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Helping our members work together to keep the lights on... today and in the future



Utilities must ensure electric reliability and affordability

SPP has proven energy imbalance markets can make this easier and more cost effective

We appreciate the potential of launching a market that would benefit all participants in the Western Interconnection





# SPP WESTERN ENERGY IMBALANCE SERVICE MARKET (WEIS) OVERVIEW

NOVEMBER 2019

*Helping our members work together to keep  
the lights on... today and in the future.*



SouthwestPowerPool



SPPorg



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3

## AGENDA

- SPP Experience
- Introduction to WEIS
- WEIS Project Details
- Market Basics
- WEIS Entities and Documentation
- WEIS Key Concepts



# SPP EXPERIENCE

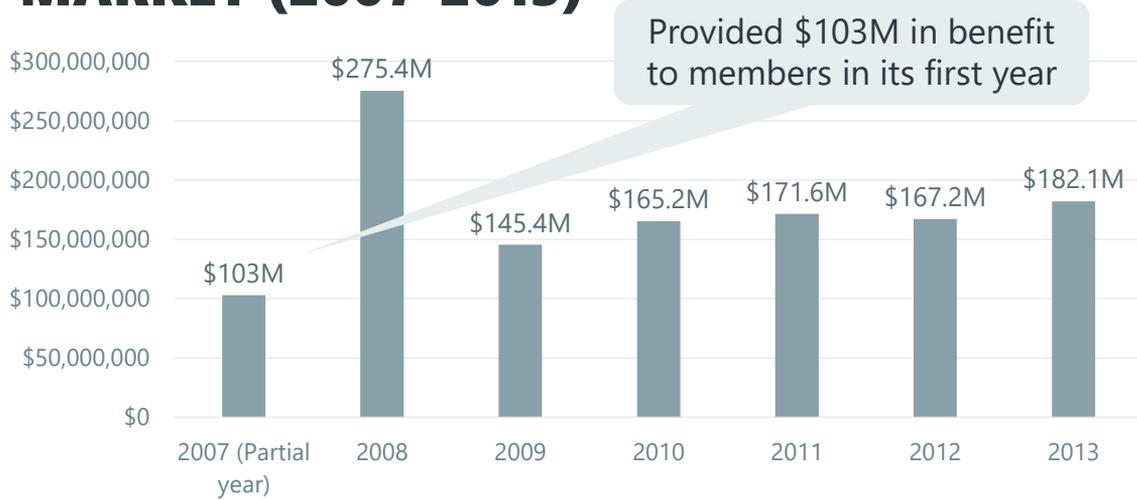


## YEARS OF EXPERIENCE

**Energy Imbalance Service (EIS) Market:**  
3/1/2007 through 3/1/2014



# YEARLY NET BENEFITS OF SPP'S EIS MARKET (2007-2013)



■ Net Benefits

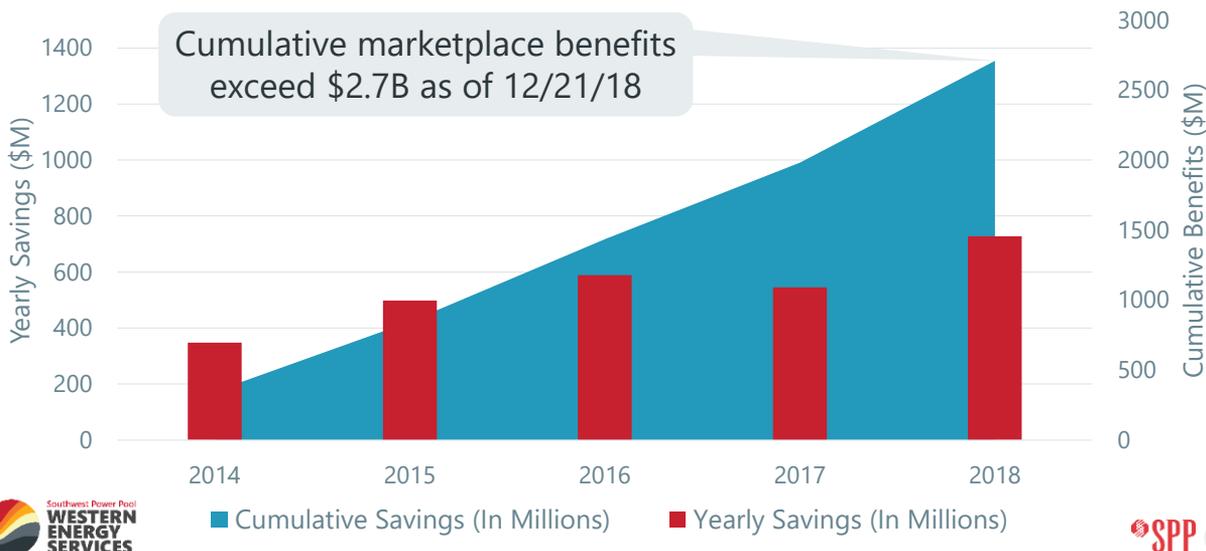


## YEARS OF EXPERIENCE

**Integrated Marketplace:**  
3/1/2014 to Present



# YEARLY NET BENEFITS OF SPP'S INTEGRATED MARKETPLACE (2014-PRESENT)

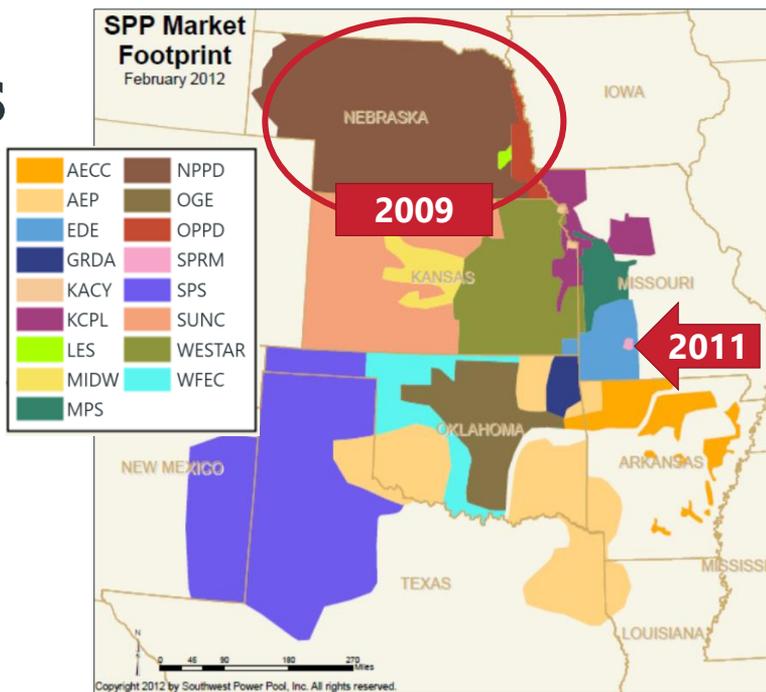


## BALANCING AUTHORITIES

Began with 12 Balancing Authorities (BAs) (2007)

NPPD, OPPD, and LES (2009)

City of Springfield Utilities (2011)



## EIS MARKET STATS



50  
Participants



627  
Resources



46.3 GW  
Peak Load

# INTRODUCTION TO WEIS

## WESTERN ENERGY SERVICES

Family of contract-based products offered to new customers in Western Interconnection:

- Unscheduled Flow Mitigation (currently providing)
- Western Reliability Coordination Services (Dec. 3, 2019)
- Western Energy Imbalance Service Market (WEIS) (Feb. 2021)
- Planning Coordination (discussing with prospective customers)

RTO Membership not required

## WEIS OVERVIEW

- SPP contract-based energy imbalance service market
- Separate and distinct from SPP's role as RTO
- Operated under separately filed WEIS Tariff
- Leverages best practices from SPP's market administration since 2007
- Foundational constructs already in place

# THE WEIS WILL:



Balance  
Generation and  
Load



Centrally  
Dispatch  
Energy



Respect  
Existing  
Constructs



Enhance  
Reliability and  
Affordability



Provide Price  
Transparency



Accounts for  
Bilateral Trading



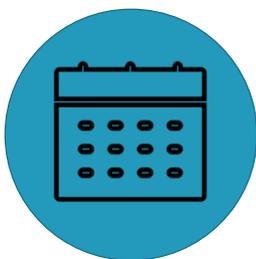
Leverage Existing  
Systems/  
Processes



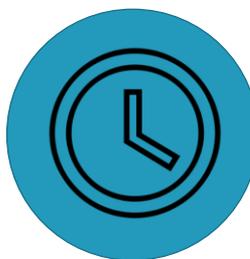
# WEIS HIGHLIGHTS



All Load and  
Resources in  
participating  
BA subject to  
**financial settlement**



Participants  
control financial  
impact through  
**energy schedules**



**5-minute  
imbalance  
settlement**

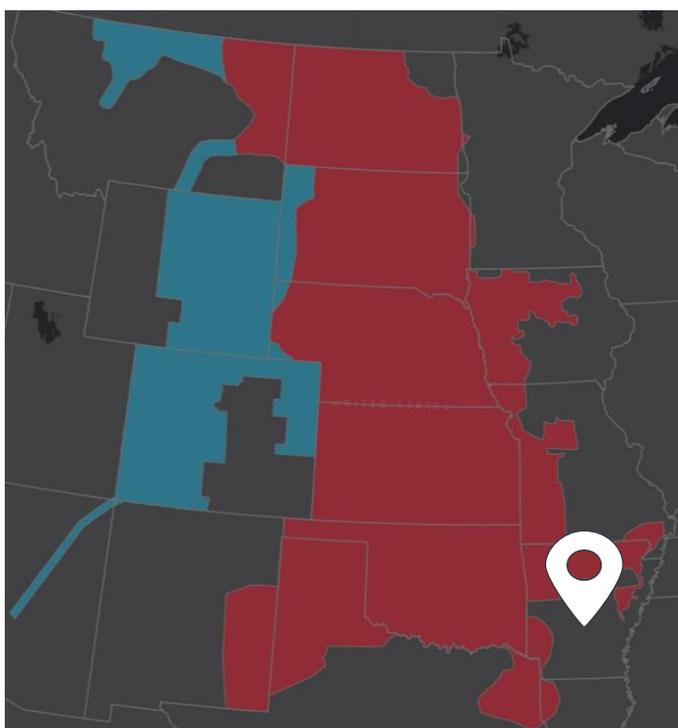


Offer-based  
**economic dispatch**  
is system-wide and  
calculated every five  
minutes



## THE WEIS WILL NOT PROVIDE:

-  Consolidated Balancing Authority
-  Day-Ahead Market
-  Transmission Congestion Rights
-  Ancillary Services
-  Reliability Coordination
-  Transmission Planning
-  Consolidation of Transmission Tariffs



## SPP'S ROLE

Oversee market activities

Support reliability

Assess supply adequacy

Provide oversight via SPP's Market Monitoring Unit



## WHY SPP?

### Homogenous Market with Single Protocol

Same language = Easier to get shadow settlement system

Same language = Easier to track market results

Modeling allows each entity to settle directly with SPP

Market monitor can monitor all participants, not just BAs



## WHY SPP?

### Proven track record of implementation

Benefit estimations include uplift

Supply adequacy reviewed to ensure balance

Native Load Hedging simplifies work for MPs

# WHY SPP?

**SPP governance where stakeholders make decisions**

Image: RTO Insider

# WHY SPP?

**Extensive experience integrating separate state/  
utility resource plans to ensure all parties benefit**



# WHY SPP?

## The SPP Culture

- Relationship-based
- Member-driven
- Independence Through Diversity
- Evolutionary vs. Revolutionary
- Reliability and Economics Inseparable



# WEIS PROJECT DETAILS

## WEIS ADMINISTRATION

Costs paid based on proportional share of Net Energy for Load (NEL)

Initial rate \$0.22 per MWh of NEL

Adjusted each year based on SPP costs and NEL of participants



## WEIS ADMINISTRATION



Four-year initial commitment

No long-term commitments after first four years



# MARKET DOCUMENTATION



**Western Joint Dispatch Agreement (WJDA)**

**WEIS Tariff**

**Market Protocols**

Define WEIS terms, procedures, responsibilities, and obligations

Changes made through Western Markets Executive Committee (WMEC)



# WEIS ADMINISTRATION

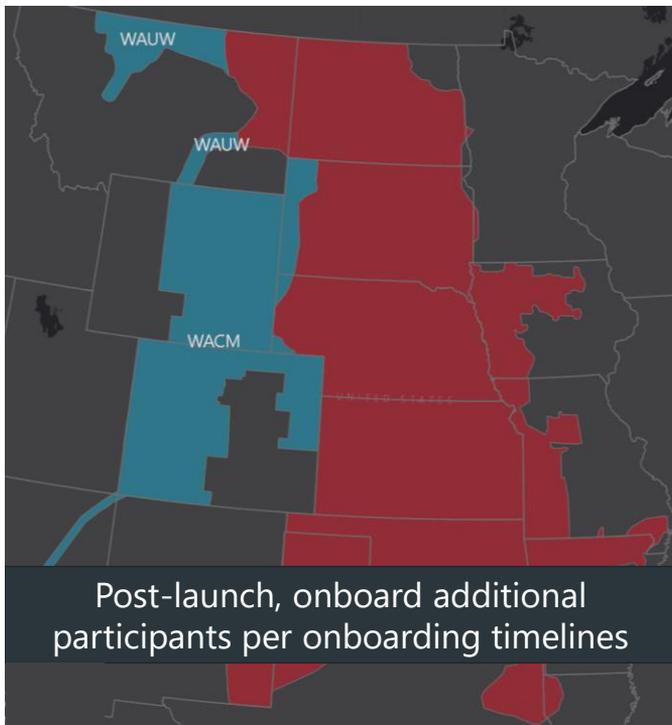
Operated under Western Joint Dispatch Agreement (WJDA)

Evolution of market through Western Markets Executive Committee (WMEC)

**I Agree**





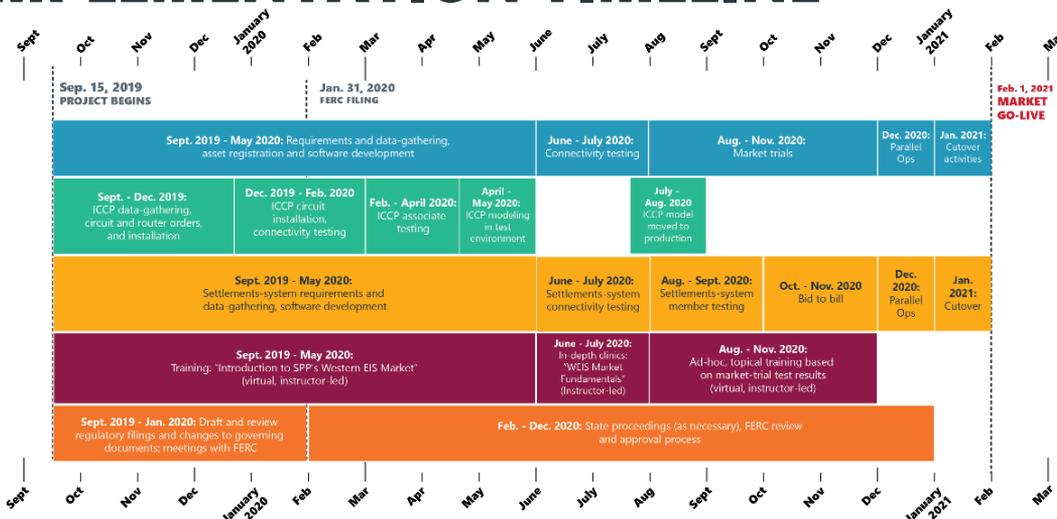


# CURRENT WEIS STATUS

## Five initial participants:

- Basin Electric
- Tri-State G&T
- WAPA Colorado River Storage Project (CRSP)
- WAPA Rocky Mountain Region (RMR)
- WAPA Upper Great Plains Region (UGP)

# IMPLEMENTATION TIMELINE



- Market implementation and market-participant onboarding
- Inter-control room communication protocol (ICCP) implementation
- Settlement-system implementation
- Training
- Regulatory process and governance

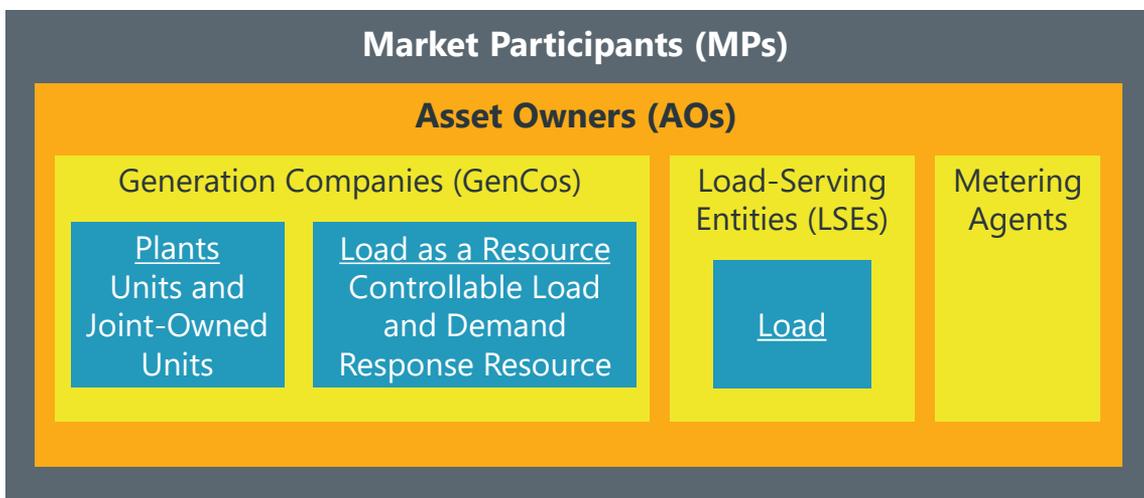
# WEIS ENTITIES AND DOCUMENTATION



## MARKET ENTITIES

Functional Roles

Assets



## MP OBLIGATIONS

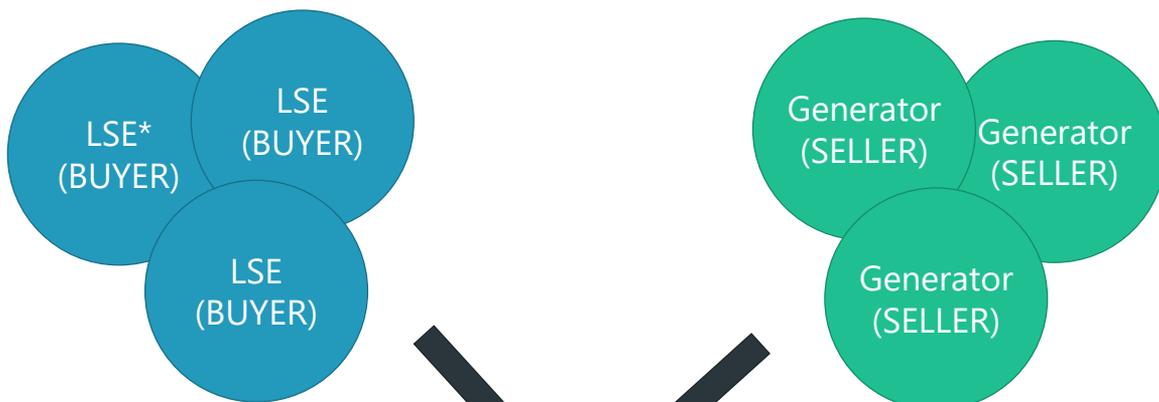
- ✓ Continue procedures to manage capacity adequacy, reserves, etc.
- ✓ Subject to EI and registration under WEIS
- ✓ Submit Resource Plans, Ancillary Service (A/S) plans, and Offer Curves once registered



## MARKET BASICS



# WHAT IS AN ENERGY MARKET?



\*LSE = Load Serving Entity



## SPP RTO AND WEIS FOOTPRINTS

RTO-Facilitated Markets...

Provide spot ENERGY MARKET required by FERC

Allow participants to OFFER RESOURCES into market

Promote use of LEAST-COST generation to address imbalance

■ Integrated Marketplace  
■ WEIS Footprint

# WHAT DOES AN ENERGY MARKET DO?

Provides Asset Owners (AOs) infrastructure to offer resources into marketplace to address Energy Imbalance (EI)



GEN

Scheduled: 100 MW

Actual: 85 MW



LOAD

Scheduled: 100 MW

Actual: 110 MW

## WHAT IS ENERGY IMBALANCE?

Difference between **prearranged schedules** of each generator and load location and what **actually happens**



# ENERGY IMBALANCE (EI) EQUATION

Actual Production or Usage – Scheduled Production or Usage

$$EI = A - S$$



## WHAT IS THE VALUE OF EI?

...by price at specific point on grid  
(Locational Marginal Price (LMP))

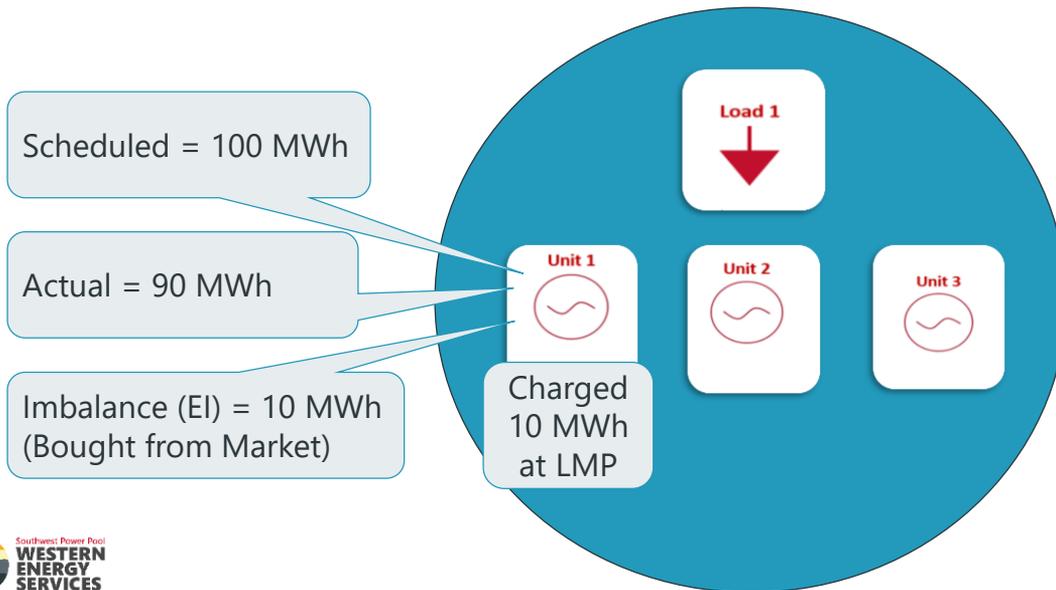
$$EI(\$) = EI \times LMP$$

EI is locational vs. the  
zonal construct for  
schedule imbalance

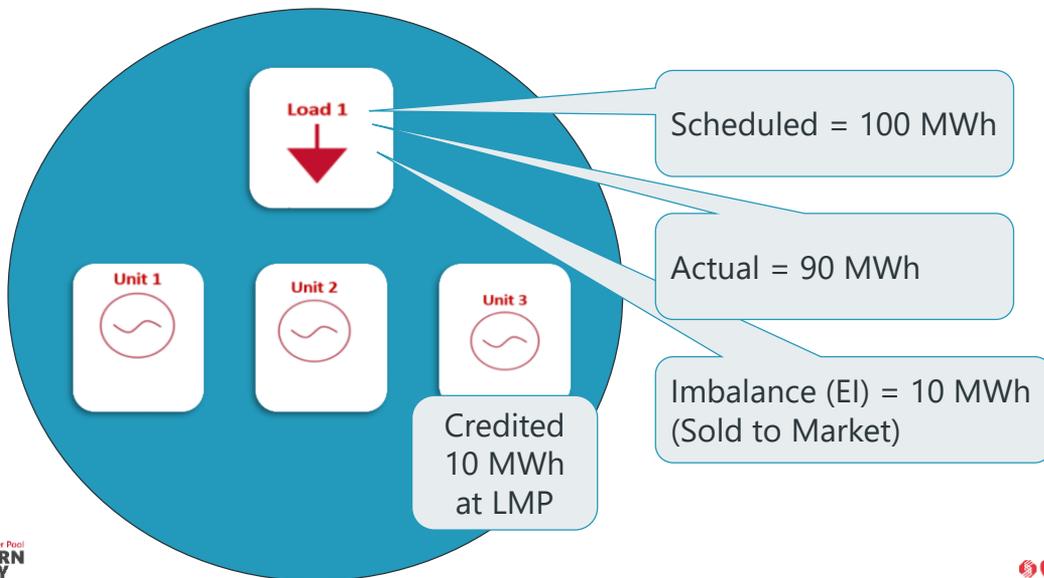
Multiply amount of EI...



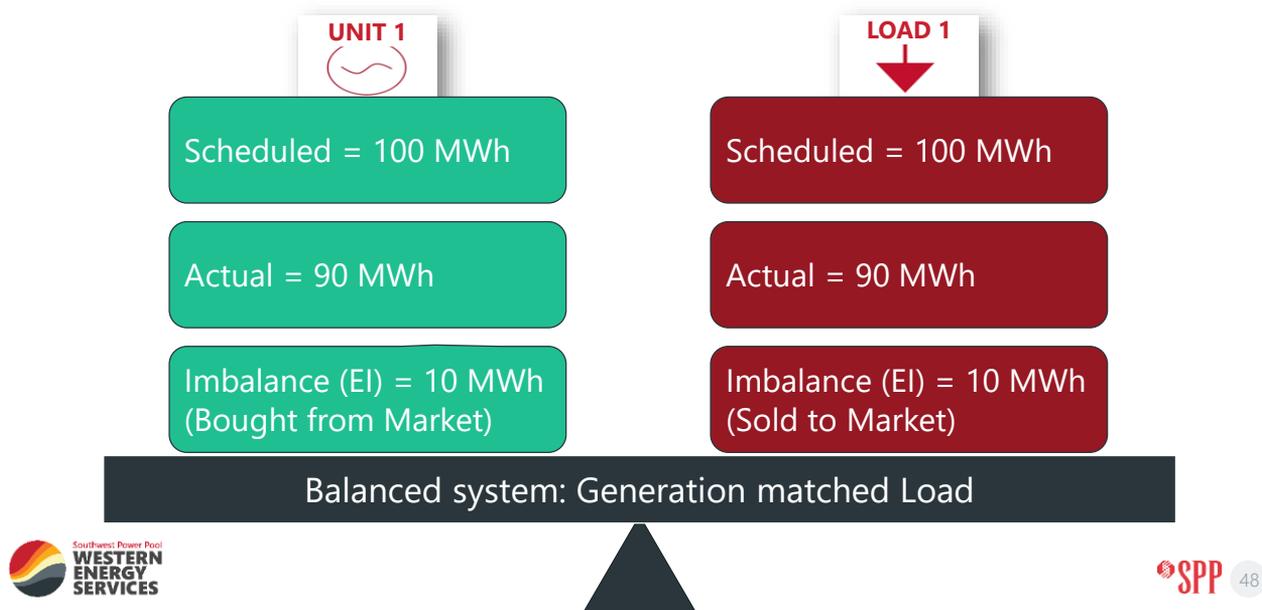
# EXAMPLE 1: IMBALANCE ENERGY



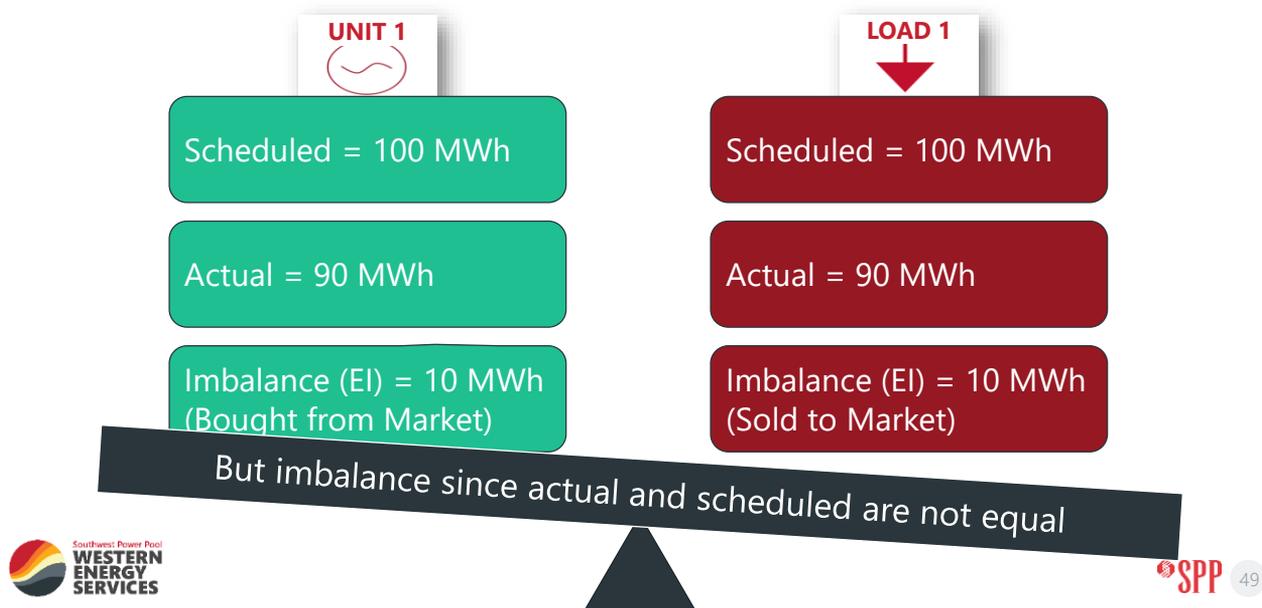
# EXAMPLE 1: IMBALANCE ENERGY



## EXAMPLE 1: IMBALANCE ENERGY



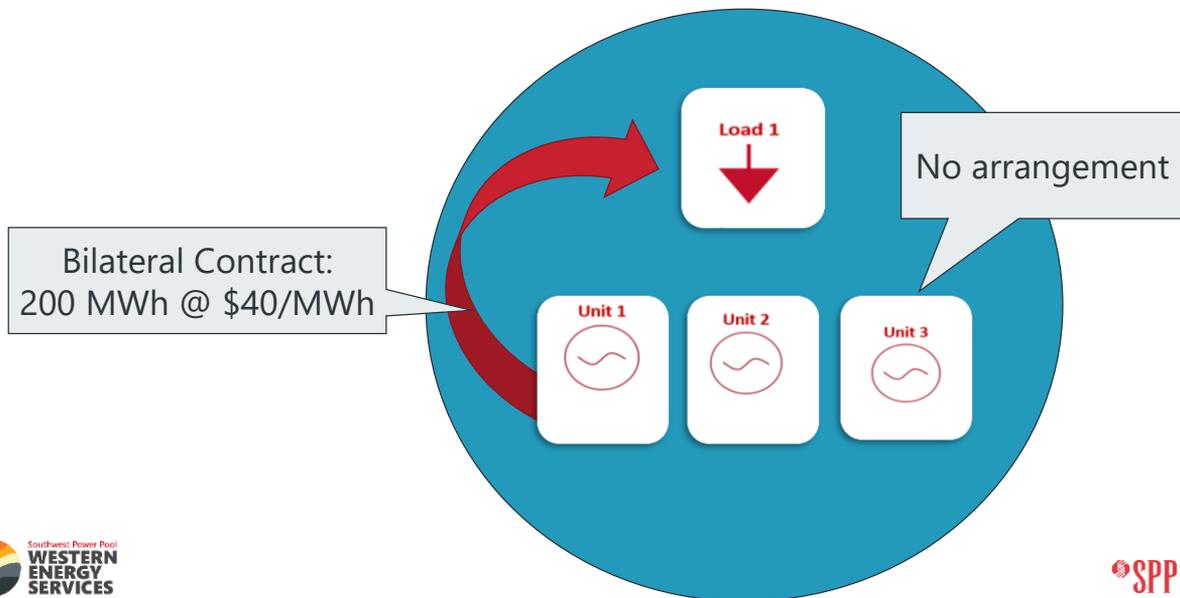
## EXAMPLE 1: IMBALANCE ENERGY



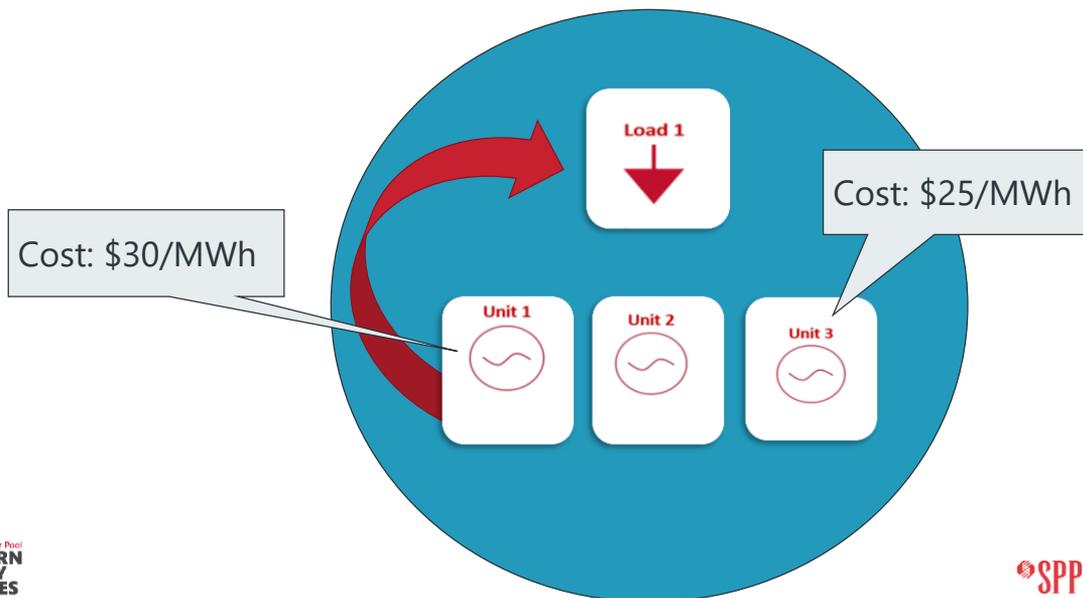
# MARKET BENEFITS



## EXAMPLE 2: NO PARTICIPATION



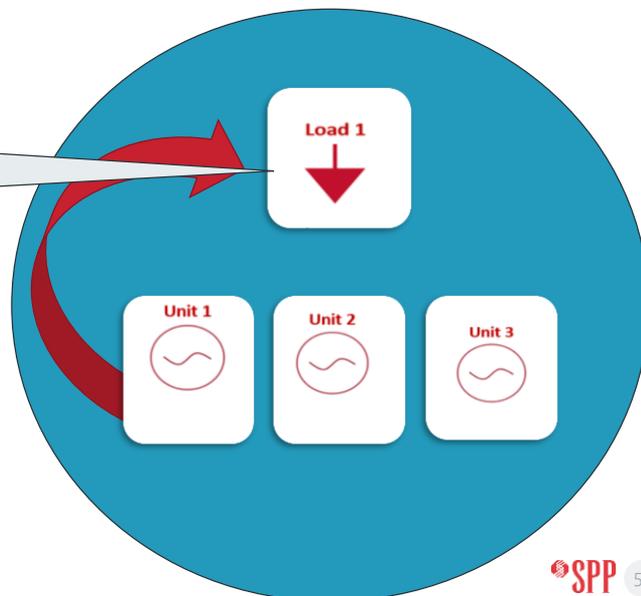
## EXAMPLE 2: NO PARTICIPATION



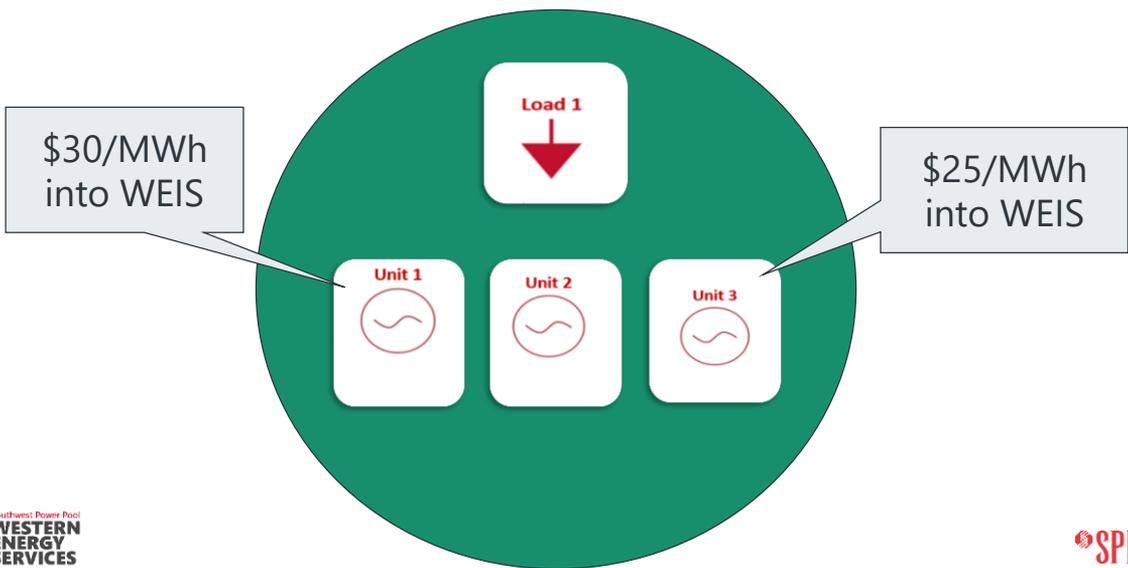
## EXAMPLE 2: NO PARTICIPATION

**Load 1:**  
Contract Purchase Price:  
200 MWh x \$40/MWh = **\$8,000**

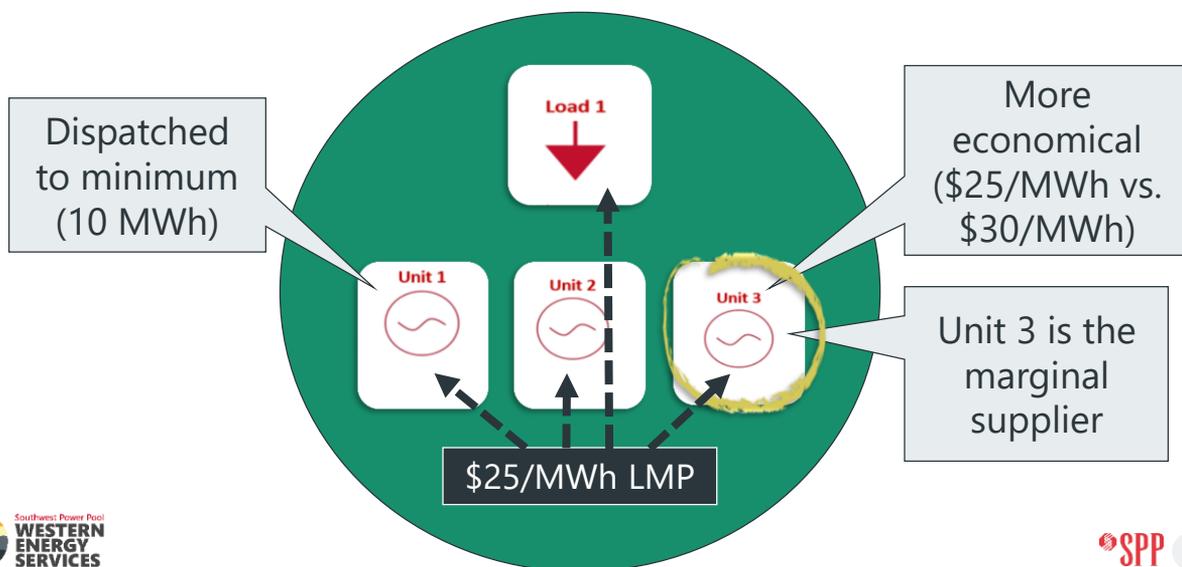
**Unit 1:**  
Contract Sale Price:  
200 MWh x \$40/MWh = **\$8,000**  
Cost to Produce:  
200 MWh x \$30/MWh = **\$6,000**  
**Net** **\$2,000**



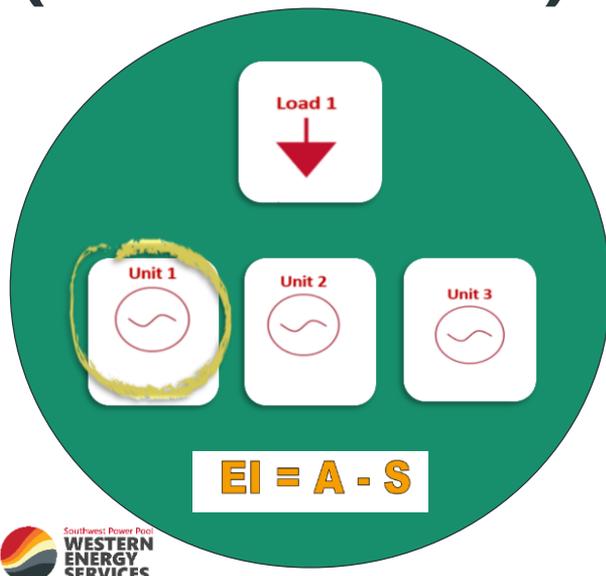
# EXAMPLE 3: MARKET PARTICIPATION (NO CONGESTION)



# EXAMPLE 3: MARKET PARTICIPATION (NO CONGESTION)



## EXAMPLE 3: MARKET PARTICIPATION (NO CONGESTION)



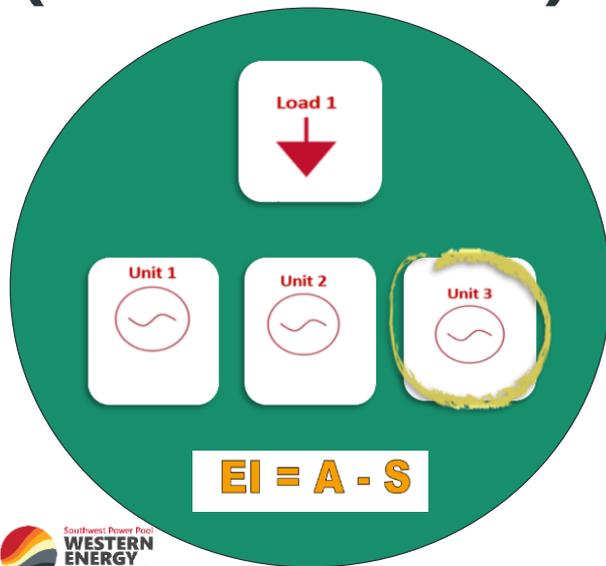
### Unit 1:

Contract Sale Price:	\$8,000
Cost to Produce:	
(10 MWh x \$30/MWh) =	\$300
EI (Buy from Market):	
(190 MWh x \$25/MWh) =	\$4,750
Net	\$2,950



57

## EXAMPLE 3: MARKET PARTICIPATION (NO CONGESTION)



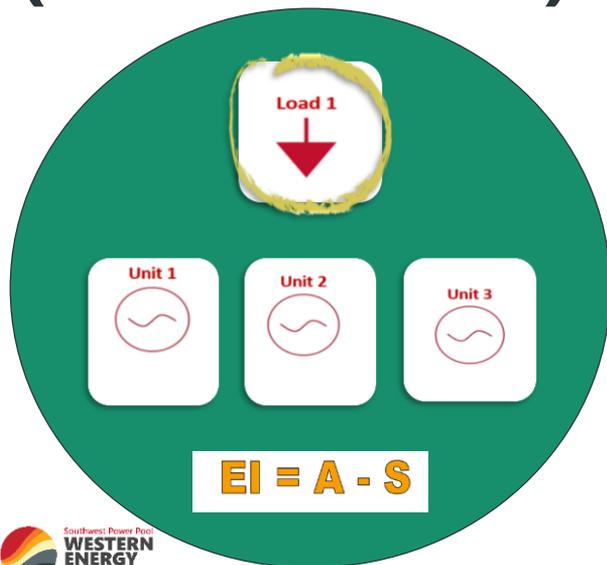
### Unit 3:

Contract Sale Price:	\$0
Cost to Produce:	
(190 MWh x \$25/MWh) =	\$4,750
EI (Sold to Market):	
(190 MWh x \$25/MWh) =	\$4,750
Net	\$0



58

# EXAMPLE 3: MARKET PARTICIPATION (NO CONGESTION)



<b>Load 1:</b>	
Contract Purchase Price:	\$8,000
EI:	\$0
<b>Net</b>	<b>\$8,000</b>



## SUMMARY

Purchased energy from WEIS in lieu of producing at higher cost (saved \$950)

- \$2,000 w/no participation vs. \$2,950 w/participation

Continues to receive compensation from Load 1 for contract

Allowed to use otherwise unused capacity

If Unit 1 and Load 1 both same participant, serve load \$950 cheaper

<b>Unit 1:</b>	
Contract Sale Price:	\$8,000
Cost to Produce:	\$300
EI (Buy from Market):	\$4,750
<b>Net</b>	<b>\$2,950</b>

<b>Unit 3:</b>	
Contract Sale Price:	\$0
Cost to Produce:	\$4,750
EI (Sold to Market):	\$4,750
<b>Net</b>	<b>\$0</b>

<b>Load 1:</b>	
Contract Purchase Price:	\$8,000
EI:	\$0
<b>Net</b>	<b>\$8,000</b>



## WEIS BENEFITS



Pool resources

Gain access to lower/  
more transparent pricing



## WEIS BENEFITS



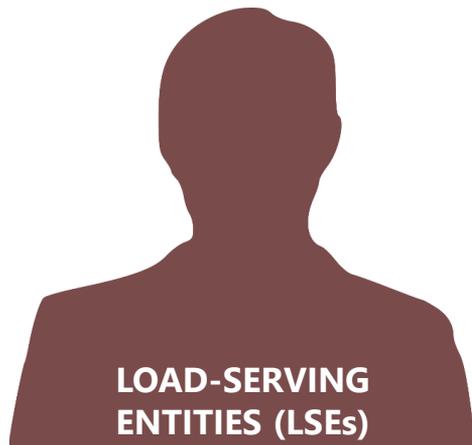
Operate closer to  
economical efficiency

Can generate less and buy  
lower-cost energy

May offer energy into market  
to gain exposure



# WEIS BENEFITS

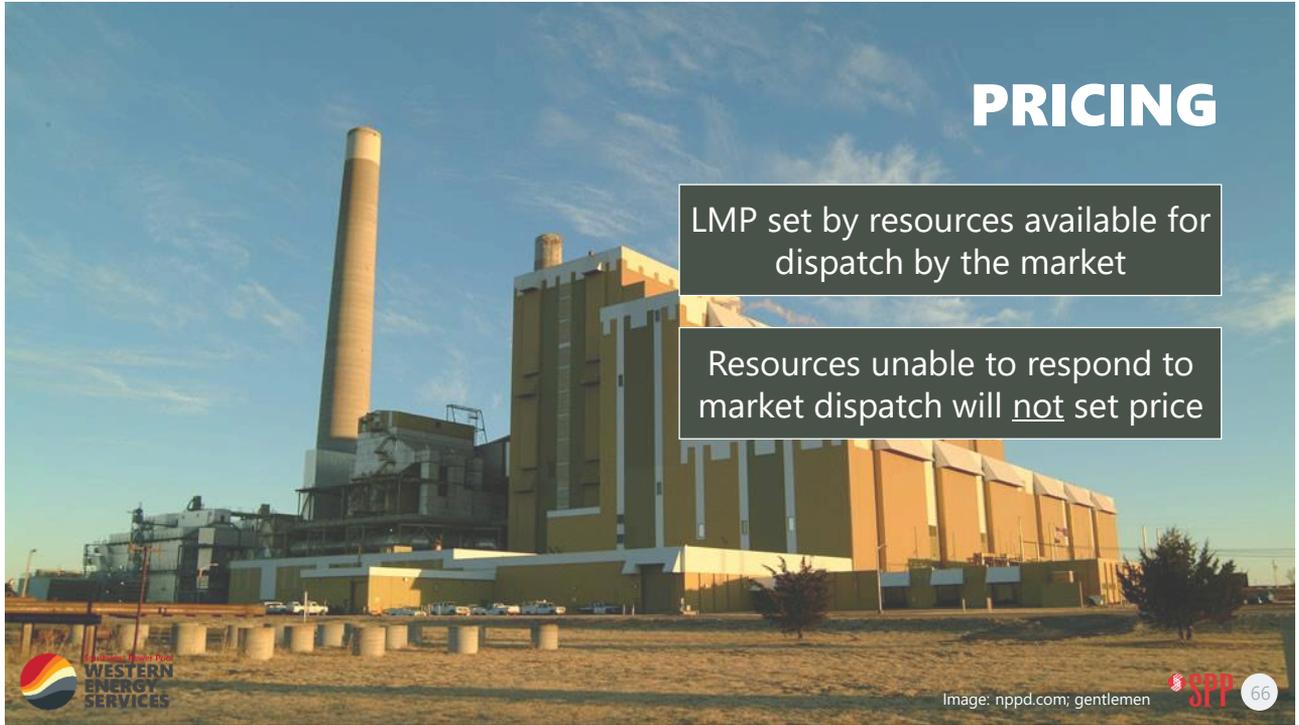


More efficient competition among suppliers (resources)

Access to lower spot energy prices

# LOCATIONAL MARGINAL PRICE (LMP)

WEIS KEY CONCEPT



# PRICING

LMP set by resources available for dispatch by the market

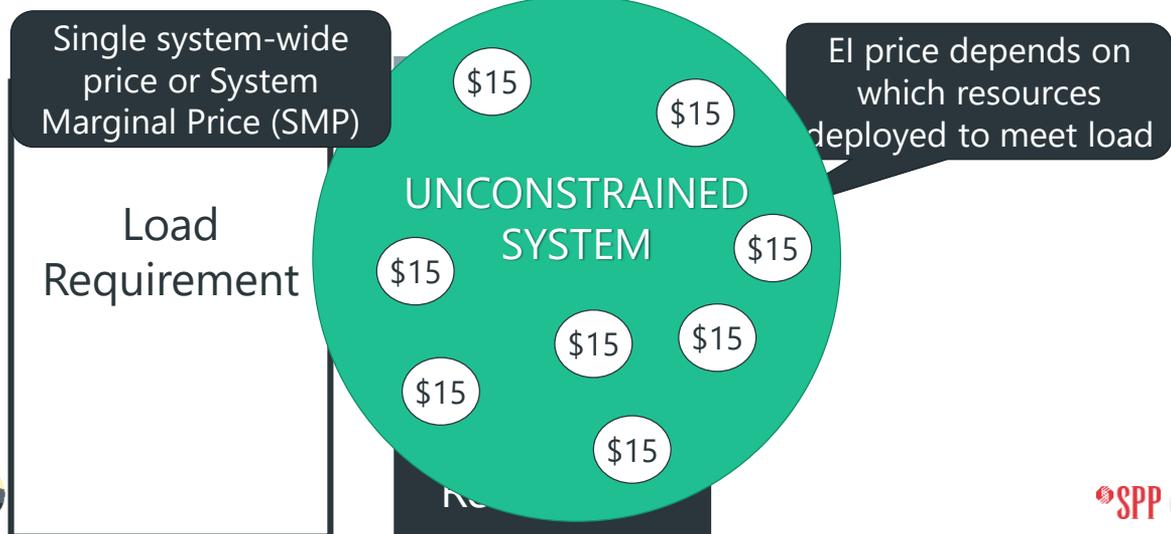
Resources unable to respond to market dispatch will not set price



Image: nppd.com; gentlemen

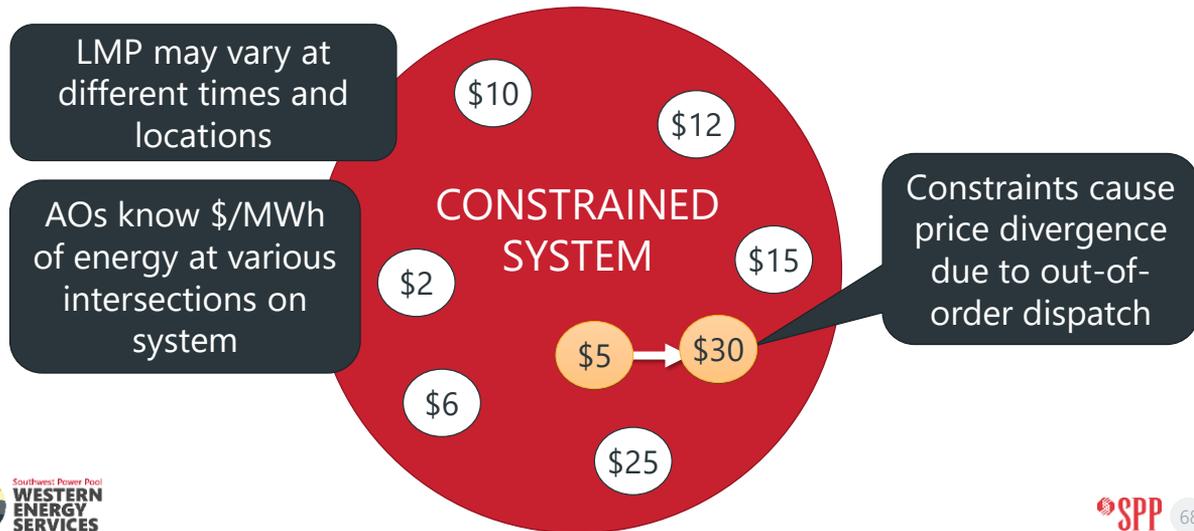


## PRICING EI – UNCONSTRAINED SYSTEM

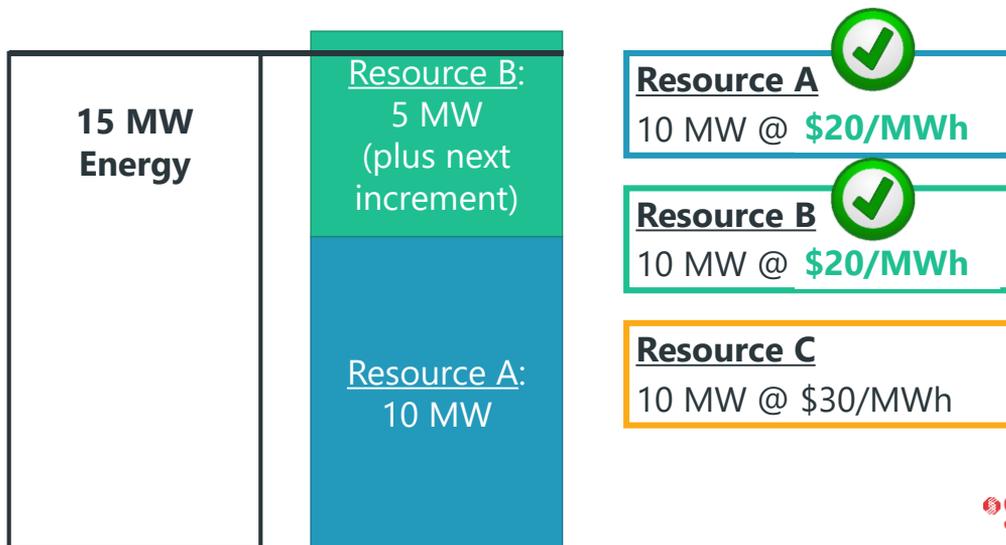


# PRICING EI – CONSTRAINED SYSTEM

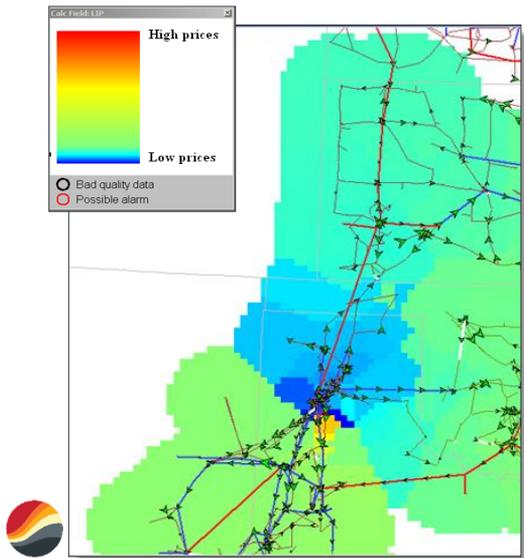
 No Marginal Losses in WEIS



# EXAMPLE: LMP UNCONSTRAINED

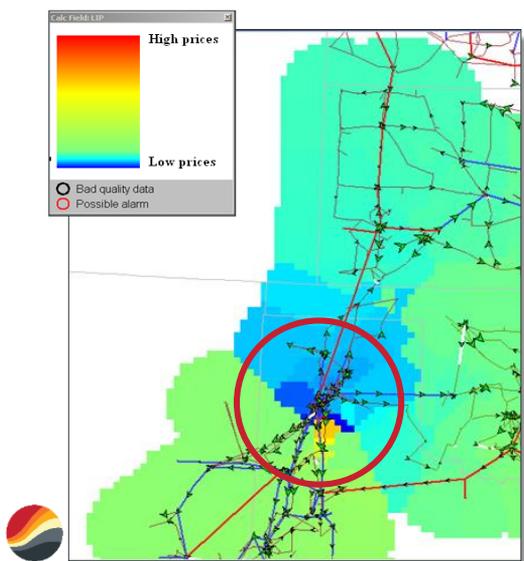


## EXAMPLE: LMP CONSTRAINED



What if it is impossible to deliver power economically while respecting **transmission limitations** of the Bulk Electric System (BES)?

## EXAMPLE: LMP CONSTRAINED



Binding constraints that prevent a limit violation usually result in:

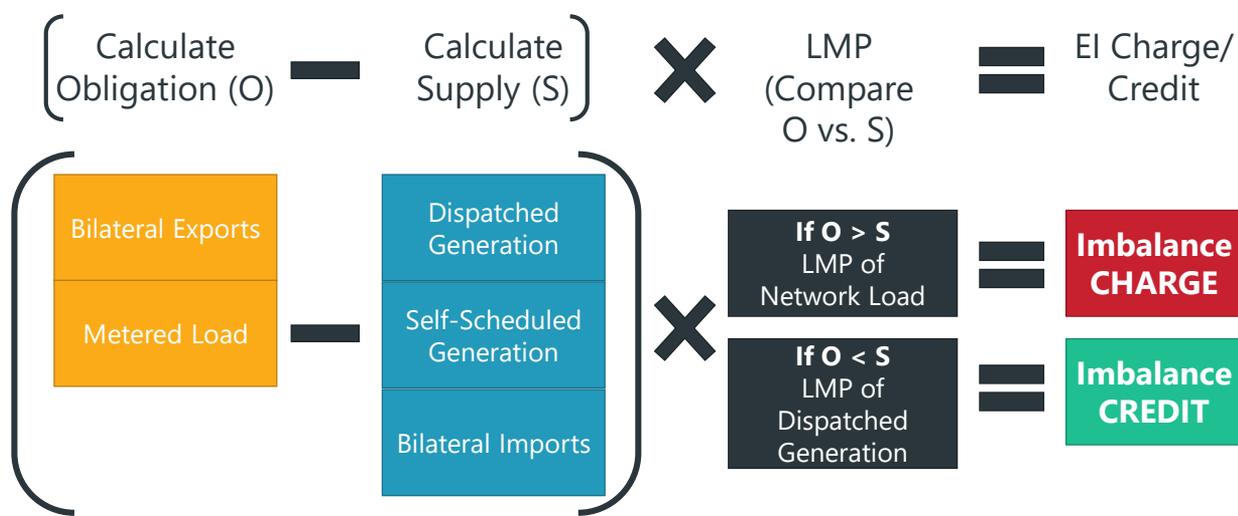
<b>Resource A</b>	3
10 MW @ \$15/MWh	
<b>Resource B</b>	1
10 MW @ \$20/MWh	
<b>Resource C</b>	2
10 MW @ \$30/MWh	

# NATIVE LOAD AND CONGESTION

WEIS KEY CONCEPT



## ACCOUNTING FOR NATIVE LOAD



# EXAMPLE 4: NATIVE LOAD

Unit A1	
\$	MW
10	50
20	75
30	90

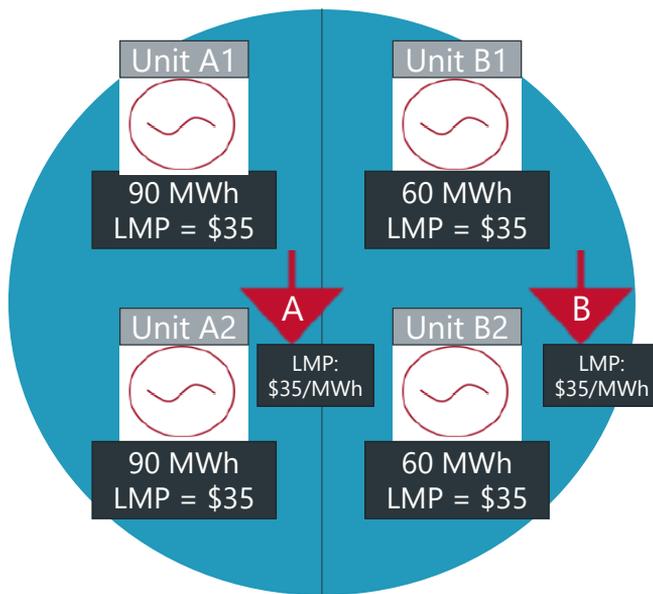
Unit A2	
\$	MW
12	50
18	75
35	90

Load A	
	MW
150	

Generation	
	MW
180	



Unit B1	
\$	MW
17	50
25	60
37	75

Unit B2	
\$	MW
18	50
25	60
36	75

Load B	
	MW
150	

Generation	
	MW
120	

75

# EXAMPLE 4: NATIVE LOAD (AO A)

Unit A1	
\$	MW
10	50
20	75
30	90

Unit A2	
\$	MW
12	50
18	75
35	90

Load A	
	MW
150	

Generation	
	MW
180	

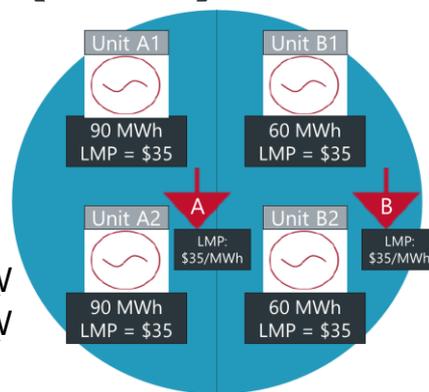
**Native Load**

Unit A1: 50 MW  
 Unit A2: 50 MW  
 Unit A2: 25 MW  
 Unit A1: 25 MW

Unit A1: 15 MW  
 Unit A2: 15 MW

**Imbalance**

Location	Imbalance	LMP	Settlement
Unit A1	15	\$35	\$525
Unit A2	15	\$35	\$525
LOAD A	0	\$35	\$0



# EXAMPLE 4: NATIVE LOAD (AO B)

Unit B1	
\$	MW
17	50
25	60
37	75

Unit B2	
\$	MW
18	50
25	60
36	75

Load B	
150	

Generation	
120	

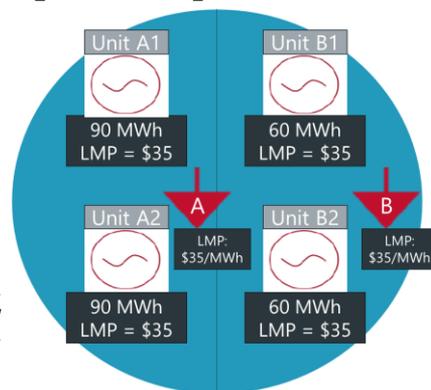
## Native Load

Unit B1: 50 MW  
 Unit B2: 50 MW  
 Unit B2: 10 MW  
 Unit B1: 10 MW

Load B: 30 MW

## Imbalance

Location	Imbalance	LMP	Settlement
Unit B1	0	\$35	\$0
Unit B2	0	\$35	\$0
LOAD B	30	\$35	\$1,050



# CONGESTION MANAGEMENT

WEIS KEY CONCEPT

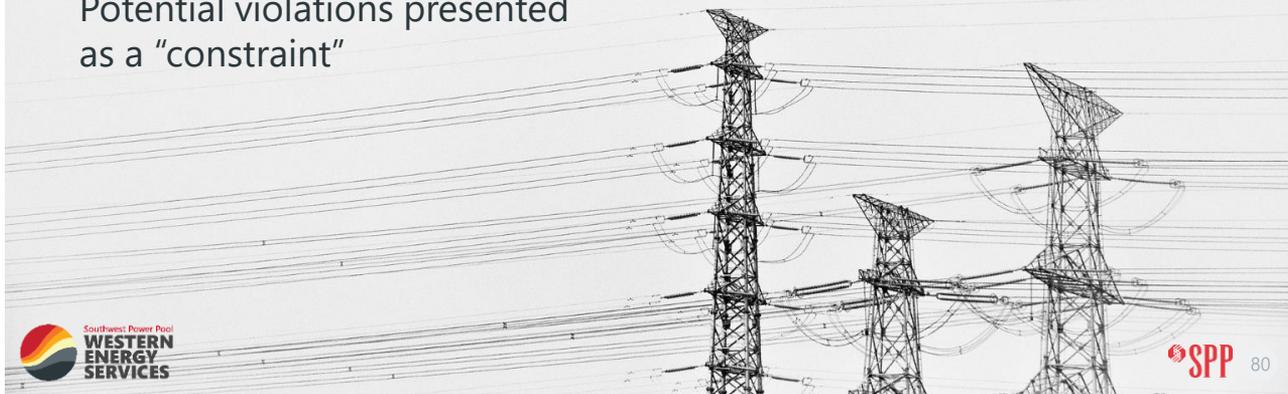


# CONSTRAINTS

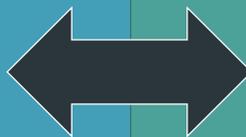
Physical equipment limitation of BES

Require implementation of Congestion Management process

Potential violations presented as a "constraint"



Reliability



Economics



# CONGESTION MANAGEMENT



System Operating Limit  
(SOL) for Line: 100 MW

Actual Flow on Line:  
110 MW

Mitigate flow limit violations  
(actual or potential):

- As ECONOMICALLY as possible
- With relief obligations as EQUITABLE as possible

Process Reliability Coordinator (RC)  
uses to maintain BES loading below  
identified SOLs (FAC-011)



# CONGESTION MANAGEMENT OPTIONS



Western RC Congestion  
Management Methodology

Unscheduled  
Flow Mitigation  
Procedure  
(UFMP)



Phase Shifter  
Operations



Generation  
Redispatch



# REVENUE NEUTRALITY UPLIFT (RNU)

WEIS KEY CONCEPT



## WEIS IS REVENUE NEUTRAL

Market Operators (MO) must account for and financially settle all EI

Image: policynote.ca



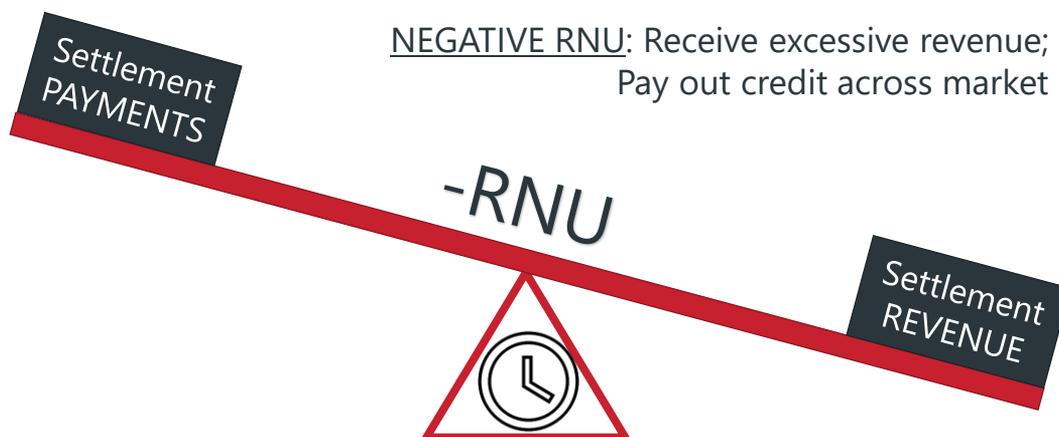
# REVENUE NEUTRALITY UPLIFT (RNU)

Ensures each hourly settlement interval equals zero



# REVENUE NEUTRALITY UPLIFT (RNU)

NEGATIVE RNU: Receive excessive revenue;  
Pay out credit across market

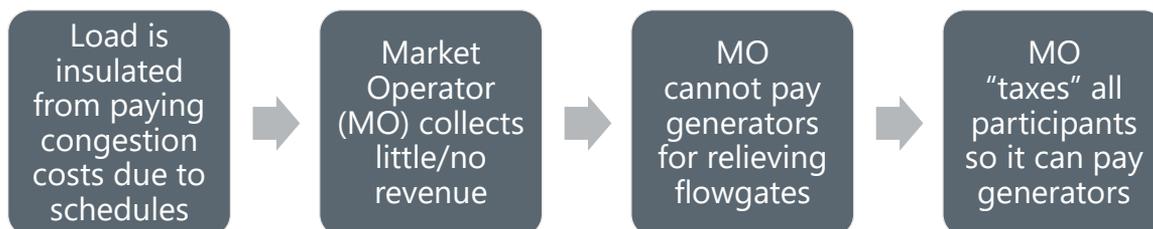


## REVENUE NEUTRALITY UPLIFT (RNU)

POSITIVE RNU: Receive insufficient revenue to pay MPs; Charge "tax" across market



## POSITIVE RNU OCCURS WHEN...



# DATA NEEDS

WEIS KEY CONCEPT



## MP DATA – SUMMARY

### Resource Plan

Resource-specific information

### Ancillary Service (A/S) Plan

Reserve and Regulation information per unit

### Offer Curve

Price information for available resources



Resource  
Plan

Resource-  
specific  
information

## RESOURCE PLAN

### Capacity data submitted:

- Minimum Limit
- Economic Minimum Capacity Operating Limit
- Economic Maximum Capacity Operating Limit
- Maximum Limit



Resource  
Plan

Resource-  
specific  
information

## RESOURCE PLAN

### Capacity data submitted:

Market Operating System (MOS) only utilizes ECONOMIC limits for Dispatch Instruction:

- Maximum
- Minimum
- Ramp



### Resource Plan

Resource-specific information

## RESOURCE PLAN

### Ramp Rate profiles (segment) for:

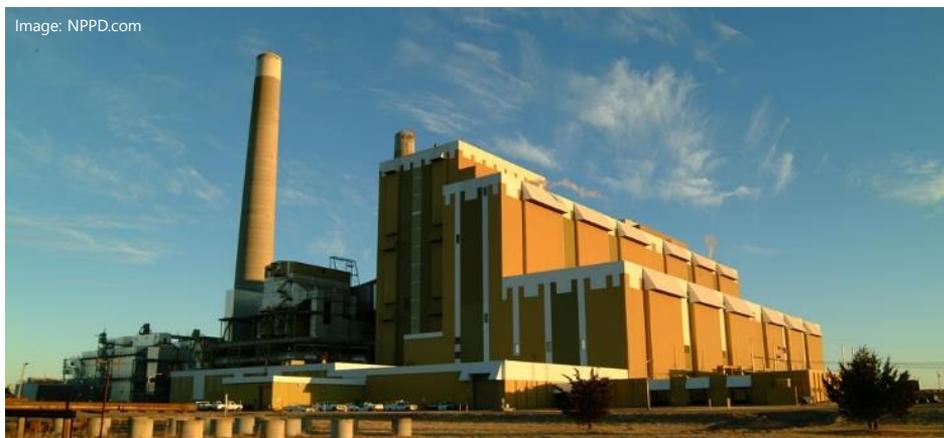
- Up Ramp Rate Limit
- Down Ramp Rate Limit
- Ramp Rate Break Point(s)



### Ancillary Service Plan

Reserve and Regulation information per unit

## ANCILLARY SERVICE (A/S) PLAN



Enables MOS to confirm MP is satisfying A/S obligations



96

Ancillary Service Plan

Reserve and Regulation information per unit

# ANCILLARY SERVICE (A/S) PLAN



Image: NPPD.com

Notifies MOS how much each resource will carry of Regulation and Contingency Reserve (CR)



97

Ancillary Service Plan

Reserve and Regulation information per unit

# ANCILLARY SERVICE (A/S) PLAN



Indicates transfers of obligations between MPs and, when self-arranged, which resources

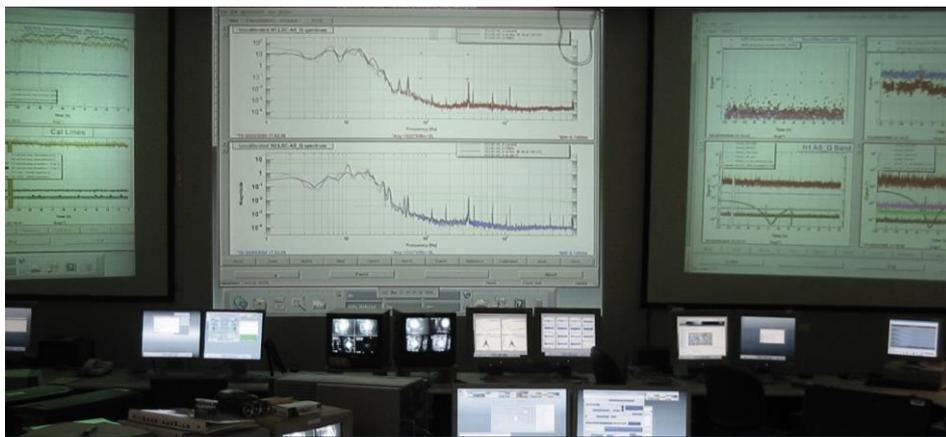


98

**Ancillary Service Plan**

Reserve and Regulation information per unit

# ANCILLARY SERVICE (A/S) PLAN

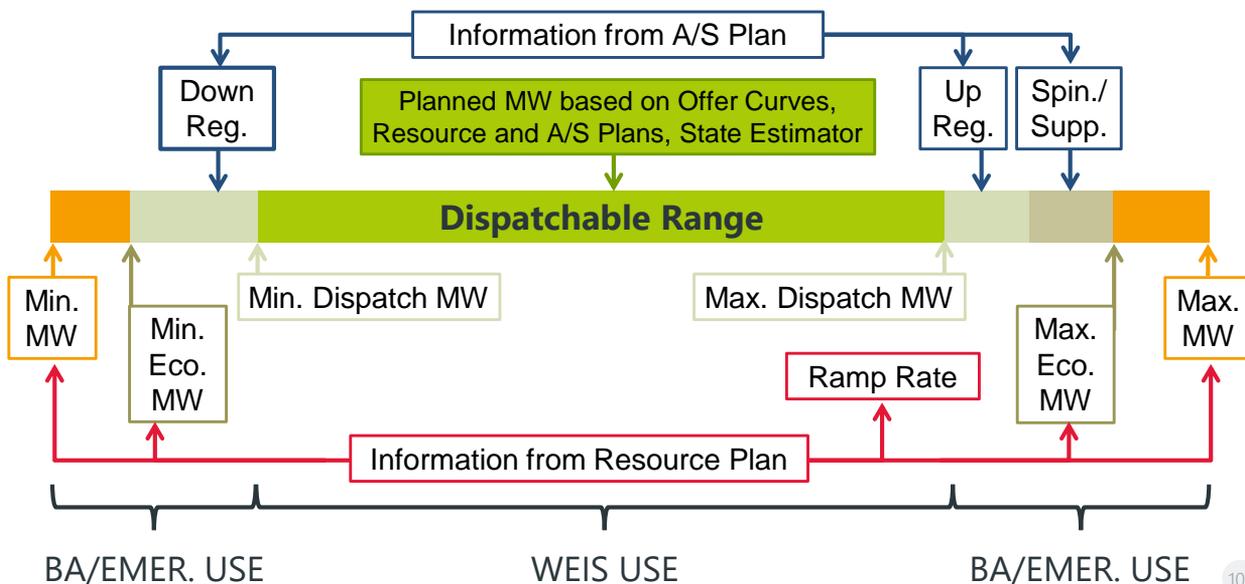


Used by MOS to ensure deployment does not consume unloaded capacity being utilized for other A/S



99

## DISPATCHABLE RANGE



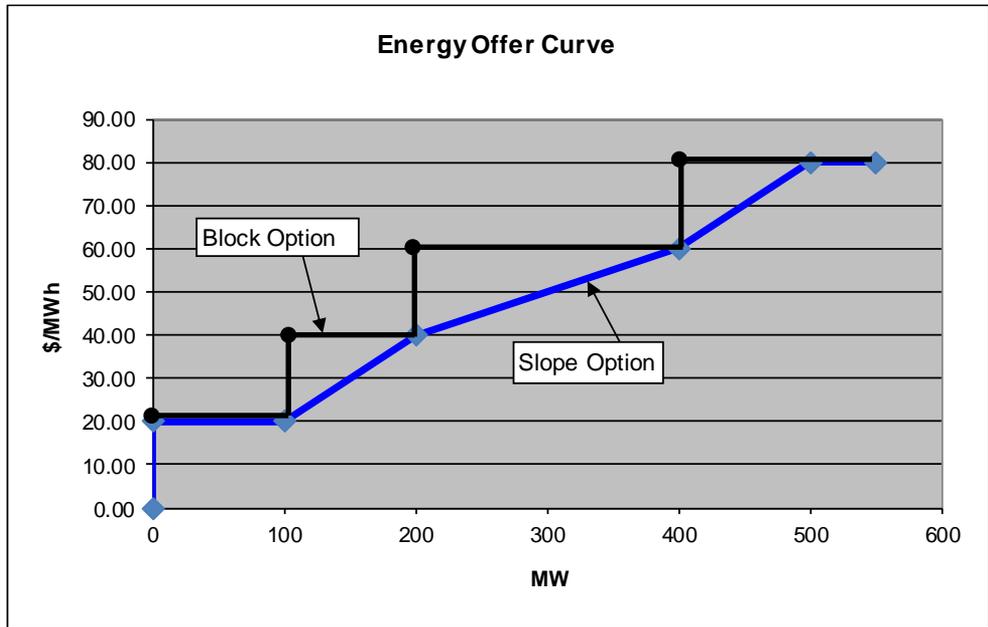
100

Offer Curve

Price

**Submitted Data**

(MW)	\$
0	\$0.00
100	\$20.00
200	\$40.00
400	\$60.00
500	\$80.00



# SUPPLY ADEQUACY ANALYSIS

WEIS KEY CONCEPT



# SUPPLY ADEQUACY STUDY

Verifies MPs have sufficient energy to meet load obligations; Based on:

**Load  
Forecast**

**Resource  
Plans**

**A/S  
Plans**

**Schedules  
from MPs**



## SUPPLY ADEQUACY TIMELINE

Study runs day ahead  
for entire next OD

Study runs hour  
ahead for next OH

Over/under sufficiency  
information sent to MP  
and host BA

**OD-1**

**OH-1**



# SUPPLY ADEQUACY PROCESS

Load + Sales – Purchases = **Energy Obligation**

MinMW < **Energy Obligation** < MaxMW

**If FALSE:** Notify inadequate MP and Host BA

MP shall update Load Forecast, Resource Plan, or Schedules



# SETTLEMENTS

WEIS KEY CONCEPT



# THE SETTLEMENT PROCESS...



Calculates **QUANTITY** of EI for each asset



Calculates **INVOICE DOLLARS** for EI



Allocates **OVER- & UNDER-** collection of revenues to AOs

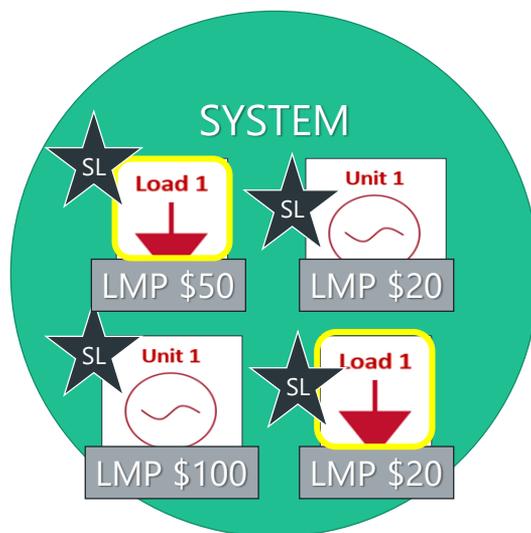


# INTRODUCTION

Each registered asset = Settlement Location (SL)

Resources settled based on LMP associated with SL

Load may choose to settle zonally or nodally



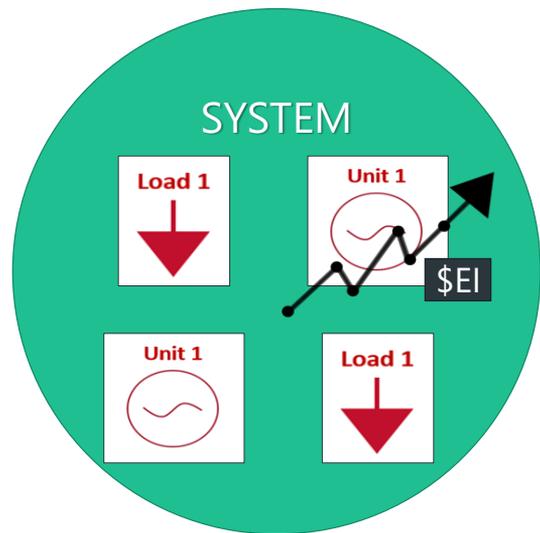
## INTRODUCTION

Self-dispatched resources responsible for imbalance charges

Cannot opt out



Remember: MO remains revenue neutral



## SETTLEMENT STATEMENTS

Produced and published for each OD

Utilize best available data for each run (actual and/or estimated)

Provide billing determinants for each OD



# INVOICES

Weekly summary of net daily charges / credits per OD by a MP and associated AO

Based on daily settlements occurred during invoice cycle

**INVOICE**

**Wed:** \$432,000

**Thurs:** -\$100,000

**Fri:** \$325,000

**Sat:** \$379,000

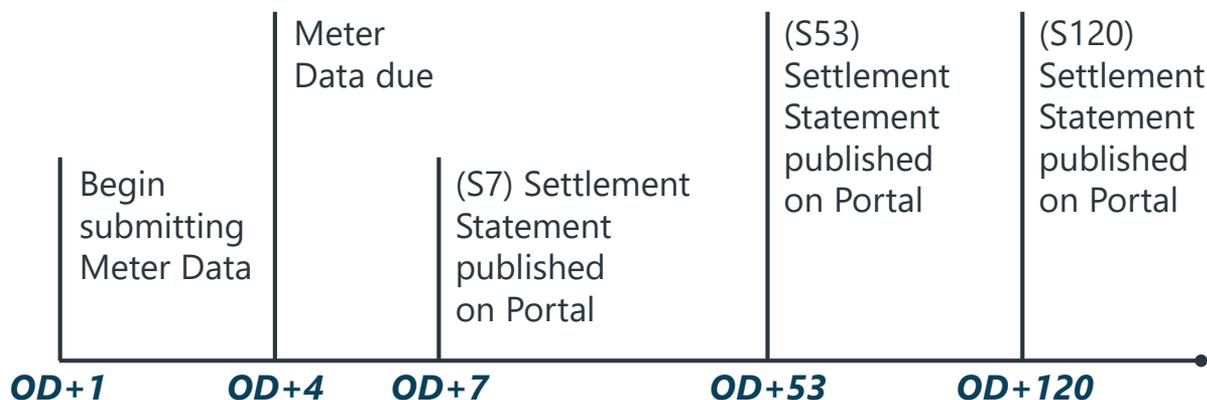
**Sun:** -\$112,000

**Mon:** \$302,000

**Tues:** \$406,000



# POST OD MARKET ACTIVITIES



Statements by settlement location, hour, and MP



# MARKET MONITORING & MITIGATION



## INTRODUCTION

- Required by FERC Order 2000
- Purpose: To monitor and mitigate potential exercise of market power



## FUNCTIONAL RESPONSIBILITIES



**DESIGN/IMPLEMENT**  
market mitigation  
measures for spot  
markets



**CONDUCT INQUIRIES**  
requested by MPs or  
initiated by market  
monitors



**MONITOR/ASSESS**  
market design for  
weaknesses/failures and  
recommend changes

# QUESTIONS?

# REQUEST MANAGEMENT SYSTEM(RMS)

- RMS allows for secure communication and document exchange
- RMS can be found here: <https://spprms.issuetrak.com>
- More general information on RMS can be found here: <https://www.spp.org/stakeholder-center/customer-relations/request-management-system/>



Welcome to Southwest Power Pool's Request Management System (RMS)

## Please Sign In

Don't have an account? Use the "Register Now" link below. **Please use your e-mail address as your User ID.**

Don't remember your Password? **DO NOT** create a new account - you won't have access to your Requests! Enter your User Id then click the "Forgot your password?" link below.

**Please note that RMS should not be used to report real-time operational issues, contact operations directly.**

**Please note: Quick search now allows subject and request #.**

The Quick Pick drop down menu is the only choice on the initial submit request screen, additional fields are available after a Quick Pick is selected. Quick Pick choice may be changed using the drop down menu on the next screen, if it was incorrectly chosen.

**Please refrain from modifying the Request Type independent of the Quick Pick menu, this can affect request routing.**

User ID:

Password:

[Register Now](#)  
[Forgot / Reset your password?](#)

[Switch To Mobile Format](#)

Sign in with User ID and Password or Register

### Submit Request

Submit Request

Quick Pick: WEIS Market

Quick Pick:  
WEIS Market

\* Class: Customer Relations

Request Status: Open

\* Request Type: WEIS Market

Subtype 1: Onboarding

Subtype 2: Registration

\* Severity: 5 Days descriptions



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