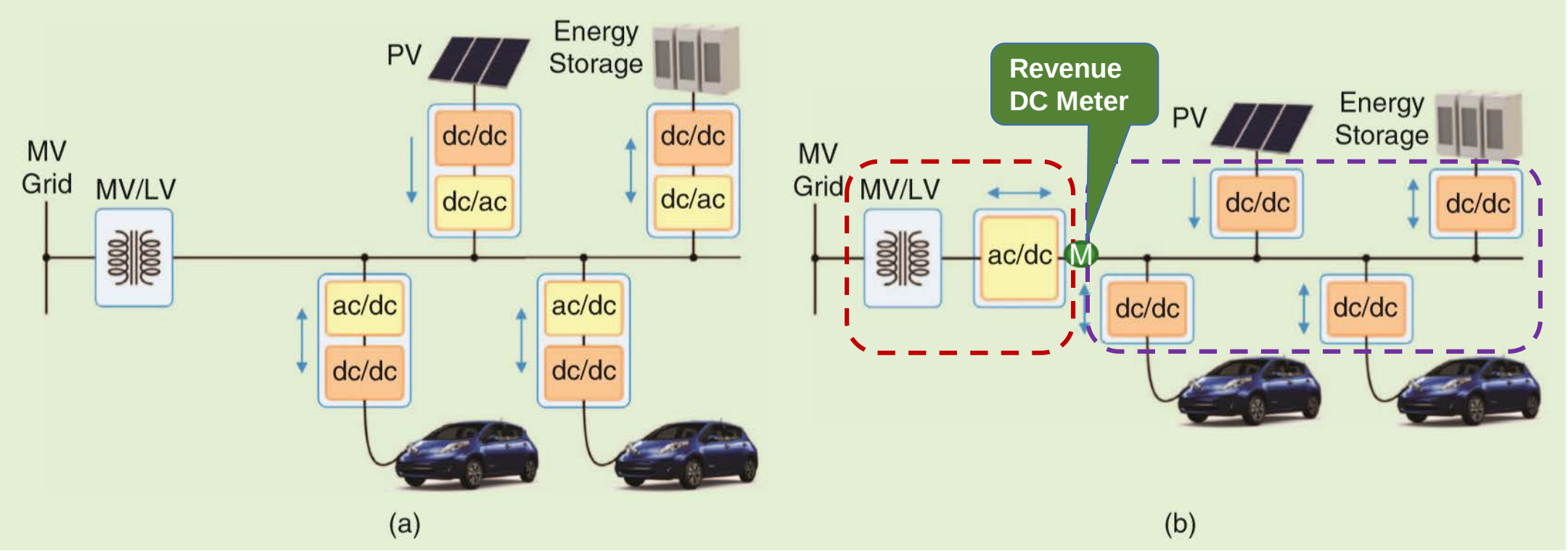
ALEX ROJAS'
UTILITY PERSPECTIVE

- Operational Technology To Consider For Fleet Vehicles
  - DC-Fed Fast chargers
  - Consolidated MW-Level Rectification
  - DC Revenue Metering
- Information Technology to Consider For Fleet Vehicles
  - Monitor, perform analytics, and dispatch EV chargers (as a DER)
- Temporal Requirements:
  - Monitor, perform analytics, and dispatch EV chargers (as a DER)
- Sample IT Deployment in Ameren's 2016 Microgrid
  - Primary, secondary, and tertiary control
- Distributed Energy Management System (DERMS)
  - Tertiary Control Functions

OPERATIONAL TECHNOLOGY TO CONSIDER FOR FLEET VEHICLES:

DC-FED FAST CHARGERS



(a) Traditional AC-Fed Fast Chargers

(b) New DC-Fed Fast Chargers

dc/dc = Direct Current to Direct Current Inverter

ac/dc = Alternating Current to Direct Current Inverter

MV = Medium Voltage

LV = Low Voltage

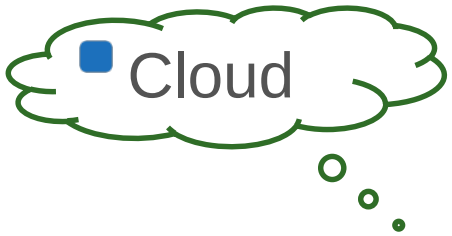
Illustration Source: *Srdjan Srdic and Srdjan Lukic, "Toward Extreme Fast Charging", IEEE Electrification Magazine / march 2019*

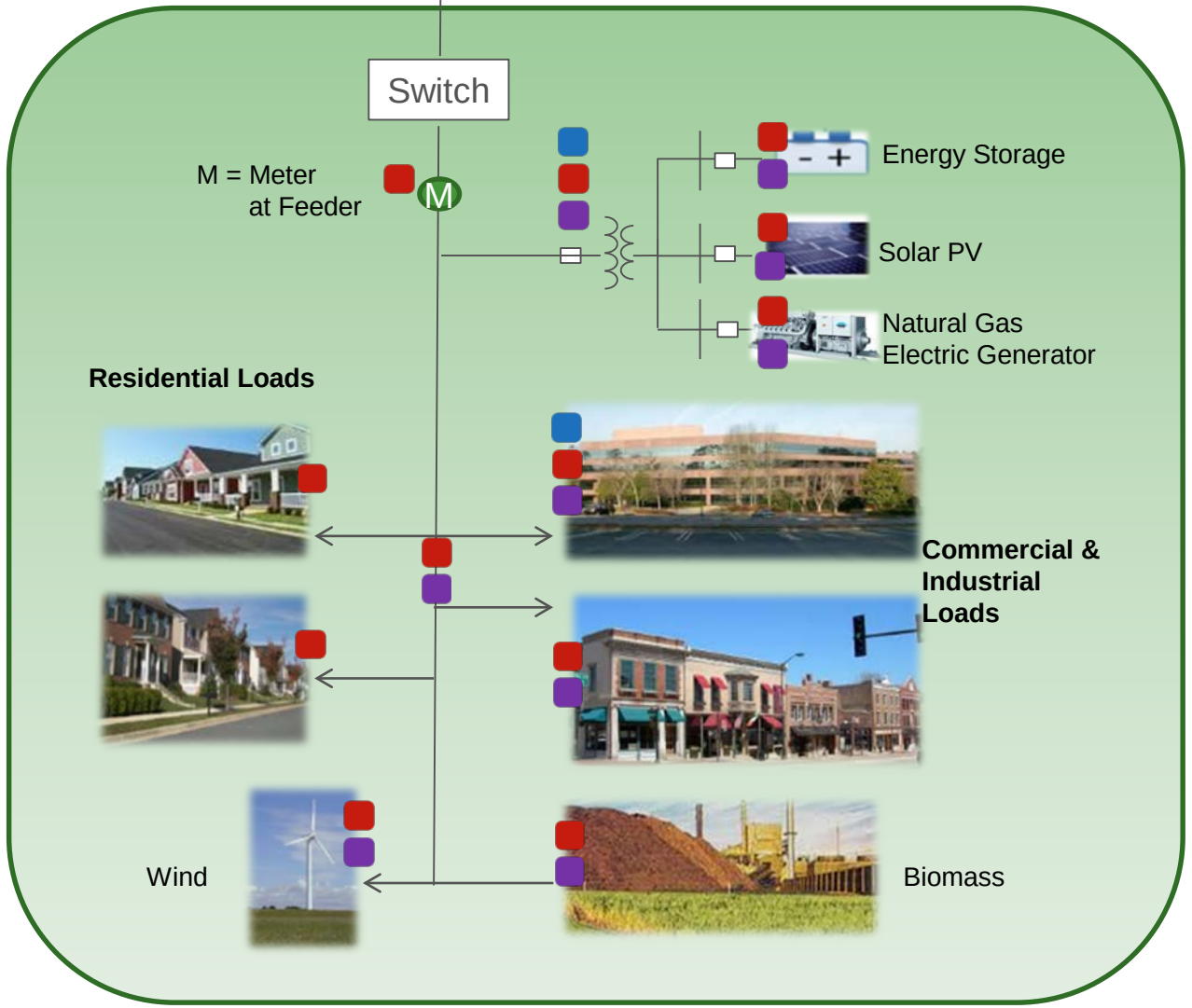
INFORMATION TECHNOLOGY TO CONSIDER FOR FLEET VEHICLES : MONITOR, PERFORM ANALYTICS, AND DISPATCH EV CHARGERS (AS A DER)

High-Latency
(Tertiary Control)

Mid-Latency
(Secondary Control)

Real-time analytics
(Primary Control)

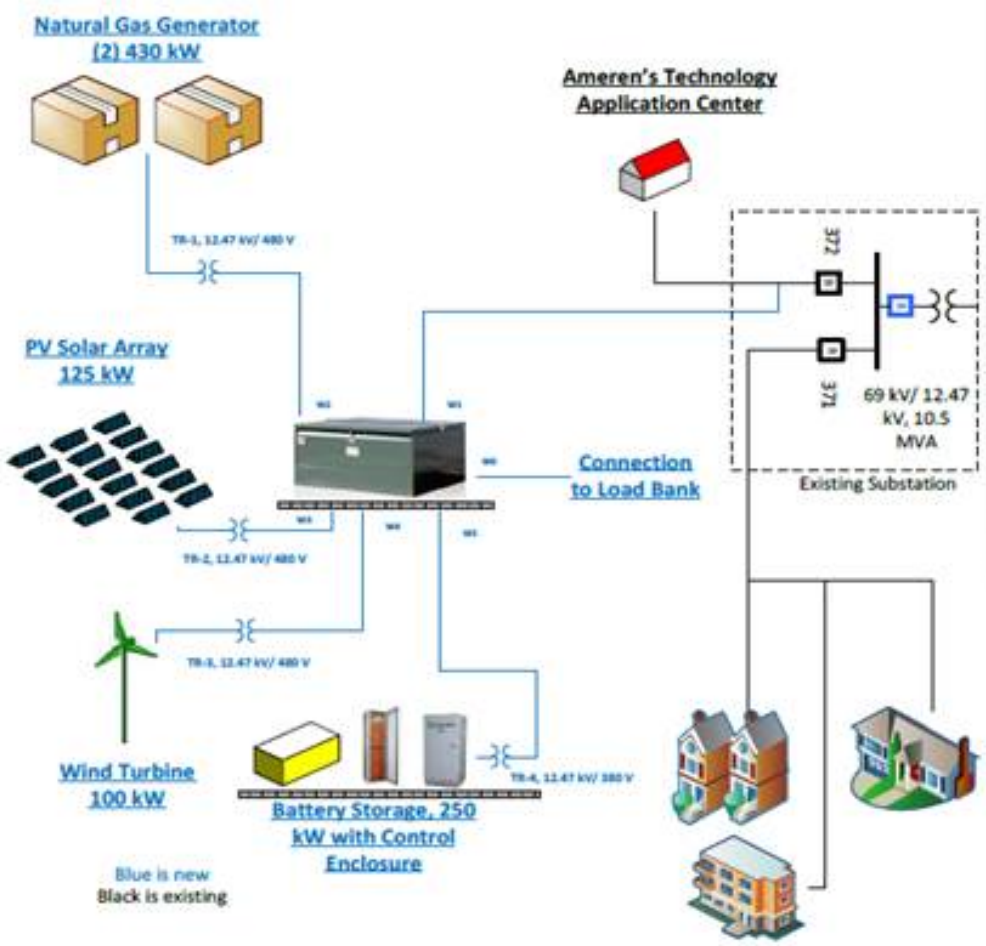




TEMPORAL REQUIREMENTS TO :
MONITOR, PERFORM ANALYTICS, AND DISPATCH EV CHARGERS (AS A DER)

Utility Analytics (Control Hierarchy)	Temporal Requirement	Typical Functions	Hosts
High-Latency (Tertiary Control)	Minutes	• EV Load Forecasting • Advanced Optimization • Modeling	Software Platform
Mid-Latency (Secondary Control)	Seconds	• SCADA • EV Charger Control • DER Control (i.e. batt)	Hardware/Software
Real-time analytics (Primary Control)	Micro- to Milli- Seconds	• Protection • AC switching Logic • DC switching logic	• DER Inverter Controllers • DC Fast Charger Controller • Protection Relays

SAMPLE IT DEPLOYMENT IN AMEREN'S 2016 MICROGRID INCLUDED: PRIMARY, SECONDARY, AND TERTIARY CONTROL



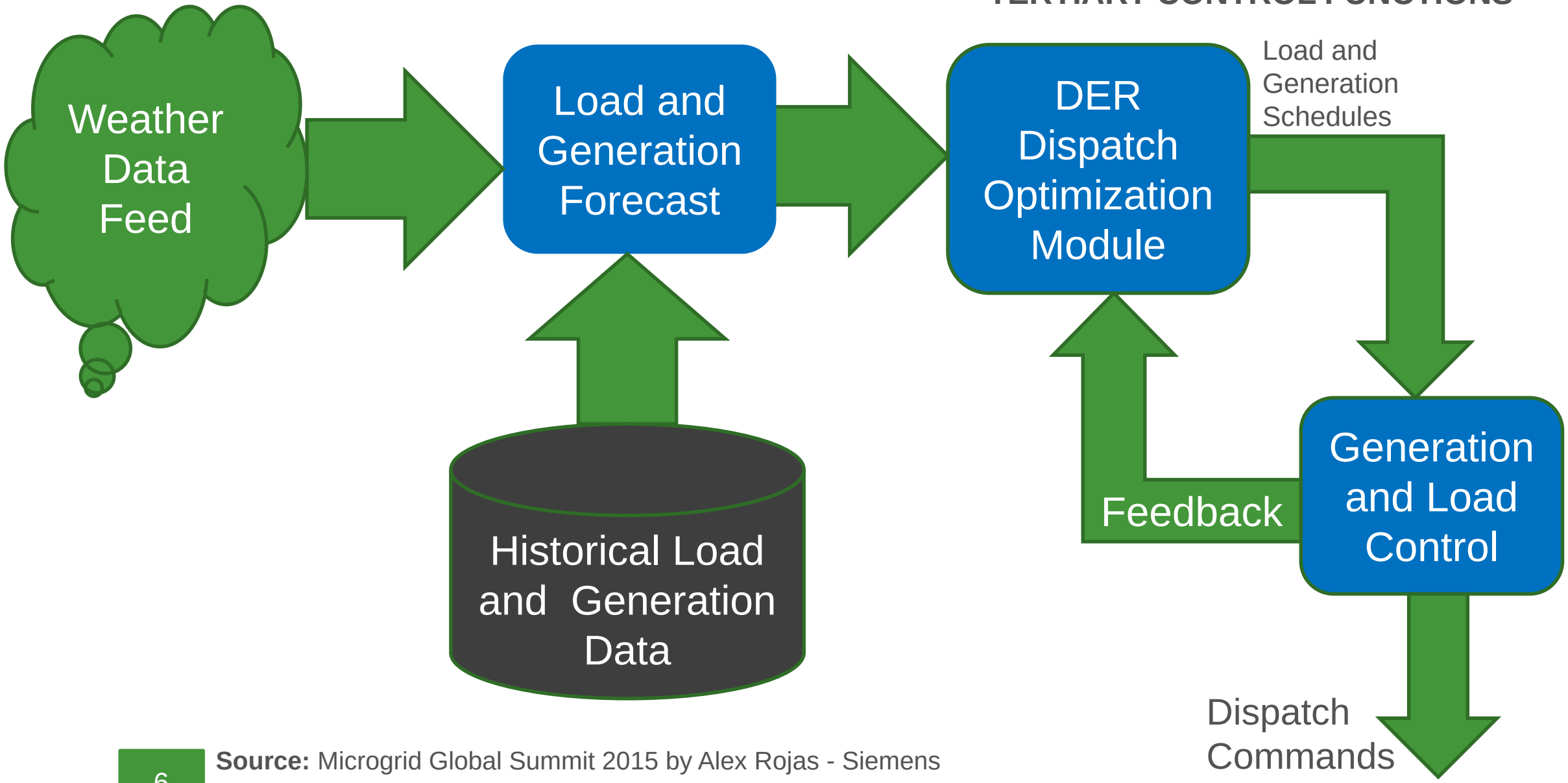
Succinct description:

An aggregation of distributed generators, loads and energy storage that form a virtual entity that interacts with Ameren Illinois Company's Advanced Distribution Management System (ADMS).

Interconnection with MISO is feasible

DISTRIBUTED ENERGY MANAGEMENT SYSTEM (DERMS):

TERTIARY CONTROL FUNCTIONS



Source: Microgrid Global Summit 2015 by Alex Rojas - Siemens

Alex Rojas - Director of Distributed Technologies at Ameren Services

For over 20 years, Mr. Rojas has developed and later transferred technology to electrical utilities and large industries. Given his expertise in information technology, operational technology, and business Alex leads a team in the implementation of innovative technologies and methods to modernize Ameren's operations, improve efficiencies and achieve customer affordability goals. Also, he has been granted a number of patents across Smart Grid technologies.

He has held leadership roles in challenging engineering positions at global technology groups, including Siemens, General Electric, and ABB. Mr. Rojas holds undergraduate and graduate degrees in Electrical Engineering from Ohio State University and Michigan Technological University. Further, an MBA degree from Southern Methodist University (top three business school in the country according to Bloomberg). Recent accomplishments include:

2019: Alex led the first utility deployment of a blockchain-based Transactive Energy platform in North America. Currently, scoping & pricing a 2020 deployment at Washington University – St. Louis.

2018: Mr. Rojas and team have been nominated and awarded **EPRI's 2018 Power Delivery Utilization Technology Transfer Award** for developing evaluation strategies for system architecture and security; test tools and methodologies to achieve scalable DER integration.

2017: Alex Rojas was nominated and later recognized as a **"Top 40 Innovator" in our nation by Public Utilities Fortnightly**. The selection committee considered Mr. Rojas' contributions to our industry in the fields of DER Integration (microgrids), energy storage technologies, asset management technologies, and more.

2016: Alex Rojas' team was awarded Ameren's President Award for outstanding accomplishment in deploying an advanced microgrid platform in Champaign, IL.