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Introduction to the Integrated Marketplace

Informational Session

Gay Anthony
Customer Trainer
ganthony@spp.org

Course Administration Details

- Attendance is an important readiness metric that will be tracked. If there is more than one person attending the training on a single conference line:
  - Register all attendees in the SPP Learning Center (LMS)
  - Send list of names to ganthony@spp.org
- Course evaluation forms will be sent through the SPP Learning Center (LMS).
- Introduction to the Integrated Marketplace training course is not eligible for CEH credits
- This session is for presentation of the Integrated Marketplace design as described in the Protocols. Please use Stakeholder meetings (i.e. MWG, etc.) as a forum for design questions or debate.
Objectives

• Understand at a high-level the Integrated Marketplace program timeline and key milestones

• Describe high-level differences between SPP’s current EIS Market and the Integrated Marketplace

• Name the Integrated Marketplace products

• Identify primary Integrated Marketplace processes, their function and interaction, and where they fit in the Market timeline

Agenda

• Program Overview

• Market Overview

• Market Activities
  • Pre Day-Ahead Market
  • Day-Ahead
  • Reliability Unit Commitment
  • Real Time Balancing Market

• Special Market Instruments
  • Financial Schedules
  • Virtual Transactions

• Transmission Congestion Rights

• Settlements

• Reference Materials
Section 1

PROGRAM OVERVIEW

Marketplace Implementation Timeline

<table>
<thead>
<tr>
<th>Program Phases</th>
<th>Design</th>
<th>Build</th>
<th>Acceptance Test</th>
<th>Test</th>
<th>Marketplace Trials</th>
<th>Interface &amp; Deployment</th>
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<tbody>
<tr>
<td>July 2021</td>
<td>Design</td>
<td>Build</td>
<td>FSAT/Pre FAT</td>
<td>FAT</td>
<td>Site Acceptance Test</td>
<td>Functional Integration Test</td>
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<td>Design</td>
<td>Build</td>
<td>FSAT/Pre FAT</td>
<td>FAT</td>
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<td>FSAT/Pre FAT</td>
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<td>Design</td>
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<td>FSAT/Pre FAT</td>
<td>FAT</td>
<td>Site Acceptance Test</td>
<td>Functional Integration Test</td>
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</tbody>
</table>

FAT: Factory Acceptance Test  | SAT: Site Acceptance Test  | FIT: Functional Integration Test  | PT: Performance Test
**SPP-Market Participant Combined Timeline**

**Key Program Dates and Milestones - 2011**

- Marketplace Introduction Informational Sessions – **July / August**
- Approval of Credit / Risk Formulation – **September 20**
- Updated SPP Legacy Application MIPO Published – **October 7**
- Vendor Initial Release of API Specs – **October 31**
- Market Overview Training Sessions – **October through March**
- Member Analyze Phase Complete *(recommended)* – **December 30**
- Participants develop market software – **2011 / 2012**
- Participants ensure staffing is adequate and trained – **2011 / 2012**
- Participants Ready for System Integration – **May 15, 2013**
- TCR Go-Live – **October 28, 2013**
- Integrated Marketplace Go-Live – **March 1, 2014**
Market Participant Milestones

- May 2014: Participants develop market software/secure staffing and training
- April 2014: Participants ready to begin 7CR test disclosure
- May 16, 2014: Participants make appropriate regulatory filings
- June 1, 2014: Participants finalise registration date necessary to participate in Marketplace

**MAY 15, 2013**
**PARTICIPANTS READY FOR SYSTEM INTEGRATION**

March 1, 2014
Integrated Marketplace Go-Live
Training Program Overview

- The training program is designed to provide participants with learning opportunities to close knowledge and skills gaps
- Learning experiences will be modular and based on end-to-end process flows
- Learning experiences may include classroom, virtual, and participant-specific outreach
- Various forms of training resource materials and performance support tools will be offered throughout the project
- On-going evaluations will be performed to assess knowledge and performance readiness, as well as the quality of course content and instruction

Training Program Objectives

- Ensure that essential training is in place and in a timely manner to support project activities
- Provide training opportunities and performance support tools that foster competent performance of market-related job tasks
- Address new business processes, job tasks, and software applications that will be impacted
- Perform training readiness assessments and implement remediation actions as required
### Training Delivery Schedule (High Level)

<table>
<thead>
<tr>
<th>Activities</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
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<td>Job Task Assessment</td>
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<td>(Level 1)</td>
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<tr>
<td>TCR Outreach</td>
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<tr>
<td>CBA Training (Level 2)</td>
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<td>Operations Markets Training</td>
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<td>(Level 2)</td>
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<td>TCR Training (Level 3)</td>
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<td>Settlements Training (Level 2)</td>
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<td>Operations Markets Training</td>
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<td>(Level 3)</td>
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<td>Settlements Training (Level 3)</td>
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<td>Integrated Marketplace Outreach</td>
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<td>— Site Visits</td>
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<td>Outreach Visits – SPP</td>
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<tr>
<td>Assessment</td>
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### Training Kickoff - Marketplace Introduction

<table>
<thead>
<tr>
<th>Course Description</th>
<th>Overview of the Integrated Marketplace program and timelines; high-level introduction of the market processes starting with pre-market activities and concluding with settlements.</th>
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<tbody>
<tr>
<td>Purpose</td>
<td>Intended to give Market Participants a good foundation of the Integrated Marketplace and a launching pad for those that will be more engaged in future months.</td>
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<tr>
<td>Audience</td>
<td>Participants at all levels</td>
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| Training Dates and Times | **July 21, 2011** 9-11 AM CT  
**July 26, 2011** 2-4 PM CT  
**August 4, 2011** 9-11 AM CT  
**August 10, 2011** 9-11 AM CT  
**August 18, 2011** 9-11 AM CT  
**August 30, 2011** 2-4 PM CT |
| Duration           | Two Hours                                                                                                                       |
| Training Forum     | Net Conferencing and Computer Based Training (CBT)                                                                               |
| Registration       | Learning Management System (LMS)                                                                                                 |
Section 2

MARKET OVERVIEW

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### EIS vs. Integrated Marketplace Features

<table>
<thead>
<tr>
<th>Capability</th>
<th>EIS</th>
<th>Integrated Marketplace</th>
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<tbody>
<tr>
<td><strong>Transmission</strong></td>
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<tr>
<td>• Reservations</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>• Scheduling (internal/external)</td>
<td>All Reservations</td>
<td>Third Party Reservations</td>
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<td>• Transmission Congestion Rights</td>
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<td>✓</td>
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<tr>
<td><strong>Energy</strong></td>
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<tr>
<td>• Bilaterals</td>
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<td>✓</td>
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<tr>
<td>• Day-Ahead Market (DA)</td>
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<td>✓</td>
</tr>
<tr>
<td>• Real-Time Balancing Market (RT)</td>
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<td>✓</td>
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<tr>
<td>• Virtual Transactions</td>
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<td>✓</td>
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<td><strong>Operating Reserve</strong></td>
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<td></td>
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<td>• Regulation</td>
<td>Self-Designated</td>
<td>Market</td>
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<tr>
<td>• Reserves</td>
<td>Self-Designed</td>
<td>Market</td>
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<td><strong>Settlements</strong></td>
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<tr>
<td>• Duration</td>
<td>Hourly</td>
<td>Hourly (DA), 5 Minutes (RT)</td>
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<td>• Pricing</td>
<td>LIP</td>
<td>LMP and MCP</td>
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<td>• Financial Schedules</td>
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<td>✓</td>
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<td><strong>Unit Commitment</strong></td>
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<td></td>
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<tr>
<td>• Self-Commitment</td>
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<td>Centralized Commitment</td>
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<tr>
<td><strong>Balancing Authority</strong></td>
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<td></td>
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<tr>
<td>16 BAs</td>
<td></td>
<td>1 BA</td>
</tr>
</tbody>
</table>
Overall Market Benefits

• Reduce total energy costs through centralized unit commitment while maintaining reliable operations

• Day-Ahead Market allows additional price assurance capability prior to Real-Time

• Includes new markets for Operating Reserve to support implementation of Consolidated Balancing Authority (CBA) and facilitate reserve sharing

BEFORE SPP Integrated Marketplace

• 16 Balancing Authorities
AFTER SPP Integrated Marketplace

- With the Integrated Marketplace, SPP will assume the role of the Balancing Authority

Balancing Authority Responsibilities

- **Calculate** Area Control Error (ACE) within the Balancing Authority Area.
- **Support** Interconnection frequency through tie-line bias area control.
- **Monitor and report** Control Performance Standards (CPS) and disturbance recovery.
- **Operate** its Balancing Authority Area to maintain load-interchange-generation balance.
- **Review** generation commitments, dispatch, and load forecasts and planned outages.
- **Provide** operational plans (generation commitment, outages, etc.) for reliability evaluation.
- **Approve and implement** interchange transactions based on appropriate criteria.
- **Provide** balancing and energy accounting functions for the SPP Balancing Authority.
- **Determine and deploy** reliability-related services (regulating reserves and contingency reserves)
- **Implement/coordinate** emergency procedures.
SPP Integrated Marketplace: Products

- Energy
- Operating Reserve
  - Regulation
    - Regulation Up
    - Regulation Down
  - Contingency Reserve
    - Spinning
    - Supplemental
- Transmission Congestion Rights (TCRs)

SPP Integrated Marketplace: Processes

- Multi-Day Reliability Assessment
- Day-Ahead Market
- Reliability Unit Commitment
- Real-Time Balancing Market
- Settlement Process
- Transmission Congestion Rights (TCR) Market
  - Coupled with Auction Revenue Rights (ARRs)
Section 3

MARKET ACTIVITIES
MARKET ACTIVITIES:
PRE DAY-AHEAD MARKET ACTIVITIES
Registration

• All Market Participants must register their loads and resources* prior to participation in the SPP Integrated Marketplace.

• A Market Participant may represent one or more asset owners and may appoint a designated agent to perform its functions.

• Market Participants have the legal relationship with SPP.

• Registration data is used for operation and settlement of the SPP Integrated Marketplace, identifying responsibilities and asset owners.

*excludes behind the meter generation less than 10 MW
MARKET ACTIVITIES:
DAY-AHEAD MARKET

Integrated Marketplace: Day-Ahead Market

- The Day-Ahead Market provides Market Participants with the ability to submit:
  - offers to sell Energy and Operating Reserve
  - bids to purchase Energy

- The Day-Ahead Market provides a financially binding schedule by which supply offers are matched with demand bids while satisfying the system Operating Reserve requirements
Integrated Marketplace: Day-Ahead Market

- Market Participants must offer enough capacity to cover their expected load and Operating Reserve requirements.
- The clearing of Energy and Operating Reserve is co-optimized.
- The clearing of Day-Ahead Market is performed via Security-Constrained Unit Commitment (SCUC) and Security-Constrained Economic Dispatch (SCED) algorithms.

Timeline:
- 0700: SPP Publishes Load Forecast
- 1100: SPP Publishes Operating Reserve Requirements
- 1100: Submit DA Demand Bids, Resource Offers (Energy & OR), Virtual bids & offers and physical transactions to SPP
- 1600: SPP Publishes Day-Ahead Market Results
- 1600: SPP clears Day-Ahead Market

The day prior to operating day
MARKET ACTIVITIES:
RELIABILITY UNIT COMMITMENT
Integrated Marketplace: Reliability Unit Commitment (RUC)

• The Reliability Unit Commitment (RUC) process is a mechanism to ensure that there is enough capacity committed for the operating day to cover the system load and Operating Reserve requirement forecasts.

• The RUC process is implemented immediately following the completion of the Day-Ahead Market:
  – Day-Ahead RUC: The RUC process executed shortly after the Day-Ahead Market completes.
  – Intra-Day RUC: Within the operating day, the RUC process executed several times (min every 4 hours) for the balance of the day.

• Multi-Day Reliability Assessment- For long start resources, a reliability assessment is performed several days prior to the Day-Ahead Market.

• The clearing in the RUC process is performed via a Security-Constrained Unit Commitment (SCUC) algorithm.

Integrated Marketplace: Reliability Unit Commitment

• All Market Participants need to submit (real-time) offers for all their registered resources that are not on planned, forced or otherwise approved outage.

• The RUC process will take into consideration the cleared resource commitment schedules from the Day-Ahead Market and updated Current Operating Plan (which could have been modified as a result of a previously cleared RUC process).

• Resources committed by any RUC (Day-Ahead or Intra-Day) or Reliability Assessment processes are subject to make whole payment given that they meet the eligibility criterion.
Reliability Unit Commitment: Day-Ahead

- **Timeline:**
  - 1700: Submit updated Resource Offers
  - 1900: SPP runs SCUC in RUC mode
  - 2000: SPP reports DA RUC results to affected Market Participants

Day Prior to Operating Day

Integrated Marketplace: Reliability Unit Commitment

- RTBM Resource Offers
- Confirmed Import, Export & Through Transactions
- DA Resource Commit Schedules
- Resource Outage Notifications
- SPP Operating Reserve Requirements
- SPP Forecasts (Load & Wind)

RUC Process

- Resource Commit / De-commit Schedules
- Resource Commitment / Regulation Notifications
- Fixed Interchange Transaction Curtailment Notification
### Integrated Marketplace: Day Ahead vs. RUC

The graph represents what is possible in the Reliability Unit Commitment process. It is unlikely that SPP will de-commit Resources cleared in the Day-Ahead Market except for in minimum generation or emergency conditions.

### Reliability Unit Commitment: Intra-Day and Day-Ahead

- **Both RUC processes share the same purpose:** ensure a reliable operating plan during the operating day

- **Both processes use similar input data:**
  - **Day-Ahead RUC:** uses the SPP available load forecast for the day-ahead period and output from Day-Ahead Market
  - **Intra-Day RUC:** uses the SPP available load forecast for the balance of the day, and output from Day-Ahead Market, Day-Ahead RUC and previously completed Intra-Day RUC processes for the current operating day
Reliability Unit Commitment: Intra-Day

- **Timeline:**
  - Intra-Day RUC Process
  - Uses RTBM Resource Offers
  - SPP runs SCUC in RUC mode
  - SPP reports RUC results to affected Market Participants

0400 0800 1200 1600 2000 2400

Current operating day

MARKET ACTIVITIES:
REAL-TIME BALANCING MARKET
Integrated Marketplace: Real-Time Balancing Market

- The Real-Time Balancing Market (RTBM) is the financially driven mechanism by which SPP balances real-time load and generation committed by the Day-Ahead Market and RUC processes.
- The clearing of Energy and Operating Reserve is co-optimized.
- The clearing in the RTBM is performed via a Security-Constrained Economic Dispatch (SCED) algorithm.
- The clearing in RTBM is performed continuously on a 5-minute basis.
- Resources will receive Dispatch Instructions for Energy and clear Operating Reserve.

---

Integrated Marketplace: Real-Time Balancing Market

- Charges are imposed on Market Participants for failure to deploy Energy and Operating Reserve as instructed.
- Market Participants submit resources:
  - Dispatch Status
  - 3-part offer: Energy offer curve
  - Operating Reserve Offer
- The SPP market accommodates the participation of external resources.
- Exports, Imports and Through Transactions
- Settlement are based on the difference between the results of the RTBM process and Day-Ahead Market.
Section 4

SPECIAL MARKET INSTRUMENTS

SPECIAL MARKET INSTRUMENTS:
FINANCIAL SCHEDULES
BEFORE SPP Integrated Marketplace & CBA

- Bilateral transactions exist between Balancing Authorities in the form of physical imports and exports of energy (tags).

AFTER SPP Integrated Marketplace and CBA

- Bilateral transactions exist between SPP Market Participants in the form of Financial Schedules.
Integrated Marketplace: Financial Schedules

- Financial Schedules are bilateral transactions of Energy or Operating reserve that **transfer financial responsibility** within the SPP Market Footprint

- Energy Financial Schedules are defined by:
  - Settlement location
  - MW amount
  - Buyer
  - Seller
  - Pricing (Day-Ahead and/or Real-Time Balancing Market)
  - Seller and Buyer confirmation of the transaction

- Operating Reserve Financial Schedules are defined by:
  - Reserve Zone
  - Operating Reserve Product
  - MW amount
  - Buyer
  - Seller
  - Pricing (DA and/or RTBM)
  - Seller and Buyer confirmation of the transaction

SPECIAL MARKET INSTRUMENTS:
VIRTUAL TRANSACTIONS
**Integrated Marketplace: Virtual Transactions**

- Virtual Transactions are Day-Ahead energy market instruments

- A Virtual Transaction can either be:
  - **Virtual Energy Offer**: a proposal by a Market Participant to **sell** Energy at a specified price, Settlement Location and period of time in the Day-Ahead Market that is **not associated with a physical Resource**.
  - **Virtual Energy Bid**: a proposal by a Market Participant to **purchase** Energy at a specified price, Settlement Location and period of time in the Day-Ahead Market that is **not associated with a physical Load**.

- When cleared by the Day-Ahead Market, the Virtual transaction will be settled at the price difference between the Day-Ahead LMP and the Real-Time LMP

---

**Virtual Offer Mechanics**

- Offer Quantity/Price into DA Market
- If DA LMP >= Offer Price, then transaction clears DA Market
- If cleared, Market Participant must **buy energy back** at Real-Time LMP:
  - Profit if DA LMP > RT LMP
  - Loss otherwise

**Virtual Bid Mechanics**

- Offer Quantity/Price into DA Market
- If DA LMP <= Bid Price, then transaction clears DA Market
- If cleared, Market Participant must **sell energy back** at Real-Time LMP:
  - Profit if DA LMP < RT LMP
  - Loss otherwise
Integrated Marketplace: Virtual Transactions

- Virtual Energy Offers and Bids are supported in the Day-Ahead Market only
- Virtual Energy Offers and Bids are subject to a transaction fee
- Virtual Energy Offers and Bids can be submitted by a Market Participant at any Settlement Location, subject to meeting credit requirements
- A Market Participant may submit a single Virtual Energy Bid and a single Virtual Energy Offer for each Asset Owners at any Settlement Location for a particular Hour
- Each Virtual Energy Offer and Bid must specify a start and stop Hour within the applicable Operating Day

Section 5
TRANSMISSION CONGESTION RIGHTS (TCR)
Understanding Congestion

Understanding Congestion Hedging

ARR Allocation / TCR Awards
Transmission System
Feasibility Test
Congestion Hedging Process
Credit Check
About Congestion

• Like traffic congestion, transmission congestion can not be completely eliminated or avoided.

• However, one can hedge to manage the uncertainty of congestion.
  – Road Traffic Congestion- EZ Pass system
  – Electricity Congestion — ARRs/TCRs

Differences from SPP’s current EIS Market

• TCRs replace use of Energy Schedules and Native Load Schedules as congestion hedges.

• Congestion hedging process moves ahead of Real-Time and even Day-Ahead operations (annual and monthly ARR allocation/TCR auction processes).

• External participants and those without assets in market footprint can participate.
What is an ARR, and who gets it?

- An Auction Revenue Right (ARR) is a Market Participant’s entitlement to a share of the revenue generated in the TCR auctions
- Allocated to Market Participants based on firm transmission rights on the SPP transmission grid

How are ARRs allocated?

- Based on following Firm Transmission Rights
  - Network Integrated Transmission Service Agreement
  - Point to Point Firm Transmission Service Request
  - Grandfathered Agreements

- Allocated Annually - Duration and Type
  - June, July, August, September (On/Off Peak)
  - Fall, Winter, Spring (On/Off Peak)
  - Allocated in three rounds

- Allocated Monthly - Duration and Type
  - Monthly single round (On/Off Peak) – as needed basis
TCRs are...

Financial Instruments that entitle the owner to a stream of revenues (or charges) based on the hourly Day-Ahead marginal congestion component differences across the path.

What are TCRs worth?

- **Benefit**
  - TCR same direction as congested flow

- **Liability**
  - TCR in opposite direction as congested flow
Where can I obtain TCRs from SPP?

• **Annual TCR auction**
  - Multi-period *(months/seasons)*
  - Multi-product *(On Peak/Off Peak)*
    - Based on reduced system capability

• **Monthly TCR auction**
  - Single or two rounds
  - Multi-product *(On Peak/Off Peak)*
  - Purchase “left over” capability

• **TCR secondary market**
  - Bilateral trading

---

**ARR-TCR Process Overview**

1. **SPP Transmission System Capability**
2. **ARRs Allocated (MWs)**
3. **Participate in TCR Auction**
4. **TCR Auction (MWs w/ Price)**
5. **Auction Revenue**
6. **ARR Holders**
7. **Congestion rights**
8. **TCR Holders**
9. **Auction Revenue Rights**
Settlement of ARRs/TCRs

- ARRs tell us how to distribute the Net Auction revenues
- TCRs settled using Day-Ahead Market prices
- Auction revenues, congestion revenues, congestion rights revenues are settled concurrently with Operating Day

ARR/TCR Project Timeline

- Market Protocols: 3Q 2010
- System Requirements: 4Q 2010
- Internal Test Runs: 3Q 2011
- Mock TCR Runs: 1Q & 2Q 2012
- Ready to Go Live: 4Q 2013
Section 6

SETTLEMENTS

Settlement

- Settlements are based on the difference between the RTBM quantities cleared and the DA Market clearing
- Settlement of Day-Ahead transactions and Transmission Congestion Rights is on an hourly basis
- Transmission Congestion Rights are settled using Day-Ahead price
- Settlement of Real-Time transactions are on a five-minute basis
- Five minute settlement supports:
  - Real-Time performance and incentive to offer more ramping capability
  - Transparency of the market and impacts of interregional actions (e.g. tagged transactions at the “top of the hour”)
  - Consistency with co-optimization logic
- Five minute settlement also removes the need to implement a “price volatility uplift” with the resulting price distortion
Locational Marginal Price (LMP)

- The LMP at a pricing location represents the cost to serve the next increment of load at that location. That value includes the cost of producing energy, and the cost of its delivery (congestion and losses).

- The difference in LMP between any 2 locations comes from their cost effectiveness in delivering energy to the load center or any other reference location (Reference Bus). Consequently, the LMP at a given pricing location can be split into the following 3 parts:
  - **Marginal Loss Component**: The economic impact (cost) of incurred losses when delivering that increment of load, measured between that location and the Reference Bus.
  - **Marginal Congestion Component**: The economic impact (cost) of network congestion when delivering that increment of load, measured between that location and the Reference Bus.
  - **Marginal Energy Component**: The effective value (cost) of delivering that increment of load, from the Reference Bus.

\[
LMP = MEC + MCC + MLG
\]

Settlement Example

- What is the relationship between the Day-Ahead and Real-Time Settlement?

\[
\begin{align*}
\text{Day-Ahead Settlement} & = \text{Day-Ahead Quantity} \times \text{Day-Ahead Price} \\
\text{Real-Time Settlement} & = \left( \text{Real-Time Quantity} - \text{Day-Ahead Quantity} \right) \times \text{Real-Time Price}
\end{align*}
\]
Settlement Disputes

- Means to challenge settlement statements for a specific Operating Day

- Statements and Invoices can be disputed for up to 90 calendar days after the final settlement statement for a specific Operating Day

- Disputes must be filed on the Portal using the Contents of Notice dispute form

- Any adjustments from a resolved dispute will be posted to a subsequent settlement statement

Market Activities

- Payments for market settlements flow through SPP
- Payments are triggered by Invoices
- Payments due to SPP must be made in full
Section 7

REFERENCE MATERIALS

Find Reference Materials

• Integrated Marketplace:
  www.SPP.org > Market > Integrated Marketplace
  - [http://spp.org/section.asp?pageID=138]
  - Integrated Marketplaces
  - Integrated Marketplace Protocols
  - Marketplace Education Sessions
  - Marketplace Implementation Timelines

• Market Working Group:
  www.SPP.org > Org Groups > Market Working Group
  - Marketplace Protocol Revision Requests, design decisions, etc.

• Change Working Group:
  www.SPP.org > Org Groups > Change Working Group
  - [http://www.spp.org/committee_detail.asp?commID=74]
  - Implementation information, timelines, etc.
Find Reference Materials

Introducing the new INTEGRATED MARKETPLACE EXPLODER

1. www.spp.org
2. Select Org Groups
3. Select link to Exploder page
4. Fill in your information, select Integrated Marketplace News, Subscribe

Common Acronyms

ARR - Auction Revenue Rights
CBA - Consolidated Balancing Authority
DA – Day-Ahead
EMS - Energy Management System
LMP - Location Marginal Price
MCC - Marginal Congestion Component
MP - Market Participants
NITS - Network Integrated Transmission Service
OR – Operating Reserve
RTBM - Real-Time Balancing Market
RUC - Reliability Unit Commitment
SCED – Security-Constrained Economic Dispatch
SCUC – Security-Constrained Unit Commitment
TCR - Transmission Congestion Rights
THANKS FOR YOUR PARTICIPATION!