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Presenters

Jason Kram

- Senior Vice President & Chief Marketing Officer - Joined PCI in 2001
- Manages PCI’s worldwide Business Development, Marketing and Sales, Account Management
- 20+ years experience in the Energy Industry
- Previous: Duke Energy, Black & Veatch, Virginia Power

Tony Delacluyse

- Director - Joined PCI in 2005
- Monitors electric markets, Consulting and Sales
- 30+ years experience in the Energy Industry (regulated and deregulated electric markets)
- Previous: MISO, Westar Energy, AES NewEnergy, MidAmerican Energy
“Chat” your questions
Agenda / Expectations

• Introduction / PCI Overview
• “Virtual” Roundtable
• CAISO EIM Speakers
  – NVE
  – APS
  – PSE
  – Utilicast
• Wrap Up / Questions
CAISO EIM Speakers Today

Mark Schackmuth
Manager Commercial & Trading Strategy
NV Energy
– Recent CAISO EIM GO-LIVE 12/1/2015

Justin Thompson
Director Resource Operations and Trading
Arizona Public Services
– Planned CAISO EIM GO-LIVE 10/1/2016

Josh Jacobs
Director Load Serving Operations
Puget Sound Energy
– Planned CAISO EIM GO-LIVE 10/1/2016

David Luedtke
President
Utilicast
– CAISO EIM System Integrator
PCI Overview

- **Company:**
  - Software Development for Energy Markets
  - 200 employees and growing
  - Founded 1992 / Privately Owned

- **Experience:**
  - Supported better utilization of asset portfolios for over 20 years.

- **System:**
  - PCI Platform
    - Analytics
    - Market Systems
    - Transmission Ops
    - Asset Operations
    - Transaction Management
    - Data Warehouse & BI

- **Market:**
  - 60% of US generation capacity using PCI
  - 70% of Fortune 500 Utility & Energy companies

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PCI Application Platform

Platform

Front Office: Transactional Database, Workflow Management, Communication, Permissions, Auditing, Web Browser Interface, APIs

Back Office: ISO Communication, Bid/Offer Management, Bid Evaluation, Price Forecasting

Trading: AESO, CAISO, ERCOT, IESO, MISO, ISONE, NYISO, PJM, SPP, MEM

Asset Operations: AESO, CAISO, ERCOT, IESO, MISO, ISONE, NYISO, PJM, SPP, MEM

Post Analysis: Markets: ALL

Optimization: ST, LT, Risk

Markets: ALL

Operational Performance Metrics

Outage Management, Journal, Plant Interface, GADS, Energy (QF) Scheduling, Gas Pipeline Scheduling

Deal Capture, E-Tag, Deal Analyst, ICE Interface, Gas Management, Contract Settlement, RT Pricing

ISO Shadow Settlement, Allocations, Pre-Settlements, Reporting, Energy Accounting

ISO Communication, Bid/Offer Management, Bid Evaluation, Price Forecasting

Transactional Database, Workflow Management, Communication, Permissions, Auditing, Web Browser Interface, APIs

PCI Data Warehouse

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PCI – CAISO EIM Solution

- Performance Analytics (PCI Post Analysis/P&L Analyzer)
- Optimization (PCI GenTrader)
- Outage Management (PCI OM)
- Meter Data Management & Allocations
- Transmission Billing (PCI EA)
- GHG Tracking & EQR Reporting (PCI Deal Management)

Cloud Based Option

- Open API and Transactional Database
- Workflow Automation
- Security and Auditing
- Communicate (PCI GenManager)
  - EIM Entity
  - CAISO
  - EESC
  - PRSC
    - Marketing & Trading
      - Front & Back Office
    - Load Serving Operations
      - Front & Back Office

PCI Confidential and Proprietary
## PCI CAISO EIM Solution Matrix

<table>
<thead>
<tr>
<th>PCI Solution CAISO EIM</th>
<th>NVE</th>
<th>APS</th>
<th>PSE</th>
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</thead>
<tbody>
<tr>
<td>M&amp;T (PRSC)</td>
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<tr>
<td>LSO/BA (EESC)</td>
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<tr>
<td>Optimization</td>
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<tr>
<td>Outage Mgmt</td>
<td>X*</td>
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<td>MDM/EA</td>
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<td>Trans Billing</td>
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<td>GHG</td>
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<td>EQR</td>
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<tr>
<td>Analyzers</td>
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<tr>
<td>Delivery</td>
<td>On-Premise</td>
<td>On-Premise</td>
<td>Cloud Hosted</td>
</tr>
</tbody>
</table>

*Partial Solution
Vendor Onsite: **December 2014 (PCI)**
Detailed Design: **March 2015**
Go-Live Date: **December 2015**
Scope:
- PCI: M&T CAISO EIM & MRTU
- OATI: BA CAISO EIM
- PCI: Outage Management*
- PCI: Analyzers – Performance Analytics
- PCI Existing: Optimization, Post Analytics, CAISO MRTU
- On Premise Implementation

Experience & Lessons Learned:
- Get FERC approval early
- Start project earlier
- M&T / BA Coordination
- Performance measurement – after the fact
**APS Overview**

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**PINNACLE WEST: WHO WE ARE**

*We are a vertically integrated, regulated electric utility in the growing southwest U.S.*

**Principal subsidiary:** aps

- Arizona Public Service Company, Arizona’s largest and longest-serving electric utility

**Customers:** 1.2 million (89% residential)

**Service Territory:**

- 34,646 square miles
- 11 of the 15 Arizona counties

**2014 Peak Demand:** 7,007 MW

**Generation Capacity:** Over 6,400 MW of owned or leased capacity (~9,400 MW with long-term contracts)

**Transmission & Distribution:** 34,937 miles

- Transmission: 5,958 miles
- Distribution: 28,979 miles

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Resources

- **Nuclear**: 1,150 MW
- **Coal**: 1,930 MW
- **Natural Gas**: 3,150 MW Owned, 1,070 MW Tolled
- **Energy Efficiency**: 400 MW
- **Solar**: 480 MW Utility Scale, ~450 MW Distributed Rooftop
- **Wind**: 290 MW
APS – Justin Thompson

• System Integrator: June 2015 (Utilicast)
• Vendor Onsite: August 2015 (PCI)
• Detailed Design: Near Completion
• Go-Live Date: October 2016
• Scope:
  – PCI: M&T CAISO EIM & MRTU
  – PCI: BA CAISO EIM
  – PCI: Energy Accounting / Transmission Billing / Meter Data Management
  – PCI: Outage Management* / GHG / EQR
  – PCI: Analyzers – Performance Analytics
  – PCI Existing: Optimization, Data Warehouse, and Post Analytics
  – On Premise Implementation
• Experience & Lessons Learned:
  – Teamed with Utilicast & PCI for CAISO EIM implementation
  – Select partners and start early / have strong dedicated PMO
PSE – Josh Jacobs

- **Headquarters:** Bellevue, Wa
- **Employees:** 2,700
- **Customers:** 770,000 Natural Gas; Over 1 Million Electric

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**PSE Energy Resource Mix (by capacity)**

- Coal: 14%
- Combined Cycle: 18%
- Simple Cycle: 12%
- Other Long-Term Contracts: 21%
- Mid-Columbia Contracts: 14%
- PSE-Owned Hydro: 5%
- Wind: 16%

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Map showing service areas in King, Thurston, Pierce, and other counties.
Pre-RFP Preparation: April 2015
Vendor Onsite: August 2015 (PCI)
Detailed Design: Complete November 2015
Go-Live Date: October 2016
Scope:
- PCI: M&T CAISO EIM & MRTU
- PCI: BA CAISO EIM
- PCI: Optimization
- PCI: Outage Management* / GHG / EQR
- PCI: Meter Data Management*/Transmission Billing*
- Hosted Solution by PCI
Experience & Lessons Learned:
- Chose PCI as sole partner to implement, integrate, and test CAISO EIM Solution
- Added significant functionality through detailed design
Utilicast Overview

Company Profile

Founded: 2000  HQ: Seattle, WA
Services: IT, Engineering and Management Consulting
Clients: Electric and Gas Utility Organizations

Distinction:
Lowest Cost-for-Experience
Exceptional Track Record and References
100% Independence from Software Vendors

Professional Service Type Provided by U.S. Region

<table>
<thead>
<tr>
<th>Service Type</th>
<th>NYISO</th>
<th>PJM</th>
<th>MISO</th>
<th>SPP</th>
<th>ERCOT</th>
<th>CAISO</th>
<th>WECC</th>
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</thead>
<tbody>
<tr>
<td>Program/ Project Management</td>
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<td>Vendor Management</td>
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<td>IT Architecture, Design &amp; Development</td>
<td>X</td>
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<td>Systems Integration</td>
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<tr>
<td>Analytics and Data Services</td>
<td>X</td>
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<tr>
<td>Testing, Verification and Validation</td>
<td>X</td>
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<tr>
<td>Compliance and Audit</td>
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<tr>
<td>Business Process Design</td>
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In addition to these U.S. regions, Utilicast has completed projects in Europe, Africa and South America.

X = 2011-15 Projects
## 19-Month Program Schedule

<table>
<thead>
<tr>
<th>Key Deliverables</th>
<th>Program Initiation</th>
<th>Business Process Design</th>
<th>Requirements</th>
<th>Design</th>
<th>Implementation</th>
<th>Testing</th>
<th>Close Out</th>
</tr>
</thead>
<tbody>
<tr>
<td>• PMO Set Up</td>
<td>• Create and/or</td>
<td>• Define Software</td>
<td>• Vendor</td>
<td>• Vendor</td>
<td>• Requirements</td>
<td>•</td>
<td>• Cut-Over Plan</td>
</tr>
<tr>
<td>• Internal Stakeholder Education</td>
<td>Gather As-is Processes and Review with SMEs</td>
<td>Requirements</td>
<td>Software Design Documents</td>
<td>Software Build</td>
<td></td>
<td>via Testing</td>
<td></td>
</tr>
<tr>
<td>• Project Plan</td>
<td>• Update As-is Processes</td>
<td>• Requirements Traceability Matrix</td>
<td>Internal Design Documents</td>
<td>Interfaces Build</td>
<td>• Defect Management</td>
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<tr>
<td>• WBS</td>
<td>• “To-Be” Review and Iterations</td>
<td>• Vendor Selection Criteria</td>
<td>Training Design</td>
<td>Training Materials Developed</td>
<td>• Readiness Criteria</td>
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<tr>
<td>• Project Staffing</td>
<td>• “To-Be” Processes Approved</td>
<td></td>
<td>Hardware</td>
<td>Infrastructure Set-Up</td>
<td>Established</td>
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<td></td>
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<td></td>
<td>Requirements from Vendor</td>
<td>Software installed on infrastructure</td>
<td>• End user Training</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>• Testing Plan</td>
<td>• Updated Requirements Traceability Matrix</td>
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<tr>
<td>CAISO Blueprint</td>
<td>• Jointly Draft Implementation Agreement</td>
<td>• Perform meter verification (may require site visits)</td>
<td>• Review ISO Market Simulation Plan</td>
<td>• Review ISO Market Simulation Plan</td>
<td>• • Requirements Verified via Testing</td>
<td></td>
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<tr>
<td>• Identified required Agreements</td>
<td>• Create data flow diagram in relation to ISO</td>
<td>• Review CIM Model Requirements</td>
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<td></td>
<td>• • Defect Management</td>
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<tr>
<td>• Set up joint PMO structure</td>
<td>• Perform Tagging &amp; Scheduling approach</td>
<td>• Confirm Tagging &amp; Scheduling approach</td>
<td>• Install new meters as appropriate</td>
<td>• Par	icipate in Parallel Operations Simulation Training</td>
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<td></td>
<td>• Provide System Development Plan, System Test Plan, and User Acceptance Test Plan</td>
<td>• Provide System Development Plan, System Test Plan, and User Acceptance Test Plan</td>
<td>• Perform system development</td>
<td>• Readiness Certification</td>
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<td></td>
<td>• Validate digital certificate roles and provisioning</td>
<td>• Validate digital certificate roles and provisioning</td>
<td>• Perform meter programming as required</td>
<td>• Go-Live Support Plan finalized</td>
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<tr>
<td></td>
<td>• Review ISO Market Simulation Plan</td>
<td>• Review ISO Market Simulation Plan</td>
<td>• Negotiate the major maintenance adders &amp; default energy bids</td>
<td>• Validate digital certificate roles and provisioning</td>
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<td></td>
<td>• Submit CIM Full Network Model</td>
<td>• Perform system interface testing</td>
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<td></td>
<td>• Establish ICP link &amp; joint data feed</td>
<td>• Perform functional integration testing</td>
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<td></td>
<td>• Perform connectivity testing to ISO</td>
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<td></td>
<td>• Perform meter data validation</td>
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Utilicast – David Luedtke

Solution Integration

- SCADA / EMS / AGC
- Load / Renewable Forecasting
- Meter Data Management
- Scheduling
- Energy Accounting
- Transmission Billing
- Outage Management
- Generation Optimization
- Marketing & Trading
- ETRM
- Settlements

- Operator & Staff Training
- Processes and Procedures
- Network & Commercial Model
- Interchange Scheduling Model
- Generation Adequacy
- Sufficiency Test Optimization
- Congestion Management
- Unit Parameter Assessment
- Bidding Strategy
- Metering
- Situational Awareness
- Analytics and Reportings

- Staff Training
- Processes and Procedures
- Shadow Settlement Verification
- OATT Accounting Support
- Post-Operating Day Assessment

- Open Access Transmission Tariff
- Stakeholder Support
- 3rd Party Training Support
- Readiness Certification
- Market Power Analysis
- Compliance

Utilicast Confidential Document
Conclusions & Questions

• Key takeaways
  – Look at all systems – not just front office based
  – Start project early
  – Have strong PMO
  – Have dedicated project team with steering committee
  – M&T / BA Coordination – single vendor is best
  – Evaluate existing systems for readiness
  – Don’t under estimate the need for interfacing and building workflow within CAISO EIM solution
Thank you!

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NV Energy
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  – CAISO EIM System Integrator
Key Takeaways

• PCI has strong expertise in CAISO EIM and will support market changes for multiple years (on premise and cloud based).

• PCI can support all CAISO EIM participant needs with a well defined solution.

• PCI has open API, auditable, and can be automated for workflow management

• PCI has experienced CAISO EIM team with several deployable resources to meet implementation needs.