

AVEVA PI WORLD

In preparation of a changing Distribution Utility Model

Ameren's look at DER and FERC 2222

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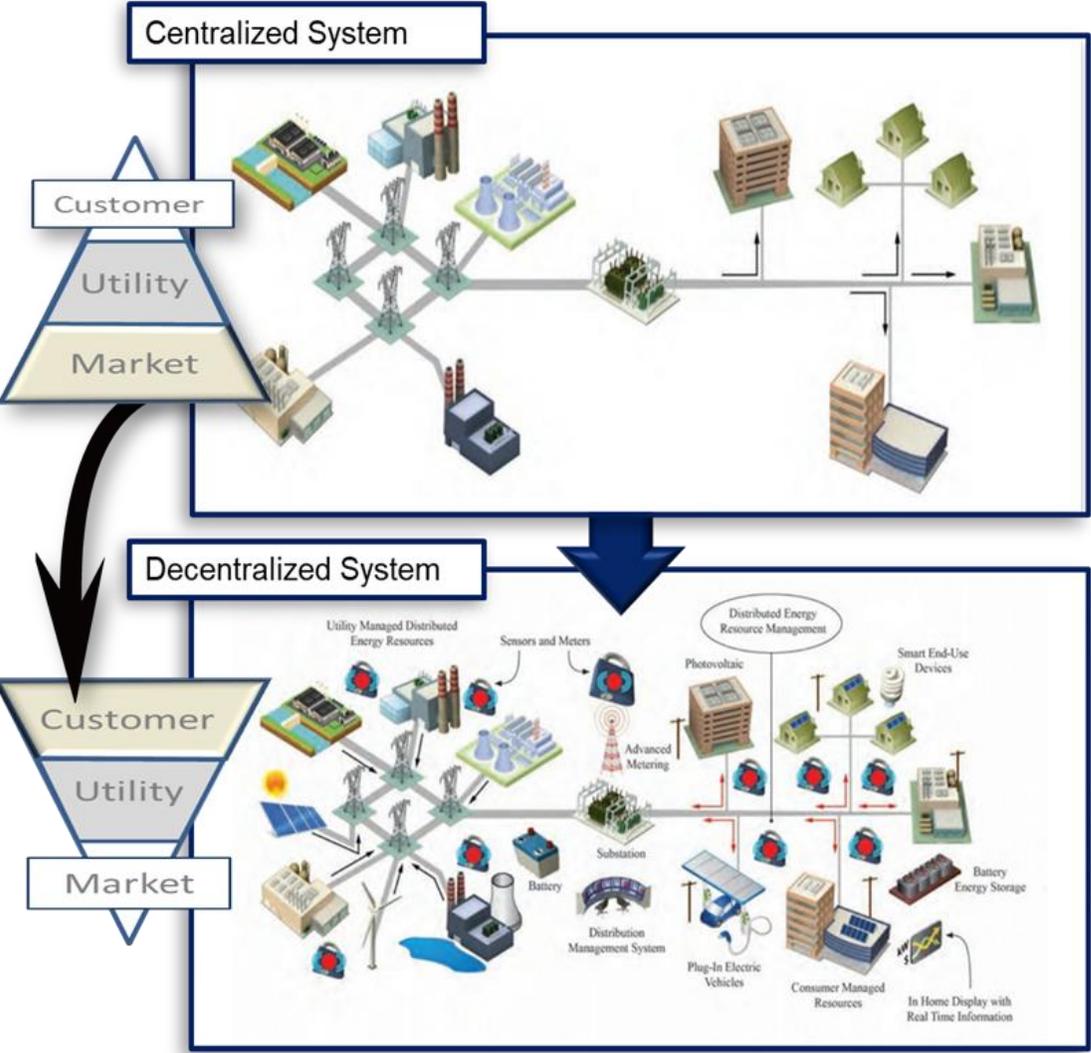
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Ameren

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

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What problems need solving?



Distributed Energy & Ancillary Services

Environmental policy is driving increased investment in distributed generation and the withdrawal of large thermal generation from the transmission system

Quantity & Control

Large amounts of small generators connected to the distribution network. Is not subject to central dispatch and may be invisible to us.

Consumer Participant

Consumers are producing and consuming electricity through rooftop solar, batteries, energy efficiency and increasingly energy management systems.

Forecasting

Renewable energy is unpredictable, variable and operated subject to consumer behaviour rather than business incentives

Social Licence

Increasingly difficult and costly to build large generation and transmission assets due to environmental impacts

Ameren Business Drivers

Proactive Initiatives

- Actively participate in the Next Grid study by providing spatial and temporal data to influence policy
- Effectively determine the locational value of DERs to respond to Senate Bill 2814
- Communicate the true value of DERs and their effect on rates to all customers
- Utilize AMI and communication backbone to position Ameren as the DSO

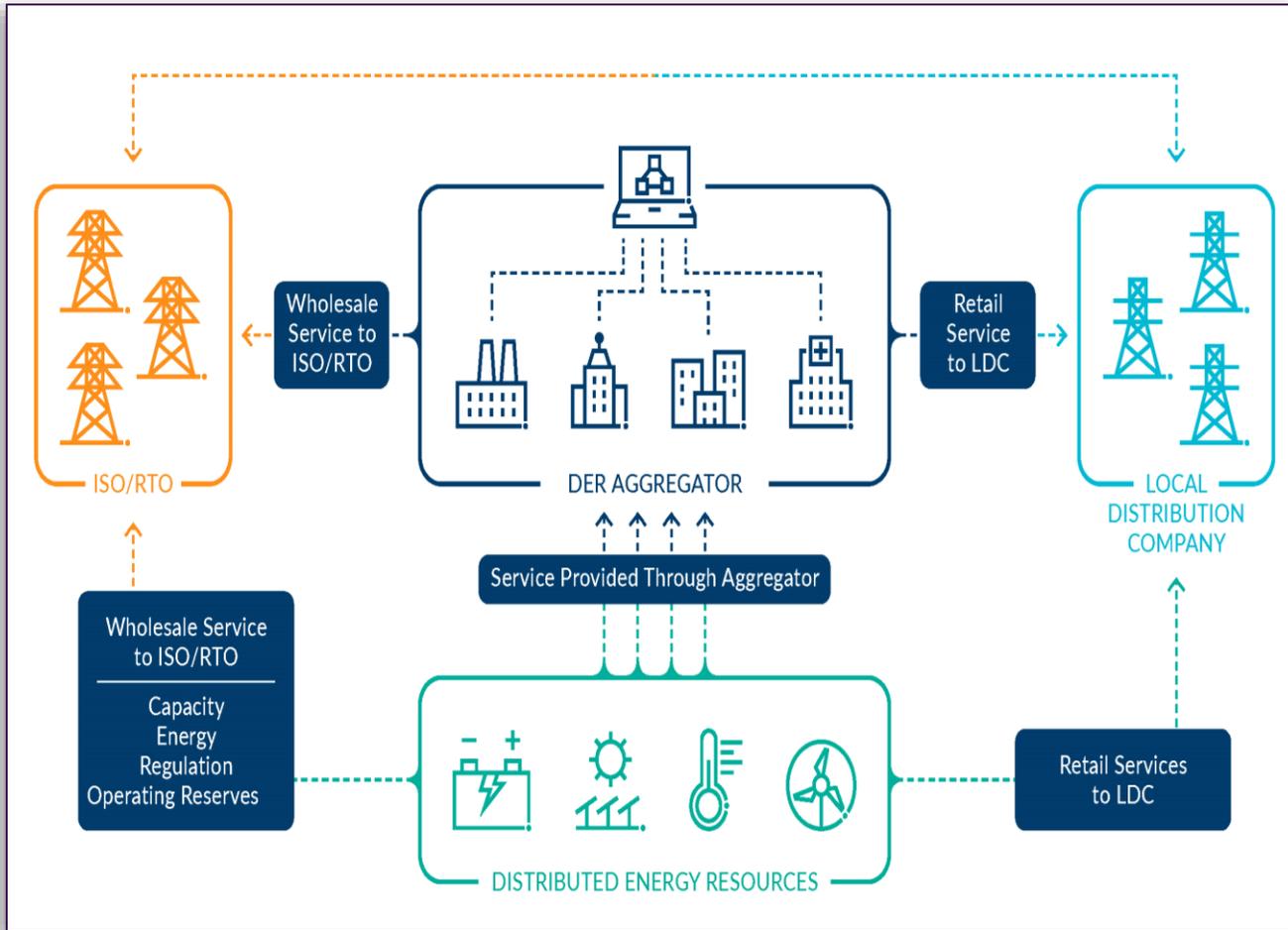
Strategic Assets

- TAC Microgrid
- Full AMI deployment in 2019
- IntelliGrid Roadmap – 4500 miles of fiber
- Transactive Energy Technology Platforms
- Operational Data Stores for Sensors

Threats / Risks

- Senate Bill 2814
- ICC Next Grid Initiative
- Growing BTM Renewable Generation
- FERC Order 2222

What is FERC Order 2222?



Leveling the Field for Distributed Resources

- Regional grid operators (ISOs and RTOs) must revise their tariffs to establish DER aggregators as a type of market participant
- These can be located on an electric utility's distribution system, a subsystem of the utility's distribution system, or behind a customer meter
- DERs are small-scale power generation or storage technologies (typically from 1 kW to 10,000 kW) that can provide an alternative to or an enhancement of the traditional electric power system
- DER "types" include electric storage, intermittent generation, distributed generation, demand response, energy efficiency, thermal storage or electric vehicles and their charging equipment

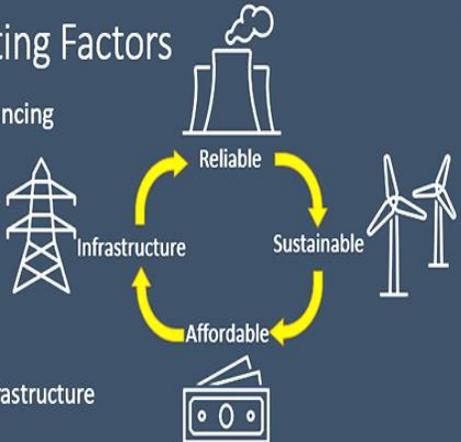
Challenges

Enabling Distributed Customer Owned Resources while maintaining a safe, reliable, secure, and affordable supply for consumers

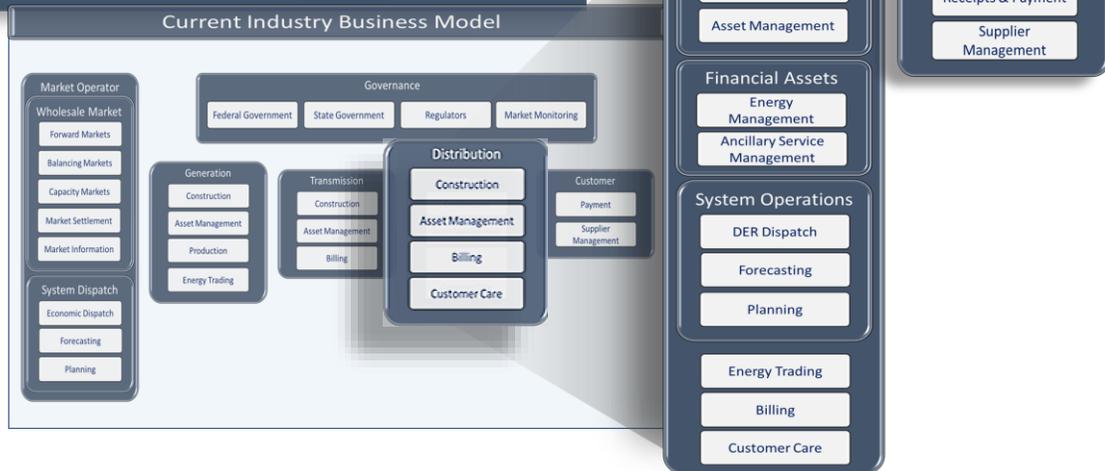
Electricity Sector Competing Factors

How will aggregated DERs assist in balancing these critical but conflicting factors

- Removing reliable generation
- Bidirectional power flows
- Delivery of needed infrastructure
- Installing intermittent generation
- Reducing our carbon footprint
- Funding reliability, sustainability and infrastructure



Fundamental Organizational Transformation



- **Verbality** - renewable supply is unpredictable and intermittent
- **Managing ADERA supply chain** - Asset to Asset Owner, to Asset Product, to Service Point, to Customer, to Aggregator, to Utility, to RTO
- **Business Capabilities** – new industry knowledge, processes, systems, skill sets
- **Asset procurement** – customer contracts and stakeholder engagement
- **Product definition** – capacity, energy, ancillary services
- **Modeling ADERAs** – bid strategy dispatch, pricing, Compliance – operating ADERAs under FERC 2222
- **Information technology** – enhancement of EMS, MMS,
- **Energy trading** – maximizing ROI, bids, offers, hedging, credit, risk management
- **Dispatch** – real-time operations of ADERAs
- **Monitoring DERs** – asset performance and bidirectional power flows
- **Settlement** – billing, receipts and payments

“I’d rather be a policy maker, than a policy taker.”

Ameren Approach to FERC Order 2222 Challenges

Evolve operating model and transition to a successful business model consistent with the requirements of FERC Order 2222, a strategy and operational assessment covering the current state of Ameren's capabilities and a roadmap to deliver the future requirements. Key areas to be considered are:

- **Current situational analysis** – from board of directors, management, employees, regulators, consumers, gain a clear understanding on where Ameren is now- its capabilities, roles and responsibilities, quality of technology solutions and skillsets that are currently known and available to build upon
- **Industry capability definition** – identify the market responsibilities and roles of Ameren under FERC Order 2222 and the transaction seams with the market operator, market participants and the consumer
- **Business capability assessment** - the primary objective, to provide Ameren with the recommended functions, technology systems and staffing levels for each business capability for Ameren's DER management steady state
- **Gap analysis** - analysis of Ameren's current and required future capabilities to define what business components need to be reenforced or built out to meet the future business model under FERC 2222. This includes a high-level review of Ameren's strategic and business plans, as well as recommendations of key performance indicators (KPIs) to monitor success

Ameren Foundational Technology Initiatives

Over the past 5 years, Ameren has built into prepare for future utility capabilities

Real-Time & Probabilistic Near-Term Look Ahead

- Real-Time AMI Integration
- Meter-Level Forecast Models:
 - Self-training models to predict load, generation for millions of assets on distribution grid
- Forecast and Real-Time Hourly distribution losses

Network Model Validation

- Maintain daily switching and topology updates
- Secondary Transformer to AMI meter ML connectivity correction with Transformer Recommendation Analysis

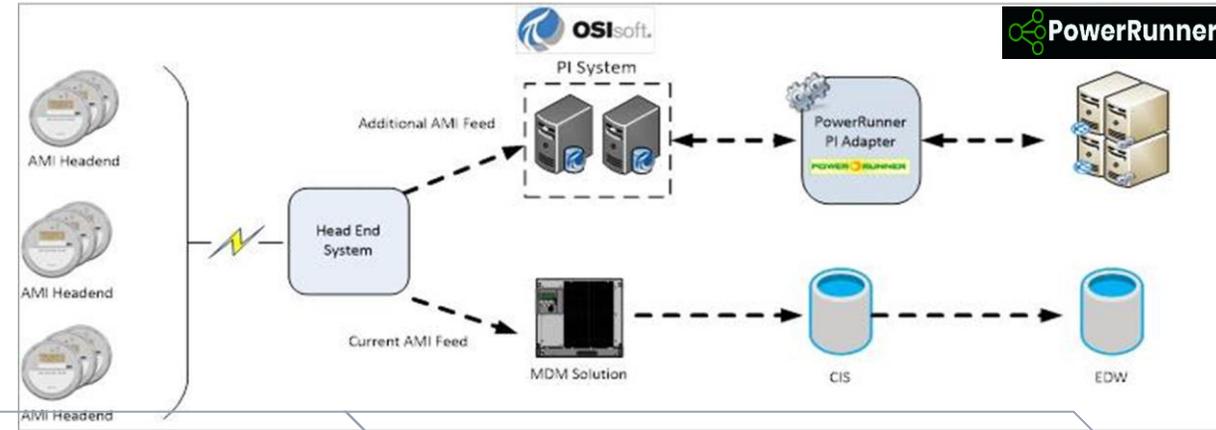
Network Security Analysis

- Capturing and presenting sub-hourly voltage readings for every Meter to:
 - Validate locational and temporal VVO performance
 - Identify Secondary Transformer Coil High and Low side winding failure detection
 - Cap Bank impact analysis
 - Tap setting analysis

Ameren Operational Data Store Vision



Utilizing AMI and other sensor data in near-real time operations in support of DER integration is cornerstone to enabling FERC 2222 key utility functions, like network security and feasibility analysis on the distribution grid



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

Benefits

Project results prove out vision to support DER NRT operational analysis on distribution grid

- Reduce AMI Sensor data latency from days to hours
- **Support situational awareness, look-ahead analysis and feasibility studies on distribution grid in support of**

Leading the Transformation

- **Organizational impacts** - implementation of FERC 2222 will be substantive - people, process and technology
- **Scope** – for a company like Ameren, the scope is analogous to both retail deregulation and wholesale market integration aspects combined. Note much of the details still need to be defined.
- **Approach** - develop an industry capability model that identifies key functions required from a **system control**, energy **market operator** and **customer** and **supplier** care perspective - highlight operational gaps that may inhibit Ameren’s ability to fulfill its mandated obligations under FERC 2222
- **Business processes** - confirm ‘critical path’ and ‘optional’ business processes that inform both technology solution design, and configuration and integration with existing Ameren system control and business functions
- **Business case definition** - develop business cases, ROI and other metrics needed to justify cost expenditures of enabling FERC 2222



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