THE SMART GRID

Webinar #6

CAREER SPOTLIGHT: CELIA JOHNSON

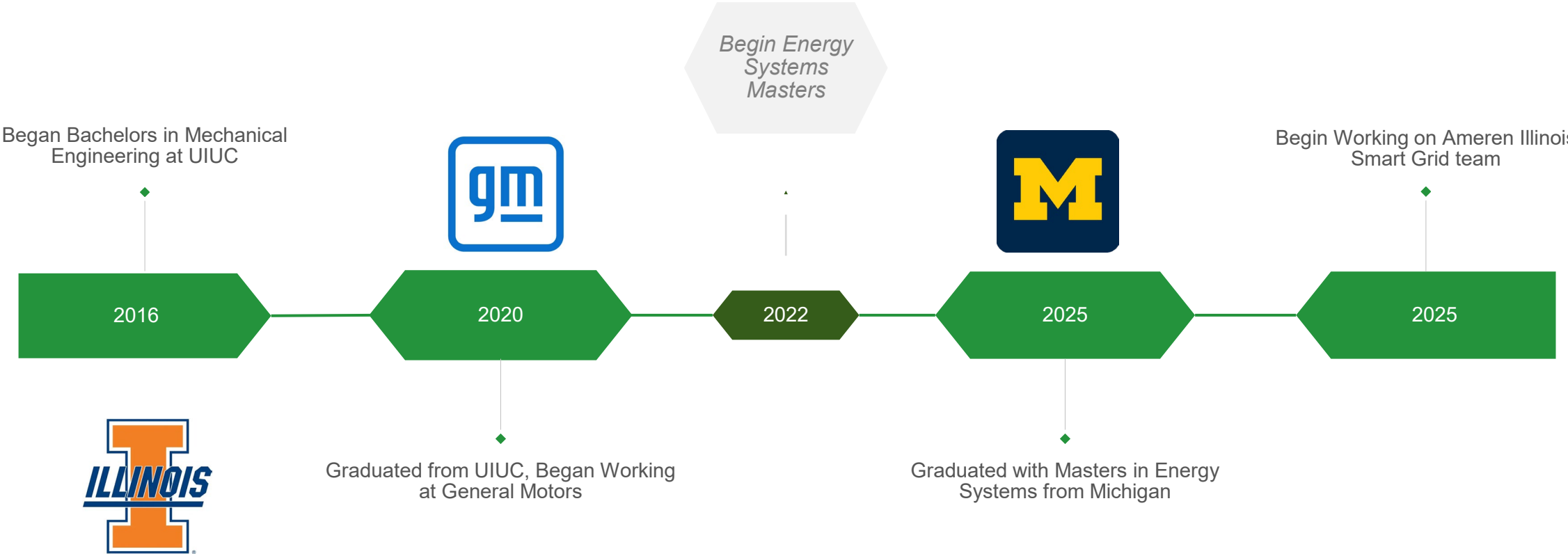
FACILITATOR, CELIA JOHNSON CONSULTING

ENERGY AND PUBLIC POLICY

GUEST SPEAKERS:
ZACH MESPLAY AND SARAH DICKINSON

Zach Mesplay

Career Engineer, Ameren Illinois



Sarah Dickinson

Career Engineer, Ameren Illinois

2017 — Graduated with Bachelors in Mechanical Engineering at SIUE

2017 — Started working at Eaton B-Line as a Value Add, Value Engineering (VAVE) Engineer

2022 — Left Eaton and came to Ameren Illinois on our Voltage Optimization team

2023 — Began working on Ameren Illinois solar sites in ESTL

Ameren Illinois Smart Grid Team

Small team with four primary goals

Team	Chris, Sarah and Zach   
Smart Grid	Operate a smart grid test bed, for testing new grid technologies prior to their introduction on the larger Ameren grid
Site Management	Manage existing renewables infrastructure, currently Champaign Technology Applications Center equipment, East St. Louis 1 and 2 solar sites
Construction Support	Support construction of new renewables sites, currently Peoria Energy Center is under construction with planned completion date of July 2026
Metrics	Keep Ameren leadership up to date with the output and status of these projects and sites

Ameren Illinois Smart Grid

- 2011 – Senate bill 1652 introduced to the Illinois State Senate, eventually leading to the passage of the Energy Infrastructure Modernization Act
- Initiated a $2.6 billion+ dollar investment by ComEd and Ameren to modernize the Illinois electric grid
- Act required that Ameren and ComEd invest in:
  - Smart meters for customers
  - Invest in AMI (Advanced Metering Infrastructure)
  - Expanded RPS (Renewable Portfolio Standards), requiring Illinois generation to be 25% renewable by 2025
  - Required that Ameren establish a smart grid test bed -> The TAC site was built following this direction

Existing Sites – Smart Grid Testbed and Microgrid

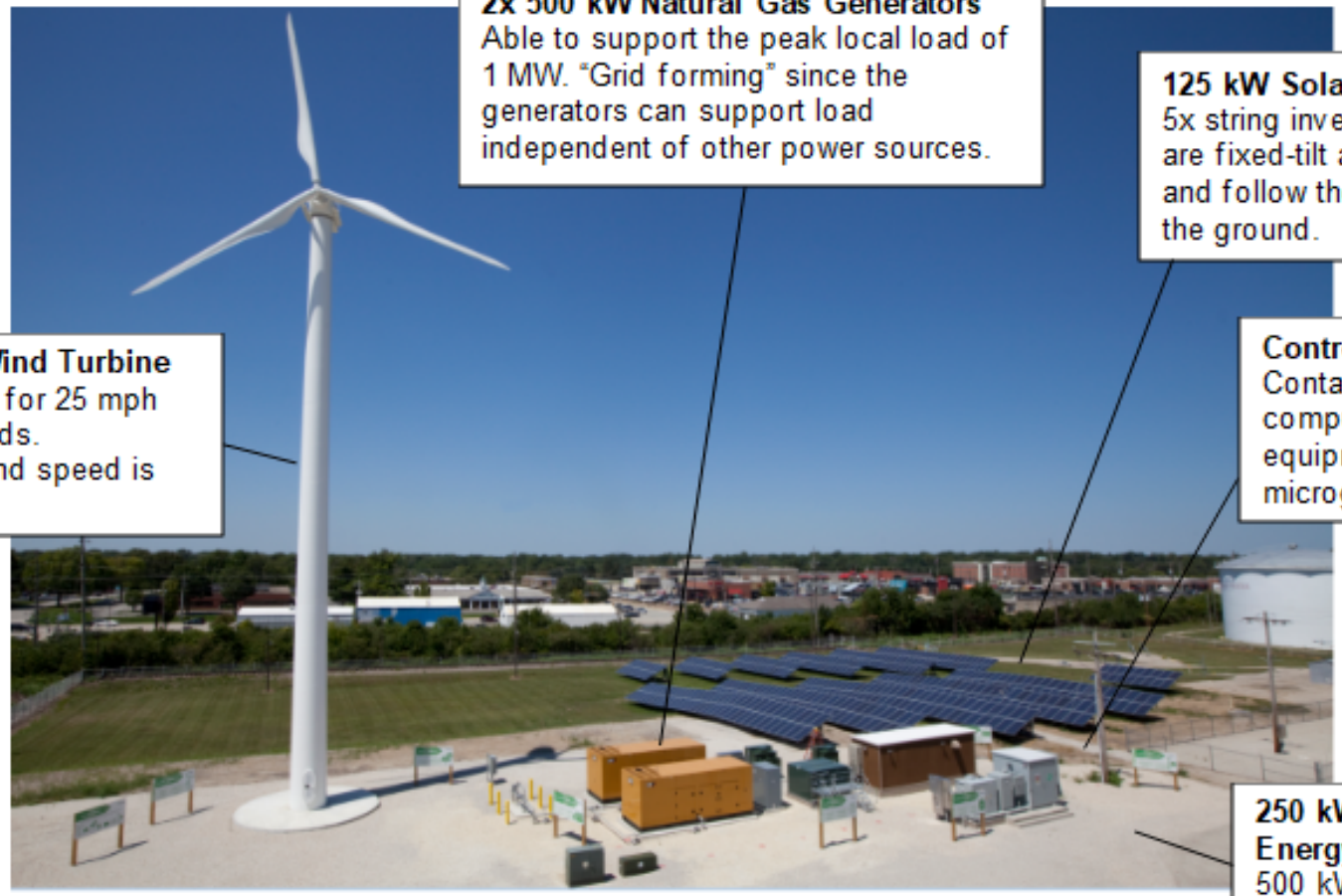
Technology Applications Center (TAC)

This site can be found just south of the U of I campus as a part of the research park.

- First phase finished construction in 2013
  - Smart Grid testbed, TAC building, and 69 kV to 12 kV substation (A)
  - Server racks for equipment installation (B)
  - Sample residential appliances (D)
  - AMI meters individually wired to building appliances (E)

Ameren Illinois TAC Microgrid

Ameren TAC Microgrid



2x 500 kW Natural Gas Generators
Able to support the peak local load of 1 MW. "Grid forming" since the generators can support load independent of other power sources.

125 kW Solar Panels
5x string inverters. Panels are fixed-tilt at 25° south and follow the contour of the ground.

100 kW Wind Turbine
Optimized for 25 mph wind speeds.
Cut-off wind speed is 117 mph.

Control Building
Contains relays, computers, and other equipment to coordinate microgrid processes.

250 kW Battery Energy Storage
500 kWh can provide peak power output for up to 2 hrs.

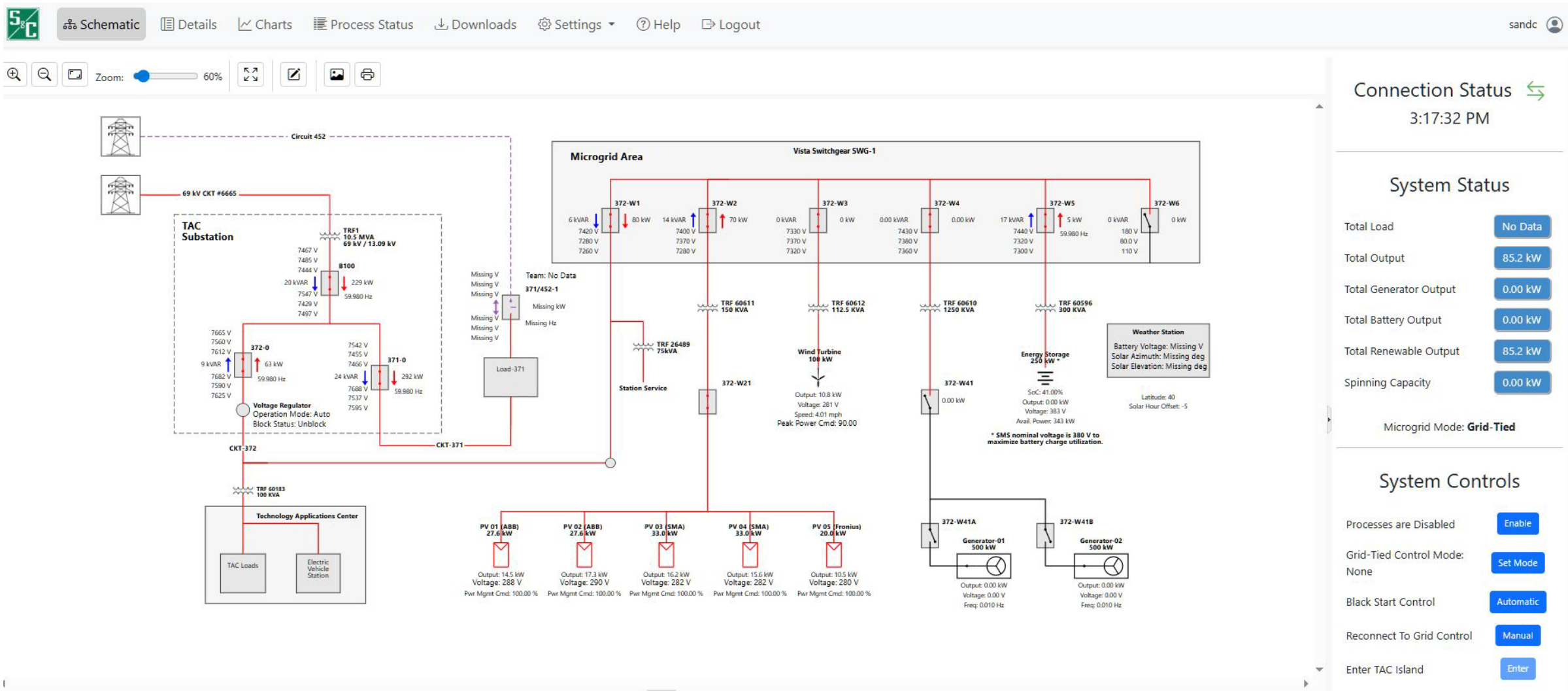
Operating Modes

In 2016, the TAC microgrid was the first in the US to support seamless transition from grid-tied to islanded and back without loss of power.

The microgrid platform operates in the following modes:

- **Grid-Connected Mode**: The microgrid optimizes the generation of power from its assets and pushes electricity from the generation resources onto the Ameren Illinois grid (12Kv or 69Kv).
- **Storm Mode**: The system ensures that all distributed energy resources are operational and ready to seamlessly transfer customers to the microgrid. If Ameren were to experience storm damage to its main supply source, these customers would not experience any outages and would continue receiving power from the microgrid.
- **Islanded Mode**: If the Ameren supply source to the TAC substation was disrupted, the microgrid would automatically detect the abnormal condition and ensure that TAC customers are supplied by the microgrid, eliminating any prolonged outages.

TAC Control System



Existing Sites – East St. Louis 1

Solar Field

- This site can be found adjacent to East St. Louis High School in East St. Louis, IL
  - Construction finished in 2022
  - Single axis tracking solar racks
  - Rated at 2520 kW AC, 3096 kW DC
  - 5292 panels
  - 21 inverters
  - Step up transformers to produce 34 kV grid voltage
  - ESL high school trades class tour

Existing Sites – East St. Louis 2

Solar Field

- Few miles from the ESL1 site
  - Construction finished in 2024
  - Rated at 1375 kW AC, 1785 kW DC
  - There are 3078 solar modules, 11 inverters
  - Outputs to the grid at 4 kV (feeder)
  - 500 kW / 1100 kWh grid scale battery

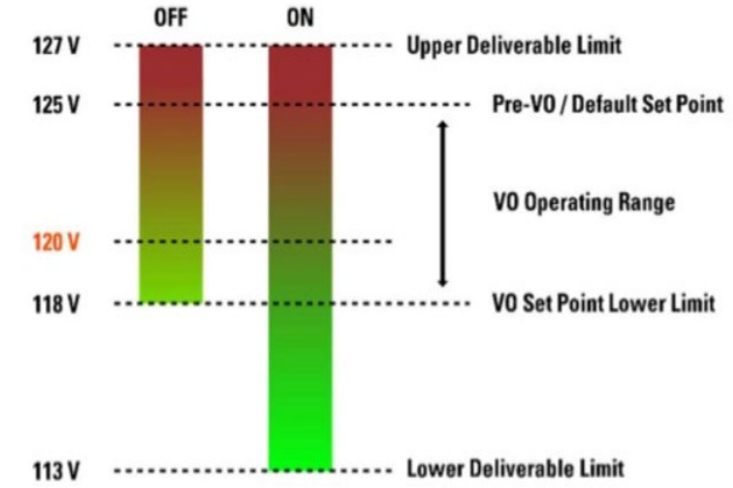
Future Sites – Peoria Energy Center

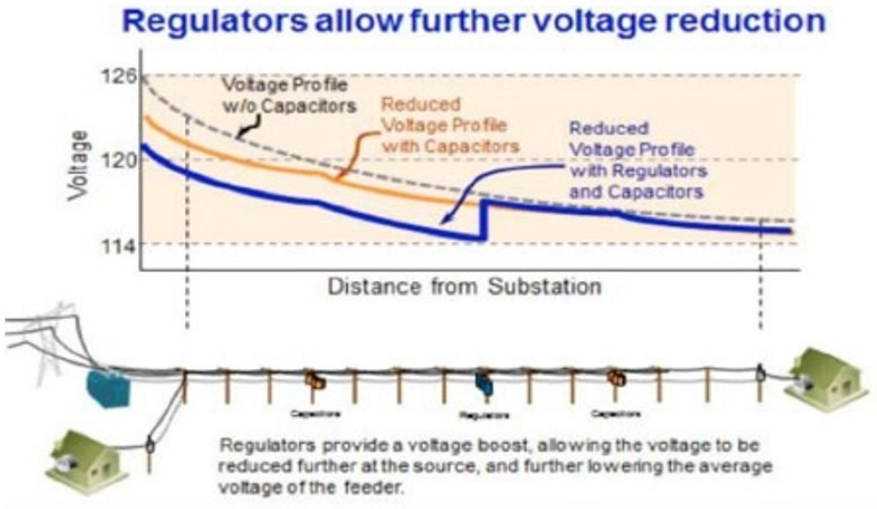
Solar Field

- Located in Pottstown, IL in Peoria County
  - Expected finish is Q3 2026
  - Rated at 2500 kW AC, 3080 kW DC
  - There are 4800 solar modules, 10 inverters
  - Outputs to the grid at 13.2 kV (feeder)
  - 4128 kWh grid scale battery

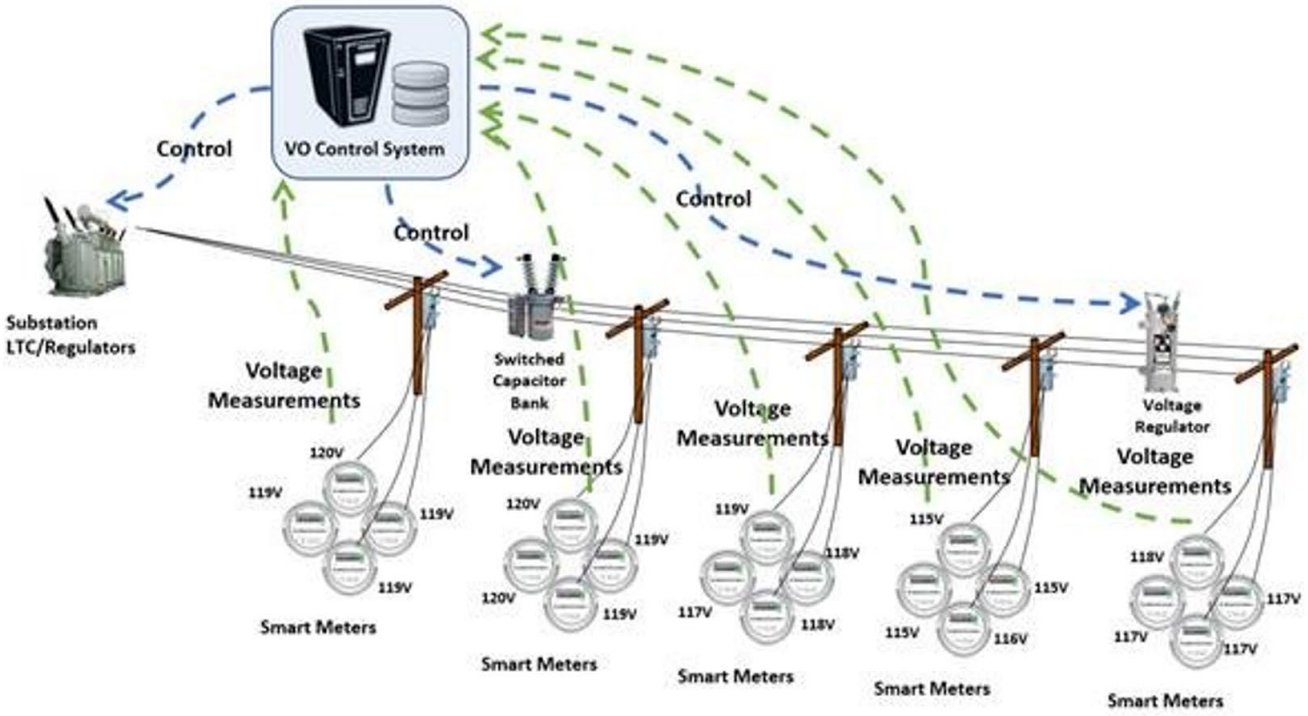
What is Voltage Optimization (VO)?

- The VO Program originated to address criteria from IL Senate Bill 2814 (Future Energy Jobs Act) which became law in June 2017, requiring Ameren Illinois Company (AIC) to file a plan with the ICC (Illinois Commerce Commission) that identified the cost-effective voltage optimization investment AIC planned to undertake through 2024.
- VO is the use of automation on distribution voltage control devises (switched capacitor banks, voltage regulates and LTC's to reduce reactive power (VAR) flows on a circuit and lower the voltage within regulatory limits to reduce end-use customer consumption and utility distribution losses.





VO (continued)



VO Program Benefits

- Increased energy savings across AIC territory:
  - AIC benefits: 3% voltage drop will yield, on average, a 2.4% load and energy reduction (system loss reduction)
  - Customer benefit: lower voltage means lower energy consumption without losing functionality of end use device
- Additional VO circuits improve overall distribution system health with greater AMI visibility.
- Benefits the grid as visibility is increased on circuits with VO through supervisory contraol and data acquisition (SCADA).
- Has potential to improve Distributed Energy Resource (DER) hosting capacity and lower DER interconnection costs.

BACKGROUND ON AMEREN CORPORATION

Ameren Corporation

FORTUNE
500
COMPANY

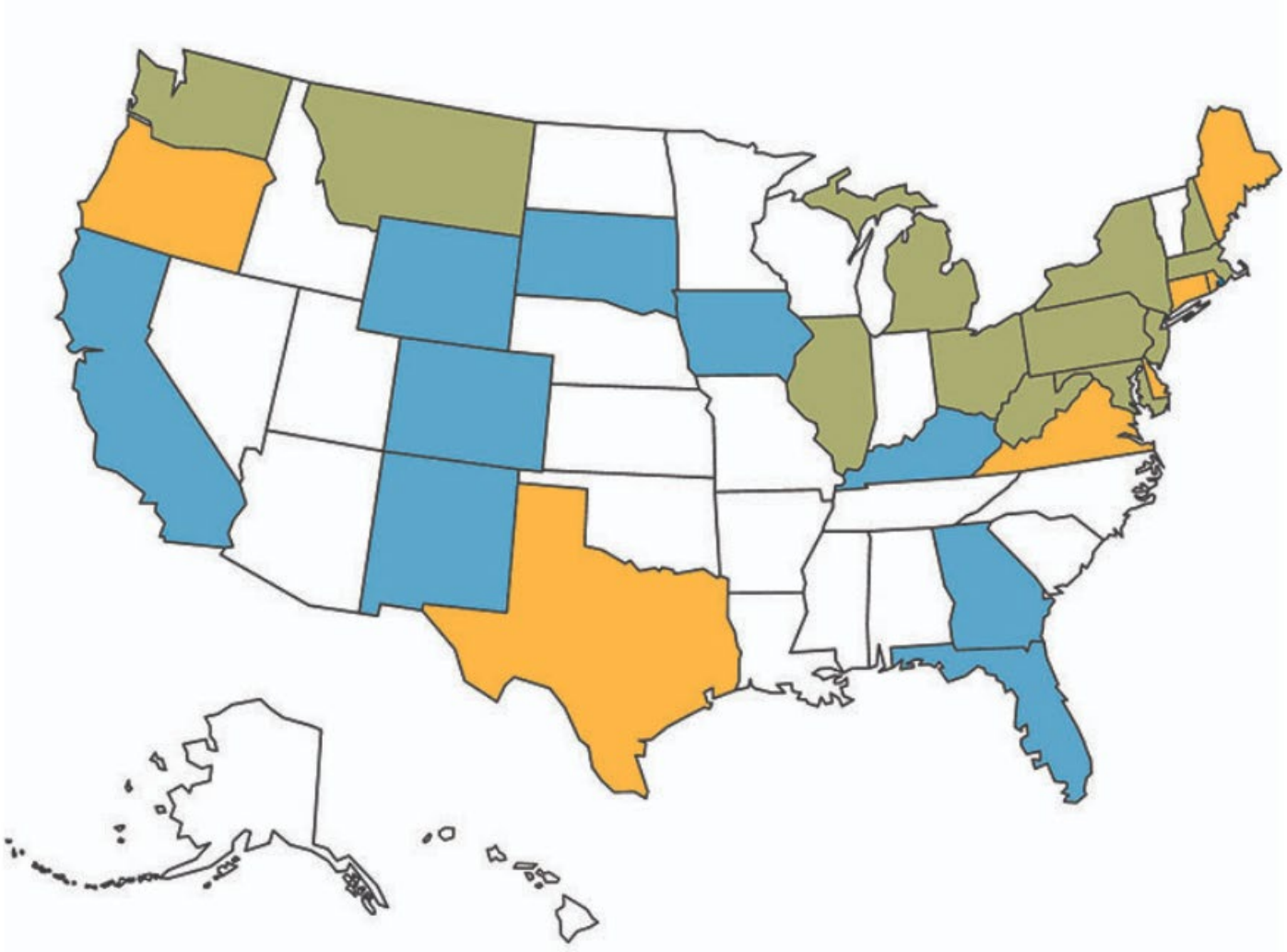
10,300 MW
ELECTRIC GENERATION

900,000
NATURAL GAS CUSTOMERS

64,000
SQUARE-MILE SERVICE TERRITORY

2.4
MILLION ELECTRIC CUSTOMERS

Utility Regulation and Deregulation



Ameren Corporation Operations

Ameren ILLINOIS | MDI MARKET DEVELOPMENT INITIATIVE

Ameren MISSOURI

This integrated utility owns a mix of energy centers with 10,200 megawatts of electric generation capacity. It is the second largest gas distributor in Missouri.

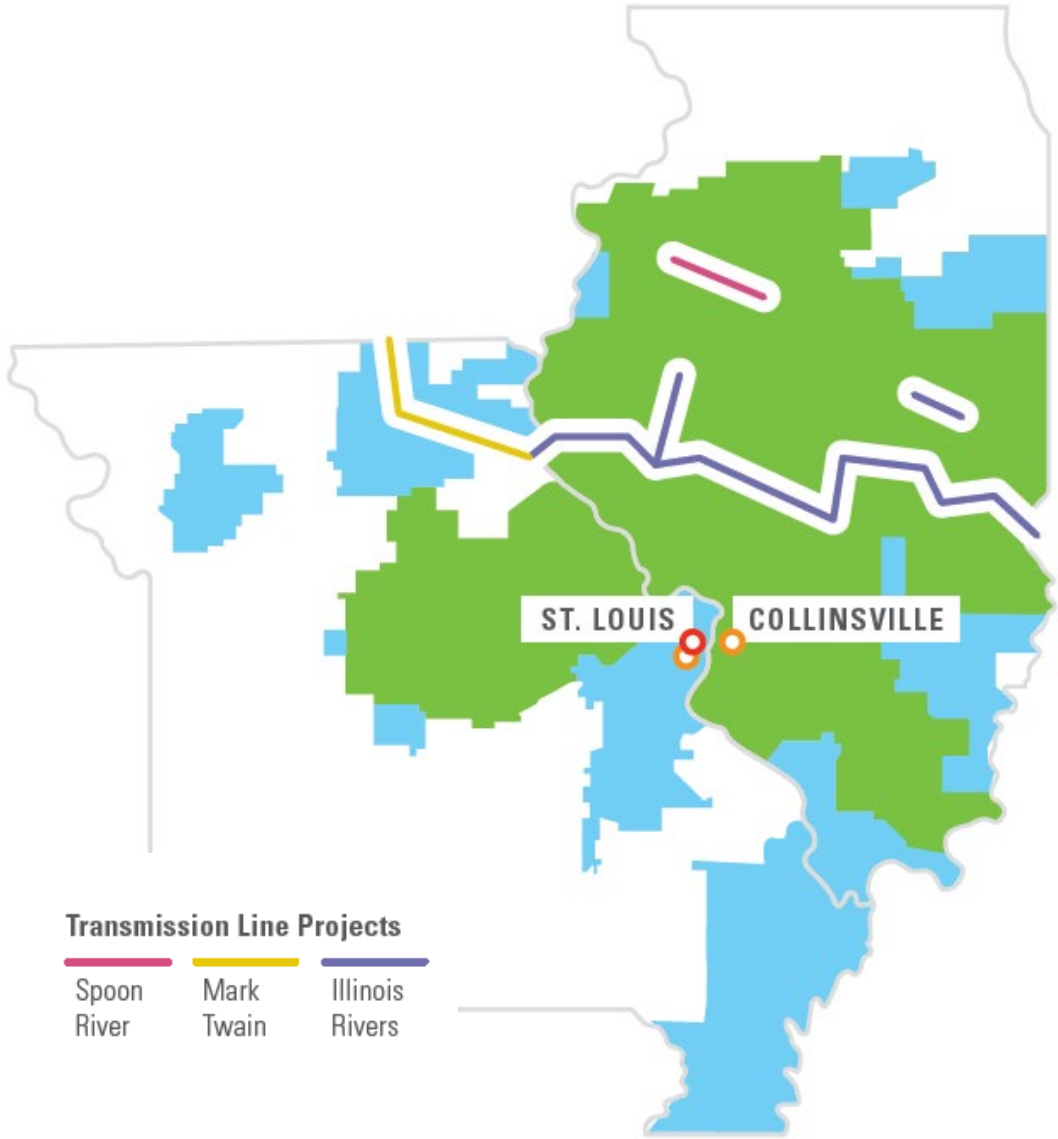
Ameren ILLINOIS

This delivery-only utility is the second largest distributor of electricity and third largest distributor of natural gas in Illinois.

Ameren TRANSMISSION

This subsidiary is dedicated to electric transmission infrastructure investment and expanding Ameren's already robust system of high-voltage lines.

Ameren Corporation Service Territory



Corporate Headquarters

Subsidiary Headquarters

Electric Service Territory

Electric & Natural Gas Territory

Transmission Line Projects

Spoon River

Mark Twain

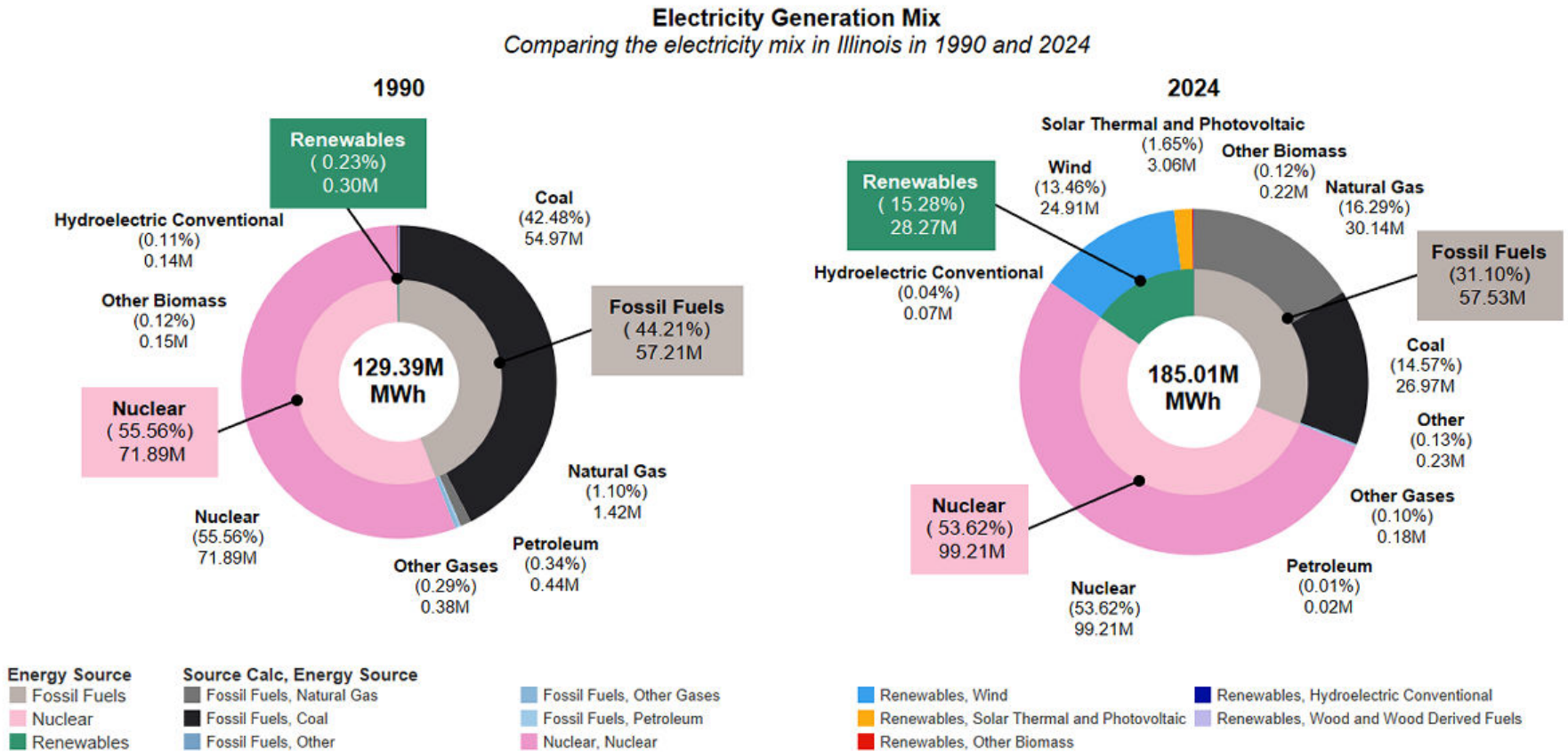
Illinois Rivers

Ameren Illinois – Renewables Regulation

Smart Grid

- Illinois is a deregulated energy state. Ameren Illinois is prevented from owning generation assets outside of a few exceptions.
- The smart grid group maintains and operates these exception generation sites.
- Climate and Equitable Jobs Act (CEJA) allowed:
  - Ameren to develop solar PV pilot projects in East St Louis and Peoria, each not exceeding $20 million
  - With a commitment to utilizing a diverse and equitable local and/or disadvantaged labor force in the pursuit of these pilots
- Inextricable tie between regulation and utility-owned renewables development.

Developing Renewables in Illinois – Energy Trends



Source: U.S. Energy Information Administration (EIA). (September 18, 2025). *Net Generation by State by Type of Producer by Energy Source (EIA-906, EIA-920, and EIA-923).*
Note: Renewables only represented 0.23% of the electricity mix in 1990. By 2024, this proportion grew to 15.28%. Nuclear has accounted for approximately half of electricity generation in Illinois throughout the 34 year period.

Developing Renewables in Illinois – Three-Legged Stool

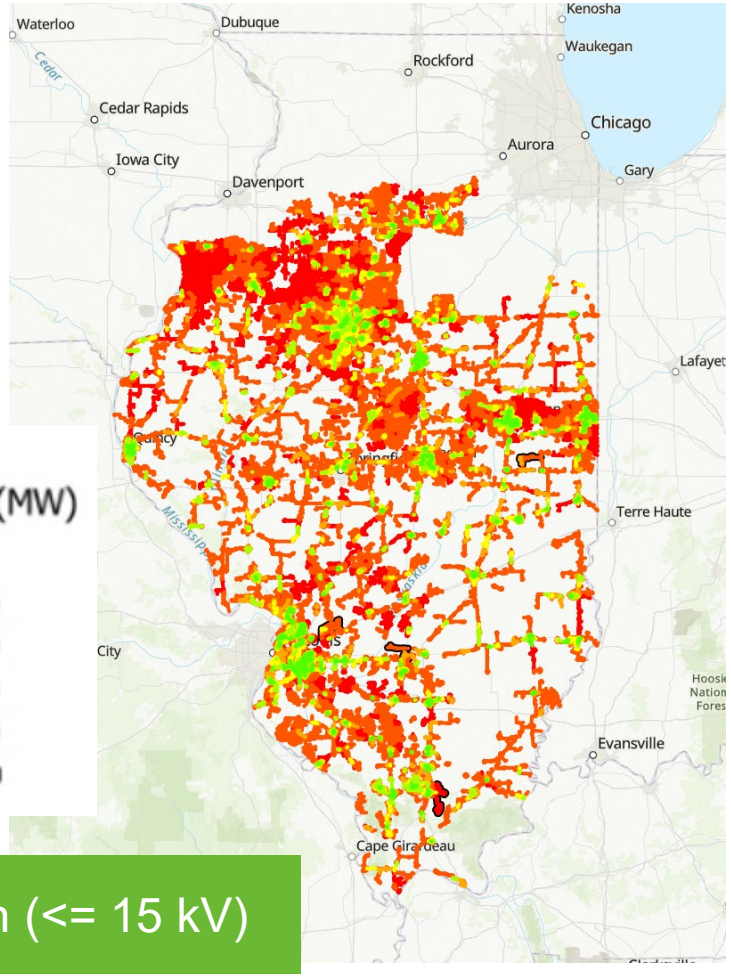
Government
Regulation – State Senate
Incentives – Congress
Cost to Borrow – Federal Reserve
Local Acceptance

Utilities
Equipment Capability
Equipment Capacity
Interconnection Queue

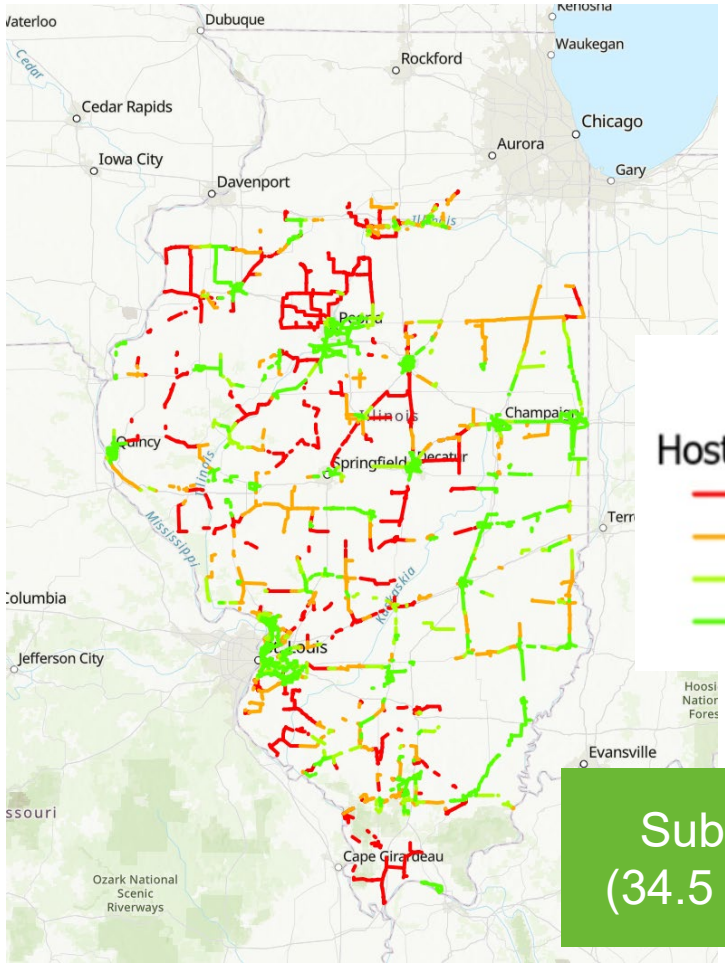
Developers
Development Expertise
Available Capital
Access to Land

Developing Renewables in Illinois – Utility Capacity

Ameren Illinois



Distribution (<= 15 kV)



Subtransmission (34.5 kV and 69 kV)

Developing Renewables in Illinois – Equipment Limitations

Electric grid was developed to support centralized, one-way power flow

- Large coal and nuclear plants that output enough power for their region
- High voltage transmission circuits to that step down to local distribution circuits

Legacy infrastructure was not built for the DER-heavy energy grid of the future.

Key limitations:

- Ratings of existing equipment – power and reactive power limits
  - Older equipment can be one-directional
- Solar and wind intermittency
- Lack of grid scale energy storage to smooth intermittencies
- Data is limited – Utility communicates with owned equipment, but not with generation assets. If intermittency occurs, utility must react.
- Insufficient transmission/distribution capacity

Developing Renewables in Illinois – Interconnection Queue

Each proposed project must go through these steps to connect to the grid:

- Grid interconnection study
- Project implementation
- Key stakeholder discussions
- Submission of project details, plans, As-Builts, etc. to utility
- Approval of an interconnection agreement between the developer and utility
- Grid interconnection

Grid interconnection can take several years from the beginning of this process, so it is crucial to consider early in development.

Currently over 3200 projects in the Ameren interconnection queue in Illinois (accessible on Illinois Developer Resources site).

Future Initiatives in the Utility Space

- Utility SCADA systems can communicate with most devices on the utility side of the meter, but are blind to the customer side of the meter.
- Centralized generation assets (like coal, nuclear, natural gas) are easier to control.
- With the growth of renewables, the grid is beginning to experience more intermittency.
  - Need to get smarter in predicting these
- **Future Technologies:**
  - DERMS (Distributed Energy Resource Management Systems)
    - Predictive models for demand spikes and outage prevention
    - Enable some forms of two-way communication with customers
- Virtual power plants
  - Combining output of consumer-owned DERs to perform similarly to a traditional power plant

Ameren ILLINOIS | MDI MARKET DEVELOPMENT INITIATIVE

QUESTIONS FOR SARAH AND ZACH?