51st State Perspectives

DERS ARE COMING AND ILLINOIS IS READY FOR THEM

IN PARTNERSHIP WITH

JUNE 2017

TABLE OF CONTENTS

EXECUTIVE SUMMARY 4
INTRODUCTION 4
BACKGROUND 7
CURRENT STATE OF THE ILLINOIS ELECTRICITY MARKET 9
- 1. Retail Market Design 9
- 2. Wholesale Market Design 11
- 3. Utility Business Model 12
- 4. Rates and Regulation 16
- 5. Asset Deployment 17
- 6. Information Technology 20

DEGREES OF TRANSFORMATION IN ILLINOIS 21
- 1. Doctrine 1: Promote Efficiencies 21
- 2. Doctrine 2: Clearly Define Roles 22
- 3. Doctrine 3: Principles of Ratemaking 25
- 4. Doctrine 4: Foster Customer Choice 26

CONCLUSION 29
APPENDIX A, UTILITY SURVEY OF GRID MODERNIZATION DEPLOYMENTS AND ACTIVITIES 30
APPENDIX B, LIST OF ACRONYMS 32

LIST OF TABLES

TABLE 1. SEPA'S 51ST STATE KEY DOCTRINES 6
TABLE 2. SNAPSHOT OF THE ILLINOIS ELECTRICITY MARKET STRUCTURE 7
TABLE 3. NUMBER OF RATE PLAN OPTIONS FOR COMED RESIDENTIAL CUSTOMERS IN 2016 16
TABLE 4. DOCTRINE 1: PROMOTE EFFICIENCIES 22
TABLE 5. DOCTRINE 2: CLEARLY DEFINE ROLES 25
TABLE 6. DOCTRINE 3: PRINCIPLES OF RATEMAKING 26
TABLE 7. DOCTRINE 4: FOSTER CUSTOMER CHOICE 28
TABLE 8: UTILITY SURVEY FOR DISTRIBUTION GRID OPERATIONS 30
TABLE 9: UTILITY SURVEY FOR DISTRIBUTION MARKET OPERATIONS 31
TABLE 10: UTILITY SURVEY FOR DISTRIBUTION SYSTEM PLANNING 31

LIST OF FIGURES

FIGURE 1. CONNECTING DOCTRINES TO SWIMLANES 6
FIGURE 2. CUSTOMER CHOICE IN ILLINOIS PARTICIPATION RATES 9
FIGURE 3. MAP OF REGIONAL TRANSMISSION ORGANIZATIONS, SHOWING ILLINOIS WITH RESPECT TO PJM AND MISO 11
FIGURE 4. COMED'S SAIFI & CAIDI TRENDS, 2010-2015 14
FIGURE 5. COMED'S INVESTMENTS IN DISTRIBUTION AUTOMATION & SUBSTATION UPGRADING, 2012-2021 18
FIGURE 6. COMED AND AMEREN SMART METER DEPLOYMENT, 2012-2018 18
FIGURE 7: COMED'S SMART GRID COMMUNICATION TIERS 19
FIGURE 8: COMED'S PLATFORM FOR UTILITY OF THE FUTURE 23
FIGURE 9: COMED'S COMMUNITY OF THE FUTURE 24

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ABOUT SEPA

SEPA facilitates collaboration across the electric power industry to enable the smart deployment and integration of clean energy resources. Our focus centers on solar, storage, demand response, electric vehicles, grid management, and other enabling technologies.

ABOUT SCOTTMADDEN

For more than 30 years, ScottMadden has helped our clients transform the way they operate, plan, and maintain the grid and interact with their customers. The Grid Transformation practice focuses on helping clients adapt to the myriad changes driven by the increasing penetration of distributed energy resources, such as distributed generation, storage, demand response, and microgrids. We help our clients choose the path that meets their reliability, customer, and regulatory goals, and then we help them implement it.

ACKNOWLEDGEMENTS

SEPA and ScottMadden would like to recognize the following individuals for their time and assistance in developing this report: Scott Baker, Andrew Barbeau, Ray Fakhoury, Mark Fronmuller, Vito Greco, Val Jensen, Brad Klein, Rao Konidena, Wei Chen Lin, Ann McCabe, Dick Munson, Meagan Pagels, David South, and Scott Vogt. We would like to thank ScottMadden's Quentin Watkins for his contributions and review. We would also like to thank the following SEPA staff for their assistance and review: Tanuj Deora, Mike Kruger, Erika Myers, Christine Stearn, and Mike Taylor.

Executive Summary

When distributed energy resources (DERs) arrive, Illinois will be ready.

Through thoughtful investment and proactive regulation, Illinois has laid the foundation for the proliferation of DERs and the attendant changes to the regulatory construct and the utility business model.

In recent years, legislation has funded significant upgrades to utility infrastructure, increasing the reliability and automation of the electric grid. As part of this investment program, the state implemented performance-based, formulaic ratemaking that has tied utilities' earnings to their success in upgrading infrastructure and improving grid reliability.

Recent legislation has furthered these goals by extending performance-based ratemaking and setting specific targets for solar power, energy efficiency and distributed generation. State law has also taken into account a future in which higher DER penetration will require a more sophisticated approach to customer compensation for behind-the-meter (BTM) resources, an approach that takes a closer look at the locational value of DERs, and allows utilities to treat distributed generation rebates as a regulatory asset and earn a return. Energy efficiency, too, can be treated as a regulatory asset and earn a return. This approach addresses both the physical infrastructure and the regulatory model while laying the foundation for both increased reliability and the mechanisms to fund it. This approach provides both short-term flexibility and the ability over the longer term to accommodate the coming changes in the power sector.

THINGS TO WATCH

- Treatment of energy efficiency expenditures as a regulatory asset earning a return
- Post-Net Energy Metering pathway of distributed generation (DG) compensation in statute tied to locational grid benefits
- Utility ability to treat distributed generation compensation for systems allowing utility-control facilitated by smart inverters as a regulatory asset earning a return
- Extension of formula rate plan for distribution assets with added performance incentives for energy efficiency expenditures
- Investments and deployments for modernizing distribution grid operations
- Evolution of the platform business concept
- NextGrid and the 21st Century regulatory model

Source: SEPA & ScottMadden, 2017

Penetration of DERs in Illinois is relatively low today, but expected to grow rapidly with the changes afoot. The state has taken important steps to enable the technical integration of DERs and to pave the way for regulatory changes that support their integration. The NextGrid initiative is poised to further these important changes.

The callout above provides a summary of key activities contributing to electricity market transformation in the state.

INTRODUCTION

While New York and California are often cited for leading the charge on innovative energy policy, Illinois has quietly solidified its position as a market to watch. During the past two decades, the legislature has passed several sweeping laws that have changed the way electricity is generated,

sold, and consumed in the state. That legislative leadership continued in 2016 with the passage of the Future Energy Jobs Act.

So, what is the state of the electricity market in the state today? How have these legislative initiatives led to transformation in the electricity market? And, most importantly, have they resulted in a modernized grid and utilities that are flexible and ready for growth in distributed energy resources[1] (DERs)?

This paper discusses the ways Illinois has and is transforming its grid to accommodate a variety of resources and will:

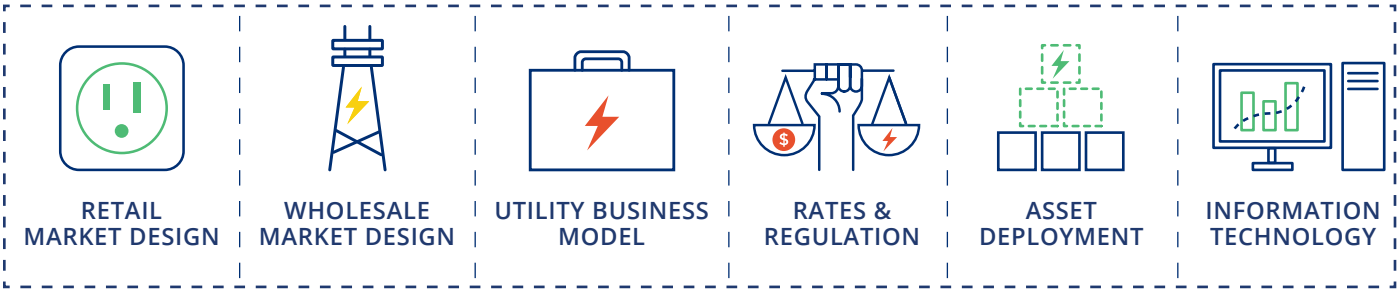
- Discuss the current state of the electricity market in Illinois,
- Evaluate the degree to which the market has transformed from a traditional centralized grid with limited customer choices to a more distributed system enabling more customer choice,
- Assess whether utilities in Illinois are prepared for rapid growth of DERs thanks to the grid modernization efforts undertaken to-date.

This paper begins by identifying the efforts taking place in particular areas through the lens of the market transformation "swimlanes" of *The 51st State—Phase II Developing Roadmaps to the Future*[2] developed by the Smart Electric Power Alliance. The swimlanes are organized to describe and highlight key areas affected by market transformation:

- Retail market design
- Wholesale market design
- Utility business models
- Rates and regulation
- Asset deployment
- Information technology

The paper then assesses the degree of transformation taking place in Illinois against four key market reform doctrines from *The 51st State—Blueprints for Electricity Market Reform*[3] (outlined in Table 1).

51ST STATE SWIMLANES



1 Distributed energy resources are physical, as well as virtual, assets that are deployed across the distribution grid, typically close to load, which can be used individually or in aggregate to provide value to the grid, individual customers, or both. For more information, see SEPA, 2016, Beyond The Meter: Distributed Energy Resources Capabilities Guide, https://sepapower.org/resource/distributed-energy-resources-capabilities-guide/

2 SEPA, 2016, The 51st State—Phase II: Developing Roadmaps to the Future, https://sepa.force.com/CPBase__item?id=a12o000000WMEg3AAH

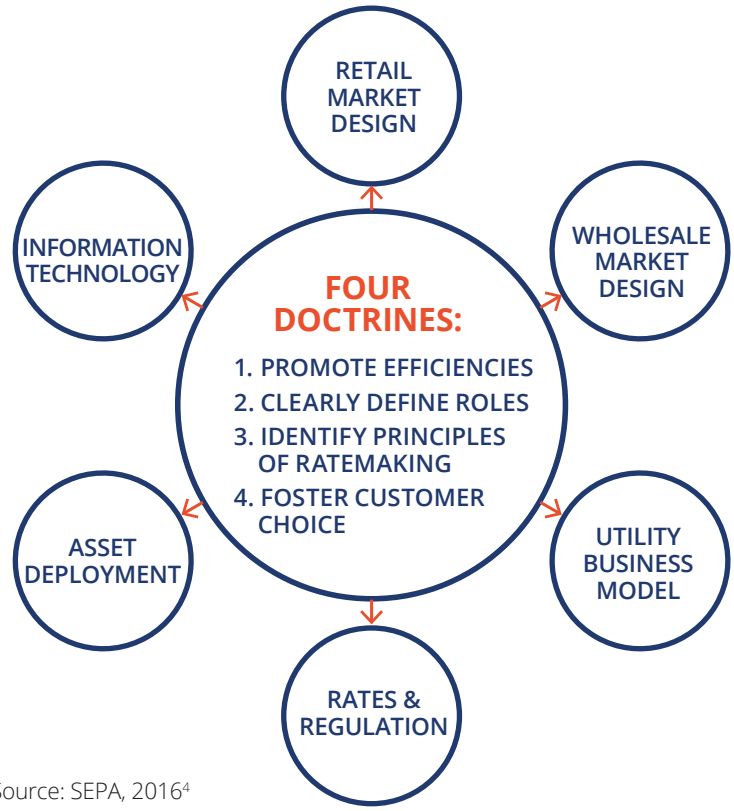
3 SEPA, 2016, The 51st State—Blueprints for Electricity Market Reform, https://sepapower.org/resource/blueprints-for-electricity-market-reform/

TABLE 1. SEPA'S 51ST STATE KEY DOCTRINES

DOCTRINE		DESCRIPTION
1.	PROMOTE EFFICIENCIES	A primary goal of the market should be to promote efficiencies in the production, consumption, and investment in energy and related technologies.
2.	CLEARLY DEFINE ROLES	The role of the utility, as a public service entity, should be clearly defined so that all market participants can understand their roles in enabling customer options in a fair, transparent, and nondiscriminatory manner.
3.	IDENTIFY PRINCIPLES OF RATEMAKING	Rate structures should provide transparent cost allocation that supports a sustainable revenue model for utility services providing a public good.
4.	FOSTER CUSTOMER CHOICE	Customers should be presented with a variety of rate and program options that expand their choice of and access to energy-related products and services that are simple, transparent, and create stable value propositions.

Source: SEPA, 2016[4]

FIGURE 1. CONNECTING DOCTRINES TO SWIMLANES



Source: SEPA, 2016[4]

The doctrines and swimlanes together encompass all aspects of electricity market structures, roles and responsibilities. The four doctrines identify key overarching elements of market transformation, while the six swimlanes structure the intricacies involved in mapping change in the industry. The two are inevitably interconnected. For example, decisions regarding how best to promote energy efficiency will drive conversations on retail markets, and utility roles and responsibilities, and have effects on ratemaking.

By combining these two frameworks, this paper provides a holistic view of the economic, operational, and regulatory factors that contribute to Illinois' readiness to manage a resilient and efficient modern grid. It describes why we believe Illinois will be ready when DERs arrive.

4 SEPA, 2016, The 51st State—Blueprints for Electricity Market Reform, https://sepapower.org/resource/blueprints-for-electricity-market-reform/

BACKGROUND

Over the past 20 years, several major pieces of legislation have driven transformation of the electricity market in the state. First, the Electric Service Customer Choice and Rate Relief Law of 1997 opened the door to energy competition. This legislation deregulated the state's two biggest electric utilities, Ameren Illinois (Ameren) and Commonwealth Edison (ComEd). Up until that point, only larger commercial and industrial customers had the ability to purchase the supply portion of their electric service from an Alternative Retail Electric Supplier (ARES), while residential and small businesses remained with their respective incumbent utilities. During the 10-year transition that followed, the Illinois Commerce Commission (ICC), which oversees the state's utilities, reduced the price of electricity by 20 percent and froze the rates for small business and residential customers.

TABLE 2. SNAPSHOT OF THE ILLINOIS ELECTRICITY MARKET STRUCTURE

SERVICE TERRITORY	Mixed (Urban and Rural)
UTILITY TYPE	99% investor-owned utility ComEd 74% Ameren 24%[5]
DER PENETRATION	Low
UTILITY STRUCTURE	Wires-only (T&D)
WHOLESALE MARKET	Organized markets: PJM and MISO
RETAIL MARKET	Fully deregulated
RENEWABLE POLICY	Renewable portfolio standard: 25% by 2025
NEM	NEM capped at 5% of peak demand

Source: SEPA & ScottMadden, 2017

In May 2002, 4.4 million residential customers became eligible to choose their electric provider for the first time, but the rate caps in place discouraged any competitive providers from serving them. In the commercial space, however, competition gained traction. By October 2005, approximately 22,000 commercial customers were buying their electricity from an alternative provider.[6] Following the expiration of the rate caps in 2007, residential customers also began switching to alternative providers in greater numbers. Today 89 alternative providers serve retail customers in Illinois, with 75 percent of customers (by usage) in ComEd's service territory and around 80 percent in Ameren's territory served by alternative providers.[7]

Net energy metering (NEM) was introduced in August 2007, when the state enacted Senate Bill 680 that requires investor-owned utilities and alternative providers' in Illinois to offer net metering. The law provides that DER generation may be supplied back to the grid at retail rates, subject to a cap. The cap limits the load of a utility's NEM customers and dual-metering customers[8] to 5 percent of the total peak demand supplied by the utility during the previous year.[9] Illinois has very low penetrations of net-metered solar as of the date of this publication.

The 2011 Energy Infrastructure Modernization Act (EIMA) was intended to improve reliability and drive the modernization of the grid with new digital

5 Based on customer counts (delivery and bundled electric service) from 2015 Form EIA-861 filings (11/21/2016)

6 The History of Deregulation in Illinois, Spark Energy, https://www.sparkenergy.com/en/blog/archive/the-history-of-electricity-deregulation-in-illinoi/

7 Illinois Commerce Commission Office of Retail Market Development, 2016, https://www.icc.illinois.gov/ormd/

8 In a dual metered set up, there are two separate meters, one measuring consumption and another meter to measure solar electricity production sent to the grid.

9 DSIRE, http://programs.dsireusa.org/system/program/detail/2700

infrastructure. As part of the program, the ICC authorized a 10-year, $2.6 billion grid modernization program for ComEd and a $648 million grid modernization program for Ameren.

The programs funded reliability and smart grid investments, including advanced metering infrastructure (AMI). EIMA also required the adoption of performance-based rates to determine the authorized return on equity (ROE), which is reset annually.

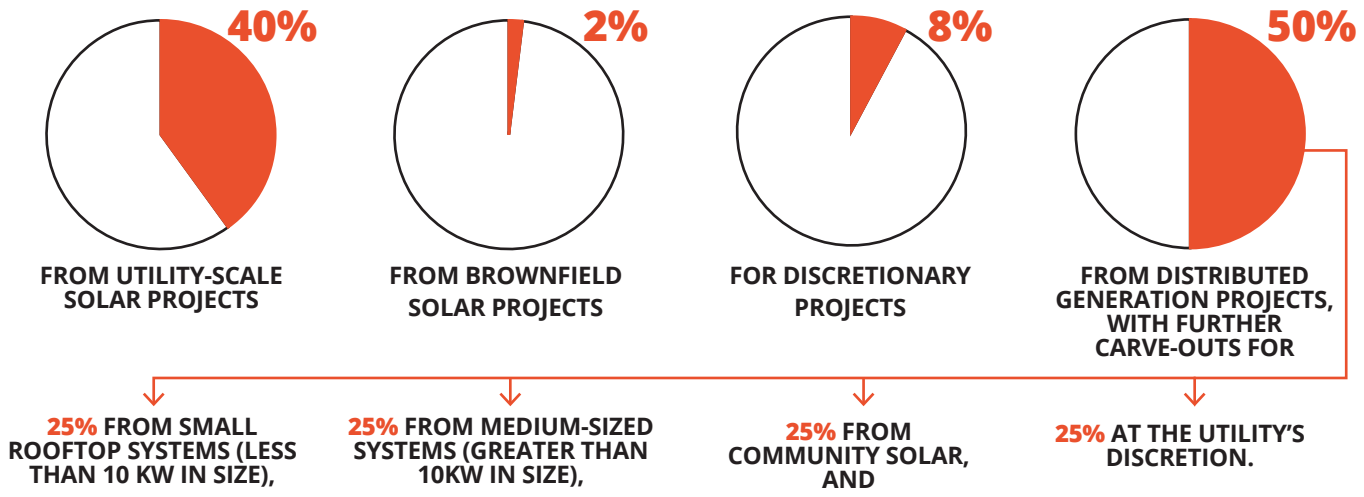
The December 2016 passage of the Future Energy Jobs Act (FEJA) brought a major expansion of energy efficiency and reinvigorated the state's renewable energy industry. The Illinois renewable portfolio standard (RPS) passed in 2007 requires that 25 percent of energy generation comes from renewable sources by 2025, but it has been stymied by a lack of consistent funding mechanisms for developers.

The FEJA attempts to address this issue by allocating $140 million per year to enhance the Illinois RPS by authorizing the Illinois Power Agency to purchase renewable energy credits (RECs) for RPS compliance. To address the additional concern that RECs might be purchased on the secondary market and not encourage new project construction, 4 million solar renewable energy credits and 4 million wind RECs are required to come from new projects in the state, translating into about 3,000 MW of solar projects and 1,300 MW of wind projects.[10]

MAJOR ENERGY LEGISLATION IN ILLINOIS

- **Electric Service Customer Choice and Rate Relief Law (1997)**—opens door to retail choice and competition in the state.
- **Energy Infrastructure Modernization Act (2011)**—drives modernization of the grid authorizing significant investments for ComEd and Ameren and establishes performance-based formula ratemaking.
- **Future Energy Jobs Act (2016)**—expands energy efficiency, addresses issues in RPS implementation, and creates a pathway for compensating distributed generation based on grid value.

WITHIN THE SOLAR PORTION OF THE BILL, THERE ARE SEVERAL CARVE-OUTS:



10 Wind projects will have a higher capacity factor than solar, hence the smaller number of megawatts. Utility Dive, How the Illinois energy reform 'fixed' the state's RPS, promising a renewables boom, Dec 22, 2016

The NEM program remains in place up to the 5 percent cap of the prior year's peak demand. However, after that cap is reached, the legislation discusses developing a pathway to a rebate based on locational value to the grid.

The legislation also requires utilities to offer rebates to distributed generation and community solar projects with smart inverters. Utilities are allowed to take control of the inverter for grid reliability services and compensate those services through a tariff. Performance-based formula ratemaking established under the EIMA was also extended through 2022.[11]

Current State of the Illinois Electricity Market

1. RETAIL MARKET DESIGN

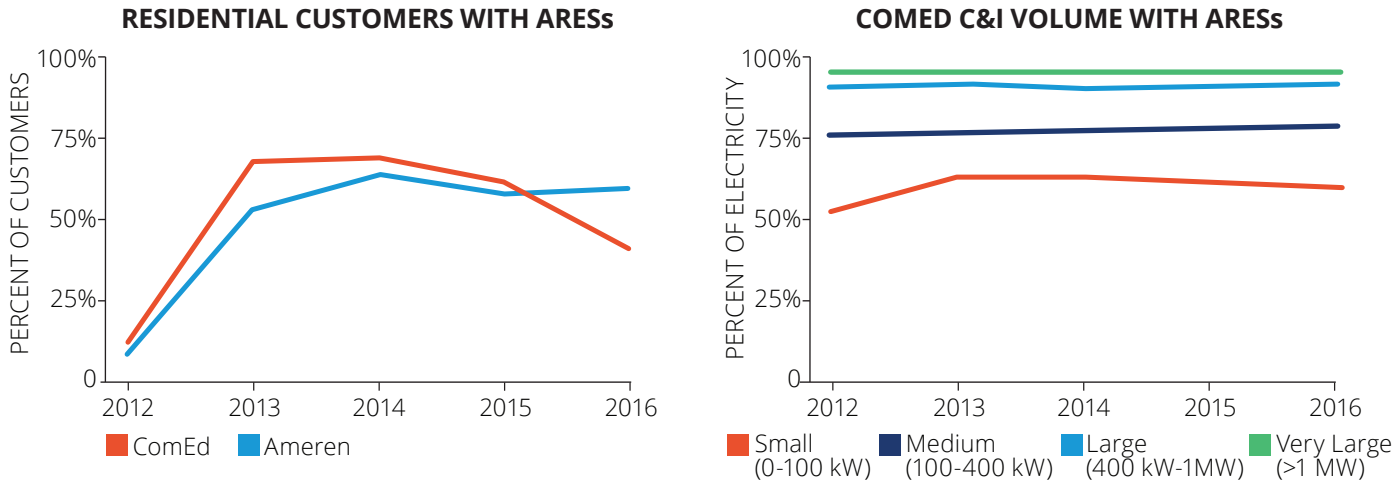
This section describes the current retail market and net energy metering in Illinois. Retail deregulation, NEM, and real-time pricing have all evolved under the laws that were passed over the last two decades.

CUSTOMER CHOICE IN ILLINOIS

Residential, commercial, and industrial customers may choose to receive electricity from a variety of providers. The distribution utility still serves as the default provider of last resort if no choice is made.

In ComEd's service territory, the majority of commercial customers buy from a competitive supplier (over 50 percent for small C&I, and over 75 percent for the larger customers) as shown in Figure 2.

FIGURE 2. CUSTOMER CHOICE IN ILLINOIS PARTICIPATION RATES



Source: Illinois Commerce Commission Office of Retail Market Development, 2016 [12]

11 Ameren presentation to the Evercore ISI Utility Conference, Jan 12, 2017, http://s21.q4cdn.com/448935352/files/doc_presentations/AEE-2017-Evercore-Conference-FINAL.pdf

12 Illinois Commerce Commission, Office Retail Market Development (ORMD), 2016 Annual Report, https://www.icc.illinois.gov/ormd/

Today, 89 alternative providers are certified to serve retail customers in Illinois. Alternative providers provide for approximately 74 percent of total electric usage of customers In ComEd's region and approximately 80 percent of the usage in Ameren Illinois' service territory.[13] Numbers have fallen or remained constant in recent years as low market prices have increased the relative competitiveness of the prices the default distribution utility can offer.

NET ENERGY METERING

Under the FEJA, existing residential net metered customers are grandfathered and NEM is preserved at the full retail rate up to a cap of 5 percent of total utility supplied peak demand.

FEJA also requires utilities to offer rebates to qualifying distributed generation and community solar projects. Projects with smart inverters that allow the utility to take control of the inverter for reliability and other grid services can be compensated by a tariff, to be determined by the commission.

Current penetration numbers are comparatively fairly low but expected to rise rapidly. ComEd, for example, currently has about 900 net metered customers totaling approximately 13 MW.[14]

Solar penetration is set to rapidly rise with the recent legislation estimated to drive 3,000 MW of solar development over the next eight years. After net metered systems cross a 3 percent threshold of peak demand, the legislation directs the ICC to begin a process for compensating DG customers with a new rebate value based on the locational, temporal, and performance-based values to the grid. The new rebate based on locational value would take effect after a 5 percent cap is reached. After the 5 percent cap is reached, NEM changes to energy-only netting[15] for new customers, with no netting of distribution and delivery service charges. Until that value is approved, commercial and community solar customers can receive a $250/kW up-front rebate. In order to be eligible for these rebates, systems must be equipped with smart inverters that enable utility control for system reliability events. Utilities ultimately will be able to treat the distributed generation rebates as regulatory assets, recover the costs, and earn a return, similar to the treatment of energy efficiency in the FEJA (see *Utility Business Model* section).

REAL-TIME PRICING

The widespread roll-out of AMI across the ComEd and Ameren service territories as part of EIMA (see section under *Asset Deployment*) has facilitated the introduction of transformative rate plans, including real-time pricing. ComEd, for instance, offers customers an hourly pricing tariff with the energy charge[16] based on:

- The PJM real-time residual locational marginal price for the ComEd Zone for the corresponding hour of use,
- The PJM net load price in $/MW-Day for the PJM Planning Year resulting in a monthly capacity charge.

To help residential customers take advantage of its hourly pricing program, Ameren offers an optional, user-friendly supplement called Power Smart Pricing. The program is administered by Elevate Energy, an independent non-profit organization. Power Smart Pricing provides educational materials, personalized updates, and an online tool to help users maximize their savings with the rate option for a flat monthly fee of $2.25.[17]

13 Illinois Commerce Commission, Office Retail Market Development (ORMD), 2016 Annual Report, https://www.icc.illinois.gov/ormd/

14 ComEd, 2017

15 Energy-only netting means customers who participate in net metering can discount the supply costs of the electricity commensurate to the production of their system but not the distribution and transmission costs of service, presenting an alternative to full retail net metering wherein all costs are discounted.

16 Commonwealth Edison Service, 2016, Schedule of Rates for Electric Service, https://www.comed.com/SiteCollectionDocuments/MyAccount/MyBillUsage/CurrentRates/Ratebook.pdf

17 Currently, 11,280 customers are enrolled in the program. https://www.powersmartpricing.org/ accessed May 26, 2017

RETAIL MARKET DESIGN IN SUMMARY

In Illinois, the market structure at the retail level affords customers increased choices and options. It is unclear, however, if this mere presence of choice on its own is enough to promote increased customer adoption of DERs.

Increases in efficiency and renewable standards with solar carve-outs and pathways for new valuation and compensation of distributed generation should stimulate customer demand with increasing choices in resources behind-the-meter.

The combination of FEJA requirements and carve-outs, with the pricing alternatives enabled by AMI (and importantly, offered by utilities) have laid the groundwork for increased proliferation of DERs.

2. WHOLESALE MARKET DESIGN

The wholesale market design can also be a key enabler of DERs; potentially as important as retail rate design. Wholesale power needs, generation planning and dispatch, and transmission planning and operations can be affected by activities in the retail marketplace. Conversely, the resources available, adopted, and operated in the retail marketplace on the customer side can be influenced by wholesale market structures that accommodate or value such resources.

Illinois participates in two competitive wholesale markets, the Midcontinent Independent System Operator (MISO) and the PJM. Illinois is one of the few states that spans portions of both PJM and MISO. ComEd belongs to PJM and Ameren to MISO.

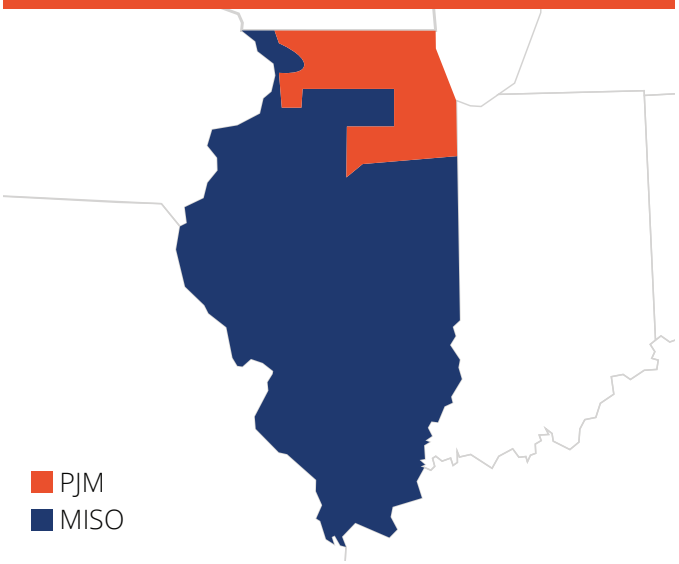
The PJM and MISO wholesale markets make generation dispatch decisions. Demand response, energy efficiency, and other DERs in Illinois may be treated as generation resources when they meet certain criteria.

PJM has a long history of demand response and energy efficiency participation in the wholesale market. Over 10,000 MW of demand response and 1,500 MW of energy efficiency resources cleared in the 2019-2020 base residual auction in PJM's capacity market.

PJM and MISO both allow DER aggregation in limited circumstances, typically linked to the requirement that the demand-side, generation, and electric storage resources are located behind the same point of interconnection or pricing node. Both regions have ongoing initiatives to increase opportunities for non-traditional resources to access and participate in their respective markets.

PJM has a low threshold for entry, with a minimum size requirement of 100 kW for all resources. In addition, some types of aggregated DERs—such

FIGURE 3. MAP OF REGIONAL TRANSMISSION ORGANIZATIONS, SHOWING ILLINOIS WITH RESPECT TO PJM AND MISO



Source: FERC, 2017[18]

18 FERC, 2017, https://www.ferc.gov/market-oversight/mkt-electric/overview.asp

as in-front-of-the-meter storage resources—are eligible to participate in the capacity, energy, and ancillary services markets. PJM also allows aggregated demand-side resources to participate in the capacity market. New capacity performance rules in PJM require that demand response resources be valued for their ability to supply year-round capacity which may lead to additional participation of aggregated DER in future auctions.

MISO does not set a predetermined size for participating resources, but has suggested a threshold of 1 MW because of current system limitations. MISO also places limitations on some energy storage and demand response resources that prevent them from providing all of the grid and market services that they may be capable of. However, MISO has been pursuing internal studies and stakeholder discussions to identify potential revisions to its tariff to enhance the participation of DERs. In October 2016, MISO staff stated that behind-the-meter generation could be incorporated into transmission planning, modeling, and retirement notifications.[19] And an ongoing review of the market is prioritizing several aspects of DER aggregation, including aggregation of behind-the-meter storage, various forms of demand response for emergency capacity, and utilizing storage as demand response. In the most recent capacity auction 98 MW of energy efficiency cleared the market.[20]

The recent Federal Energy Regulatory Commission (FERC) Notice of Proposed Rulemaking (NOPR) under docket number RM16-23-000 released November 17, 2016, proposes that each ISO or RTO be required to revise its tariff to allow energy storage and DER aggregators to participate in ways that recognize their physical and operational characteristics. [21]

WHOLESALE POWER MARKETS IN SUMMARY

DERs currently have some ability to play a role in wholesale markets, but this is limited by current classifications that do not take into account all of their operational characteristics, particularly for storage. Behind-the-meter DERs are at a disadvantage in both markets. For other types of DER technologies, both markets limit the services and roles they may provide.

The FERC NOPR may guide further reform in this area, especially if FERC takes an active role on the issue in the future. As these two markets converge or diverge in their DER rules, we may see different products and services in different parts of the state. PJM is currently further ahead than MISO regarding DER integration, potentially creating bifurcated DER usage and value within the state.

3. UTILITY BUSINESS MODEL

Regardless of how the future of electricity markets unfolds, the wires-only transmission and distribution utility will remain critical to ensuring the provision of safe, reliable, cost-effective service. While utilities' current natural monopoly status may dictate the basic form and function of the utility of the future (e.g., providing distribution services might remain unchanged), the utility will undergo dramatic transformation to support new choices for customers, new markets, exchanges, and transactions, while maintaining reliable electric service for customers.

19 RTO Insider, 2016, MISO Ponders Changes to Behind-the-Meter Generation Rules, https://www.rtoinsider.com/miso-behind-the-meter-generation-rules-32391/

20 MISO, 2017, 2017/2018 Planning Resource Auction Results - MISO, https://www.misoenergy.org/Library/Repository/Report/Resource%20Adequacy/AuctionResults/2017-2018%20PRA%20Summary.pdf

21 SEPA and EEI will be publishing a review of the technical challenges to DER aggregation in summer 2017.

Investor-owned utilities in Illinois remain traditional wires-only distribution utilities, but their business has undergone a series of shifts, from decoupling and deregulation in the 1990s, to performance-based ratemaking and smart grid pilots in the 2010s. Municipal utility systems and cooperatives were not required to restructure and still serve as traditional vertically integrated utilities with both generation and transmission assets.

TRADITIONAL COST-OF-SERVICE, FORMULA-RATES, AND PERFORMANCE TARGETS

Under the EIMA, ComEd and Ameren both pursued infrastructure investments authorized by the legislation and filed for the allowed formula rates. Introduced with EIMA and extended and updated via the FEJA, the utility ROE floats with the 12-month average of 30-year Treasuries plus 580 basis points.[22]

The EIMA also introduced performance-based formula rates adjusted downward based on utility adherence to various performance measures, including reliability, customer benefit, and diversity goals. While reliability metrics have largely been met, authorized and earned ROEs have also declined as 30-year Treasuries have fallen.

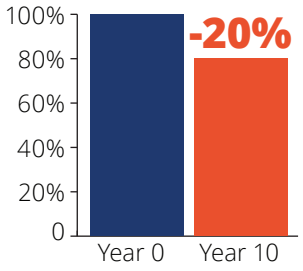
Though ROEs have fallen, the formula rate plan has served to help the utility avoid regulatory lag and mitigate the risk associated with the traditional rate filing process. It has provided greater certainty of cost recovery as the rate base grows, by providing greater confidence in investment plans to maintain and upgrade the grid. This certainty of regulatory outcome has led to critical investments in grid modernization.[23]

PERFORMANCE GOALS

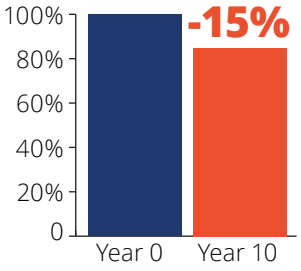
The EIMA provided ComEd and Ameren with the option to file for a performance-based formula rate to recover the costs of major grid modernization investments. The performance criteria included the requirement to meet the following metrics (see "Reliability Goals" & "Customer & Diversity Benefit Goals" callout boxes) or risk reduction of their authorized ROE.

Under the EIMA, ComEd's absolute System Average Interruption Frequency Index (SAIFI) and Customer

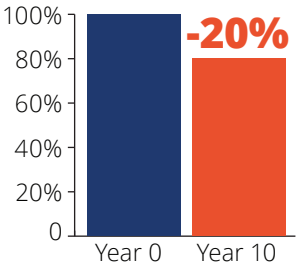
RELIABILITY GOALS



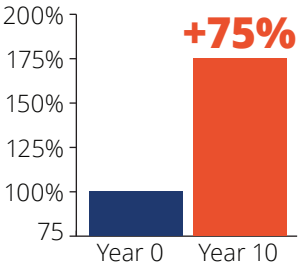
Total System Average Interruption Frequency Index (SAIFI)
20 percent reduction in outage frequency over 10 years,



System Customer Average Interruption Duration Index (CAIDI)
15 percent reduction in average outage duration over 10 years,



Southern and Northern Region SAIFI
20 percent reduction in outage frequency over 10 years,

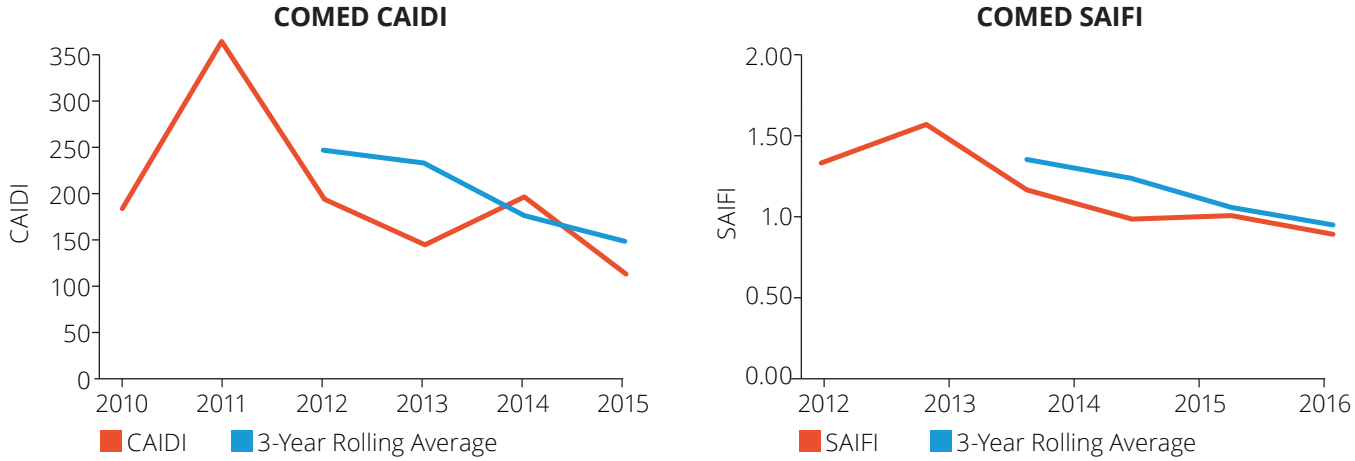


Service ReliabilityTarget
75 percent improvement in the total number of customers who exceed service reliability targets over 10 years.

22 Initially 600 with the EIMA, and updated to 580 with the FEJA.

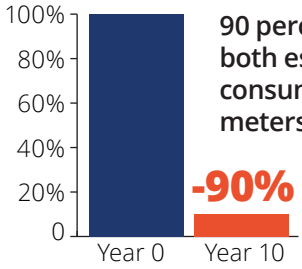
23 In conversation with Scott Vogt, Vice President of Energy Acquisition at ComEd, 2017.

FIGURE 4. COMED'S CAIDI & SAIFI TRENDS, 2010-2015



Source: Illinois Commerce Commission, 2016

CUSTOMER & DIVERSITY BENEFIT GOALS



- Estimated bills[24]—90 percent reduction in 10 years
- Deployment of advanced metering infrastructure
- Consumption on inactive meters—90 percent reduction in 10 years
- Unaccounted for energy[25]—50 percent reduction in 10 years
- Uncollectible expenses—$30M reduction over 10 years
- Increasing capital expenditures with minority- and women-owned businesses over 10 years

Average Interruption Duration Index (CAIDI), inclusive of major weather events, have been steadily improving, indicative of increasing grid resiliency and reliability. (See Figure 4.)

The infrastructure upgrades under EIMA have provided various benefits to customers through fewer and shorter outages, savings from utility efficiency improvements passed on to customers, and customer choice and energy management enabled by AMI such as peak time rebates for opt-in customers.

Requirements established by the Illinois legislature are poised to drive further transformative change concerning how much energy is consumed in the state. Prior to passage of the FEJA in 2016, Illinois already had decoupling measures in place that separated utility revenues from energy consumption. The passage of FEJA establishes the following:

- **Sets demand reduction targets:**
  - ComEd: 17 percent reduction by 2025 and 21.5 percent by 2030,
  - Ameren: 13 percent reduction by 2025 and 16 percent by 2030.
- **Increases energy efficiency rate impact cap from 2 percent to 4 percent.**

24 When meters are inaccessible, utilities estimate customer bills.

25 Unaccounted for energy due to inaccuracy, tampering, theft, or malfunction can result in revenue loss for utilities.

The ratemaking structure shifts under the FEJA, providing an "energy efficiency formula rate." As mentioned, authorized ROE for relevant investments will be established based on the 30-year Treasuries plus 580 basis points. Authorized ROE is increased or reduced by 8 basis points to a maximum of 200 basis points for each 1 percent above or below the annual demand reduction target.[26]

Under the FEJA, a utility can treat future distributed generation rebates in a similar manner to energy efficiency, that is, as virtual regulatory assets upon which it can earn a return, potentially displacing other capital as the value of that asset to the grid is better understood.

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SMART GRID INITIATIVES

The smart grid test bed initiatives undertaken by ComEd and Ameren beginning in 2012 are testing the potential of new offerings, programs, products, and services that may benefit customers.

Examples of smart grid pilot activities include:[27]

- Superconductor development
- Fuel cell demonstration
- Microgrid development
- Nanogrid: AC/DC hybrid systems
- Smart LED streetlights
- Smart meter connected devices such as in-home displays, energy gateways, smart thermostats, usage analytics, and monitoring
- Green Button Initiative Connect My Data
- Energy management systems

UTILITY BUSINESS MODEL IN SUMMARY

The primary business activities in utilities are governed by traditional cost of service regulation, but performance-based ratemaking, while nascent, has signaled a shift to more transformative structures. The passage of the FEJA with the ability to treat energy efficiency expenditures and distributed generation rebates as regulatory assets and earn a return, along with extending formula rates and instituting performance-based ratemaking incentives for efficiency in the state, advances this shift. New products and services are being piloted in the smart grid test beds that could lead to important innovations in terms of the utility's role in the market and its potential shift to becoming a service platform that enables more transactions with and among customers. Combined with the EIMA, the FEJA signals the state's strong intention to transform how electricity is generated and consumed in the state, what products and services are available to customers and, ultimately, how utilities make money, recover costs, and interact with customers.

26 Illinois Public Act 099-0906 Section 8-103B.d.2.C and g.7.A, http://www.ilga.gov/legislation/publicacts/99/PDF/099-0906.pdf

27 ComEd Quarterly Test Bed Report 4Q16, https://www.icc.illinois.gov/downloads/public/Test%20Bed%20Quarterly%20Report%202016%20Q4_FINAL_20170214.pdf

4. RATES AND REGULATION

As new markets emerge and utility business models evolve to keep pace with technological innovation and with customers' desire for choice and control, rate design and the regulatory construct will need to be modified. Many states across the nation are involved in vigorous debates on rate reform issues, such as the long-term viability of NEM, the utility of the future, the value of solar, the value of DER, and grid modernization. These debates and proceedings all point to an acknowledgment in the regulatory arena of the need to reassess how resources are valued, how utility rates are set, and how costs are recovered.

RATE STRUCTURES

In Illinois, there are many rate plans for customers to choose from, including real-time prices that vary by hour with the market price of energy. Table 3 below breaks down the offerings for residential customers in 2016.

REGULATION AND RATEMAKING

The formula rate described in the "*Utility Business Model*" section results in a predictable and repeatable ratemaking process that provides:

- Recovery of prudently and reasonably incurred utility investments
- A formula for calculating a utility's cost of equity and rate of return

Under the performance-based formula ratemaking structure, the ratemaking timeframe is now 8-9 months versus the 11.5 months prior to passage of EIMA. Utilities are required to file rate cases annually and provide the Commission with the opportunity to review planned investments and provide recovery of prudently incurred actual costs based on year-end rate base. This practice will continue under the FEJA until 2030.

The new ratemaking framework in Illinois reduces regulatory lag, providing recovery of actual costs on an annual basis, continues revenue decoupling, and provides an enhanced framework for energy efficiency.[28]

NEXTGRID AND THE 21ST CENTURY REGULATORY MODEL

The Illinois Commerce Commission has initiated a collaborative process called "NextGrid" in which industry and other stakeholders can develop a shared understanding of key issues and recommendations for the evolving electric utility industry and the Utility of the Future.

The drivers for the ICC undertaking the NextGrid initiative include the transforming utility industry, driving innovation and economic development, empowering customers and communities, and creating a 21st Century Regulatory Model.[29]

TABLE 3. NUMBER OF RATE PLAN OPTIONS FOR COMED RESIDENTIAL CUSTOMERS IN 2016[30]

TOTAL NUMBER	FIXED RATE	VARIABLE RATE	< 12-MONTH TERM	12-MONTH TERM	13-23-MONTH TERM	24-MONTH TERM	> 24-MONTH TERM	GREEN POWER
94	73	17	32	33	6	18	5	26

Source: Illinois Commerce Commission, Office of Retail Market Development, 2016[31]

28 Ameren, UBS and Morgan Stanley Utilities Conferences March 1-2, 2017, http://s21.q4cdn.com/448935352/files/doc_presentations/2017/feb/UBS-and-Morgan-Stanley-Conferences-Presentation-FINAL.pdf

29 From emails with ICC staff

30 Survey of rate offerings for ComED.

31 From the Illinois Commerce Commission, Office of Retail Market Development (ORMD), 2016 Annual Report, https://www.icc.illinois.gov/downloads/public/2016%20ORMD%20Section%2020-110%20report.pdf

Key Issues to be explored include:

- Public utility and regulatory models to facilitate integration of DERs and transactions across the network, while enhancing reliability and resilience
- Policies to maximize customer and social benefits of new technologies and energy markets, while protecting consumers and making electricity affordable to low-income customers
- Rate designs to encourage innovation and efficiency, while promoting competition and mitigating cost-shifting between customers
- Utilization of technologies to optimize system operations and enhance reliability while enabling shared value[32]

RATES AND REGULATIONS IN SUMMARY

Illinois has implemented some innovative measures to evolve traditional rates and regulatory models, such as performance-based formula rates and earning returns on energy efficiency and distributed generation rebates. Additionally, time-of-use rates are offered voluntarily via the real-time pricing programs. While performance-based ratemaking and allowing utilities to earn a return on efficiency and distributed generation rebates provide a basis to incentivize new revenue models that go beyond traditional utility business models, they are still nascent. ComEd has independently articulated an overarching guiding vision of the concept of the utility as a platform (see "ComEd's Vision of the Utility as a Platform" in Figure 8) and the ICC has expressed interest, via the NextGrid initiative, in a "21st Century Regulatory Model."

5. ASSET DEPLOYMENT

Future investments in the electric utility system will require an unprecedented amount of automation across the distribution system and new technology deployment for increased visibility and control in balancing the grid. The grid of the future will require new hardware and grid assets, both in front of and behind-the-meter. Utilities in Illinois are pursuing major smart grid and distribution automation initiatives, initially authorized under the EIMA.

DISTRIBUTION AUTOMATION AND UPGRADING

Many different distribution automation (DA) technologies are being deployed, including:[33, 34]

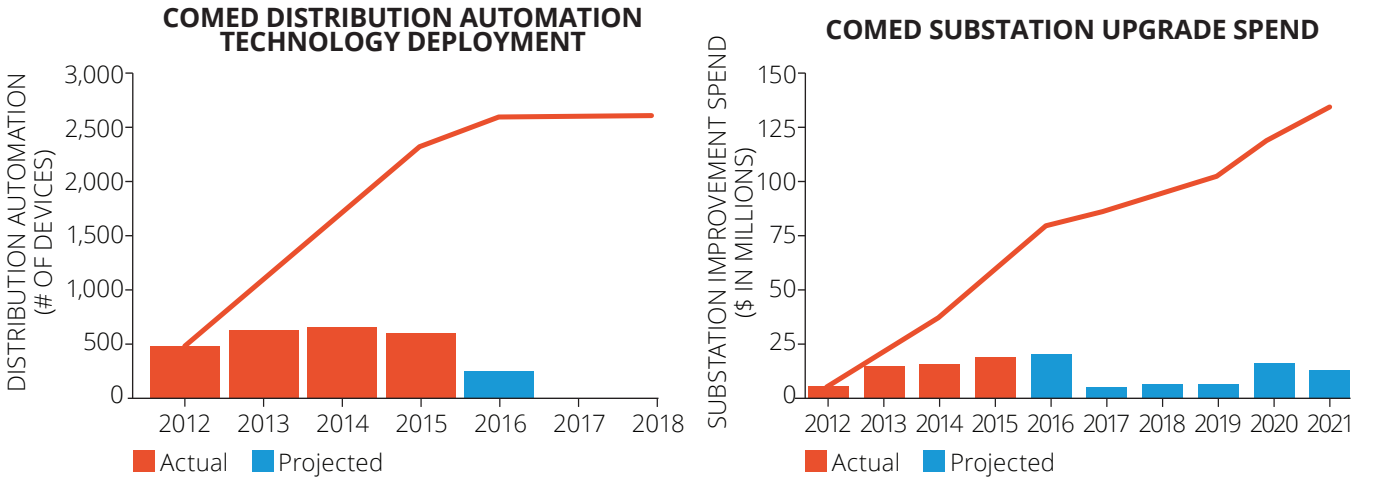
- **Primary distribution automation**—low voltage automation schemes in self-isolation with smart switching devices
- **Communication infrastructure**—multi-layered smart grid communications networks
- **Distribution substation metering**—distribution substation transformer and circuit load metering that will be remotely read and reported through the supervisory control and data acquisition (SCADA) system
- **High voltage distribution automation**—smart switching devices on select high voltage distribution lines
- **Smart grid test beds**—distribution system locations where smart grid related equipment, services, and business models can be tested within a utility scale environment

32 From emails with ICC staff

33 ComEd Infrastructure Investment Plan 2016 Update, https://www.icc.illinois.gov/electricity/utilityreporting/InfrastructureInvestmentPlans.aspx

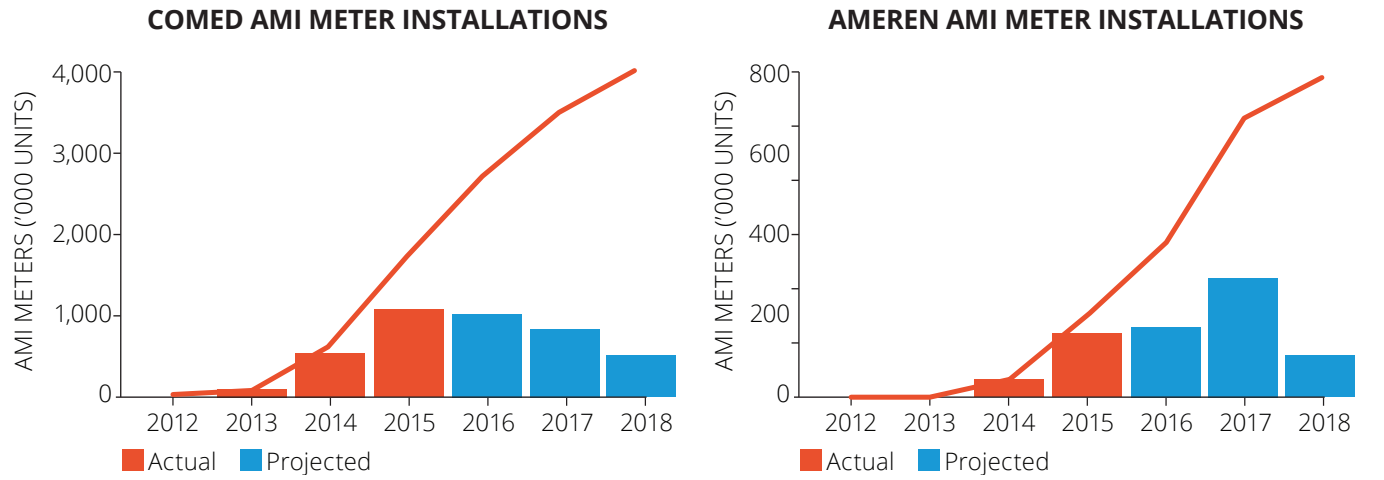
34 Ameren Infrastructure Investment Program 2015 Update, https://www.icc.illinois.gov/electricity/utilityreporting/InfrastructureInvestmentPlans.aspx

FIGURE 5. COMED'S INVESTMENTS IN DISTRIBUTION AUTOMATION & SUBSTATION UPGRADES, 2012-2021



Source: Commonwealth Edison Infrastructure Investment Plan, 2016 [35]

FIGURE 6. COMED AND AMEREN SMART METER DEPLOYMENT, 2012-2018



Source: ComEd Infrastructure Investment Plan 2016 Update[35] and Ameren 2016 Annual Updates, 2016[36]

COMED COMMUNICATIONS INFRASTRUCTURE

ComEd's communication infrastructure efforts are expected to form the "foundation platform" for enabling future smart grid technologies and to provide a secure, tiered, robust, and deterministic communications architecture capable of meeting current and future system needs.

35 ComEd Infrastructure Investment Plan 2016 Update, https://www.icc.illinois.gov/electricity/utilityreporting/InfrastructureInvestmentPlans.aspx

36 See Illinois Commerce Commission, https://www.icc.illinois.gov/electricity/utilityreporting/InfrastructureInvestmentPlans.aspx

SMART METERS

As part of their participation in the EIMA, ComEd and Ameren developed and implemented aggressive AMI deployment plans.

ComEd plans to complete installation of smart meters across its entire service territory by 2018, and Ameren requested and was granted by the ICC the ability to reach 100 percent AMI deployment by 2019.[37]

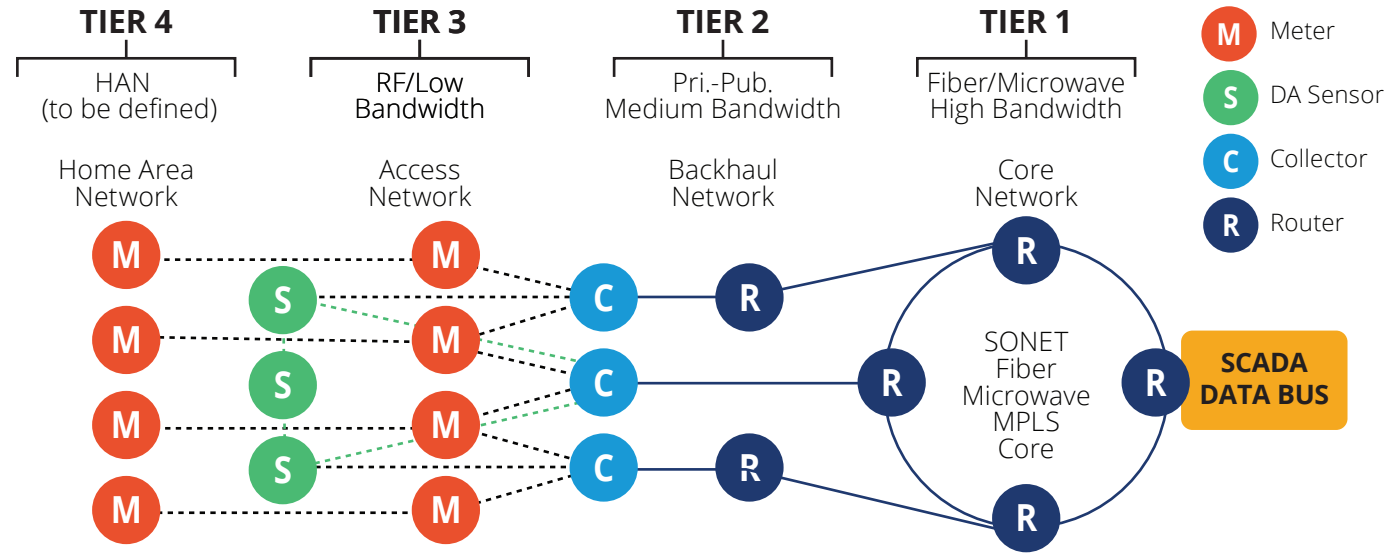
AMI deployment is designed to provide enhanced benefits to customers:

- Improved efficiency/reduced operating costs from automated meter reading and remote connect/disconnect features
- Reduction in estimated bills
- Service activation/deactivation on date requested
- Access to usage and other information to aid in energy and cost management
- Improved reliability through faster response to restoring power, and monitoring the system to proactively address issues that might lead to service problems

TECHNOLOGIES FOR DISTRIBUTION GRID OPERATIONS

Utilities in Illinois are making investments or planning for future needs across all main categories of technologies necessary for the operation of a modern distribution grid. The charts in the Appendix use the technology taxonomy from the Department of Energy's Next Generation Distribution System Platform (DSPx)[38] to show key technologies and infrastructure for a modern distribution grid. See Appendix for details on particular technologies in grid operations and technologies and practices for distribution market operations and distribution system planning.

FIGURE 7: COMED'S SMART GRID COMMUNICATION TIERS



Source: ComEd's Infrastructure investment plan 2016 annual update[39]

37 Ameren Illinois, 2017 AIC AMI Plan Update, 2017, https://www.icc.illinois.gov/downloads/public/2017%20AIC%20AMI%20Plan%20Update%20Final.pdf

38 The Department of Energy's DSPx technology framework provides a structured overview of key technologies "necessary for the operation of the modern distribution grid to ensure reliable, safe operation while enabling customer choice and increasing integration of DER." For more information, see http://doe-dspx.org/wp-content/uploads/2017/03/Modern-Distribution-Grid_Volume-II_v1.1_03272017.pdf

39 See Illinois Commerce Commission, https://www.icc.illinois.gov/electricity/utilityreporting/InfrastructureInvestmentPlans.aspx

ASSET DEPLOYMENT IN SUMMARY

The EIMA laid the groundwork for significant upgrades to utility distribution systems, encouraging major investments in smart meters, smart grid technologies, and distribution automation. These will enable the utilities to manage a grid with increased responsiveness, resilience, flexibility, and greater integration of DERs. In every category of major technologies necessary for modern grid operations, Illinois' utilities are making investments and plans for an evolving mix of technologies and generation resources.

6. INFORMATION TECHNOLOGY

Software platforms and communication protocols underpin the deployment of a "smarter" grid. The grid of the future will require additional functionality across a number of dimensions: distribution system operations and planning, asset monitoring and control, and customer data and engagement. The information infrastructure and architecture will increasingly need to collect, store, analyze, respond, and act on data in a real-time manner while managing cybersecurity and privacy concerns. These investments were made under EIMA in both utilities.

Given the focus on increased automation and communications, management of cybersecurity is crucial. The utilities are following the key principles below in implementing smart grid programs:

- Overall security model to address confidentiality, integrity, availability, and nonrepudiation of data[40]
- Data secured to ensure customer privacy,
- Customer data encrypted using methods similar to those used for ATMs and online transactions[41]
- Communications infrastructure aligned with industry best practices and existing security standards
- Cyber security incorporated from an end-to-end, holistic perspective[42]
- Cyber-secure data communications networks

AMEREN SOFTWARE UPGRADES

Advanced Distribution Management System (ADMS):

- ADMS is a fully-integrated suite of applications that provides distribution system operators with a common user interface to monitor, control, and manage the electric distribution system and smart devices throughout the distribution system.
- Ameren will rely on its ADMS in order to replace its existing Distribution SCADA System (DSCADA) and its Outage Analysis System (OAS).

Replacement for the distribution engineering tool:

- Ameren's efforts seek to replace its current engineering analysis tool. The current tool has limitations related to circuit balancing, capacitor bank placements, and voltage drop calculations. As distribution engineering becomes part of the proposed project design in new smart grid programs, these new functionalities will need to be in place.

40 Commonwealth Edison Company's Infrastructure Investment Plan 2016 Annual Update April 1, 2016, p. 72

41 ComEd presentation delivered to the Environmental and Energy Study Institute on June 18, 2014, http://www.eesi.org/files/Anil-Dhawan-061814-original.pdf

42 Commonwealth Edison Company's Infrastructure Investment Plan 2016 Annual Update April 1, 2016, p. 92

CUSTOMER DATA

Access to customer data both by customers themselves and by third parties is key to enabling new markets for energy-related products and services. A new data-sharing program offered by ComEd allows companies and researchers to access anonymous usage information from smart meters across its service territory.

The goal of the program is to expand the range of products and services ComEd can offer to customers and third parties. The new data program builds on the Green Button Initiative, a joint effort among utilities and technology companies to allow customers to download their energy usage data to take advantage of online energy management services.

Green Button also gives customers the option to voluntarily share their specific usage data with third party providers.[43] Proper safeguards will be critical to ensure data security and privacy while at the same time offering customers an easy pathway for using and sharing data to enable new offerings and services for customers.

INFORMATION TECHNOLOGY IN SUMMARY

The investment and plans undertaken by the utilities in Illinois in distribution automation, data sharing, and the enabling secure communications networks are foundational elements for a more efficient, modern grid that enables markets and provides greater customer choice and control. The utilities benefit from additional data to better plan and operate the grid.

Degrees of Transformation in Illinois

Examining each of the swimlanes individually, we can identify key market-defining attributes and map how recent changes affect each of these elements. Placing these important changes in the context of the doctrines can help stakeholders take note of the areas of significant focus and activity, gauge the rate of transformation, identify important connecting points and gaps, and ultimately arrive at a more holistic view of market transformation in a particular jurisdiction.

DOCTRINE 1: PROMOTE EFFICIENCIES

A primary goal of the market should be to promote efficiencies in the production, consumption, and investment in energy and related technologies.

Through its focus on energy efficiency, infrastructure investment, and performance-based ratemaking, Illinois has promoted the efficient use of both electricity by consumers and of the grid itself.

The combination of infrastructure investment, proactive ratemaking, alternative rates for customers and formal efficiency programs all speak to the focus this has received to date in Illinois. Looking forward, as more DERs connect to the system, planning and operations of the grid will have to continue to evolve to ensure the ongoing efficiency of both the production of electricity and the management of the transmission and distribution system.

43 UtilityDive, 2017, Illinois regulators approve ComEd's smart meter data sharing program, http://www.utilitydive.com/news/illinois-regulators-approve-comeds-smart-meter-data-sharing-program/436338/

TABLE 4. DOCTRINE 1: PROMOTE EFFICIENCIES

CURRENT SOLUTIONS	INCREMENTAL CHANGES →		TRANSFORMATIVE CHANGES
PROMOTE ENERGY EFFICIENCY	▪ Increasing cap on energy efficiency investment from 2% rate increase cap to 4%	▪ Utilities are wires only and revenues are decoupled, eliminating disincentives to investment in energy efficiency ▪ Utilities can earn a return on energy efficiency ▪ Real-time usage information is available to customers through the Green Button Initiative	▪ Introduction of retail real-time pricing structures will help to address desire for demand-based charges
INVESTMENT IN DISTRIBUTION AUTOMATION		▪ Utilities are investing in two-way communications on the distribution system, including AMI ▪ Control equipment is being deployed as standard equipment, including DSCADA, and outage management	

Source: SEPA & ScottMadden, 2017

DOCTRINE 2: CLEARLY DEFINE ROLES

The role of the utility, as a public service entity, should be clearly defined so that all market participants can understand their roles in enabling customer options in a fair, transparent, and nondiscriminatory manner.

The roles of utilities, merchant generators, the wholesale markets, and Alternative Retail Electric Suppliers (ARES) are clear as they pertain to the current electric grid, which relies on central station generation, long haul transmission and the distribution network. As resources proliferate on the grid that do not easily fit into the roles as currently defined, additional work to clarify roles in the wholesale and potential retail marketplaces may be necessary.

Energy storage provides a good example. The entire industry is considering how energy storage should participate in wholesale markets. The recent FERC NOPR mentioned earlier is a significant step towards defining how, where, and when energy storage can be used. However, this is not entirely a wholesale question as energy storage may have significant benefits on the distribution system as well. In the case of these types of assets, the state will need to consider who can own the resource, under what circumstances it can be dispatched, and the interplay between the wholesale market and the local distribution system.

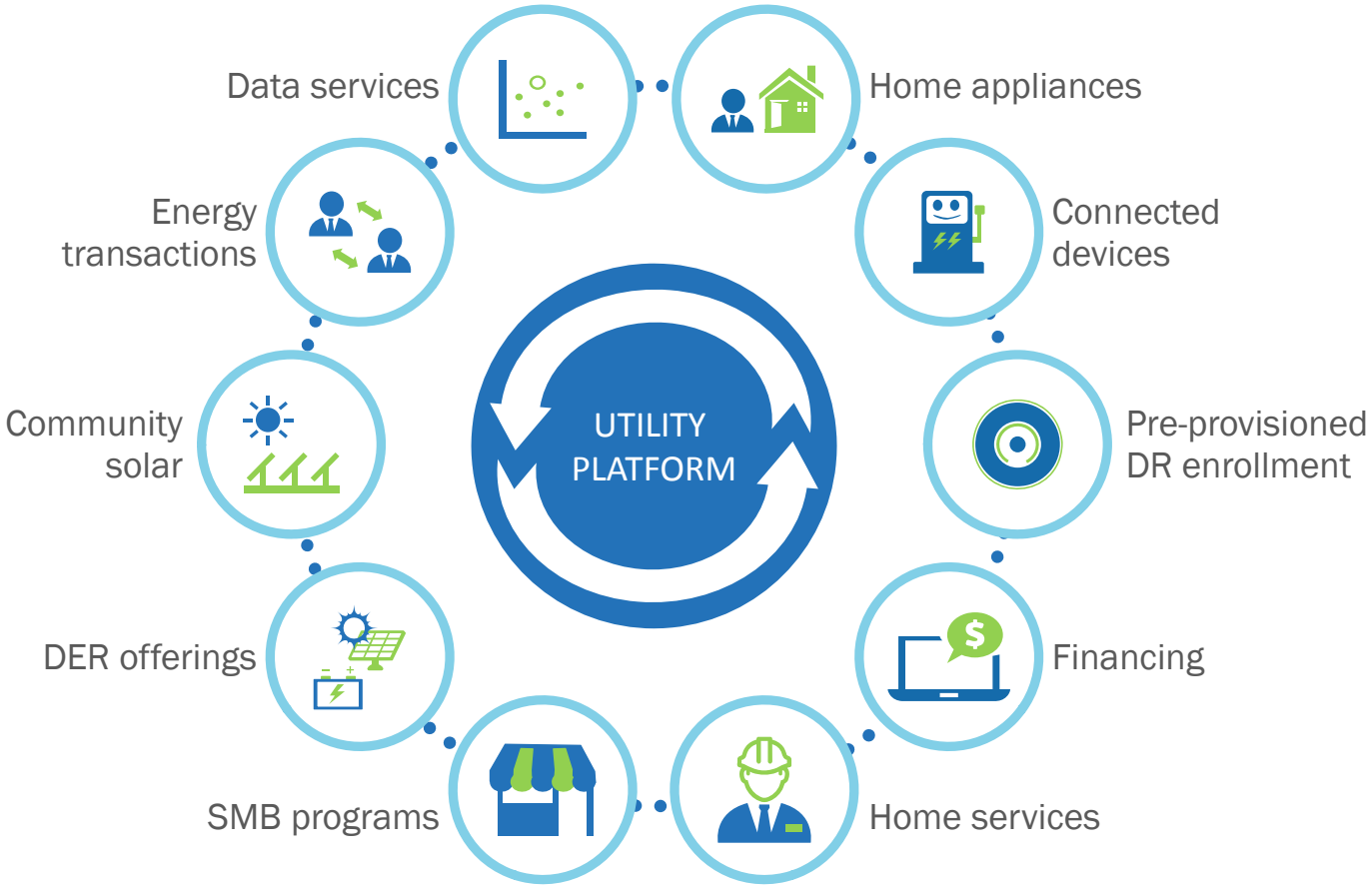
Clarity of roles related to these new assets will be important to incorporating DERs into the grid and creating incentives for various utility and non-utility participants to introduce new products and services. In order to maintain the momentum of the transformation of the energy landscape in Illinois, ownership rules and requirements will have to be developed and communicated to all parties.

Though the state has not explicitly articulated a vision of moving the utility business model toward a platform-provider model, ComEd has expressed a vision that certainly suggests a continued shift in that direction, and some of the language in the ICC's NextGrid initiative suggests a similar evolution of the utility serving to enable and facilitate greater customer participation and transactions.

COMED'S VISION OF THE UTILITY AS A PLATFORM

While there is no state initiative, ComEd has communicated a vision of the utility as a network or platform that allows customers to plug-in and engage in energy services. As essentially a platform provider, ComEd envisions a world where the role of the utility is to facilitate and maximize those transactions, from exchanging energy and capacity or ancillary services with the utility or engaging in peer-to-peer derivative transactions. ComEd is currently undertaking an evaluation of the capabilities needed, infrastructure required and the cost and value to customers. Additionally, ComEd is testing a number of potential technologies for customers in this overarching rethinking of how to offer the greatest value as a utility that is transacting with growing numbers of distributed points on the system. ComEd has several activities to determine what offerings customers might find particularly compelling and how to make transactions more fluid, and more appealing for customers

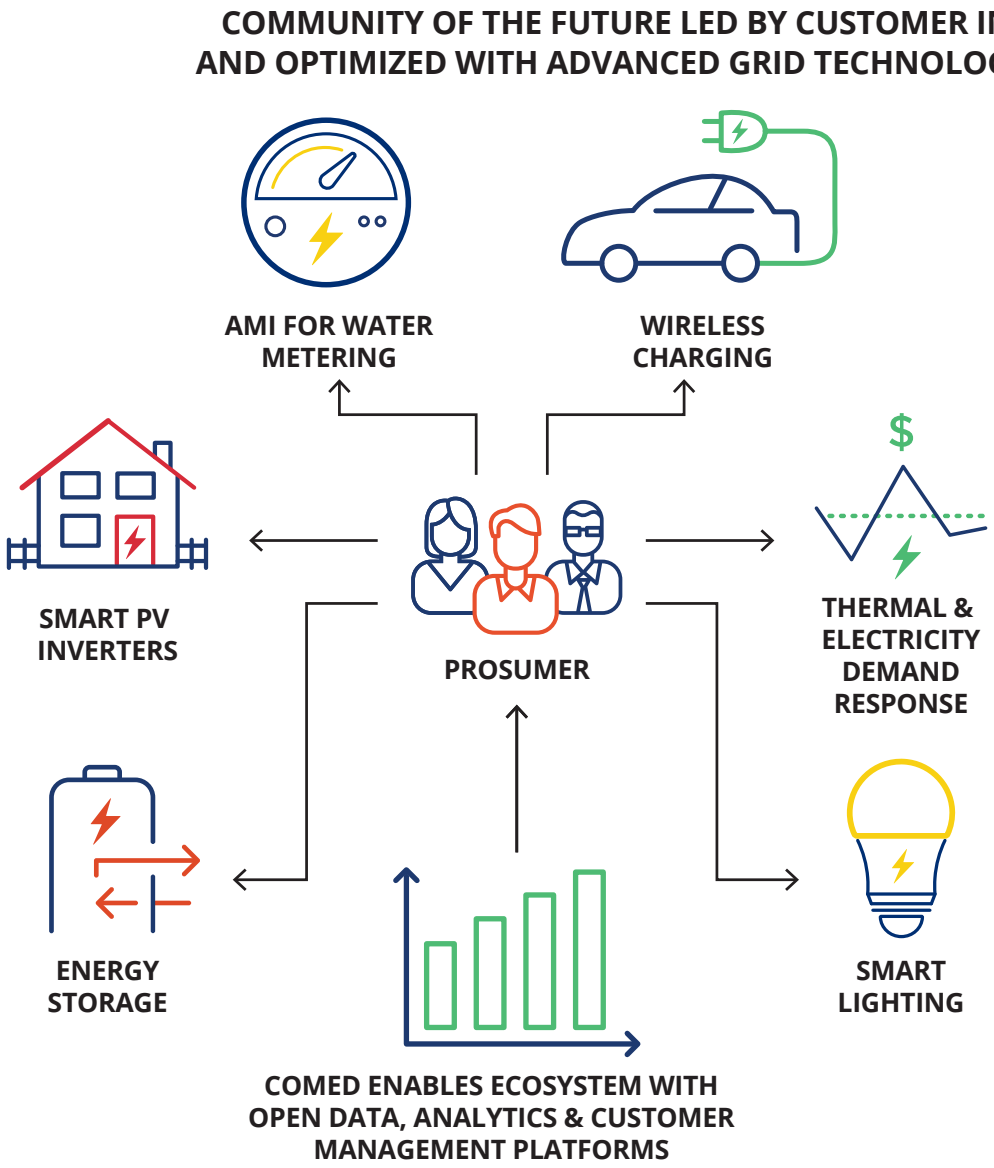
FIGURE 8: COMED'S PLATFORM FOR UTILITY OF THE FUTURE[44]



Source: ComEd, 2016

44 ComEd presentation delivered at the SmartGrid Consumer Collaborative, Members Meeting Interactive Workshop, Sept 21-22, 2016

FIGURE 9: COMED'S COMMUNITY OF THE FUTURE[45]



TECHNOLOGIES/ OFFERINGS TO BE TESTED:

- Smart inverters
- Energy storage
- Wireless charging
- Transactive energy
- Smart EV charging
- Smart street lighting
- AMI for water metering
- Service package
- Smart thermostat control
- Select low-income energy management devices and education
- EV to thermostat pairing

DEVELOPED DATA ANALYTICS TOOLS

- Resiliency metrics
- Microgrid optimization tool—secured a patent
- Hosting capacity—in patent process
- Distribution state estimation

Source: ComEd, 2016

45 ComEd presentation delivered at the Utility of the Future, Midwestern Governor's Conference, June 15, 2016

TABLE 5. DOCTRINE 2: CLEARLY DEFINE ROLES			
CURRENT SOLUTIONS	**INCREMENTAL CHANGES** ⟶		**TRANSFORMATIVE CHANGES**
UTILITY STRUCTURE	▪ Utilities are distribution "wires only"	▪ Utilities participate in RTO/ISOs, either PJM or MISO	
DETERMINATION OF UTILITY ROLES AND RESPONSIBILITIES	▪ Utilities are full public service corporations and providers of last resort	▪ Potential partnership concepts with solution providers are being developed through the smart grid test beds	▪ Evolution of the platform business concept (ComEd Vision)

Source: SEPA & ScottMadden, 2017

DOCTRINE 3: PRINCIPLES OF RATEMAKING

Rate structures should provide transparent cost allocation that supports a sustainable revenue model for utility services providing a public good.

Illinois' use of performance-based ratemaking, cost of service model and decoupling have served the state well in driving desired outcomes, i.e., increased investment in the grid, advanced technologies, etc. The alternative rate options for customers today provide important choices. For as long as the state continues to see low levels of DERs, these actions will likely continue to drive beneficial results for customers and utilities. As DERs proliferate on the system, there may be greater interest in dynamic rates, particularly where appliances and devices behind-the-meter begin to feature more automation, requiring less customer intervention to respond to real-time price signals.

As the state sees an influx of DERs and the attendant challenges of integrating them, such as reduced loads, the move to include DERs in addressing utility capex requirements, and the integration of third party solutions, i.e., microgrids, Illinois will likely need to further advance the ratemaking construct to maintain "transparent cost allocation" and a "sustainable revenue model for utilities."

EVOLVING DER VALUATION FRAMEWORKS IN ILLINOIS

- **Value of DER**—Under the FEJA, once the 3 percent net metering threshold is hit, the ICC is required to develop a distributed generation rebate based on value to the grid. The value of the rebate will need to account for the geographic, time-based, and performance-based benefits to the grid.
- **Community Solar Challenges**—The FEJA defines a framework for community solar and provides incentives that are expected to grow community solar in the state. The restructured market provides an interesting case study for valuing the benefits of community solar. Many of the benefits in valuing a community solar project may not flow back to the transmission and distribution utility that is not responsible for generation.[46] Community solar projects in the state may also present challenges in the utility role in billing. Unlike in vertically integrated states, the distribution utility could potentially ultimately serve as a facilitator between the community solar project and the retail and wholesale market.

46 West Monroe Partners, Community Solar Economic Value Proposition, April 2017, https://www.cookcountyil.gov/file/5003/download?token=s1hGgRB_

TABLE 6. DOCTRINE 3: PRINCIPLES OF RATEMAKING

CURRENT SOLUTIONS	INCREMENTAL CHANGES → TRANSFORMATIVE CHANGES		
PRINCIPLES OF RATEMAKING	▪ Cost of service ratemaking remains in place with performance incentives around various metrics	▪ Formula ratemaking	▪ Performance-based ratemaking ▪ Earning return on energy efficiency investments & distributed generation rebates
DETERMINATION OF PRINCIPLES OF RATEMAKING	▪ Retention of predominantly variable rate design ▪ Introduction of opt-in pure dynamic rate design with demand charge for residential customers	▪ Value-based distribution generation rebate after net metering caps are reached ▪ Eligible projects can be compensated for value to the grid with smart inverter control	
ENHANCED ASSURANCE OF COST RECOVERY	▪ Decoupling has been in place since 1997	▪ A prudency determination takes place based on year-end rate base with the ICC ▪ Under the FEJA, utilities can earn a return on the administration of the energy efficiency programs[47] with a performance incentive ▪ Under the FEJA, utilities can treat distributed generation rebates as a regulatory asset and earn a return	

Source: SEPA & ScottMadden, 2017

In states that have seen high penetrations of DERs, these challenges have required a review of the ratemaking model. Fortunately, Illinois' initiatives to date have laid a foundation to begin to address these questions. Other states' experiences will offer both lessons learned and cautionary tales. Of particular interest in Illinois is the articulated pathway to align compensation with the value to the grid by time, location, and performance after net metering caps are reached.

DOCTRINE 4: FOSTER CUSTOMER CHOICE

Customers should be presented with a variety of rate and program options that expand their choice of and access to energy-related products and services, and that are simple, transparent, and create stable value propositions.

Illinois has provided a wide range of customer options; from standard volumetric rates to green supply with a fixed supply price for an extended term to dynamic rates with real-time pricing and demand charges tied to the RTO.

The rate structures are made sustainable by rate increase caps included in both EIMA and FEJA. In the FEJA, rates cannot increase more than:

47 Crain's Chicago Business, 2016, Guess who gets zapped by Springfield's latest energy-efficiency plan, http://www.chicagobusiness.com/article/20161105/ISSUE01/311059996/guess-who-gets-zapped-by-springfields-latest-energy-efficiency-plan

COMED SAMPLE CUSTOMER OFFERINGS[48]

- **Residential—Bidgely HomeBeat™**: The system provides customers with personalized energy reports detailing how and when they use energy in their homes. The HomeBeat energy monitor connects directly to the smart meter and provides real-time energy usage data to the Bidgely cloud. The information is analyzed in near-real-time to provide appliance-level energy use to the participant through the Bidgely web and mobile platform. The technology also allows ComEd to provide real-time energy insights, such as high-usage alerts via mobile push notification within minutes of use.
- **Bring Your Own Thermostat (BYOT) program**: ComEd is also leading a BYOT program as a migration away from the traditional utility residential direct load control programs. In the program, ComEd allows customers to choose and connect their own smart device that allows the utility to send a signal to control the thermostat, with an allowance for customer override. Partnering with Nest, ComEd offers customers the opportunity to participate in Rush Hour Rewards[49], and earn incentive payments and rewards.
- **Commercial and Industrial—Root3 Balance**: Root3's Balance energy management system for C&I customers uses big data and predictive analytics to optimize energy operations and enable strategic energy planning at chilled water, steam, cogeneration, and compressed air plants. The algorithms continuously predict the safest, most reliable, and most cost-effective way to run a plant. The system requires no capital investment as it uses data from a plant's existing sensors and meters.

- **Residential**: $0.25 per month (based on the average) over the 13-year life of the law
- **Commercial:** Cap of 1.3 percent (based on 2015 rates) over the 13-year life of the law

Assuming that customers will want increasing choice and control, ComEd has indicated interest in testing a whole suite of new offerings for customers to drive customer choices to grid value (see "ComEd's Vision of the Utility as a Platform"). As a preliminary move to this broader vision, ComEd launched a marketplace selling thermostats and other ancillary equipment as a test of whether customers would transact with the utility—and potentially in the future, engage in peer to peer transactions as well. Current concepts being evaluated and tested range from behavioral incentive programs to new renewable energy technologies, and from smart meter connected devices to analytics services.

Commercial and industrial customers retain greater choice in both PJM and MISO wholesale markets with the option to participate in demand response and energy efficiency programs.

As additional products and services are rolled out more broadly, customer choice will be further enhanced, adding more DER options to the current menu of products, services, and rate choices. The challenge for Illinois will be to ensure that the ratemaking model continues to support an ever-increasing number of customer options offered by various types of DERs.

48 ComEd 4Q16 Smart Grid Test Bed Report

49 Nest, https://nest.com/legal/energy-partner/ce/

TABLE 7. DOCTRINE 4: FOSTER CUSTOMER CHOICE

CURRENT SOLUTIONS	INCREMENTAL CHANGES → TRANSFORMATIVE CHANGES		
MULTIPLE RATE ALTERNATIVES OFFERED TO CUSTOMERS	▪ Standard volumetric rates remain for customers not interested in more complex offerings	▪ Multiple supply-side supplier options are available with varying plan features such as green energy and length of fixed price for supply ▪ C&I customers have multiple supplier options and are eligible for bundled or unbundled service	▪ Opt-in residential dynamic rates with real-time pricing and demand charges based on the RTO have been introduced
MULTIPLE ENERGY PROGRAMS OFFERED TO CUSTOMERS	▪ Green pricing programs ▪ Community solar will be available under the FEJA with a specific enhanced program for low-income customers ▪ Retail energy deregulation is in place	▪ Commercial and industrial customers can participate in both demand response and energy efficiency programs ▪ PJM is ahead of MISO in providing options to retail customers to participate in wholesale markets ▪ ComEd testing a host of new "community of the future" customer offerings	▪ Evolution of the platform business concept, facilitating increased transactions with and among customers (ComEd Vision)
INCREASED TRANSPARENCY FOR CONSUMERS		▪ The Green Button Initiative provides customers with real-time price data and the ability to easily share information with 3rd parties	▪ ComEd's data sharing program provides access to anonymous usage data to 3rd parties[50]
STRATEGIES TO MANAGE BILL STABILITY	▪ Rate increase caps are in place for all customer classes under the FEJA where supported programs will be cut if rate increase caps are exceeded	▪ Accelerated rate cases take place annually under the EIMA to update ROE and authorized investments	

Source: SEPA & ScottMadden, 2017

50 Illinois Regulators Approve ComEd's Smart Meter Data Sharing Program, Utility Dive, Feb 16, 2017, http://www.utilitydive.com/news/illinois-regulators-approve-comeds-smart-meter-data-sharing-program/436338/

Conclusion

Illinois has laid an excellent foundation that positions it well for modernization of the grid and increasing penetrations of DERs and renewables. When DERs arrive at scale, the state will be ready.

Transformative grid modernization initiatives completed under the EIMA provide the technical and operational capability for utilities to manage fluctuations in load brought on by DER, energy efficiency, and demand response programs. These hardware and software upgrades have been accompanied by innovative programs such as real-time pricing programs for retail customers and the piloting of many new technologies and business models through the utilities' smart grid test beds. The requirements, incentives, and directives of the FEJA are expected to encourage renewables and DER.

Illinois has done the work necessary to develop a grid that can accommodate these resources. As noted in the discussion of the doctrines, the state has created a system that is efficient and offers significant customer choice, based on the alternatives available today.

A rapid acceleration of demand for DERs will be facilitated by the important work to date, however, that does not mean the integration of DERs and evolution of the business model will be easy.

The next challenge will be to evolve the regulatory construct to the benefit of all parties, ensuring that customers receive the benefits of new products, utilities are able to provide reliable, cost effective service and third parties have the opportunity to participate in a way that helps meet these goals. Utilities will remain responsible for the reliable operation of the grid; the key will be to ensure that the business model and regulatory framework continue to drive to this result while enabling new products and services.

THINGS TO WATCH

- Treatment of energy efficiency expenditures as a regulatory asset earning a return
- Post-Net Energy Metering pathway of distributed generation (DG) compensation in statute tied to locational grid benefits
- Utility ability to treat distributed generation compensation for systems allowing utility-control facilitated by smart inverters as a regulatory asset earning a return
- Extension of formula rate plan for distribution assets with added performance incentives for energy efficiency expenditures
- Investments and deployments for modernizing distribution grid operations
- Evolution of the platform business concept
- NextGrid and the 21st Century regulatory model

Source: SEPA & ScottMadden, 2017

Appendix A

UTILITY SURVEY OF GRID MODERNIZATION DEPLOYMENTS AND ACTIVITIES

LEGEND ● Currently deployed or in practice ◐ Testing or piloting phase ● Investigating or under consideration ● Planning for ○ No need or plans at this time

TABLE 8: UTILITY SURVEY FOR DISTRIBUTION GRID OPERATIONS

CATEGORY	TECHNOLOGY	AMEREN	COMED
DISTRIBUTED RESOURCE MANAGEMENT	DERMS	●	●
	DRMS	●	●
	Microgrid Interface	◐	●
FIELD AUTOMATION	Distribution Automation	●	●
	Volt-var Management	◐	●
	Power Flow Controllers	○	○
SUBSTATION AUTOMATION	Substation SCADA	●	●
	Advanced Protection	●	●
OPERATIONAL COMMUNICATIONS INFRASTRUCTURE	Wide Area Network Communications	●	●
	Field Area Network	●	●
	Neighborhood Area Network	●	●
	Network Management System	●	●
SENSING & MEASUREMENT	Advanced Customer Metering	●	●
	Production Metering	○	●
	Grid Asset Sensors	●	●
	Environmental Sensors	●	●
	Grid Sensors	●	◐
OPERATIONAL ANALYTICS	Field Data Management	●	●
	Electrical Network Connectivity Model	●	●
	Distribution State Estimation	●	●
	Outage Management (OMS)	●	●
	Geographic Information System	●	●
OPTIMIZATION ANALYTICS	Asset Management	●	●
	DER Optimization	◐	◐

LEGEND

- ● Currently deployed or in practice
- ◐ Testing or piloting phase
- ● Investigating or under consideration
- ● Planning for
- ○ No need or plans at this time

TABLE 9: UTILITY SURVEY FOR DISTRIBUTION MARKET OPERATIONS

CATEGORY	TECHNOLOGY	AMEREN	COMED
Distribution Operational Market	Market Settlement	●	●
	Market Portals	○	●
	Market Compliance and Surveillance	○	●

TABLE 10: UTILITY SURVEY FOR DISTRIBUTION SYSTEM PLANNING

CATEGORY	TECHNOLOGY	AMEREN	COMED
FORECASTING	DER Forecasting	●	●
	Load Forecasting	●	●
POWER FLOW ANALYSIS	Peak Capacity Planning Study	●	●
	Voltage Drop Study	●	●
	Ampacity Study	●	●
	Contingency & Restoration Study	●	●
	Reliability Study	●	●
	Time Series Power Flow Analysis	●	●
	Load Profile Study	●	●
	Stochastic Analysis	○	●
	Volt-var Study	●	●
	Balanced & Unbalanced Power Flow Analysis	●	●
POWER QUALITY ANALYSIS	Voltage Sag/Swell Study	●	●
	Harmonics Study	●	●
FAULT ANALYSIS	Arc Flash Hazard Analysis	●	●
	Protection Coordination Study	●	●
	Fault Probability Analysis	○	○
ADVANCED OPTIMIZATION	Advanced Optimization	◐	○

Source: Survey responses from ComEd, Ameren, 2017. Framework of technologies from the Department of Energy's next generation distribution system platform (DSPx).

Appendix B

LIST OF ACRONYMS

AC	Alternating Current
ADMS	Advanced Distribution Management System
AMI	Advanced Metering Infrastructure
ARES	Alternative Retail Electric Supplier
BYOT	Bring Your Own Thermostat
C&I	Commercial and Industrial
DC	Direct Current
DER	Distributed Energy Resource
DG	Distributed Generation
DSCADA	Distribution Supervisory Control and Data Acquisition
DSPX	Next Generation Distribution System Platform
EIMA	Energy Infrastructure Modernization Act
FEJA	Future Energy Jobs Act
FERC	Federal Energy Regulatory Commission

ICC	Illinois Commerce Commission
ISO	Independent System Operator
KW	kilowatt
MISO	Midcontinent Independent System Operator
MW	Megawatt
NEM	Net Energy Metering
NOPR	Notice of Proposed Rulemaking
OAS	Outage Analysis System
PJM	PJM Interconnection
REC	Renewable Energy Credit
ROE	Return on Equity
RPS	Renewable Portfolio Standard
RTO	Regional Transmission Organization
SCADA	Supervisory Control and Data Acquisition
SEPA	Smart Electric Power Alliance

Smart Electric Power Alliance

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