

Illinois Electricity System

GUIDING PRINCIPLES AND POLICY FRAMEWORK



JULY 15, 2010



GALVIN
ELECTRICITY
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Illinois Electricity System Guiding Principles and Policy Framework

Sponsored by the Galvin Electricity Initiative

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July 15, 2010



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Illinois Electricity System Guiding Principles and Policy Framework is sponsored by the nonprofit Galvin Electricity Initiative.

The Initiative, launched by former Motorola CEO Robert W. Galvin with former EPRI CEO Kurt Yeager, has brought together many of the nation's leading electricity experts to reinvent our electric power system into one that is fundamentally more affordable, reliable, clean and energy-efficient. The Initiative has created innovative business and technology blueprints for the ultimate smart grid — the Perfect Power System. Based on smart microgrids, the system meets the needs of 21st century consumers and provides reliable, secure electricity regardless of nature's wrath or security threats.

To pave the way for Perfect Power and system transformation as a whole, the Initiative is advocating for new policies that reflect a set of guiding principles — the electricity consumer's bill of rights. For more information on the Electricity Consumer Principles, the policy framework or the Perfect Power System, visit www.galvinpower.org. Here you will find an array of information on every dimension of the intelligent grid transformation and the Initiative's goal of perfect electricity service for every consumer.



Preface

The Electricity Constitutional Principles provided herein resulted from engaging electricity leaders, scholars, practitioners and consumers in a dialogue on innovative models and governance that would lead to a more consumer-responsive electricity system.

The nonprofit, public interest Galvin Electricity Initiative advocates the reinvention of how electricity is generated, delivered and used. The Initiative is motivated by the conviction that the economic vitality of the U.S. is threatened by an obsolete and vulnerable electricity system, a system that has staved off innovation and renewal for decades. The technology required to achieve electricity service perfection exists; what is lacking is a regulatory framework that encourages power system innovation and consumer service quality.

The Initiative is seeking to transform the outmoded electricity governance rules and regulations that are based on principles that no longer best serve its constituents. Robert Galvin, who founded the Initiative, sought to form a “Team of Leaders” in Illinois that could shape new thinking and principles to guide future policymaking. Mr. Galvin researched and wrote a book regarding the influence of the Scottish Enlightenment on our Nation’s founding fathers,¹ which is summarized in the points below. This research provides insight into the unconventional thinking that is needed to successfully change established governance, and which guided the leaders who created the U.S. Constitution and Bill of Rights.

- A group of leaders must step outside the crowd and advocate what is right.
- The proposed change must be accompanied by a candid acknowledgment of the deficiencies of the existing structure or governance. Mr. Galvin stated that “...leaders and the people alike are naturally blame placers. To them, their condition is the fault of someone else.... As long as a country (or industry) hides behind this invalid excuse, it will languish.” Mr. Galvin challenged industry leaders to acknowledge today’s deficiencies.
- Change must come from noble purposes. What better purpose than to serve the citizen ratepayer?
- The application of “enlightened thinking — the way of thinking that is free, open, objective, rational, and tolerant versus a thinking that is self centered and unduly traditional.”
- “Resistance to existing restrictive ways is a natural right, is in order, and is essential.”
- “The new governance structure must provide for adequate checks and balances....”
- “The constructive roles of commerce and property must be embraced.” This is brought forth herein by principles that provide for consumer choice, the right for locally controlled smart microgrids and private investment into grid modernization.

This document describes a set of new Illinois electricity governance principles, an “Electricity Constitution,” based on the above thinking. This proposed Electricity Constitution was developed by a team of Illinois stakeholders and is based on hundreds of meetings with electricity stakeholders and city leadership. This

¹ Galvin, R. (2002). *America's Founding Secret: What the Scottish Enlightenment Taught Our Founding Fathers*. Rowman & Littlefield Publishers.



includes the results of a series of smart grid workshops hosted by the Initiative and summarized in the Center for Neighborhood Technology report, “Empowering Consumers Through a Modern Electric Grid.”²

These efforts culminated in a “Constitutional convention” that was held in the Village of Oak Park, which included the following organizations:

- Galvin Electricity Initiative
- Citizens Utility Board
- DuPage Mayors and Managers Conference
- Illinois Power Agency
- Northwest Municipal Conference
- Village of Oak Park
- Village of Lincolnwood

² Illinois Smart Grid Initiative. (2009). *Empowering Consumers Through a Modern Electric Grid*. Center for Neighborhood Technology.



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Executive Summary

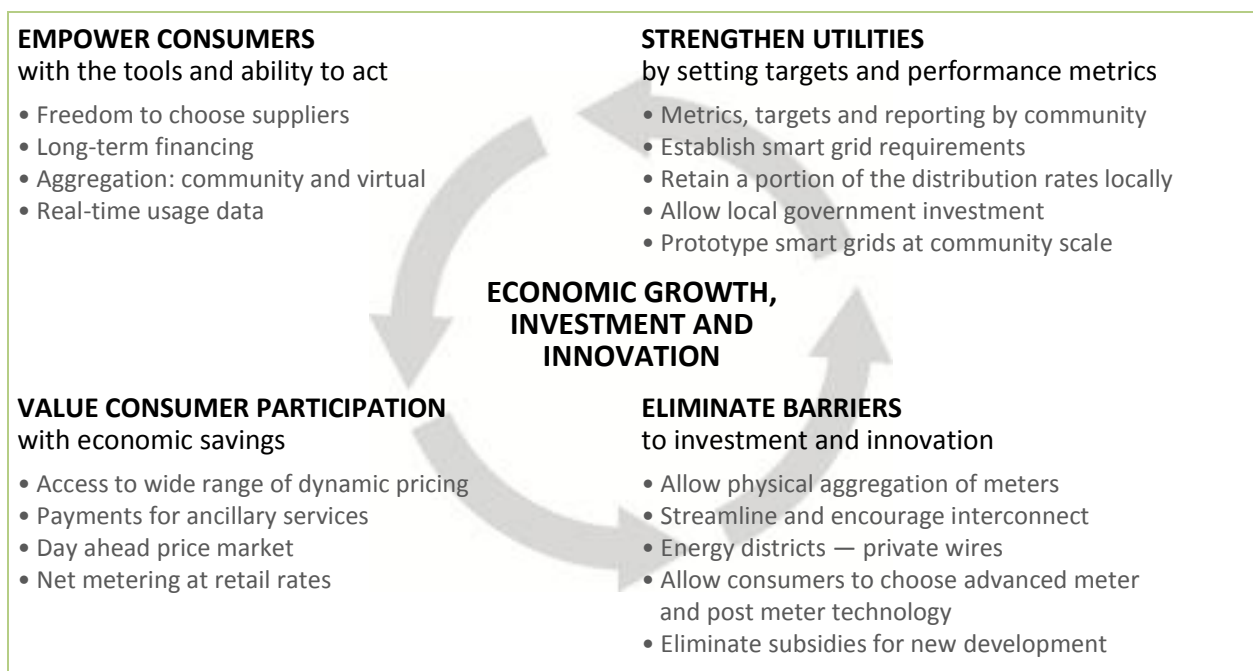
The Galvin Electricity Initiative is seeking to assist the citizens of our home state, Illinois, in establishing a set of guiding principles and a policy framework that will provide a foundation for establishing a more consumer-driven electricity system. The establishment a set of electricity principles follows the model of the U.S. Constitution — fundamental, enduring principles designed to guide policymaking and implementation, while also leading future generations in successfully adapting to changing circumstances.

The following Illinois Electricity Principles and policy framework are the result of discussions with a wide range of key Illinois electricity stakeholders. The Principles are intended to reflect Illinois’ broad desire to establish a much more consumer-responsive and environmentally responsible electricity system. The 21st century power system we envision depends on communities and consumers, large and small, collaborating with utilities and entrepreneurs to most effectively leverage smart technology by enacting the necessary enabling policies.

The proposed policy framework can achieve the following benefits:

- Create local jobs and improve the competitiveness of states and cities, facilitating economic development and ensuring American cities can succeed in fiercely competitive global markets;
- Engage consumers, local governments and entrepreneurs to lower cost, demand and environmental impacts;
- Unlock the benefits of smart grid technology and encourage investment and innovation;
- Prepare utilities for this technology revolution, which will forever change the way consumers use electricity; and
- Substantially increase reliability, accountability and efficiency while achieving climate change goals.

Figure 1: Proposed Policy Framework





1 Electricity System Principles

The Galvin Electricity Initiative proposes the following set of policy principles as a basis for establishing a new consumer-focused “Electricity Constitution” to best serve Illinois and its citizens. The Principles were identified through a process of engaging key Illinois electricity stakeholders and evaluating innovative policies that have been successfully applied elsewhere. The result is intended to guide policymaking and pave the way for a truly consumer value-focused electricity model in which communities and their citizens are active participants and benefactors, not just captive ratepayers.

Today’s obsolete electricity supply system was designed early in the 20th century to maximize the supply of electricity. This objective was appropriate when the nation was still being electrified and electricity demand was doubling every decade. The urgent transformation to a modern smart grid is, however, essential to meeting the needs of today’s fully electrified homes and businesses. Now, the emphasis must be on managing both electricity supply and demand to most cost-effectively, efficiently and reliably serve 21st century Illinois consumers, while reducing the need for expensive new power generation, transmission and distribution infrastructure.

The basic idea is to transform today’s passive, one-way, analog electricity delivery system into one that is a redundant two-way, self-correcting and aware system that can automatically address disruptions and accommodate consumer participation — in other words, a “smart grid.” The goal is to establish a consumer-driven electricity system that addresses several major challenges:

- **The rapidly rising cost** of energy in a fuel-constrained world;
- **The comprehensive transformation of the U.S. economy and society** from an analog mechanical to a digital, electronic enabling structure;
- **The increased vulnerability of electric service** to natural and man-made disturbances and the resulting impact on health, safety and local economies; and
- **The desire to reduce carbon emissions and produce a sustainable energy future.**

Today’s power distribution system is as out of step with the needs of the 21st century as horse and buggy paths were to automobiles a century ago. The technology required for smart distribution grids is commercially available today. However, the current laws, policies and practices in Illinois — which are also an obsolete legacy of the earlier, New Deal, supply-at-all-costs era — effectively discourage smart distribution grids and limit the benefit or value of smart technology. The ultimate value of the smart grid transformation to Illinois communities and all their citizens, therefore, depends on regulatory policies and practices that reflect updated, consumer-focused principles.

Informed and empowered communities and citizens are essential to mobilizing this transformation. Consumers are paying an exorbitant sum — in cash — for what is wrong with today’s antiquated, unreliable, inefficient and vulnerable power system. When consumers understand the economic and other benefits from modernizing the system and the rules that control it, they will demand this change. Indeed, the savings to consumers from changing the regulations to enable truly modern, smart power distribution grids will immediately exceed the costs and will only continue to grow.

A “Team of Leaders” came together in Illinois to establish a set of guiding principles that will provide the basis for evaluating the consumer service effectiveness of existing and proposed electricity policies and legislation in Illinois. The establishment of these principles follows the model of the U.S. Constitution. That



is, these ideas comprise fundamental, enduring principles designed to guide policymaking and implementation, while also leading future generations in adapting successfully to changing circumstances:

- 1) Citizens must have the right to access all retail electricity services, in free, competitive markets with user-friendly means and incentives to use this authority to their best advantage. This includes access to dynamic prices, meter interval data in real time and clean generation sources.
- 2) Citizens, businesses and communities must have the right to aggregate consumer electricity services, including meters, and implement free-market distributed generation microgrids that best meet their individual service needs.
- 3) Citizens, businesses and communities must have the right to a standard and consistent level of electricity reliability and quality, one that meets the needs of today's digital economy, while recognizing that electricity is now essential to life safety and security.
- 4) Communities must have the right to participate in improving the electricity system through coordinated planning with utilities, long-term public financing (e.g., on-bill financing) and competitive performance.
- 5) Utilities must be held accountable to consumers for specific performance goals and reporting of: a) reliability indices; b) costs for upgrades, repairs, and operations and maintenance (O&M); c) source energy usage; d) carbon emissions; e) demand response; f) asset utilization; and g) energy costs.
- 6) Electricity distribution utility revenues must be based on the quality, efficiency and reliability of their bulk power distribution service performance and not electricity consumption.

Several jurisdictions, including the DuPage Mayors and Managers Conference, adopted these principles as a resolution (Attachment 1).³ These principles were also updated a number of times based on subsequent feedback and circulated broadly by the Initiative.

³ Dupage Mayors and Managers Conference. (2009, April 15). A Resolution Endorsing Guiding Principles for a Consumer, Value-Driven Electricity System in Illinois.



2 Challenges Faced by Illinois Electricity Consumers

Today's electricity system was designed 100 years ago to provide lighting and power to our nation's industrial growth. Today the grid is also critical to our safety, and our digital economy requires levels of service that today's grid simply cannot provide. Yet we still depend upon this system, which is exposed and vulnerable and features critical components that are more than 50 years old; it throws away more than two-thirds of the fossil fuel actually consumed, emits more than a ton of carbon per MWh during the work week and regularly fails us.

The most common argument against upgrading the electric grid is that it would be too expensive. While consumers acknowledge that the grid is not perfect and that they would like to see it improved, most will not support paying for upgrades to a system that they can more or less live with as is. The problem is that most consumers do not realize that they are paying for an outdated system that is no longer appropriate for today. Consumers continue to spend money on repairing and maintaining an inefficient system instead of paying for improvements that could *reduce or even eliminate* these costs. The question is not whether we should pay, because we are already paying. The question is what would we rather pay for: a steady stream of waste, or an investment to stop it?

Illinois' electricity system is costing consumers hundreds of millions of dollars in wasted fuel, lost productivity, increased cost of goods, damaged goods, spoiled food and lost jobs.

Current power lines are out in the open, rendering them vulnerable to weather, animals and accidents. Today's dumb grid cannot stop faults from propagating and utilities may have no idea who is out of power. They search around, find the problem and fix it by hand. This takes time. The more time it takes, the more it costs the utility and consumers. Ultimately, poor efficiency and reliability costs Illinois jobs, as high technology companies move to areas with reliable electricity systems that can meet their needs.

The power plants and lines that generate and carry power to our cities and towns have to send a lot of electricity a long way. Because fossil fuels used to be cheap, these large power plants are very inefficient. In addition, because the power travels long distances, the power lines bleed power to the surrounding air — up to 10 percent is wasted. This cannot be helped; it is simply a law of nature. The farther you send power, the more power you lose. The power plant generates, and the consumers pay for, 3.3 units of energy to deliver *one unit*.⁴

Consumers could continue paying for this waste, or we could pay for improvements that would eliminate the waste. Think of it as a one-time payment to the plumber to fix the leaky faucet; if you do not pay to have it fixed now, you will be paying in drips until you do.

The Initiative interviewed several local governments to determine how today's electricity system impacts their residents. The events experienced by the residents at Oak Park, Ill., exemplify these effects and are described in the text box on page 8.

⁴ ENERGY STAR. (2007). *Methodology for Incorporating Source Energy Use, ENERGY STAR Performance Ratings*. Retrieved from http://www.energystar.gov/index.cfm?c=evaluate_performance.bus_benchmark_comm_bldgs#tech



A View From Local Governments

Tom Barwin, the Oak Park Village Manager, expressed his frustration with the increasing number and duration of power outages impacting the Villages residents. The village has no way of knowing when residents lose power. Village officials wait to hear from residents and dispatch police to determine the extent of the outage. Barwin explained that today, electricity is critical to life safety, and power outages put Oak Park's residents at significant risk. At greatest risk are senior citizens, some of whom depend upon electricity for oxygen and breathing ventilators. Seniors in multi-story buildings need assistance when elevators stop working. Police and fire department personnel must be diverted from protecting neighborhoods to perform recovery operations. Many residents utilize candles for light, a fire and safety hazard. Overall, a power outage is an incredible safety risk to communities.

Barwin went on to say that power outages have a significant economic impact. A multi-day outage costs residents at a minimum several hundred dollars for lost food. Many parkways are littered with furniture, carpets and other personal items damaged as a result of inoperable sump pumps. Local business is interrupted, causing thousands of dollars in lost sales.

Barwin noted that residents are interested in being provided with tools for lower costs and carbon emissions related to electricity consumption. Currently the village receives no data regarding consumption patterns and environmental impacts. The village is eager to work with ComEd and residents to develop, finance and implement a long-term improvement plan that will improve reliability and provide customers with the tools they need to lower both costs and environmental impacts.

Unlike Oak Park, the city of Naperville, Ill., is virtually outage free. Naperville owns and operates its own electricity system, called a municipal utility or microgrid. The system is underground and thus protected from storms, allowing the city to allocate the money collected from residents on further improvements.

Village of Naperville case study, <http://www.galvinpower.org/transforming-grid/perfect-power-systems/illinois/naperville-smart-grid-initiative>



3 Illinois Electricity Landscape

The Initiative met with and discussed the electricity landscape with most of the key stakeholders who participated in the Illinois Smart Grid Initiative. These discussions confirmed a need for action and raised a number of issues and questions. These workshops also identified a few areas of agreement:

- 1) Illinois electricity consumers, utilities and leaders share a common vision for the Illinois electricity system — cost-competitive, efficient, reliable and clean.
- 2) Illinois electricity consumers face significant challenges and can anticipate that electricity costs will increase in the absence of change. Higher costs will result from:
 - Rising generation and distribution costs due to increases in fuel costs, higher costs to serve peak load and adding the cost of carbon; and
 - Increased costs associated with outages including lost productivity, lost jobs and costs associated with replacing damaged goods.
- 3) New technology and system designs can be leveraged to improve grid performance, including smart meters, smart switches, advanced communications, distributed generation and improved distribution.
- 4) Consumer groups and local governments are not convinced that the consumer benefits justify the costs associated with the smart grid, thereby increasing — not decreasing — consumer bills.

Smart grid proponents argued that smart technology would enable consumers to:

- Lower their electricity bills by taking action to reduce usage during peak demand periods or shifting usage to lower cost periods — nights and weekends;
- Moderate increases in bulk peak power prices as entire communities reduce their demand in peak periods; and
- Leverage local renewable and more efficient generation to lower the cost of electricity in peak periods.

The key word is “enable.” In other words, technology alone will not lower a consumer’s electricity bill; fundamentally, it is a price signal or a new building standard that causes action and the resulting savings. The consumer acts when there is a benefit from that action. Therefore, realizing the benefits of smart grid investments for all consumers requires new “smart” policies.

Unlocking benefits requires a combination of **smart technology** and **smart policy**.



3.1 Current Policy Landscape

Illinois consumers, communities, its legislature and utilities have been very active in the pursuit of new policies aimed at improving performance. This includes:

- In 1997, the Illinois General Assembly passed the Electric Service Customer Choice and Rate Relief Law of 1997 (the “1997 Law”).⁵ This change was chiefly predicated on a concern over electric rates that had increased substantially for most Illinois consumers after the generation building programs of the 1970s and ’80s. The 1997 Act held out the promise of lower rates and more consumer-centric electric service providers, as well as the possibility of new and innovative services. However, legislators underestimated the myriad policy barriers that exist that impede customer participation and choice.
- In 1999, the Illinois General Assembly passed electricity reliability metrics and reporting.⁶ This change was predicated by a concern over the lack of overall system reliability.
- In 2007, the General Assembly created the Illinois Power Agency (“IPA”) via the Illinois Power Agency Act, P.A. 095-0481 (the “IPAA”).⁷ The IPA is tasked with procuring power for consumers that have not selected a third-party provider.
- In 2007, the General Assembly passed legislation providing communities with the authority to aggregate consumers to gain market power.⁸
- In 2008, the Illinois Commerce Commission ordered an immediate evaluation of advanced metering infrastructure (AMI) in the ComEd territory, and has also ordered the development of strategic plans for smart grids for both ComEd and Ameren Illinois.⁹
- In 2009, the General Assembly improved the community choice aggregation (CCA) legislation¹⁰ resulting in more than 20 cities passing referendums to move forward with electricity procurement generating in the range of 20 percent savings for consumers.

⁵ Illinois General Assembly. (1997, December 16). (220 ILCS 5/) *Public Utilities Act: Article XVI. Electric Service Customer Choice and Rate Relief Law of 1997*. Retrieved from <http://www.ilga.gov/legislation/ilcs/ilcs4.asp?DocName=022000050HArt.+XVI&ActID=1277&ChapterID=23&SeqStart=35800000&SeqEnd=40900000>

⁶ Illinois General Assembly. (1998, June 10). *Title 83: Public Utilities, Chapter 1: Illinois Commerce Commission, Subchapter c: Electric Utilities, Part 411 Reliability*. Retrieved from <http://www.ilga.gov/commission/jcar/admincode/083/08300411sections.html>

⁷ Illinois General Assembly. (2007, August 28). (20 ILCS 3855/) *Illinois Power Agency Act*. Retrieved from <http://www.ilga.gov/legislation/ilcs/ilcs4.asp?DocName=002038550HArt.+1&ActID=2934&ChapterID=5&SeqStart=100000&SeqEnd=3700000>

⁸ Illinois General Assembly. (2007, August 21). *Public Act 095-0311, HB0351 Enrolled, (220 ILCS 5/17-800 new) Sec. 17-800. Aggregation of electrical load by municipalities and counties*. Retrieved from <http://www.ilga.gov/legislation/publicacts/fulltext.asp?Name=095-0311>

⁹ Illinois Commerce Commission. (2008, September 10). *Commonwealth Edison Company: Proposed general increase in electric rates, Order 07-0566, pages 137-143*. Retrieved from <http://www.icc.illinois.gov/e-docket/>

¹⁰ Illinois General Assembly. (2009, August 10). *Public Act 096-0176, HB 0722 enrolled, (20 ILCS 3855/1-92 new) Sec. 1-92. Aggregation of electrical load by municipalities and counties*. Retrieved from <http://www.ilga.gov/legislation/publicacts/96/096-0176.htm>



3.2 What Are the Policy Gaps in Illinois?

In 1997, the Illinois General Assembly took the first step to provide consumers with improved electricity service — retail competition. Then in 1999, Illinois leadership established reliability metrics and reporting. Ten years later, overall reliability has not improved appreciably and retail competition has yet to reach Illinois residential customers. This lack of progress is due mainly to a regulatory framework that was established more than 70 years ago — a framework that has staved off innovation and efficiency.

Illinois leaders came together in a series of meetings over two years. This included three workshops (i.e., the Illinois Smart Grid Initiative) facilitated by the Center for Neighborhood Technology and a series of meetings facilitated by the Galvin Electricity Initiative with a team of leaders made up of village managers, consumer groups and entrepreneurs. These meetings revealed a number of regulatory barriers and practices that choke off private investment, innovation and efficiency.

Below is a summary of some of the regulatory barriers preventing improved electricity system:

- 1) Utilities charge each customer for operations, maintenance, repair and improvements to the electricity grid. However, many consumers and communities do not receive a standard level of service. Utility-supplied reliability metrics reveal that some communities experience virtually no outages, while other experience more than three extended outages per customer per year. Furthermore, distribution monies are not allocated to each community in a fair and equitable fashion. Some communities have not received any system improvements for 50 years. A review of the ComEd annual reliability reports reveals that the majority of the \$300 million annual grid improvement budget is spent on the higher voltage distribution system, even though most of the system failures occur at lower voltage system levels.¹¹
- 2) Local developers are not allowed to invest in electricity system features for new development and site renovations where the site is intersected by public streets. This limits private investment into electricity system improvements.
- 3) For the most part, utilities do not have effective performance metrics that ensure that consumer needs are being met in a cost-effective manner.
- 4) Illinois consumers are not provided with the full value of consumer-supplied ancillary services, thereby reducing the value of private investment into demand response, energy efficiency and local distributed generation. Utilities are provided with full cost recovery for adding capacity without equal financial consideration of demand-side alternatives.
- 5) The current policy structure provides an unfair advantage to grid expansion, which can be financed over a 30-year period, while investments by consumers, facility owners and communities must demonstrate a payback of five or less years. Within this structure, rate payer-funded utility system expansion has an economic advantage.
- 6) Utilities are rewarded for increasing electricity consumption and demand, providing a disincentive to support energy efficiency and demand reduction. The current structure has led to utilities utilizing earnings from consumer funding to oppose proposed rule changes that would increase energy efficiency, distributed generation and consumer action to reduce electricity usage and demand.

¹¹ Illinois Commerce Commission. (2010). *Electric Reliability Reports*. Retrieved from <http://www.icc.illinois.gov/electricity/electricreliability.aspx>



- 7) Consumers foot the bill for inefficient buildings that continue to be constructed under dated building codes. The typical consumer can pay up to \$200 more a year to pay for electricity that is wasted.
- 8) “Dumb meters” cannot record power usage and therefore require a utility worker to physically read each meter. Furthermore, they don’t provide consumers access to lower cost, off-peak power prices via time-of-use rates or dynamic pricing.
- 9) Existing Illinois rules prohibit multi-tenant building owners from installing or aggregating smart meters to secure competitive retail electricity and offer other retail electricity services.
- 10) Utilities are allowed to use ratepayer monies to pay for system expansion to support new load from developments and businesses.



4 Policy Framework

This policy framework is the result of research into Illinois and national electricity system policies, studies and reports. The Initiative also engaged consumer groups, industry leaders and local governments to shape these recommendations. These principles and policies are designed to maximize the consumer benefits and lower the overall costs of smart grid investments, recognizing that the benefits can far exceed the costs.¹² This includes:

- Empowering consumers and communities;
- Valuing consumer action;
- Removing barriers; and
- Holding utilities and suppliers accountable to consumers.

Below is a summary of the specific policy objectives that have been identified by the team of leaders as necessary to implement the guiding electricity system principles. The Initiative prepared briefs for each policy objective that provide a discussion of the issues, current policy landscape, approaches for closing the policy gap, benefits/value and implementation strategy.

4.1 Policy Solutions

4.1.1 Reforms that Empower Consumers and Communities

Retail competition — Allow communities, businesses and consumers to purchase electricity from whomever they choose. Allow building owners, aggregated communities and industry to procure low-carbon and renewable generation sources directly.

Leaders: Illinois, Pennsylvania, Massachusetts, New York, Connecticut and Texas have established both wholesale and retail choice.¹³

Aggregation — Establish rules that allow communities, campuses and facility owners to aggregate meter loads and billing physically and virtually for procurement, to use local clean generation and to receive payment for ancillary services.

Leaders: Ohio, Illinois, Massachusetts and California allow residential aggregation, giving customers the ability to purchase renewable energy and reshape their load profile. Ohio also allows multi-tenant aggregation, in which building owners can install rooftop solar panels and sell the power to their tenants.¹⁴

Long-term financing — Establish community long-term financing mechanisms for energy efficiency, distributed energy, backup power and grid improvements, placing demand-side improvements and consumer participation on financial par with grid capacity additions. Also, eliminate punitive tax provisions for community-funded grid improvements.

¹² Yeager, K., Kelly, J., & Rouse, G. (2009). *Illinois Electricity System Principles*. Galvin Electricity Initiative.

¹³ U.S. Energy Information Administration. (2010). *Status of Electricity Restructuring by State*. Retrieved from http://www.eia.gov/cneaf/electricity/page/restructuring/restructure_elect.html

¹⁴ American Local Power Project. (2010). *Community Choice Aggregation*. Retrieved from New Rules Project: <http://www.local.org/aggreat.html>



Leaders: California, New York, Colorado, Virginia, New Mexico, Texas and Ohio all have laws allowing community long-term financing mechanisms for these types of improvements.¹⁵ See www.pacefinancing.org for more information and case studies. Also, see an alternate financing approach at www.thebabylonproject.org.

Community Grids (microgrids) —

- Establish rules that enable local investment in distribution system improvements and establish local governments as a partner:
 - Encourage local planning and reporting
 - Retain distribution dollars locally
 - Have local on-bill financing of grid improvements
 - Encourage private development of advanced microgrids
 - Allow private wires
- Eliminate laws and statutes that prohibit local governments, developers and others from owning electricity systems that cross public rights of way.
- Establish rules that allow for privately owned microgrids, district energy systems and combined heat and power as part of either new or existing development.
- Establish rules that allow communities to plan for and invest in system upgrades similar to any other infrastructure improvements. For example, these rules could require that a percentage of the collected distribution rates be allocated to communities for improvements based on their needs.

Leaders: The Illinois Commerce Commission has passed a rider allowing for Local Government Compliance Adjustment, or LGC. The LGC allows Illinois communities to request local improvements from the utility and cover the ensuing costs via their residents' utility bills.¹⁶ Connecticut allows the establishment of privately owned energy districts, which facilitate microgrid development.¹⁷

4.1.2 Reforms that Value Consumer Action

Price transparency — Provide consumers access to a wide variety of dynamic pricing options, including day-ahead and real-time pricing. Smart grids that automatically provide real-time wireless usage data and price signals to each household encourage innovators to provide intelligent solutions to consumers that will save significant money and electricity while providing new value (e.g., virtual energy audits, appliance diagnostics, security, convenience etc.).

Leaders: Massachusetts, Connecticut, New York, Pennsylvania, Illinois, Maryland and Texas (restructured states), plus Alabama (non-restructured) offer dynamic pricing options to large commercial customers.

¹⁵ Database of State Incentives for Renewables & Efficiency (DSIRE). (2010). *Summary Maps: PACE Financing Policies*. Retrieved from <http://www.dsireusa.org/summarymaps/index.cfm?ee=1&RE=1>

¹⁶ Commonwealth Edison Company. (2009, January 15). *Rider LGC: Local Government Compliance Adjustment, filed with the Illinois Commerce Commission*. Retrieved from <https://www.comed.com>

¹⁷ McCarthy, K. E. (2007, November 30). *Energy Improvement District: OLR Research Report*. Retrieved from <http://www.ci.stamford.ct.us/content/25/50/258/92789/93749.aspx>



Only a few states — among them Illinois, Texas and Washington state — are offering real-time rates for residential customers.¹⁹

Net metering — Establish net metering rules that allow customers to roll over excess electricity generation to offset their total annual usage or sell local distributed generation back to the grid at appropriate rates. Retail net metering allows consumers to install distributed generation up to a size limit and net meter at retail rates. Virtual net metering allows multi-building owners and local governments to install distributed generation in one building and net meter at retail rates all their buildings within a radius of several miles.

Leaders: Numerous states have retail net metering programs. Pennsylvania ACT 129 has established both virtual and physical net metering rules. California, Florida, Illinois and Vermont have used net metering as a performance-based grant program to fund certain technologies by paying more than retail rates for solar energy delivered, commonly called a feed-in tariff.¹⁸

Consumer service payments — Assign a value to customer-supplied grid services such as demand response, voltage support/spinning reserve, carbon reduction and power-generating capacity.

Leaders: Illinois, New York, Massachusetts, Connecticut, Pennsylvania and Texas offer payments for demand-response. In addition, PJM in Pennsylvania and NYISO in New York are piloting capacity payment programs that will allow for greater customer participation.^{19, 20, 21}

4.1.3 Reforms That Eliminate Barriers

Consumer access to energy data and devices — Give consumers access to secure wireless real-time interval data. Also, allow consumers to select their meter and post meter device suppliers to allow this market to grow freely and offer customers choice and reasonable prices *while avoiding stranded advanced metering infrastructure (AMI) assets that could be obsolete in a few years*. Further, policies should establish standards and specifications for advanced meters to ensure quality and compatibility.

Leaders: There are numerous state, utility and third-party programs with varying specifications. Texas has established specific advanced meter requirements.²² In addition, some customers are installing AMI downstream of the utility meter to verify their bills and conserve energy. States such as Connecticut are using rebates to allow customers to choose their own in-home devices.²³

Streamline interconnect rules and processes — These processes have been a cumbersome and expensive barrier to local, clean distributed energy.

Leaders: States that have done this well include Oregon, Maryland, New Jersey, New York and New Mexico, as well as the District of Columbia. More information on these policies can be found in the NNEC report, “Freeing the Grid: Best and Worst Practices in State Net Metering Policies and Interconnection Procedures.”

¹⁸ Database of State Incentives for Renewables & Efficiency (DSIRE). (2010). *Summary Maps: Net-Metering Policies*. Retrieved from <http://www.dsireusa.org/summarymaps/index.cfm?ee=1&RE=1>

¹⁹ PJM. (2010). *Ancillary Services*. Retrieved from <http://pjm.com/markets-and-operations/ancillary-services.aspx>

²⁰ NYISO. (2010). *Ancillary Services*. Retrieved from http://www.nyiso.com/public/markets_operations/market_data/ancillary/index.jsp

²¹ ISO New England. (2010). *Ancillary Services*. Retrieved from http://www.iso-ne.com/nwsiss/grid_mkts/how_mkts_wrk/anc_svcs/index.html

²² Texas Legislature. (2007, May). *HB2129*. Retrieved from <http://www.capitol.state.tx.us/BillLookup/Text.aspx?LegSess=79R&Bill=HB2129>

²³ Connecticut Department of Energy & Environmental Protection. (2009). *Connecticut Energy Efficiency Fund*. Retrieved from http://www.ctenergyinfo.com/ct_energy_efficiency_fund.htm



4.1.4 Reforms that Hold Utilities and Suppliers Accountable to Consumers

Smart grid program oversight — Establish detailed smart grid performance goals, metrics, reporting and program requirements. These ensure utilities are accountable to ratepayers. The Initiative has established a comprehensive set of electricity system performance measures that can be leveraged for the purpose of holding utilities and suppliers accountable.

Leaders: The California Public Utility Commission and the Department of Energy have identified smart grid goals and program requirements. Illinois obtains spending breakouts while the PJM ISO tracks demand-response performance.

Reliability targets — Establish reliability standards with incentives and penalties that put state utilities on a path to providing a standard level of electricity quality. These standards would be achieved over time and would help guide utility improvement spending.

Leaders: These targets are widely leveraged in Europe and Asia. Several U.S. states have implemented reliability metrics and targets, among them Massachusetts, Illinois and New York, but they are often weak. In Illinois, they include reporting of annual improvement spending by category.²⁴

Performance-based rates — Establish performance-based rate recovery to incent utilities based on overall performance — including reliability, cost and customer service — and not simply on the amount of electricity they sell. This decouples utility revenues from commodity sales and removes the incentive to expand usage to increase revenue while tying utility earnings to performance.

Leaders: Massachusetts²⁵ and California²⁶ have implemented legislation establishing performance-based rate recovery and/or decoupling and reward demand reduction that results from demographic, economic, technological and market impacts.

²⁴ Davies Consulting Inc. (2005). *State of Distribution Reliability Regulation in the United States*. Washington D.C.: Edison Electric Institute.

²⁵ Massachusetts Department of Telecommunications and Energy. (2007). *D.T.E. 04-116-C Service Quality Guidelines*.

²⁶ The California Public Utilities Commission. (2007). *California's Next Step: Decoupling "Plus"*.



5 Electricity System Visions

What would the grid of the future look like if the investment could be justified? What would the smart grid improve? What would it enable consumers to do?

The electricity system future depicted herein and resulting consumer benefits depends upon the new policy framework outlined in Section 4.0.

A View of an Improved Electricity System

Ideally, power lines would be buried safely underground like plumbing, but even with the lines remaining overhead there are plenty of ways to improve the grid.

When the power line is damaged in a smart grid, the fault is sensed and isolated before customers lose power, protecting homes or businesses from an outage. Smart switches presently sold on the market can sense a problem in the line and instantaneously re-route power around the problem area. Since the power is still on, the repair crew can be scheduled during normal business hours. This means fewer repair personnel on call and lower repair costs. Also, smart switches locate the problem, so repair crews are not being paid to look around. Sometimes a crew will not even have to be deployed since the switches can turn the power back on automatically if the problem is temporary. This saves in labor costs and materials while keeping the power on. As a result, consumers are paying for power and not for repairs.

In a smart grid, there will be many distributed local power plants that will complement the existing fleet of larger inefficient central power plants. These local or distributed power plants can be fueled by the sun, bio-fuels, natural gas and other low-carbon sources and can be hidden from view in buildings that are indistinguishable from their neighbors. These local generators can be networked together to support each other in the event of an outage to keep the power on. Best of all, since they are close by, previously wasted heat is captured and utilized and equipment does not lose energy to the air. The power you pay for is the power you use.

Of course, these improvements will cost the utility — and therefore the consumer — money. By upgrading the electricity system, consumers save much more by:

- Reducing electricity costs and usage;
- Eliminating outage costs; and
- Improving productivity, local economies and competitiveness.

See Section 3.2 for an example of a smart grid for a community.



5.1 What Are the Potential Savings and Costs?

The costs and potential benefits of comprehensive grid modernization to a typical Illinois household are summarized in the tables on the following page. **The benefits can exceed the costs by a factor of two or more.** However, achieving these benefits requires changes to the current policy framework in Illinois (see Section 2 and Tables 1 and 2).

Unfortunately, in today's obsolete utility accounting system and policy framework, Illinois consumers will not receive all of the benefits afforded by a smart grid. Table 1 summarizes the quantitative benefits. Other qualitative benefits from a smart distribution grid include fairer and more equitable electricity rates, improved customer satisfaction, motivation for and assimilation of continued innovation, development of robust competition with expanded and higher quality retail offerings, and perhaps most important, greater security with reduced vulnerability to both natural and man-made intrusions. As noted earlier, the annual benefits to Illinois communities and their citizens relative to the cost of distribution system modernization makes the smart decision a no-brainer.

By automating the distribution system, the smart grid will seamlessly connect all people and devices that generate, distribute or use energy. To maximize the smart grid value and avoid obsolescence, it must be based on policies that require open architecture "plug and play" standards. These are essential to enabling both Moore's Law (exponentially decreasing cost) and Metcalf's law (exponentially increasing value) to be maintained through continuous innovation. This smart grid architecture follows the same open standard design principle as the amazingly successful Internet Protocol. As a result, the new smart grid "Electronet" will also be able to effectively leverage the more than 1 billion dollar Internet investment. In this regard, AMI is an important enabling component but it is not the smart grid.

Especially important today is the fact that only a smart grid can reliably get the most from clean, renewable and distributed energy sources, such as wind and solar, while dramatically reducing greenhouse gas emissions. This will include the capability to charge electric cars that will soon be filling the roads and highways of Illinois without the need to add expensive new electricity-generating capacity. In fact, drivers will be paid by smart grid operators to share their stored electricity with the grid.

For Illinois consumers, a smart grid incorporating advanced metering will offer an unprecedented level of control over their electricity cost and usage. The resulting opportunities to improve energy efficiency while reducing electricity costs are profound. Indeed, with this upgraded grid, the electricity service business model will no longer be based on simply selling more bulk electricity.



Table 1: Smart Grid Potential Benefits

<u>Smart Grid Benefits Per Residential Ratepayer</u>	
<u>Category</u>	<u>Net Present Value \$/year</u>
1. Electricity Consumption Savings*	\$120
2. Time of Use Savings, Shifting Peak Demand*	\$110
3. Improved Reliability	\$400
4. Avoided Capacity Costs	\$180
5. Reduced Power Distribution and Competition Losses	\$20
6. Households Become Electricity Suppliers	\$140
7. CO2 Emissions Reduction	\$100
Approximate Annual Savings	\$1070
Life Safety and Homeland Security	Significant

Source: Data collected for the Perfect Power Institute "Potential Benefits and Costs Associated with Grid Modernization: A Preliminary Assessment," pending 2011 publication.

Table 2: Smart Grid Costs

<u>Grid Modernization Costs Per Residential Ratepayer</u>	
<u>Technology</u>	<u>Estimated Cost Per Household, \$/year</u>
1. Clean Power Supply – Bulk and Local	\$80
2. Transmission and Area Distribution	\$12
3. Distribution Automation	\$12
4. Substation Automation	\$25
5. Circuit Loops and Smart Switches	\$47
6. Underground Cables	\$50
7. Building Clean Energy Supply	\$46
8. Smart Meters	\$20
9. Home Automation	\$100
Total Annual Estimated Cost	\$390

Source: Data collected for the Perfect Power Institute "Potential Benefits and Costs Associated with Grid Modernization: A Preliminary Assessment," pending 2011 publication.



The following is intended to put the quantifiable benefits summarized above in better perspective.

First, the cost of electricity unreliability is passed on to consumers in the price of all the goods and services that they purchase. This adds at least \$800 a year to each household's expenses and on average more than doubles the real cost of electricity. While a smart local distribution grid cannot eliminate all these unreliability costs, it can easily reduce them by at least half.

Second, a smart grid that automatically provides real-time wireless usage data and price signals to each household encourages innovators to provide intelligent solutions to consumers that will save significant money and electricity, while providing new value (e.g., virtual energy audits, appliance diagnostics, security, convenience, etc.). The price of electricity can easily range by five-fold over the course of a day with the peak occurring in those two or three hours when demand is highest. Not only will the household be able to save money on its utility bill each month, it will also eliminate the need and cost of very expensive peak-power generating capacity. These avoidable costs are now passed on by the utility in its bills and rate cases. In effect, a smart grid with real-time pricing enables the consumer's appliances to exchange *negawatts* for *megawatts* with no loss in service.

Finally, one of the biggest, but now hidden, benefits of a smart distribution grid to Illinois' communities and citizens is the opportunity for job creation and increased income. This is a particularly valuable opportunity for Illinois, which ranks only 14th in terms of per capita gross domestic product and has been steadily losing ground this decade.²⁷ In fact, in January of 2010, the unemployment rate for Illinois was 11.2 percent compared to a national average of 9.7 percent.²⁸ This issue has been notably led by two commercial categories that are especially dependent on the reliability and quality of electricity: Professional and technical services, and durable goods manufacturing.

Smart, modern community power distribution grids would help remedy this trend and lead to retaining and attracting the modern digital industries with the higher value jobs they create. Certainly, the human and natural resources of Illinois, coupled with its advantageous central location, make it a more attractive job site than most other states — if and when the electricity infrastructure can better meet the strict reliability and quality demands of 21st century industry and commerce.

5.2 Smart Grid Tool Box

After completing designs of several prototypes, the Initiative identified several common elements for the grid of the future. The specific tools available to utilities, communities and consumers, as well as the potential value, are summarized in Table 3. However, unlocking the full value of each tool requires a new policy framework.

²⁷ U.S. Census Bureau. (2010). *The 2010 Statistical Abstract: State Rankings*. Retrieved from <http://www.census.gov/compendia/statab/rankings.html>

²⁸ Bureau of Labor Statistics. (2010, January). *Overview of BLS Statistics on Unemployment*. Retrieved from <http://www.bls.gov/bls/unemployment.htm>



Table 3: Smart Grid Features

Smart Grid Features	Benefit
Advanced metering	<ol style="list-style-type: none"> 1. Necessary for integrating solar PV or other on-site generation 2. Enables time of use pricing and a means for the consumer to gain access to lower cost off-peak power and reduce demand to lower their electricity bill 3. Reduces utility operations and maintenance cost 4. Enables utilities to locate outages
Smart switches	<ol style="list-style-type: none"> 5. Provide for automatic isolation of faults and rerouting to redundant supply, thereby eliminating outages 6. Replace dumb fuses, enabling two-way flow of electricity and net metering of solar PV and plug-in hybrids 7. Enables the grid to maintain system balance during storms, heat waves and other disturbances, thereby reducing outages
Underground feeders	<ol style="list-style-type: none"> 8. Reduces outages and maintenance cost for unreliable feeders 9. Eliminates unsightly overhead poles/wires, allowing for greening of spaces
Looping/Circuit redundancy or looping	<ol style="list-style-type: none"> 10. Connects isolated substation feeders to provide consumers with a redundant supply when storms or animals damage lines
Substation generation	<ol style="list-style-type: none"> 11. In cases where the electricity system cannot be protected and redundant electricity supply cannot be provided, local generation can be provided at the substation. Substation generation can be utilized for demand response and ancillary services.
Facility distributed generation	<ol style="list-style-type: none"> 12. When renewable and high-efficiency, low-carbon resources are available at the point of use, it reduces energy costs, provides local demand response capability and improves efficiency of energy use.
Microgrids	<ol style="list-style-type: none"> 13. Universities, cities and developers can provide local high-efficiency and high-reliability microgrids that provide smart grid features funded by the private sector not rate payer money.
Energy efficiency	<ol style="list-style-type: none"> 14. Advanced lighting, smart transactive appliances, building automation, building materials, building designs and local generation can reduce overall energy use and energy use per unit of economic activity.
Advanced communications	<ol style="list-style-type: none"> 15. Provides for the instantaneous communication of information among the customer, utility and system operator, providing for seamless operation, improved reliability and improved accountability
Technology-ready structures	<ol style="list-style-type: none"> 16. Building homes, multi-tenant, commercial and other facilities with the electric infrastructure and space to accommodate emerging technologies, thereby reducing future advanced technology integration costs. For example, homes can be built wired for solar PV.

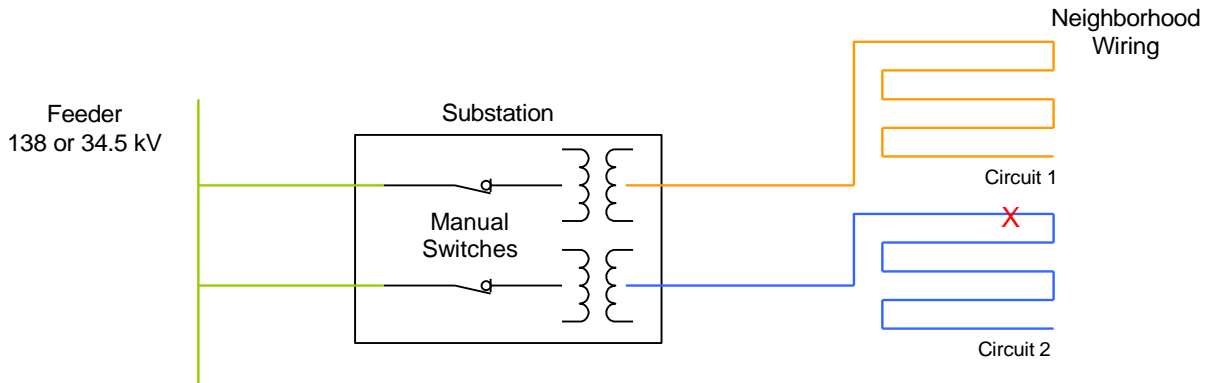


5.3 Smart Grid Prototype

The Initiative worked with the Village of Hinsdale to develop a system design for improving reliability and providing consumers with tools for lowering costs. The preliminary smart grid system design includes the following elements:

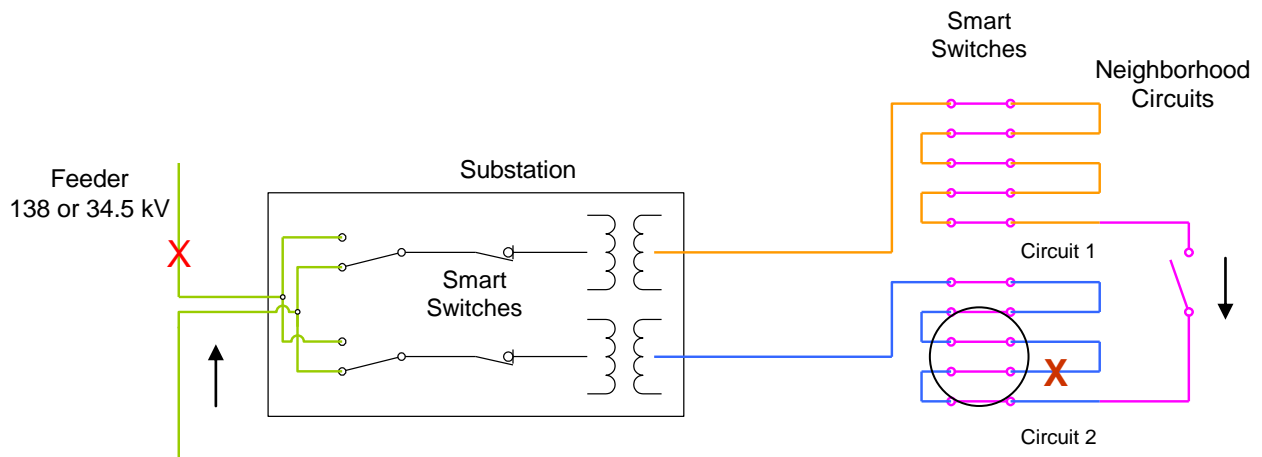
- 1) Substation redundancy through the application of smart switches. The figure below depicts an existing radial feed with manual switches and no isolation on the substation supply feeds. Any faults on the supply to the substation will blackout the entire substation. Faults on a circuit will blackout the circuit and may propagate to the supply substation, blacking it out.

Figure 2: Existing Radial Feed with Manual Switches



Reconfiguring the cables as shown in Figure 3 provides **substation redundant feeds**. The substation manual switches can be replaced with **smart sectionalizing switches** (substation automation) that isolate faults and automatically connect to the alternate substation feed so that customers are not interrupted when a power line is damaged.

Figure 3: Redundant Feeds with Smart Switches



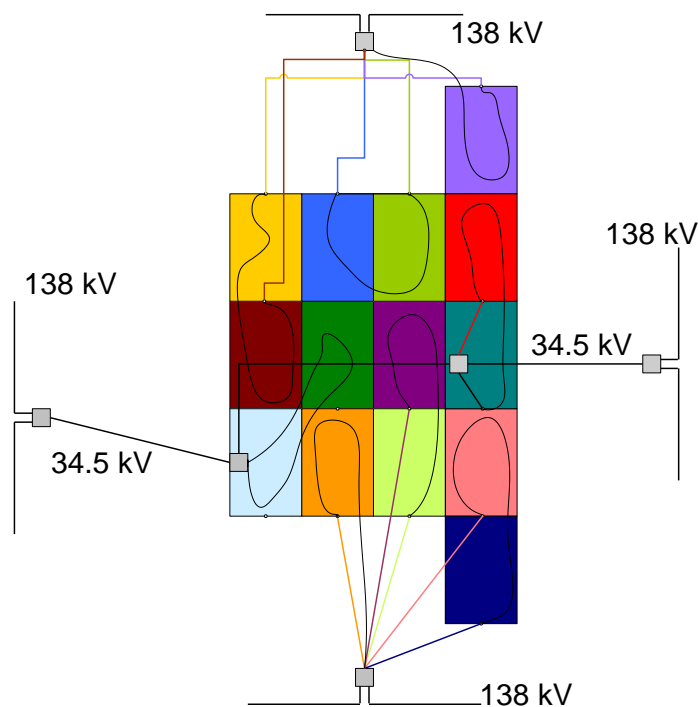


- 2) Currently residents in Hinsdale are served by a single radial feed from a ComEd substation. Each radial feed can be connected with a cable and a smart switch to create **circuit loops**. Circuit loops and the addition of sectional smart switches will isolate faults and limit the outage to a few customers. These upgrades can be done over a period of time. Once completed, the entire village will be a networked smart grid and downed power lines will impact only a few customers.

Another benefit of the networked smart grid is that it can accommodate bidirectional power flow from solar, plug-in hybrids and other clean local generation sources. The current grid cannot. See Figure 4.

- 3) While smart switches and redundant circuit looping will improve reliability, it does not eliminate outages. A smart grid design deploys distributed generation at critical loads or at substations that cannot economically be supplied with an alternate feed. **Distributed generation** will provide power locally when the grid is lost. Distributed generation also can be utilized to lower electricity cost.

Figure 4: Circuit Loops





- 4) All customers will be provided the opportunity to lower their electricity costs by taking advantage of **dynamic or hourly electricity pricing**. This can only be enabled if **advanced interval metering** is installed.
- 5) Local governments can leverage electricity aggregation programs, which will allow the community to work with residents to flatten the community load profile and reduce electricity procurement costs. In addition, the village will be able to generate revenue from participation in PJM ancillary service markets (demand response, capacity markets, etc.). Distributed generation assets will also allow the village to buy electricity in real time by acting as a hedge against electricity price spikes. The electricity savings and revenues can be utilized to invest in the grid improvements discussed above.

CenterPoint Energy at the July 2008 DOE Smart Grid conference stated that advanced meters can only benefit consumers when implemented with dynamic pricing. CenterPoint is a Texas utility that is implementing AMI for all customers based on documented cost/benefit. This includes:

 - 1) Utility O&M savings
 - 2) Customer bill savings
 - 3) Wholesale electricity cost savings
 - 4) Reduced outage costs and durations due to faster reporting and response
- 6) Local governments can offer solar PV, backup generation and energy efficiency services through on-bill financing programs whereby the city finances these improvements through low-cost bonds and charging the customer a small fee (e.g., less than the savings) on their water or garbage service bill.

This prototype system design can be implemented in cooperation with ComEd and the private sector. Each party will provide investment into a portion of the design. Once completed, the local government and its residents will be working together to optimize the local electricity system, provide ancillary services to ComEd/PJM and reduce the environmental impacts of electricity use.



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Attachment 1 – DuPage Mayors and Managers Resolution

DUPAGE MAYORS AND MANAGERS CONFERENCE

2008-09-12

A RESOLUTION ENDORSING GUIDING PRINCIPLES FOR A CONSUMER, VALUE-DRIVEN ELECTRICITY SYSTEM IN ILLINOIS

WHEREAS, today's electricity system a) costs each household thousands of dollars a year due to power outages; b) wastes immense quantities of energy in the distribution process, and c) is the largest contributor to man-made carbon emissions; and

WHEREAS, many communities in Illinois suffer from power outages at a frequency that exceeds the national average. One Illinois town of 20,000, reported an astonishing 150 outages in 2008. Consumers foot the bill, paying over \$6 billion in lost productivity and recovery costs in the state, each year; and

WHEREAS, unreliable electricity jeopardizes the state's ability to attract new business and manufacturers – and to keep those that currently call Illinois home, and

WHEREAS, the average annual electricity bill for Illinois residential customers has been increasing over the past few years; and

WHEREAS, the Illinois electricity system does not offer consumers the tools such as smart meters and price signals that provide the ability and economic incentives to invest in demand reduction technologies; and

WHEREAS, Illinois current electricity policy structure severely limits improvement, innovation, consumer participation, customer choice, and private investment thereby increasing modernization costs and limiting consumer value; and

WHEREAS, Illinois electric utilities have entered into a Smart Grid rate making process to explore the costs and benefits associated with investing billions of consumer dollars in grid modernization; and

WHEREAS, a new policy structure is called for that fosters innovation, leverages local capital and resources, and incentivize utilities to work in concert with customers to transform today's grid in a cost effective manner.

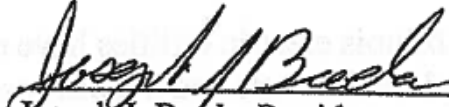
NOW, THEREFORE, BE IT RESOLVED by the DuPage Mayors and Managers Conference that we express our endorsement of the following Principles which will be utilized to guide improvements to electricity system rules, rates, and policies to produce a more consumer driven electricity system - cost effective, reliable and environmentally sustainable:



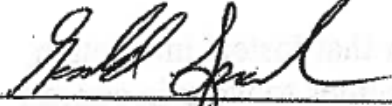
1. Citizens must have the right to access all retail electricity services, in free, competitive markets with user-friendly means and incentives to use this authority to their best advantage. This includes access to dynamic prices, meter interval data in real time, and clean generation sources.
2. Citizens, businesses and communities must have the right to aggregate consumer electricity services, including meters, and to implement free-market distributed generation microgrids that best meet their individual service needs.
3. Citizens, businesses and communities must have the right to a standard and consistent level of electricity reliability and quality, one that meets the needs of today's digital economy while recognizing that electricity is now essential to life safety and security.
4. Communities must have the right to participate in improving the electricity system through coordinated planning with utilities, long term public financing (e.g. on-bill financing), and competitive performance.
5. Utilities must be held accountability to consumers for specific performance goals and reporting of: a) reliability indices; b) costs for upgrades, repairs, and O&M; c) source energy usage; d) carbon emissions; e) demand response; f) asset utilization; and g) energy costs.
6. Electricity distribution utility revenues must be based on the quality, efficiency and reliability of their bulk power distribution service performance and not electricity consumption.

BE IT FURTHER RESOLVED that the Conference shall send copies of this Resolution to the Governor and all Statewide Officers, DuPage Legislators, DuPage Federal Delegation, DuPage County Officials, DuPage Mayors, Commonwealth Edison Officials, and other interested parties.

Adopted by the members of the DuPage Mayors and Managers Conference at a regular meeting thereof held on the 15th day of April, 2009, and approved by me as President on the same day.



Joseph J. Broda, President



Gerald Sprecher, Secretary/Treasurer