Reducing AMI Latency to Improved Near-real Time Situational Awareness

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Conference Theme & Keywords

Agenda

- Introduction

- Drivers of Change: Integrating AMI into Operations

- Ameren, PowerRunner and OSIsoft PI

  - **Ameren PowerRunner Partnership**

  - **Business Drivers of PowerRunner and PI Solution (Use Case)**

  - **Overview of PowerRunner and PI Solution**

Ameren Overview

- Ameren Corporation is a Fortune 500 company that trades on the New York Stock Exchange under the symbol AEE

- Ameren was created by the combination of three Illinois utilities (CIPSCO Incorporated, CILCO Inc. and Illinois Power Company) and Union Electric Company of St. Louis

- Employing more than 8,500 people, Ameren powers the quality of life for **2.4 million electric** customers and more than **900,000 natural gas** customers across a **64,000-square-mile area**

- Ameren Missouri ranks as the largest electric power provider in Missouri

- Ameren companies generate a net capacity of nearly **10,200 megawatts of electricity** and own more than **8,000 circuit miles of transmission lines**

PowerRunner Overview

- PowerRunner solutions join disparate OT and IT data sources to deliver over **20 in production business solutions** supporting grid ops, system planning and financial analysis

- These solutions apply **machine learning** technology with **self-tuning algorithms** and a robust **calculation engine** to provide diagnostic, predictive and prescriptive solutions.

- Through a **self-service** front end, subject matter experts **harness big data** to create custom data views and apply operational or financial calculations to asset level data to support recurring and ad hoc requirements.

Industry in Transition

Declining Load Growth
- Manufacturing to Service Economy
- Energy Efficiency
- Net Metering Programs
- Future Load Growth is Flat

Legislative and Regulatory Initiatives
- Net Metering Programs
- Non-Wires Alternatives
- Grid Modernization
- Shift towards Transactive Energy Model

Wholesale Power Market Pressures
- Clean Power Plan
- Nuclear Plant Regulations
- Natural Gas as the Bridge Fuel
- Matching Load to Gen

Revenue Model Pressure
- Declining Load and Net Metering
- Pressure on Volumetric Rate/Revenue Model
- ROE on Capital Investments at Risk
- How to Drive New Revenues through a Transactive Energy Model Platform

This Time it is Different
This transition is truly a transformation. The pace of this transformation is difficult to predict because it is a bottom up consumer driven transformation vs. a top down regulatory initiative. It is inevitable that on site generation, electric vehicles and energy storage will change the operational and commercial business models of the utility

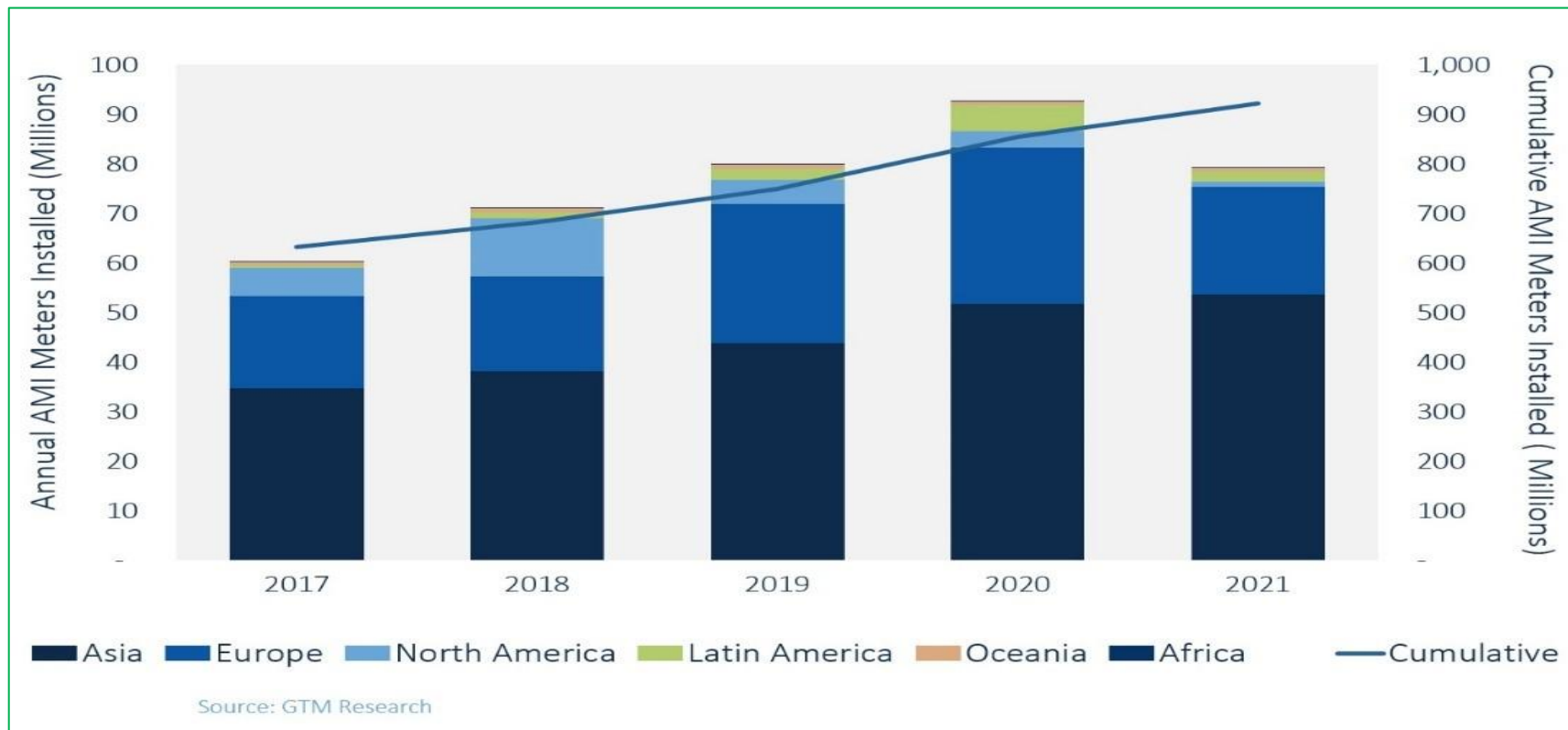# Drivers of transformation are Universal-US & Global

74% of States are implementing Grid Modernization initiatives

- Solar Programs
- Net Metering
- Advanced DR
- Electric Vehicles
- Energy Storage

Figure 1. Legislative and Regulatory Action on Grid Modernization (Q1 2017)
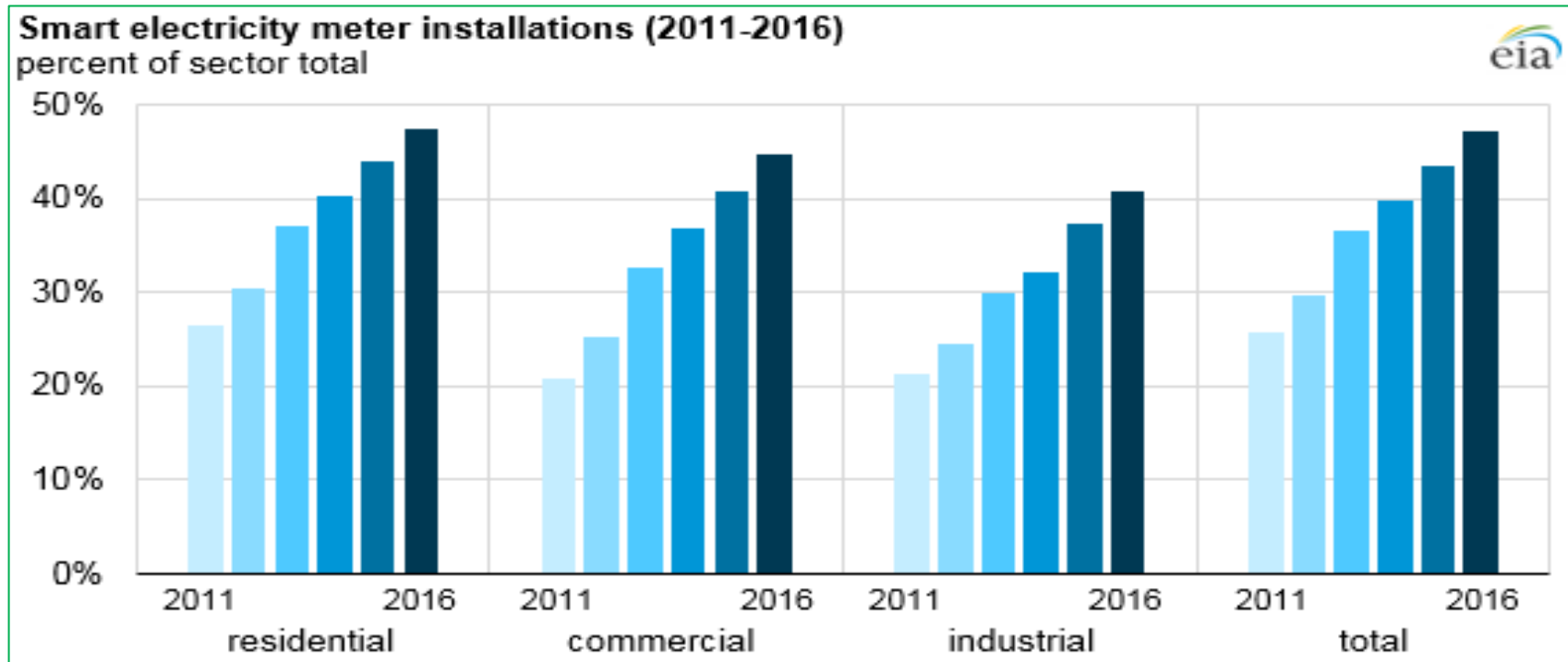
Q1 2017 action
No recent action

AMI: Backbone of Grid Information

Source: GTM Research
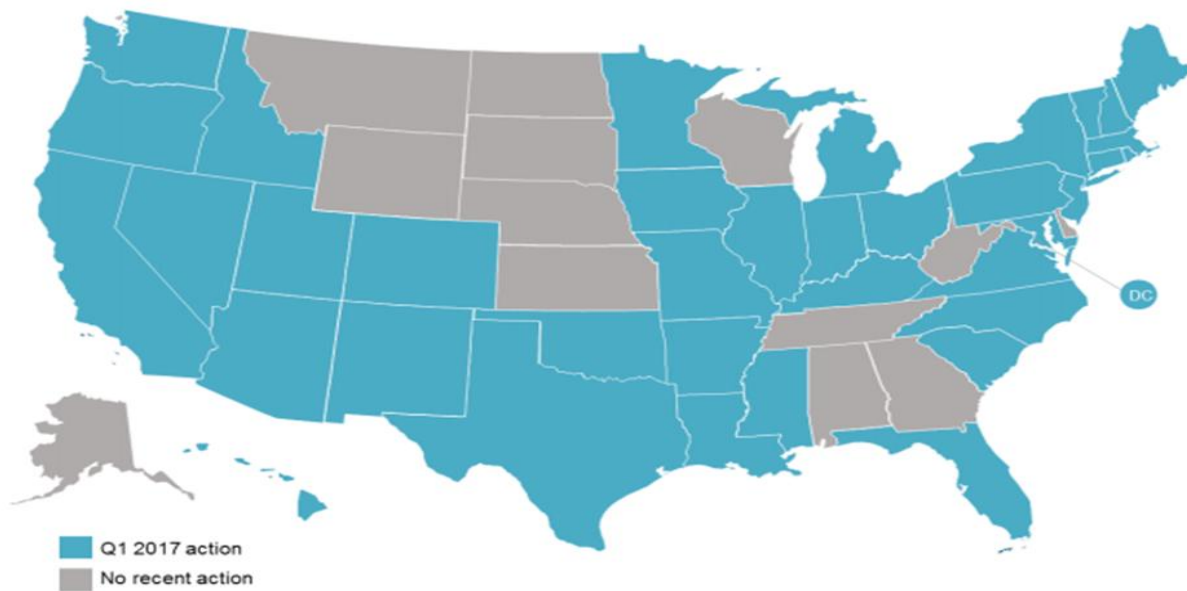
AMI: Backbone of Grid Information

- Installations of smart meters have more than doubled since 2010
- About half of all 150 million U.S. electricity customer accounts now have smart meters

Smart electricity meter installations (2011-2016)
percent of sector total

Increased Value from AMI

- **Ameren and PowerRunner identified 18 unique <u>Systems Operations and Planning use cases</u> that could benefit from improved downstream granular spatial and temporal data-typically generated from Advanced Meter Infrastructure (AMI)**

- **Detailed analysis of the key performance indicators (KPIs) associated with each use case yielded over $60M in combined annualized benefits:**

Grid Operations Use Cases			
Use Case	Description	Benefits* from AMI	Temporal** Granularity
UC1	Hourly Load Scheduling(Sub-hourly)	Improved	5 Minute
UC2	Outage Management Load Analysis	Improved	Hourly
UC3	Localized Capacity/Resource Management (Ops)	Improved	15 Minute
UC4	Microgrid & Distributed Energy Resource Integration	Improved	5 Minute
UC5	Dynamic Load Asset Management	Improved	15 Minute
UC6	Asset Model Extension	Improved	15 Minute
UC7	Black Start Restoration	Improved	5 Minute
UC8	Service Point Analysis	Required	5 Minute
UC9	Unaccounted for Energy & Line Loss Calculations	Required	15 Minute
UC10	Conservation Voltage Reduction (CVR)	Required	5 Minute
UC11	Volt/VAR Optimization (VVO)	Required	5 Minute
UC12	Customer Heuristic Analysis	Improved	15 Minute
UC13	Localized Capacity/Resource Management (Planning)	Improved	Hourly
UC14	Distributed Energy Resource Siting & Planning	Improved	Hourly
UC15	Asset Load Analysis	Improved	Hourly
UC16	Asset Health - Condition Based Maintenance	Improved	Hourly
UC17	Position Management	Improved	Hourly
UC18	Capacity Distribution	Improved	Hourly

Partnership with Ameren

Foundational Platform from previous initiatives…

Descriptive Solutions	**PowerRunner Energy Platform** Daily capacity settlement on 1.5M captured by LSE and reported to MISO	• Operating on 1.5M assets • Aggregating assets by LSE • Reporting PLC of LSEs to MISO • Versioning for detailed archiving
Diagnostic Solutions	**RevRunner** Revenue analysis on 2.6M service points (assets) in IL and MO	• Operating on 2.6M assets • Hourly revenue analysis by asset • Aggregate analysis by grouping • On-demand P&L Analysis
Predictive Solutions	**ForRunner** Asset level hourly forecasts (load, generation, voltage, revenue) on 2.6M assets	• Operating on 2.6M assets • Hourly forecasts for each asset • Aggregate asset forecasts
Prescriptive Solutions	Combining all of the installed PowerRunner solutions to support Ameren as the preferred Distribution System Operator (DSO)	• ICC mandated "Value of DER" determination • DLMP Determination • Transactive Energy Management

Near-Real Time AMI Data Integration

DRIVE REAL-TIME OPERATIONS VALUE FROM AMI DATA

Project Scope

- OSIsoft and PowerRunner integrate near-real time AMI and other operational data into PI and PowerRunner Energy Platform to support real-time operations
- PI integrates with data feed out of AMI head-end stream
- PowerRunner Energy Platform extracts this data from PI to present actionable near real-time data and *predictive analytics* to grid operators

Project Objectives

- Reduce AMI data latency to provide value to distribution and transmission operations by integrating AMI data from PI/PR solution to real-time applications
- Provide Ameren with granular spatial and temporal visibility of voltage and current responses and predictions in near real-time enabling analytics and advanced applications (not currently possible)

PI and PR Value Proposition

Operational Data Management System (ODMS) where PI System serves as the core data integration layer bridges those silo data sources for use in operations in near-real time to support the new needs of Operations in a modernizing Utility Company

- **The PI System is a data storage layer that is able to perform core tasks:**
  - Gather time-series operational data from all manner of disparate sensors, control systems, and other critical operation systems
  - Separates critical systems from the users of the data, adding an extra layer of security
  - Develops a method to provide physical context to the data for use within the operations team and enterprise systems
  - Provides a near term system for situational awareness, root cause analysis, and process improvements

- **PI System supports two converging architectures:**
  - IT: System data like GIS, synchrophasors, fault detection devices, and smart meters
  - OT: Operational level data for outage management, voltage optimization, phase balancing, and ADMS

- **PowerRunner- PI integration:**
  - Asset data available to enterprise data warehouses and analytic systems where time-series data combined with other enterprise systems can provide long term value to the enterprise

"Timely" time-series data is difficult to process through IT enterprise systems

Use Case: Near-Real Time Asset Load Analysis

Reducing AMI Latency to Provide System Operators with Improved Situational Awareness

PowerRunner utilizes near-real time AMI data gathered by the PI System to assess current and voltage conditions on distribution grid assets to identify potential violations or other conditions that may impact grid reliability

- The PI System will poll the selected AMI headend systems and store the time-series data for kW, kWh, volts and meter events in the PI historian
- Through the PowerRunner-PI adaptor, AMI data will be extracted from the PI System and presented in the PowerRunner Energy Platform
- Combining AMI, SCADA and asset management data, near-real time dashboards developed to display continually refreshed current and voltage conditions on grid assets with potential violation indications

**Annual Savings estimated from the 2016 Grid Ops Use Case Analysis Report**

Use Case 15 – Asset Load Analysis $6M+

Additional Future Grid Ops Use Cases Supported by Near-Real Time AMI Data

- DER Management/Optimization
- Outage Management Load Analysis
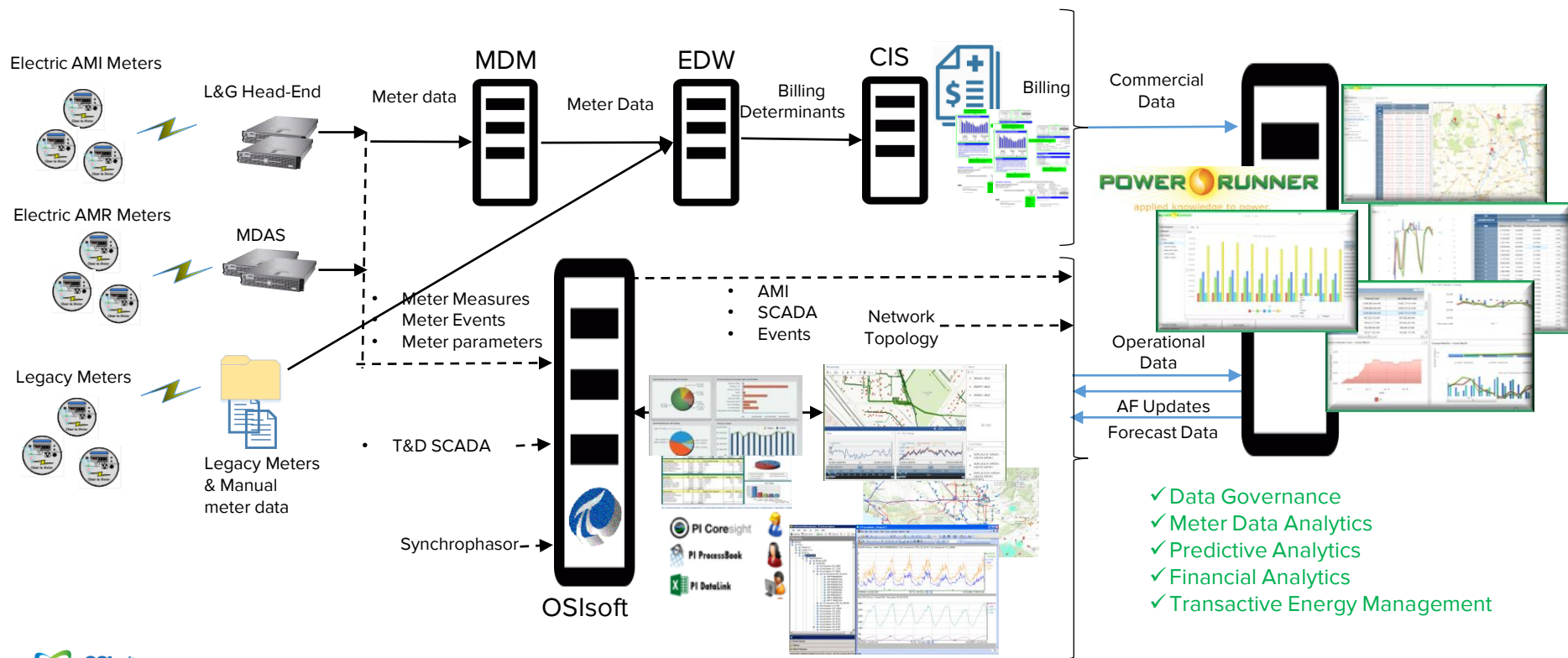- Black Start Restoration
- VVO & CVR

Use Case: Near-Real Time Asset Load Analysis

- PI system Integration with L&G Meter System
- Implementation of the PowerRunner-PI Adaptor
- PowerRunner Integration with Ameren OMS
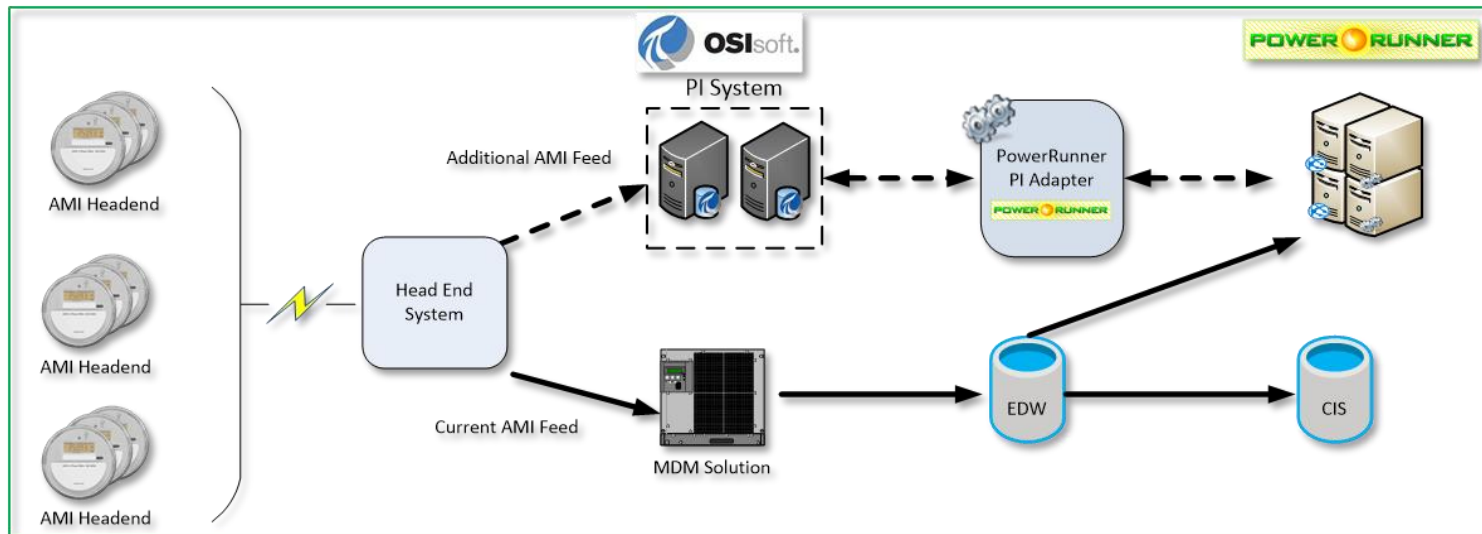
- Key Business decisions- **When to invest in future:**
  - Current communications limitations polling
  - Additional bandwidth requirements or other costs associated with increased polling frequency

PI System's ODMS with PowerRunner Platform

Electric AMI Meters

L&G Head-End

Meter data

MDM — Meter Data

EDW — Billing Determinants

CIS — Billing

Commercial Data

Electric AMR Meters

MDAS

- Meter Measures
- Meter Events
- Meter parameters

- AMI
- SCADA
- Events

Network Topology

Operational Data

AF Updates
Forecast Data

Legacy Meters

Legacy Meters & Manual meter data

- T&D SCADA

Synchrophasor

OSIsoft

PI Coresight
PI ProcessBook
PI DataLink

POWER RUNNER
applied knowledge to power

✓ Data Governance
✓ Meter Data Analytics
✓ Predictive Analytics
✓ Financial Analytics
✓ Transactive Energy Management

PowerRunner-PI Integrator: Out-of-Box AMI

Functional

- **Versioning**, for meter data changes (i.e. estimates v. actuals)
- Attribute **Value Hierarchy** (i.e. Use "Actuals" over "Estimate")
- **Effective dating** for changing attributes/ dimensions (i.e. model changes, topology changes, asset exchange/ recommission etc.)
- **Automated AF updates**

Scalable

- Meter/Measure level metadata for 10s of millions of Attribute Tags
- **Efficient scalability** on the **Application Server** vs. database resources
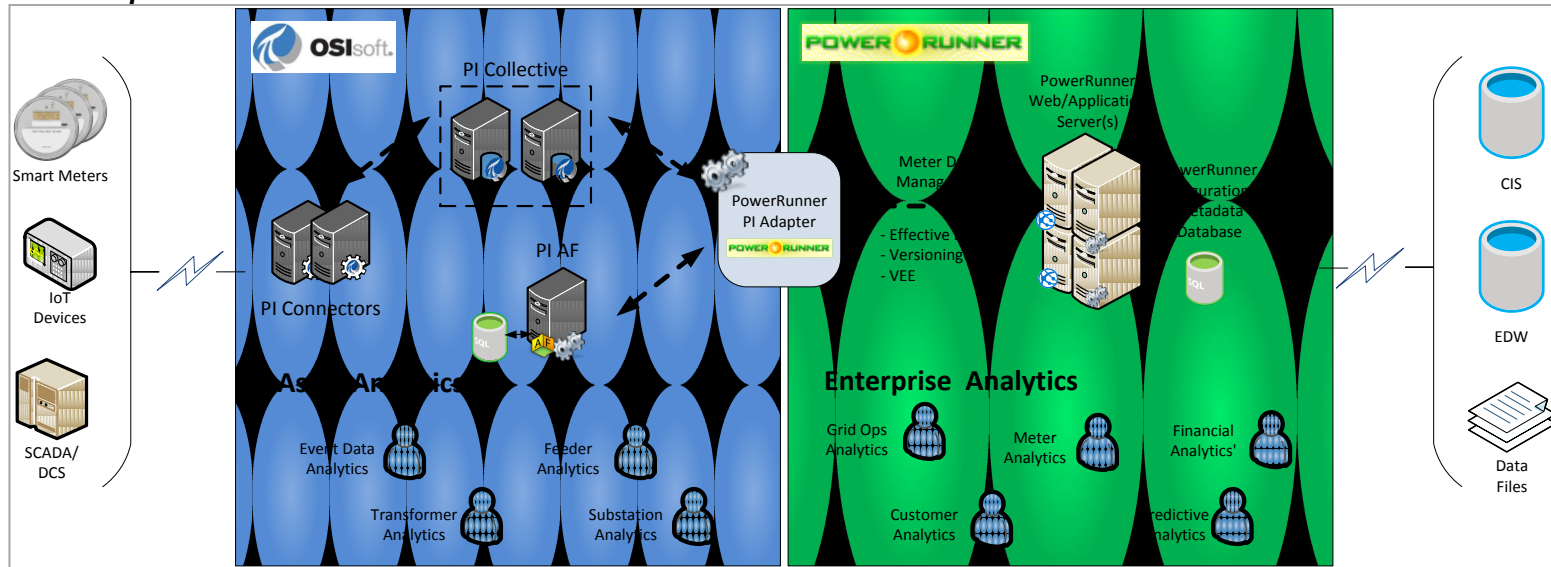
Ameren Near-Real Time AMI Data Integration

Operationalize AMI meter data to support Grid Operations for distribution asset situational awareness, look-ahead analysis and near-real time fidelity support

CHALLENGE

Reducing AMI data latency to refresh intervals that support Grid Operation in near-real time

- AMI data latency from EDW
- Device polling frequency and scheduling
- Data validation and confidence

SOLUTION

AMI Headend integration with the PI & PowerRunner platform to present near-real time Grid Operations support

- PI – L&G Headend Adapter
- PowerRunner-PI Adapter

RESULTS

Project results are projected to reduce AMI data latency from days to hours

- Reduce data latency from days to hours
- Improve situational awareness on distribution grid

Thought Leadership

Ameren contributing to industry transition discussion through:

Ameren Loss Analysis - Increasing use of distributed energy resources drives development of real-time system loss analysis Link to article

Utility Survival in the Transactive Model of the 21st Century Grid link to article

Consumer and PUC Demands for Clean Energy Making DER Valuation a Necessary but Complex Exercise for Regulated Utilities Link to article

Transitioning to Transactive Cost of Service Link to article

How Utility-Startup Mashups Are Bringing New Grid Tech to Market Link to article

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Merci

谢谢

Спасибо

Danke

Gracias

Thank You

감사합니다

ありがとう

Grazie

Obrigado

Optional: Click to add a takeaway you
wish the audience to leave with.