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
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)

Provided $103M in benefit to members in its first year

YEARS OF EXPERIENCE

Integrated Marketplace: 3/1/2014 to Present
YEARLY NET BENEFITS OF SPP’S INTEGRATED MARKETPLACE (2014-PRESENT)

Cumulative marketplace benefits exceed $2.7B as of 12/21/18

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
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

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)
WESTERN MARKETS EXECUTIVE COMMITTEE (WMEC)

Comprised of reps from each non-affiliated WJDA signatory

- Board recognition
- Finalize market rules
- Approve/reject Tariff amendments
- Establish market protocols
- Recommend WJDA amendments

WMEC ON SPP.ORG
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)

Post-launch, onboard additional participants per onboarding timelines

IMPLEMENTATION TIMELINE
MARKET ENTITIES

Market Participants (MPs)
- Asset Owners (AOs)
  - Generation Companies (GenCos):
    - Plants
    - Units and Joint-Owned Units
  - Load as a Resource Controllable Load and Demand Response Resource
  - Load-Serving Entities (LSEs): Load
  - Metering Agents

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
WHAT IS AN ENERGY MARKET?

LSE* (BUYER)
LSE (BUYER)
Generator (SELLER)
Generator (SELLER)

*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
WHAT DOES AN ENERGY MARKET DO?

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

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))

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

El is locational vs. the zonal construct for schedule imbalance

Multiply amount of EI...
EXAMPLE 1: IMBALANCE ENERGY

Scheduled = 100 MWh

Actual = 90 MWh

Imbalance (EI) = 10 MWh (Bought from Market)

Charged 10 MWh at LMP

EXAMPLE 1: IMBALANCE ENERGY

Scheduled = 100 MWh

Actual = 90 MWh

Imbalance (EI) = 10 MWh (Sold to Market)

Credited 10 MWh at LMP
EXAMPLE 1: IMBALANCE ENERGY

UNIT 1

Scheduled = 100 MWh
Actual = 90 MWh

Imbalance (EI) = 10 MWh
(Bought from Market)

LOAD 1

Scheduled = 100 MWh
Actual = 90 MWh

Imbalance (EI) = 10 MWh
(Sold to Market)

Balanced system: Generation matched Load

EXAMPLE 1: IMBALANCE ENERGY

UNIT 1

Scheduled = 100 MWh
Actual = 90 MWh

Imbalance (EI) = 10 MWh
(Bought from Market)

LOAD 1

Scheduled = 100 MWh
Actual = 90 MWh

Imbalance (EI) = 10 MWh
(Sold to Market)

But imbalance since actual and scheduled are not equal
MARKET BENEFITS

EXAMPLE 2: NO PARTICIPATION

Bilateral Contract: 200 MWh @ $40/MWh

No arrangement
EXAMPLE 2: NO PARTICIPATION

Cost: $30/MWh

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

Load 1
Cost: $25/MWh
EXAMPLE 3: MARKET PARTICIPATION (NO CONGESTION)

$30/MWh into WEIS

$25/MWh into WEIS

More economical ($25/MWh vs. $30/MWh)

Dispatched to minimum (10 MWh)

Unit 3 is the marginal supplier

$25/MWh LMP
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

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
EXAMPLE 3: MARKET PARTICIPATION (NO CONGESTION)

Load 1:
- Contract Purchase Price: $8,000
- EI: $0
- Net: $8,000

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
**WEIS BENEFITS**

**ASSET OWNERS (AOs)**

- Pool resources
- Gain access to lower/more transparent pricing

**WEIS BENEFITS**

**GEN. COS**

- 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

LOAD-SERVING ENTITIES (LSEs)

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

PRICING EI – UNCONSTRAINED SYSTEM

Load Requirement

EI price depends on which resources deployed to meet load

Single system-wide price or System Marginal Price (SMP)

$15 $15 $15 $15 $15

UNCONSTRAINED SYSTEM

$15 $15 $15 $15
PRICING EI – CONSTRAINED SYSTEM

LMP may vary at different times and locations

AOs know $/MWh of energy at various intersections on system

Constraints cause price divergence due to out-of-order dispatch

EXAMPLE: LMP UNCONSTRAINED

15 MW Energy

Resource A: 10 MW
10 MW @ $20/MWh

Resource B: 5 MW (plus next increment)
10 MW @ $20/MWh

Resource C: 10 MW
10 MW @ $30/MWh
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:

- **Resource A**
  - 10 MW @ $15/MWh
- **Resource B**
  - 10 MW @ $20/MWh
- **Resource C**
  - 10 MW @ $30/MWh
NATIVE LOAD AND CONGESTION
WEIS KEY CONCEPT

ACCOUNTING FOR NATIVE LOAD

Calculate Obligation (O)  -  Calculate Supply (S)  \times  LMP (Compare O vs. S)  =  EIC Charge/Credit

- Bilateral Exports
- Metered Load

- Dispatched Generation
- Self-Scheduled Generation
- Bilateral Imports

If O > S
LMP of Network Load
- Imbalance CHARGE

If O < S
LMP of Dispatched Generation
- Imbalance CREDIT
EXAMPLE 4: NATIVE LOAD

Unit A1
- $ 10: 50 MW
- $ 20: 75 MW
- $ 30: 90 MW

Unit A2
- $ 12: 50 MW
- $ 18: 75 MW
- $ 35: 90 MW

Load A
- 150

Generation
- 180

EXAMPLE 4: NATIVE LOAD (AO A)

Native Load
- Unit A1: 50 MW
- Unit A2: 50 MW
- Unit A2: 25 MW
- Unit A1: 25 MW

Imbalance
- Unit A1: 15 MW
- Unit A2: 15 MW

<table>
<thead>
<tr>
<th>Location</th>
<th>Imbalance</th>
<th>LMP</th>
<th>Settlement</th>
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<tbody>
<tr>
<td>Unit A1</td>
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</tr>
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<td>Unit A2</td>
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<td>$525</td>
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<tr>
<td>LOAD A</td>
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<td>$35</td>
<td>$0</td>
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</table>

Source: SPP
EXAMPLE 4: NATIVE LOAD (AO B)

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<th>Unit B1</th>
<th>$</th>
<th>MW</th>
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<tbody>
<tr>
<td>17</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>60</td>
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<td>37</td>
<td>75</td>
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<table>
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<th>MW</th>
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<td>60</td>
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<td>36</td>
<td>75</td>
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<table>
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<table>
<thead>
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<th>$</th>
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<tbody>
<tr>
<td>120</td>
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</tr>
</tbody>
</table>

Native Load
- Unit B1: 50 MW
- Unit B2: 50 MW
- Unit B2: 10 MW
- Unit B1: 10 MW

Load B: 30 MW

Imbalance

<table>
<thead>
<tr>
<th>Location</th>
<th>Imbalance</th>
<th>LMP</th>
<th>Settlement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit B1</td>
<td>0</td>
<td>$35</td>
<td>$0</td>
</tr>
<tr>
<td>Unit B2</td>
<td>0</td>
<td>$35</td>
<td>$0</td>
</tr>
<tr>
<td>LOAD B</td>
<td>30</td>
<td>$35</td>
<td>$1,050</td>
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</table>

CONGESTION MANAGEMENT

WEIS KEY CONCEPT
CONSTRAINTS

Physical equipment limitation of BES
Require implementation of Congestion Management process
Potential violations presented as a “constraint”
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

- **Settlement PAYMENTS**
  - $0

- **Settlement REVENUE**

---

**REVENUE NEUTRALITY UPLIFT (RNU)**

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

- **Settlement PAYMENTS**

- **Settlement REVENUE**

---

- **SPP**
REVENUE NEUTRALITY UPLIFT (RNU)

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

POSITIVE RNU OCCURS WHEN...

Load is insulated from paying congestion costs due to schedules

Market Operator (MO) collects little/no revenue

MO cannot pay generators for relieving flowgates

MO “taxes” all participants so it can pay generators
DATA NEEDS
WEIS KEY CONCEPT

MP DATA – SUMMARY

<table>
<thead>
<tr>
<th>Resource Plan</th>
<th>Ancillary Service (A/S) Plan</th>
<th>Offer Curve</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resource-specific information</td>
<td>Reserve and Regulation information per unit</td>
<td>Price information for available resources</td>
</tr>
</tbody>
</table>
RESOURCE PLAN

Capacity data submitted:

• Minimum Limit
• Economic Minimum Capacity Operating Limit
• Economic Maximum Capacity Operating Limit
• Maximum Limit

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

• Maximum
• Minimum
• Ramp
RESOURCE PLAN

Ramp Rate profiles (segment) for:
- Up Ramp Rate Limit
- Down Ramp Rate Limit
- Ramp Rate Break Point(s)

ANCILLARY SERVICE (A/S) PLAN

Enables MOS to confirm MP is satisfying A/S obligations
ANCILLARY SERVICE (A/S) PLAN

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

ANCILLARY SERVICE (A/S) PLAN

Indicates transfers of obligations between MPs and, when self-arranged, which resources
ANCILLARY SERVICE (A/S) PLAN

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

DISPATCHABLE RANGE

Information from A/S Plan

Planned MW based on Offer Curves, Resource and A/S Plans, State Estimator

Dispatchable Range

Information from Resource Plan

Min. MW
Min. Eco. MW
Min. Dispatch MW
Max. Dispatch MW
Max. Eco. MW
Max. MW

Ramp Rate

BA/EMER. USE
WEIS USE
BA/EMER. USE
Energy Offer Curve

<table>
<thead>
<tr>
<th>MW</th>
<th>$/MWh</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>$0.00</td>
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<tr>
<td>100</td>
<td>$20.00</td>
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<tr>
<td>200</td>
<td>$40.00</td>
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<tr>
<td>400</td>
<td>$60.00</td>
</tr>
<tr>
<td>500</td>
<td>$80.00</td>
</tr>
</tbody>
</table>

Block Option

Slope Option

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

- **OD-1**: Study runs day ahead for entire next OD.
- **OH-1**: Study runs hour ahead for next OH.
- Over/under sufficiency information sent to MP and host BA.
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

SYSTEM

LOAD 1

LMP $50

UNIT 1

LMP $20

LMP $100

LMP $20
INTRODUCTION

Self-dispatched resources responsible for imbalance charges
Cannot opt out

⚠️ Remember: MO remains revenue neutral

SYSTEM

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

Begin submitting Meter Data

Meter Data due

(S7) Settlement Statement published on Portal

(S53) Settlement Statement published on Portal

(S120) Settlement Statement published on Portal

Statements by settlement location, hour, and MP
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.

Sign in with User ID and Password or Register
Quick Pick: WEIS Market