (IFM Obligation Rate) = 3.213

Obligation for Virtual demand to pay IFM Tier 1 Uplift – Calculation

IFM Tier 1 Uplift Obligation = IFM Load Uplift Obligation + IFM VD Award Uplift Obligation

SCID	Virtual Demand	Virtual Supply	Net VD	IFM Tier 1 Oblig
SC1	20	0	20	1.72
SC2	47.8	0	47.8	4.11
SC3	100	25	75	6.45
SC4	5	13	-8	
SC5	343	250	93	8.00

- Where IFM Load Uplift Oblig = Physical Demand – Physical Supply +
- Where IFM VD Award Uplift Oblig. =
 $(\text{BAHourlyDANetPositiveVirtualDemand} / \text{CAISOHourlyDANetPositiveVirtualDemandAwardQuantity}_1)^* \text{IFMSystemWideVirtualDemandAwardUpliftObligation}_2$

¹ CAISOHourlyDANetPositiveVirtualDemandAwardQuantity = 740

² IFMSystemWideVirtualDemandAwardUpliftObligation = 63.68

Obligation for Virtual Demand to pay IFM Tier 1 Uplift - Allocation

- Allocated to SCs with a positive net virtual demand position
- IFM Tier 1 Charge = IFM Tier 1 Uplift Obligation * IFM Obligation Rate
 - IFM Obligation Rate = 3.213

SCID	Virtual Demand	Virtual Supply	Net VD	IFM Tier 1 Oblig	IFM BCR Uplift \$
SC1	20	0	20	1.72	\$ 5.53
SC2	47.8	0	47.8	4.11	\$ 13.22
SC3	100	25	75	6.45	\$ 20.74
SC4	5	13	-8		
SC5	343	250	93	8.00	\$ 25.72

Module summary

- When is IFM tier 1 uplift obligation is triggered?
 - When the system wide virtual or physical demand is positive
- The SC will be allocated IFM tier 1 uplift obligation if...
 - The portfolio has a positive net virtual or physical demand