Overview

I. Transmission
   A. Transmission Investment
   B. FERC Order 1000 – Transmission Planning and Cost Allocation
      - Status of implementation nationally and in the West
      - Discussion of CAISO lines to be built in AZ and NV
   C. Transmission Rate Incentives

II. Energy Imbalance Market
   A. Background
   B. New CAISO, PacifiCorp, and NV Energy EIM
      - Drivers for participation, implementation, and performance
   C. Possible New Northwest Intra-Hour Energy-Only Market
I. Transmission
A. Transmission Investment

A. Historical and Future Transmission Additions

- 3,000 to 7,000 circuit-miles per year reported for 2013-16 in U.S.; Equivalent to $7-16 billion (averaging $12b) per year nationwide
- Up from 1985-2005, but still below levels of 1960s to early 1980s
- Significant replacement/upgrade needs over next decade(s)

Source: Brattle Group, 2013
EPA’s proposed Clean Power Plan would require states to cut carbon pollution from power sector by **30% from 2005 levels by 2030**, with interim goals starting in 2020.

Each state would have flexibility to choose how to meet goal, including use of four building blocks:

- Make fossil-fuel fired plants more efficient
- Use low-emitting power sources more
- Use more low or zero emitting power sources
- Use electricity more efficiently

States can develop a state-only plan or collaborate with each other to develop plans on a multi-state basis.

Final rule to be issued June 2015.

If adopted, likely to increase need for new transmission investment.
California GHG and Clean Energy Goals

**Current GHG Goals**

- AB 32, the “California Global Warming Solutions Act of 2006,” requires reduction in GHG emissions to **1990 levels by 2020**
- State goal is **80% below 1990 levels by 2050**

**Gov. Brown’s New Energy Goals**

- **50%** of electricity from renewable sources by **2030**
- Reduce petroleum use in cars and trucks by **up to 50%**
- **Double** the amount of efficiency achieved in existing buildings (increasing the existing goal by about **50%**)

Source: California Air Resources Board
B. FERC Order 1000 – Transmission Planning and Cost Allocation

• Issued in 2011 on decisions on rehearing, Orders 1000A and 1000B, were issued in 2012

• Basics: Directed all public utility transmission providers to:
  – Develop a regional transmission planning process which considers transmission needs driven by federal, state, and local public policy mandates
  – Participate in broader interregional transmission coordination
  – Establish new cost allocation methods for regional and interregional transmission facilities that result from the Order 1000 processes, based on six cost allocation principles.
  – Remove from their FERC-jurisdictional tariffs any “federal right of first refusal” to an incumbent public utility transmission provider to construct regional transmission facilities

• Deadlines: Regional plans, 2012; interregional plans, 2013
• Upheld in all respects by the U.S. Court of Appeals for the D.C. Circuit in 2014
1. Status of Implementation Nationally

- **Regional Plans**
  - All Regional compliance filings have been made
  - FERC has accepted all, at least in part
  - Many pending cases challenging FERC orders on compliance filings

- **Inter-Regional Compliance Filings**
  - FERC only recently began to act on these filings
  - None fully accepted yet
  - No litigation yet

Source: FERC
Regional Transmission Organizations
Order 1000 Transmission Planning Regions

Source: FERC
2. Status of Implementation in the West: Regional Filings

- Order 1000 in effect in all regions in the West
- Status of regional filings:
  - CAISO – Accepted; no judicial challenges
  - Columbia Grid – Accepted in part with compliance filings pending; one judicial challenge by Avista thus far
  - Northern Tier – Accepted in part with compliance filings pending; no judicial challenges thus far
  - WestConnect - Accepted in part with compliance filings pending; one judicial challenge by El Paso thus far
Participation Issues in Regional Filings

• Relationship between regions and non-FERC jurisdictional transmission providers is important in the West
  – Examples: Columbia Grid with BPA; WestConnect with WAPA and public power utilities

• FERC Review
  – FERC’s initial position: To participate, must enroll in region
  – Compromise reached in FERC orders issued Sept. 18, 2014:
    • Planning: Non-jurisdictional entities can have the Region plan for them without requiring them to enroll
    • Cost allocation: If non-jurisdictional entities enroll, they must participate in binding cost-allocation
WestConnect Challenges
Boundaries and Participation

- Note challenges with footprint, especially CA municipal utilities

- Note challenges with participation
  - All entities required to sign Planning Participation Agreement (“PPA”) to become a voting member
  - Entities in grey (non-FERC jurisdictional entities) participate in Order 890 transmission planning process, but have not signed PPA yet
WestConnect Challenges
Integration and New Approaches

- Under Order 890, WestConnect planning was done by three sub-groups
- For Order 1000 compliance, three sub-regions have been merged
- There is a need to change approaches used, including doing economic analysis using production cost modeling for the first time

Source: WestConnect
## 2015 WestConnect Projects

<table>
<thead>
<tr>
<th>State(s) Traversed</th>
<th>Number of Projects</th>
<th>Transmission Line Project Miles</th>
<th>Planned Investment ($ x 1,000)</th>
<th>Number of Projects</th>
<th>Transmission Line Project Miles</th>
<th>Conceptual Investment ($ x 1,000)</th>
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<tbody>
<tr>
<td>Arizona</td>
<td>66</td>
<td>555</td>
<td>$722,000</td>
<td>49</td>
<td>1,089</td>
<td>$1,020,000</td>
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<tr>
<td>California</td>
<td>21</td>
<td>815</td>
<td>$3,154,000</td>
<td>2</td>
<td>140</td>
<td>$54,000</td>
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<tr>
<td>Colorado</td>
<td>26</td>
<td>386</td>
<td>$532,000</td>
<td>10</td>
<td>668</td>
<td>$1,312,000</td>
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<tr>
<td>Nebraska</td>
<td>1</td>
<td>0</td>
<td>$4,000</td>
<td>0</td>
<td>0</td>
<td>$</td>
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<tr>
<td>Nevada</td>
<td>21</td>
<td>23</td>
<td>$248,000</td>
<td>8</td>
<td>293</td>
<td>$667,000</td>
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<tr>
<td>New Mexico</td>
<td>15</td>
<td>107</td>
<td>$131,000</td>
<td>2</td>
<td>255</td>
<td>$602,000</td>
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<tr>
<td>South Dakota</td>
<td>1</td>
<td>0</td>
<td>$4,000</td>
<td>0</td>
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<td>$</td>
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<td>Texas</td>
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<td>14</td>
<td>$34,000</td>
<td>0</td>
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<td>$</td>
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<tr>
<td>Wyoming</td>
<td>6</td>
<td>217</td>
<td>$108,000</td>
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<tr>
<td>Multi-State</td>
<td>14</td>
<td>3,217</td>
<td>$8,357,000</td>
<td>4</td>
<td>4,475</td>
<td>$8,400,000</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>183</strong></td>
<td><strong>5,334</strong></td>
<td><strong>$13,294,000</strong></td>
<td><strong>75</strong></td>
<td><strong>6,920</strong></td>
<td><strong>$12,055,000</strong></td>
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</tbody>
</table>

Source: WestConnect
3. Status of Implementation in the West - Interregional Filing

- Western regions collaborated on common tariff language for their initial interregional filing in 2013

- Key concepts
  - Regional processes are foundation
  - Planning procedures include:
    - Interregional planning coordination and data exchange
    - Identification and joint evaluation of Interregional Transmission Facilities (“ITFs”) (i.e. lines which interconnect at least two planning regions and seek interregional cost allocation)
      - Standard is whether ITFs would address regional transmission needs more efficiently or cost-effectively than separate regional transmission facilities
    - Cost allocation procedures for lines selected by regions for inclusion in plan for purposes of cost allocation, which requires a benefits determination and assignment of costs
Western Inter-Regional Filings, 2014-15

• FERC issued first order on Dec. 18, 2014, accepting almost all of filing
• Compliance filings required of CAISO and Columbia Grid which relate to clarifications of proposed tariff language, which were filed February 17, 2015
• Western planning regions already voluntarily implementing
• Columbia Grid tariff provisions took effect January 1, 2015
• New tariff provisions are to take effect October 1, 2015, for CAISO, NTTG, and WestConnect
• West-wide meeting held February 26, 2014
West-Wide Coordination 2015

From Presentation for West-Wide Inter-Regional Meeting, Feb. 26, 2015
4. CAISO Transmission Plans and Impact on Its Neighbors

- In 2012, CAISO began implementation of a new transmission planning process
  - Identifies reliability, policy-driven, and economic projects
  - All costs of >200 kV lines are paid by all users of grid through transmission access charge
- In 2012-13, CAISO identified a large number of new transmission projects in CA and started to use its competitive solicitation process, e.g.
  - Gates – Gregg
    - Reliability project, with policy and economic benefits in PG&E service territory
    - Approximately 59 miles of 230 kV line; cost $115-$145 million
    - Five applicants and project sponsor selected was PG&E and MidAmerican Transmission LLC, in conjunction with Citizens Energy Corporation
  - Sycamore-Pennasquitos
    - Policy-driven project in SDG&E service territory
    - Approximately 11 miles of 230 kV line; cost $111- $221 million
    - Four applicants and project sponsor selected was SDG&E, in conjunction with Citizens Energy Corporation
CAISO Lines into Arizona and Nevada

• In 2013-14, CAISO identified many projects expected to cost almost $2 billion, including two economic projects to neighboring states, currently in competitive solicitation process –
  – Delaney-Colorado River – CA and AZ
    • 115-140 miles, 500 kV line, cost approximately $300 million
  – Harry Allen-Eldorado – NV
    • 60 miles, 500 kV line, cost approximately $144 million
• 100% of the cost of both of these lines will be paid for by CAISO ratepayers which will be rolled into the Transmission Access Charge
• Need to comply with all applicable federal, state, and local permitting laws
Delaney-Colorado River
Delaney-Colorado River Benefits

- Production cost model shows sufficient economic benefits
- Improves deliverability of renewable resources
- Improves reliability in the event of outage of major import line

### Table 5.7-25: Cost-benefit analysis of the proposed Delaney – Colorado River 500 kV

<table>
<thead>
<tr>
<th>7% discount rate</th>
<th>Capacity Benefit</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>200 MW</td>
</tr>
<tr>
<td>Total benefit ($M)</td>
<td>406</td>
</tr>
<tr>
<td>Total cost ($M)</td>
<td>442-469</td>
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<tr>
<td>Benefit-cost ratio</td>
<td>0.87-0.93</td>
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</table>

### Table 5.7-26: Cost-benefit analysis of the proposed Delaney – Colorado River 500 kV

<table>
<thead>
<tr>
<th>5% discount rate (sensitivity)</th>
<th>Capacity Benefit</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>200 MW</td>
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<tr>
<td>Total benefit ($M)</td>
<td>528</td>
</tr>
<tr>
<td>Total cost ($M)</td>
<td>530-560</td>
</tr>
<tr>
<td>Benefit-cost ratio</td>
<td>0.95-1.0</td>
</tr>
</tbody>
</table>

Source: CAISO
Impact of Delaney-Colorado River on Generation

Figure 5.7-15: Generation changes with addition of the Delaney - Colorado River 500 kV line

Source: CAISO

Note the expected increase in usage of combined-cycle generators in Arizona
Applicants for Project Sponsor

- Validated applications received from:
  - DCR Transmission, LLC (a joint venture between Abengoa Transmission & Infrastructure and an affiliate of Stanwood Energy Group Global, Inc.)
  - California Transmission Development LLC (a wholly owned subsidiary of LS Power & Associates)
  - NextEra Energy Transmission West LLC (a wholly owned subsidiary of NextEra Energy Transmission)
  - Southern California Edison Company
  - TransCanyon DCR LLC (wholly owned by TransCanyon LLC)

- Currently in collaboration phase, so some applicants may decide to work together

- CAISO target for selection of Project Sponsor is June 12, 2015
The Harry Allen-Eldorado 500 kV Transmission Project
## Harry Allen-Eldorado Benefits

<table>
<thead>
<tr>
<th>Assumptions</th>
<th>5% Real Discount Rate, 10% ROE</th>
<th>5% Real Discount Rate, 11% ROE</th>
<th>7% Real Discount Rate, 10% ROE</th>
<th>7% Real Discount Rate, 11% ROE</th>
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<tbody>
<tr>
<td>Dispatch Benefits</td>
<td>$157</td>
<td>$157</td>
<td>$119</td>
<td>$119</td>
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<tr>
<td>Capacity Benefits</td>
<td>$189</td>
<td>$189</td>
<td>$148</td>
<td>$148</td>
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<tr>
<td><strong>Total Gross Benefits</strong></td>
<td><strong>$346</strong></td>
<td><strong>$346</strong></td>
<td><strong>$267</strong></td>
<td><strong>$267</strong></td>
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<tr>
<td>Revenue Requirement for line</td>
<td>$288</td>
<td>$301</td>
<td>$240</td>
<td>$252</td>
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<tr>
<td>BCR</td>
<td>1.20</td>
<td>1.15</td>
<td>1.11</td>
<td>1.06</td>
</tr>
</tbody>
</table>

Other benefits not quantified:

- Renewable integration
- Reliability

Source: CAISO
Impact of Harry Allen-Eldorado on Generation

Figure 4: Generation changes with addition of the Harry Allen – Eldorado 500 kV line for Year 2024

Note the expected increase in usage of combined-cycle generators in Nevada.

Source: CAISO
Current Schedule for Harry Allen-Eldorado

- April 30 – Applications due
- May 5 – Validated list of applicants due
- Collaboration period, if applicable
- November 17 (or fifty days later if collaboration) – Selection announced
C. Transmission Rate Incentives

- FERC has exclusive authority to set transmission rates
- In 2005 Congress gave FERC authority to adopt rate incentives under FPA Section 219
- Sample incentives
  - FERC can reduce risks by, for example, pre-authorizing: (1) recovery of Construction Work in Progress ("CWIP"); (2) recovery of pre-commercial costs as an expense or as a regulatory asset; and (3) recovery abandoned plant
  - FERC will increase the ROE for turning over control to RTO, ISO
  - FERC can also authorize an increased rate of return on equity for taking on significant risks
- FERC Implementation
  - Orders 679: Nexus test - connection between the incentive(s) requested and the proposed investment
  - FERC Order 679-A: Facilities for which incentives are sought must enhance reliability or reduce congestion
  - In 2012, after receiving 85 applications for $60 billion of investment, FERC Issued Policy Statement which tightened standards, especially for granting higher return on equity
Recent Applications for Incentive Rates

- Recent applications for incentive rates for projects that result from competitive solicitation
  - Gates-Gregg (Project Sponsor is partnership of PG&E and Mid-American)
    - PG&E – FERC authorized recovery of abandoned plant and 50 basis point ROE adder for RTO participation
    - Mid-American – FERC authorized same incentives as for PG&E and (1) recovery of pre-commercial costs as regulatory asset; and (2) hypothetical capital structure of 52% equity/48% debt
  - Suncrest-Pennasquitos (SDG&E is sole Project Sponsor)
    - SDG&E requested recovery of abandoned plant and 100 basis point ROE adder
- Note that ratepayer costs may be higher than if these projects were solely projects of the State’s utilities only
II. Energy Imbalance Market
A. Background

Basics

• What is it?
• How does it work?
• What are the benefits?
• Who is currently participating?

Source: CAISO
Balancing Authority Areas

- A balancing authority ("BA") matches generation with load and maintains electric frequency of the grid in a balancing authority area ("BAA")
- There are 37 BAs in the western interconnection
- Today, each BA balances load and generation separately

Source: CAISO
Balancing Authority Interaction

**BEFORE**

- Each BA balances load and generation manually and maintains reserves

**AFTER**

- EIM resolves imbalances in real time through an automated multi-BAA energy dispatch service

Source: CAISO
EIM Market Operations

Milestones for 3:00 – 3:15 (Market 1)

T-75: Base schedules and energy bids due (Resources)

T-55: Updated base schedules are submitted if necessary (Resources)

T-40: Updated base schedules are submitted if necessary (Entity SC)

T-20: E-tagging deadline (Entity SC)

T-22.5: 15-minute scheduled awards published

T-37.5: Start of Market 1 optimization

T-45: Results of sufficiency test published

T-60: Results of sufficiency test published

Source: CAISO
NREL Study of West-wide EIM

- In 2013 NREL studied the potential benefits of a West-wide EIM
- Conclusions:
  - Increasing the temporal and geographic footprint to the entire West would moderate the variability of renewable generation and electricity demand
  - By introducing 5-minute economic dispatch to meet imbalances, there could be
    - More efficient dispatch of generators
    - More efficient clearing of imbalances
    - Reduced need for flexibility reserves, often provided by quick-response reserves
NREL West-wide EIM Study Results

- With full participation in the West, there would be an annual West-wide operating benefit between $146 and $294 million per year.
- There is an additional benefit of approximately $1.3 billion per year associated with moving from hourly to 10-minute dispatch.
- Benefits would be somewhat less with reduced participation or lower natural gas prices.

Source: NREL
Distribution of Benefits for West-Wide EIM

- Distribution of benefits would not be uniform
- This is a map of change in locational marginal prices between a full EIM and hourly BAU scenarios
- Locational marginal prices go down the most in areas in dark blue benefit, followed by areas in turquoise

Source: NREL
B. New CA ISO, PacifiCorp, NV Energy EIM

- CAISO and PacifiCorp
  - In 2013 signed MOU regarding development of EIM
  - In 2014 received FERC approval and EIM went live
- Addition of NV Energy
  - In 2013 signed MOU regarding participation in EIM
  - In 2014 NV Energy received approval from PUCN
  - In 2015, expect to receive FERC approval to join EIM
- Note: PacifiCorp in 2005 and NV Energy in 2013 were purchased by subsidiaries of Berkshire-Hathaway

Source: CAISO
1. Drivers for Participation in EIM

- In CA, high RPS requirement – 33% by 2020
- Most of renewables are intermittent (solar PV and wind)
- Expected to lead to over generation and curtailment

Source: CPUC, RPS Quarterly Report, 3d Quarter 2014
CAISO Net Load

Net Load is load less wind and solar generation

Source: CAISO
RPS Curtailment in CAISO

RPS Curtailment in 2024 – 40% RPS Scenario

Source: CAISO
Benefits to PacifiCorp

- PacifiCorp had study done of the benefits to PacifiCorp
- Found significant benefits, which increased with transfer capability

Source: Study by E-Three for PacifiCorp
Benefits of NV Energy Participation

- CAISO and NV Energy had study done of benefits to EIM participants to having NV Energy join EIM
  - Study concluded that there would be significant benefits that would increase over time
- NV Energy also made a case for the benefits of joining an EIM to the PUCN to get its consent to join the EIM
  - Noted benefits to Nevada of facilitating development of renewable resources

Figure 1. Low and high range incremental gross annual benefits to all participants from NV Energy Participation in EIM (2013$)

Note: Figure represents total incremental benefits to all EIM participants as a result of NV Energy’s participation in the EIM.

Source: Study by ABB and E-Three for CAISO and NV Energy
2. Implementation

- **Entity implementation agreements**
  - PacifiCorp FERC approval: June 28, 2013
  - NV Energy FERC approval: June 13, 2014

- **Design**
  - Tariff amendment filings by CAISO and PacifiCorp: February 2014
  - Initial FERC approval: June 19, 2014
  - Several amendments

- **Implementation** - Fully binding on November 1, 2014
Design Basics

- Any balancing authority can join and become an “EIM Entity”
- In BAAs outside the CAISO, participation by generators is voluntary
- Generators that want to participate sign an agreement to become an “EIM Participating Resource” in the CAISO
- Participants only sell energy in the 5-minute real time market
- CAISO uses its market software to economically dispatch generators in all of the EIM Entities
- Prices are settled by the CAISO
- Pancaked rates are avoided by imposing no wheeling charges, but this is being revisited
- There is currently a small administrative fee
Market Power Concerns

- Only part of tariff filing which required significant additional work before implementation
- Intervenors noted that PacifiCorp affiliates own much of generation in PACE and PACW
- FERC agreed with intervenors that proposed tariff provisions relating to market power monitoring for transfers between BAAs were inadequate
- Resolved by having CAISO Department of Market Monitoring agree to monitor real-time transfers in and among all BAAs
Governance

**Stakeholder Transition Committee**

- **Roles**: advise on EIM matters, propose independent EIM structure
- **Sectors**: investor owned utilities, publicly owned utilities, generators and marketers, alternative energy providers, EIM participants, government agencies, public interest entities
- **Open meetings, CAISO staff support, no compensation**
- **To be replaced when permanent governance structure is adopted in late 2015**

**Composition**

- **Chairperson**: Rebecca Wagner, Public Utilities Commission of Nevada
- **Members**:

  - Stephen Beuning
  - Tony Braun
  - Dede Hapner
  - Natalie Hocken
  - Travis Kavulla
  - Kevin Lynch
  - Mark Smith
  - Walter Spansel
  - Rebecca Wagner
  - Robert Weisenmiller
  - Carl Zichella
  - Xcel Energy, Inc.
  - Braun Blaising McLaughlin & Smith, PC
  - Pacific Gas and Electric Company
  - Representative from EIM Entity PacifiCorp
  - Montana Public Service Commission
  - Iberdrola Renewables
  - Calpine Corporation
  - Representative from EIM Entity NV Energy
  - Public Utilities Commission of Nevada
  - California Energy Commission
  - Natural Resources Defense Council
3. Performance

EIM transfer in fifteen-minute market between PAC and California

Source: CAISO
Recent EIM Energy Transfers

- EIM dispatched energy transfers up to:
  - 421 MW in a 15 min interval from PACW to ISO
  - 220 MW from ISO to PACW
  - 200 MW from PACE to PACW

Source: CAISO
Recent Cost-Benefit Analysis

Benefits were calculated as difference between operating with EIM and without EIM. Thus far, overall benefits observed are estimated to be $5.97 million, which is in line with forecasts. Benefits reflect more efficient dispatch in the 15-minute market and reduced renewable energy curtailment, but does not yet include benefit of reduced flexibility reserves.

### Estimated Benefits – In Millions of Dollars

<table>
<thead>
<tr>
<th></th>
<th>November</th>
<th>December</th>
<th>Total</th>
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<tr>
<td>ISO</td>
<td>$0.65</td>
<td>$0.59</td>
<td>$1.24</td>
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<tr>
<td>PACE</td>
<td>$1.05</td>
<td>$1.26</td>
<td>$2.31</td>
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<tr>
<td>PACW</td>
<td>$1.39</td>
<td>$1.03</td>
<td>$2.42</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>$3.09</strong></td>
<td><strong>$2.88</strong></td>
<td><strong>$5.97</strong></td>
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</tbody>
</table>

Source: CAISO
EIM Modifications and Enhancements

- **Modifications Needed Immediately**
  - Price volatility at start-up
  - FERC approval of waiver
  - Now proposing 12-month transition pricing
- **One Year Enhancements**
  - Many enhancements under consideration

Source: CAISO
C. Possible New Northwest Intra-Hour Energy-Only Market

- BPA and the Northwest Power Pool ("NWPP") are working on developing a Security Constrained Economic Dispatch ("SCED") system, which is a within hour energy-only market.
- SCED systems already exist elsewhere in the US, and BPA and NWPP intend to base their system on that used by the Southwest Power Pool.
- NWPP issued an RFP for market design Oct. 31, 2014.
- A FERC filing for a declaratory order is expected soon.
SCED Overview

**What the SCED is:**

- An intra-hour market for non-firm energy
- A tool for centralized real time re-dispatch of units’ voluntarily offered range operations
- A market in which participation
  - is voluntary for generators offering economic re-dispatch flexibility (i.e. offered dispatchable range)
  - is mandatory for any imbalance (loads or generation) in the footprint composed of participating BAs

**What the SCED is NOT:**

- An RTO (with planning, day-ahead markets, BA consolidation)
- A centralized unit commitment tool
- A capacity market
- A replacement for the current contractual business structure
Conclusions

• Transmission
  – In the last ten years, pursuit of environmental goals relating to renewable energy and climate change have led to the death of transmission planning as we knew it
  – Tremendous challenges lie ahead, particularly with respect to inter-regional planning and cost allocation in the West

• Real-time markets
  – In the last three years, the addition of intermittent renewable resources and improvements in automation have begun to permit integration of real-time energy markets
  – More Western participation in real-time energy imbalance markets is likely