Beyond Utility 2.0 to Energy Democracy

Why a technological transformation in the electricity business should unlock an economic transformation that grants power to the people.

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ILSR's DEMOCRATIC ENERGY INITIATIVE

Executive Summary

The 130-year old electricity system is undergoing a historic transition, as new, decentralized technologies undermine a decades-old centralized utility business model. Energy efficiency and conservation have undercut utility revenue, even as rooftop solar begins to erode electricity demand right at the source.

There's a growing discussion about a 21st century "Utility 2.0" business model that would reward utilities for achieving an efficient, low-carbon, and flexible electricity system.

It's not a moment too soon.

Utilities have made battlegrounds out of nearly 20 states, fighting their own customers about installing rooftop solar and other measures. They continue to invest in the infrastructure – power plants and power lines – for a 20th century, centralized electricity system, assets that may be stranded by the exponential growth of on-site power generation, distributed energy storage, and electric vehicles. They struggle to retain control and ownership of the electricity system even as technology increasingly lends itself to decentralized control and ownership.

It's not entirely the utilities' fault.

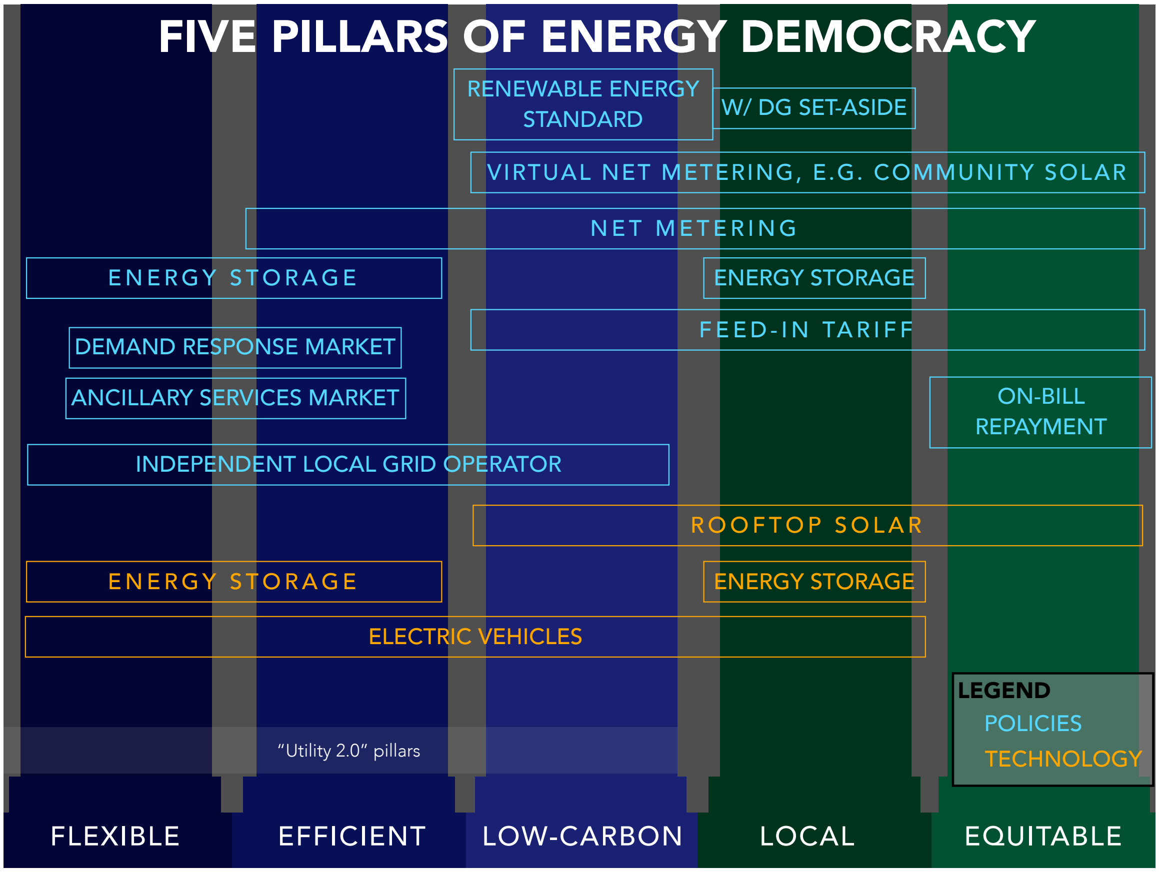
Utilities face mixed incentives. States have layered requirements for renewable energy and energy efficiency on top of a business model where many utilities still profit from growing electricity sales and building their own power plants. State and federal regulators frequently make decisions about utility investments without complete information about cost-effective alternatives.

What is popularly known as Utility 2.0 is a new business model designed to solve many of these problems, properly aligning financial incentives with the outcomes most participants want from the electricity system. But Utility 2.0 may not go far enough.

Rooftop solar, smartphones, and widespread energy storage will give utility customers unprecedented opportunities to control their energy usage, and to capture their share of the $364 billion spent on electricity each year. The rules and principles of a 21st century electricity system must go beyond an efficient, low-carbon, and flexible grid to encourage capture of the *economic* opportunities for individuals and communities. This requires two additional principles: local control and equitable access. Combined, these are the five keys to Utility 3.0, or energy democracy, that can unlock an economic transformation that parallels the technological one, by allowing communities to maximize capture of their local energy dollar.

This report provides:

- A short history of the electricity system to explain how we got here.
- A discussion of the existing tensions within the present electricity business brought about by three new developments: the rapid expansion of decentralized rooftop solar and energy efficiency that challenge utility revenue, a fragmented regulatory system, and the fierce lobbying of utilities to protect their business interests.
- An analysis of the benefits and shortcomings of the Utility 2.0 model.
- A proposal for a Utility 3.0, or energy democracy model, that can create an electricity system that benefits everyone, not just utilities.



While Utility 2.0 will provide the 21st century electric utility with incentives driving it toward a clean, efficient, flexible grid, energy democracy ensures that the benefits of this transformation are widely shared with utility customers. It means that customers wield substantial decision making power over their own and their community's energy economy. It means that all utility customers will have access to ownership and authority, especially those that have disproportionately paid for the externalities of the 20th century grid. It means that technology will make participation in a networked, transactive energy system simple for utility customers whether they are amateur engineers or "just pay my bill"-ers. It means shifting more of the $364 billion spent on energy from centralized, monopoly utilities to their value-building customers. It builds a self-interested political movement for accelerating the transformation to a low-carbon energy system: a climate necessity.

ENERGY DEMOCRACY

It's as fundamental a change in the ownership of the energy economy as Utility 2.0 is a response to the change in the technology and scale of power generation.

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John Farrell

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Introduction

The U.S. electricity system is undergoing the biggest change in its 130-year history. The scale of electricity generation is rapidly shrinking, from coal and nuclear power plants that can power a million homes to solar and wind power plants that power a few to a few hundred nearby homes. Electricity demand has leveled off, so that every unit of new wind and solar power produced for the grid displaces a unit of fossil fuel energy. Batteries and electric vehicles provide new tools for distributed energy storage. Smartphones and smart appliances are giving electricity customers unprecedented opportunities to manage their energy use.[1]

A growing number of experts in and out of the utility industry believe this shift in source and scale of power generation to distributed and renewable is largely inevitable.[2] The technological change challenges us to redesign the electricity system.

"The way we structured utilities 100 years ago...doesn't work today," says Richard Kauffman, New York energy czar.[3]

Many are calling this potential adaptation "Utility 2.0" – a second generation electric company that can accommodate and thrive alongside distributed clean power generation, energy storage, and advanced energy management. Many utilities are fighting this transition, clinging to the inertia that has kept them in business for decades as sovereigns of the grid.

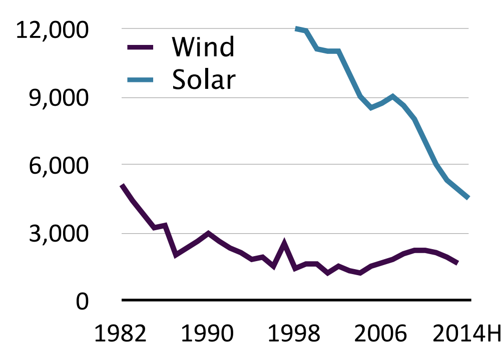
Up for grabs is $364 billion in annual electricity sales.[4]

There's an unprecedented opportunity to keep that money within communities. Already, half a million households have on-site solar power plants, a quarter million have an electric vehicle, and 6 in 10 have a smartphone. The costs of local energy production and management are falling rapidly.

But history and regulatory and institutional inertia mean that most of the revenue in the electricity system continues to flow away from utility customers and their communities.

In "Utility 1.0," both the technology of the original electricity system and its ownership were large and centralized. Vertically-integrated utility companies owned everything, from the power plant to the meter outside a home or business. In an era when cost-effective power generation came from coal or nuclear – with massive economies of scale – centralized ownership was the key to raising the capital for power generation. Utilities were rewarded with public monopolies and guaranteed rates of return to attract low-cost capital and drive down costs.

U.S. Installed Cost of Wind and Solar Power ($/kilowatt)



Source: Lawrence Berkeley Labs

Utility 1.0 is a business model for an electricity system entirely owned by the electric company, from power plant to transmission and distribution network to the meter on the building. The system is based on large power plants that capture the economies of scale in producing power from fossil and nuclear fuels.

The new technologies of power generation no longer require the same scale or centralization of ownership. The shift toward these decentralized power sources like solar is nearly inevitable as the cost of distributed renewable energy continues to fall, and for-profit (investor-owned) utilities in particular identify ways to profit from clean energy.

Utility 2.0 is an adaptation, a business model that allows utilities to accommodate the shift to new technologies and achieve a 21st century electricity system that is efficient, low-carbon, and flexible. Proponents envision a local electricity or distribution grid managed independently from the owners of power plants and other energy resources, creating a marketplace for utility and non-utility participants to provide their services. It's a bold and necessary step toward a business model that mirrors the changes in the scale and technology of electricity.

But Utility 2.0 will prove inadequate if it remains indifferent to the flow of energy dollars out of communities.

ENERGY DEMOCRACY

It's as fundamental a change in the ownership of the energy economy as Utility 2.0 is a response to the change in the technology and scale of power generation.

Local control and equitable access are the keys to unlocking an economic transformation that parallels the technological one, by allowing communities to maximize capture of their local energy dollar. It means an energy system that empowers electricity customers to manage their electricity use, produce power individually or collectively, and transact with their neighbors, local businesses, and their city. Consumers become, in Alvin Toffler's elegant description "prosumers." They can make the decision as to whether to consume, or produce, or store electricity at any given moment. Individuals and communities, formerly simply passive observers of utility-driven power generation, can become the agents of their own energy futures.

We might call this new electricity business model Utility 3.0, or as we do in this report, **energy democracy**. It's as fundamental a change in the ownership of the energy economy as Utility 2.0 is a response to the change in the technology and scale of power generation.

Energy democracy seems daunting because it means confronting the economic and political might of (monopoly) incumbents. But it's also enormously worthwhile, because in giving communities the opportunity to recapture billions of currently-exported energy dollars, it builds a self-interested political movement for accelerating the transformation to a low-carbon energy system: a climate necessity.

This report explores what's brought us to this moment, the core principles and existing practice of Utility 2.0 and energy democracy, and key strategies to ensure that the transformation of the electricity system is both a technological marvel and an equitable economic engine.

A Prelude to Utility 2.0

The Golden Age of the electricity system began in the mid twentieth century, the natural evolution of a model pioneered several decades earlier when Samuel Insull of Chicago's Commonwealth Edison led a movement toward monopolies. A single, investor-owned company would generate, transmit and sell electricity to the final customer. In return for a monopoly, utilities would be subject to state regulation. States provided utilities with their costs plus a fair rate of return in exchange for reliable and universal service.

This formula was similarly used by rural electric cooperatives and municipal utilities, and it encouraged large investments to meet the needs of a growing population and even faster growing electricity demand.

Three waves of change have broken over the electricity industry, but none as transformative as today's. A timeline on page 9 illustrates, in brief, the past 40 years of change, also described below.

The First Wave of Change

The quadrupling of oil prices in 1974 and again in 1979-80 ended the cozy and predictable golden age. The price of fossil fueled electricity soared while higher interest rates dramatically increased the cost of power plants. At the same time substantially higher prices led to a sudden slowing of per capita electricity consumption. Several utilities went bankrupt. Investors fled. A 1984 cover story in Business Week wondered, "Are Utilities Obsolete?"

State regulators responded with a new "least cost planning" approach that required utilities to consider cost effective energy efficiency improvements before building new power plants. It was only partially effective, failing to cultivate many energy efficiency investments that utilities could not make money on, but improving planning for new power plants. In an effort to reduce reliance on oil, the federal government enacted the 1978 Public Utility Regulatory Policies Act (PURPA), which opened the electricity generation market to non-utility generators who used higher efficiency or renewable-fueled power plants.[5]

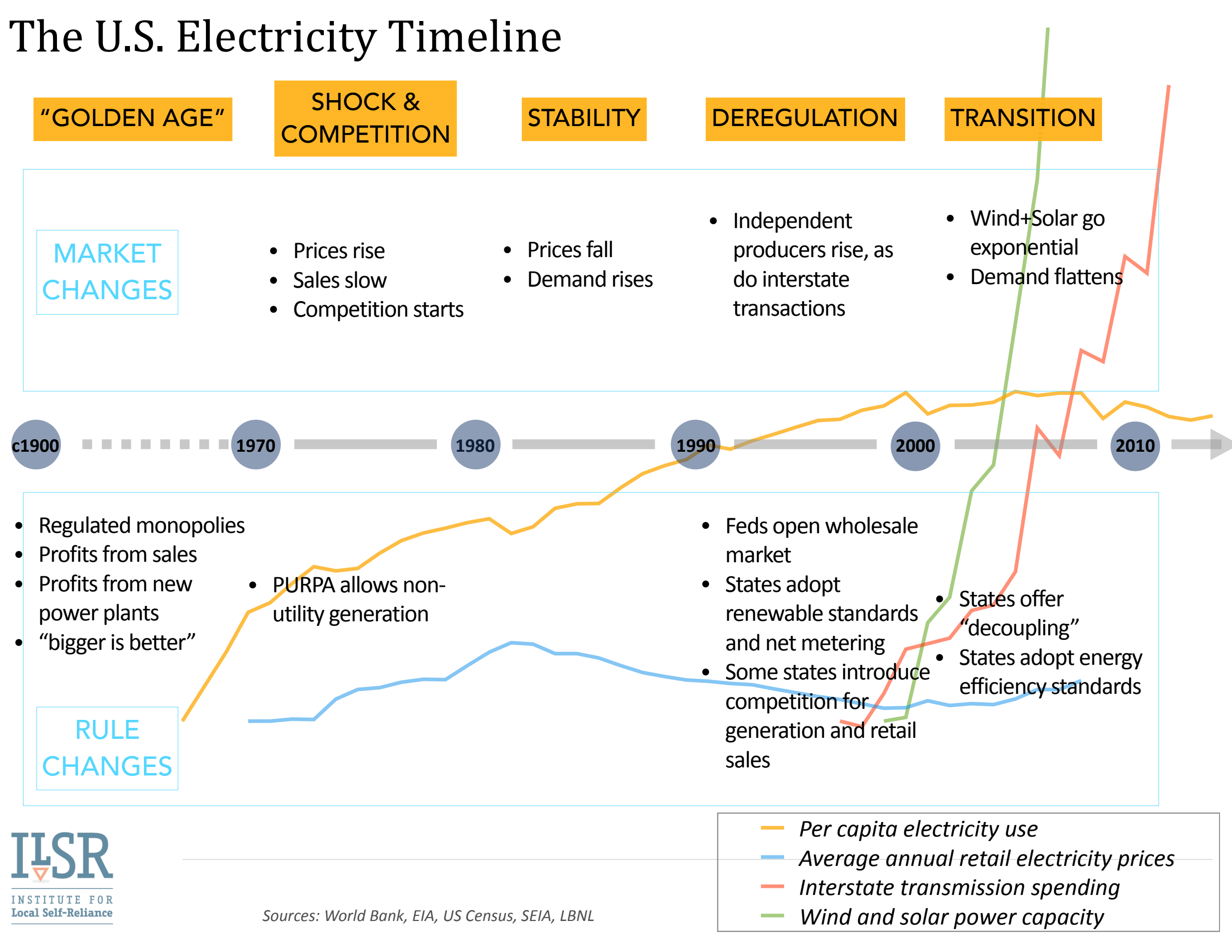
The Second Wave of Change

By 1990, independent power producers (IPPs) were adding more new power plant capacity than traditional utilities and they lobbied for the freedom to sell power outside their local utility's service area. In response to this aggressive campaign – led by Enron – Congress deregulated the wholesale market and made the electricity transmission grid a common carrier.[6]

This deregulation led to an explosion in transmission line investment to meet the increasing, long-distance bulk transfer of power.[7] The regulation of the new interstate market similarly grew, with the Federal Energy Regulatory Commission (FERC) implementing rules to overcome the conflict of interest between utilities that generated their own power, but that had to share their transmission lines with competitors. The rules were only marginally successful, until FERC insisted on greater structural separation by creating new entities to oversee transmission access and pricing.

> "By the mid 1990s IPPs were no longer small businesses. Six of the top eleven IPPs and ten of the top 20 were electric utility affiliates. Southern California Edison's subsidiary, Mission Energy, for example, was the largest "independent" in terms of ownership of non-utility generating projects."
>
> David Morris, *Seeing the Light*

Independent power producers also wanted competition at the meter, and lobbied states for permission to sell directly to final customers. About half of the states deregulated retail electricity sales, requiring many former monopoly utilities to divest some or all of their generating capacity and increasingly becoming distribution utilities. (Retail competition proved elusive, however, and California's near-bankruptcy due to price manipulation by Enron and others led many states to freeze or reverse retail deregulation.)



The 1990s were also the sustained entree to renewable energy, with the first wave of state renewable energy requirements – in 12 states – adopted prior to 2000.[8] Utilities initially fought renewable energy standards, but opposition waned as utilities saw remote wind farms generating 100-500 megawatts of power as compatible with the traditional centralized utility model. State requirements for utility-scale renewable power were accompanied by the adoption of net metering statutes, allowing electricity customers to net their energy use and production on a monthly basis. These policies had a minimal impact until decades later.

The Third Wave of Change

It was economics as much as new state policy in the mid-2000s that powered a third wave of change, a wave that has yet to retreat.

A second tier of states adopted renewable energy standards (some with set-asides for distributed renewable energy), voluntary green purchasing programs, and numerous state energy efficiency standards. Some states and utilities adopted feed-in tariff programs or substantial incentive programs for distributed solar, such as the California Solar Initiative, or solar renewable energy credit markets. The market introduced third party ownership, providing substantial simplification of going solar for homeowners and businesses. Most important, the economics of solar – large and small – improved dramatically, leading to a surge in installations.[9]

Sensing the foundations shifting under the Utility 1.0 business model as energy use decreased and customers began generating more of their own power, states began experimenting with "decoupling" and "lost revenue adjustments." These policies allowed utilities to maintain revenue even as electricity sales fall.

These incremental policy changes are insufficient.

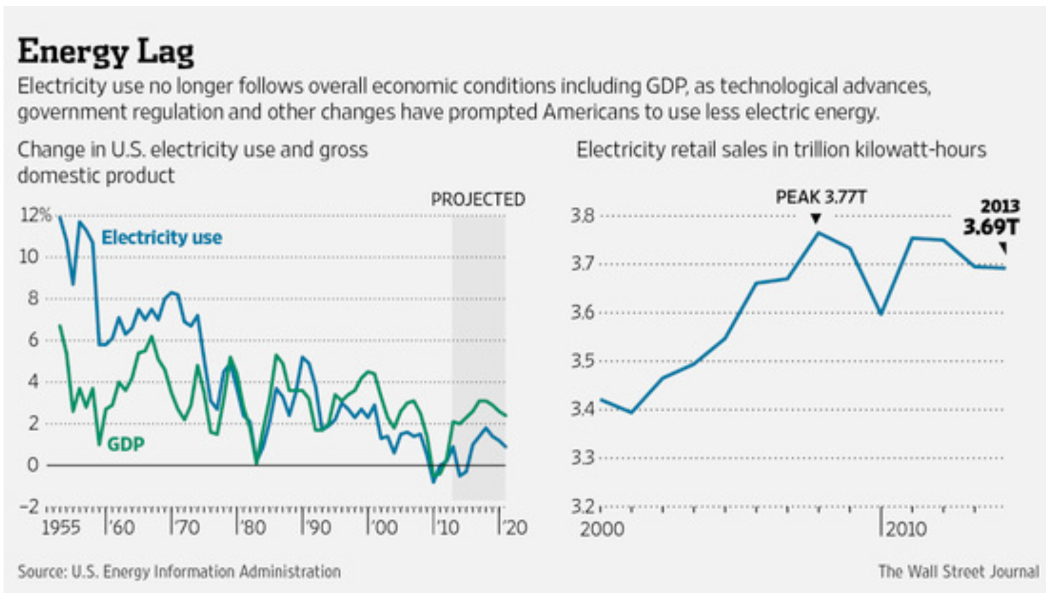
Solar energy, in particular, has become the flashpoint (in over 20 states[10]) for the struggle between utilities and their customers for control of the future electricity system. Unlike previous innovations, solar is rising at the same time that widespread use of smartphones and distributed computing could allow – with an open market for innovation – utility customers unprecedented power to shape their energy use and production.

The Present

Aggressive state policy and cost reductions for clean energy have created two business model crises for electric utilities: stagnant sales and exponentially rising production from distributed renewable sources.

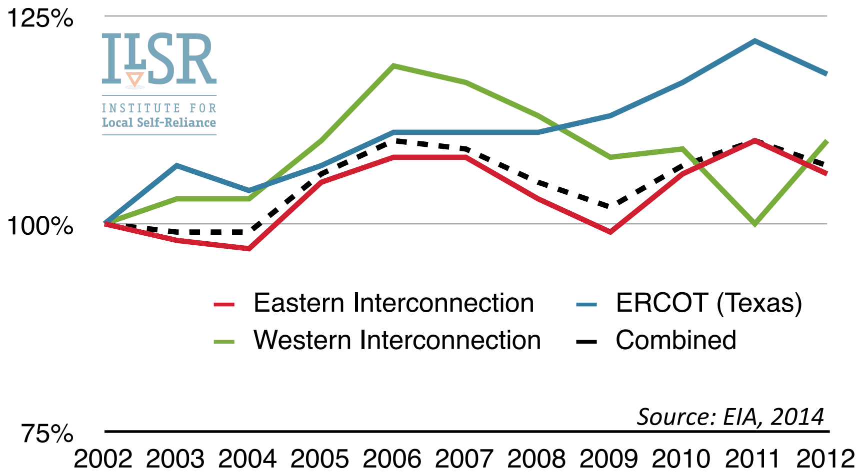
The End of Rising Electricity Consumption

Overall electricity sales peaked nearly six years ago, and per capita consumption has been stagnant for over a decade. The Wall Street Journal reports that electricity use has almost entirely decoupled from economic growth; that is, the U.S. economy can grow without increasing electricity consumption.[11]



Although total sales may be stagnant, utilities are facing a need for increasing "peak" capacity (short duration times when energy demand is at its maximum), shown below. The chart indicates the change in the maximum demand for different regions of the U.S. electricity system, called "balancing regions" because they are geographic areas within which supply and demand are balanced. The data points are the hour of highest demand in a given year, and the trend is upward for every region.

Summer Peak Demand by Grid Balancing Regions (2002 = 100%)



The traditional way utilities meet rising peak energy use is by building new power plant capacity – most still do this today. Stagnant sales mean utilities have to raise rates to recover the cost of building new power plants, whereas previously they could spread the cost over rising sales.

This means that if regulators do nothing to encourage alternatives to new power plants, electric rates are likely to continue rising rapidly (they're up 50% faster than inflation since 2001).[12]

A BETTER WAY?

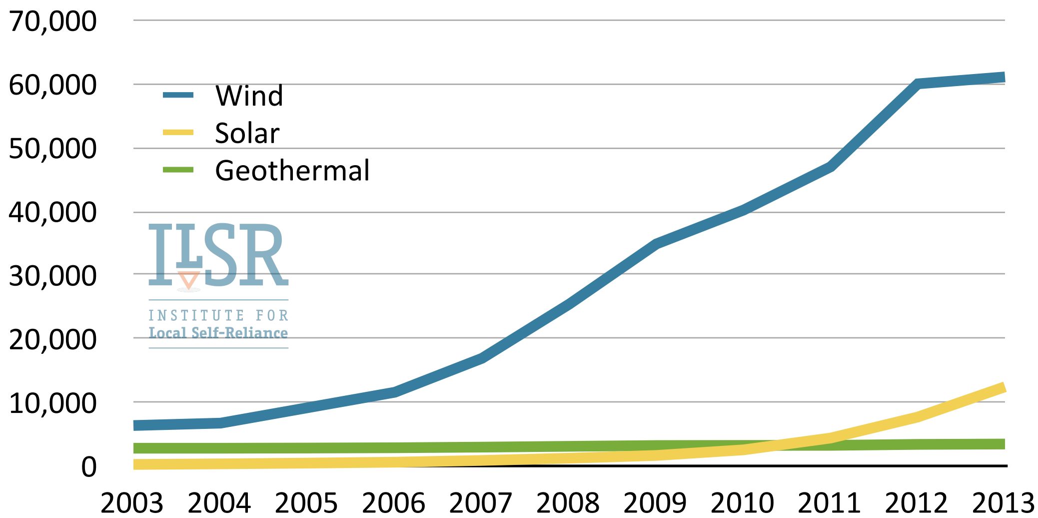
The bulk power system is designed to meet retail peak demand, which in New York tends to be approximately 75 percent higher than the average load. For that reason, much of the system is underutilized most of the time.

Reforming the Energy Vision

Surging Renewable Energy Growth

Renewable energy (excluding hydro power) supplied 7% of U.S. electricity in the first half of 2014, up from 2% in the year 2000. Including conventional hydro power (from large dams), renewable energy supplied 14% of U.S. power in the most recent year.[13]

Installed Wind and Solar Power Capacity (Megawatts)



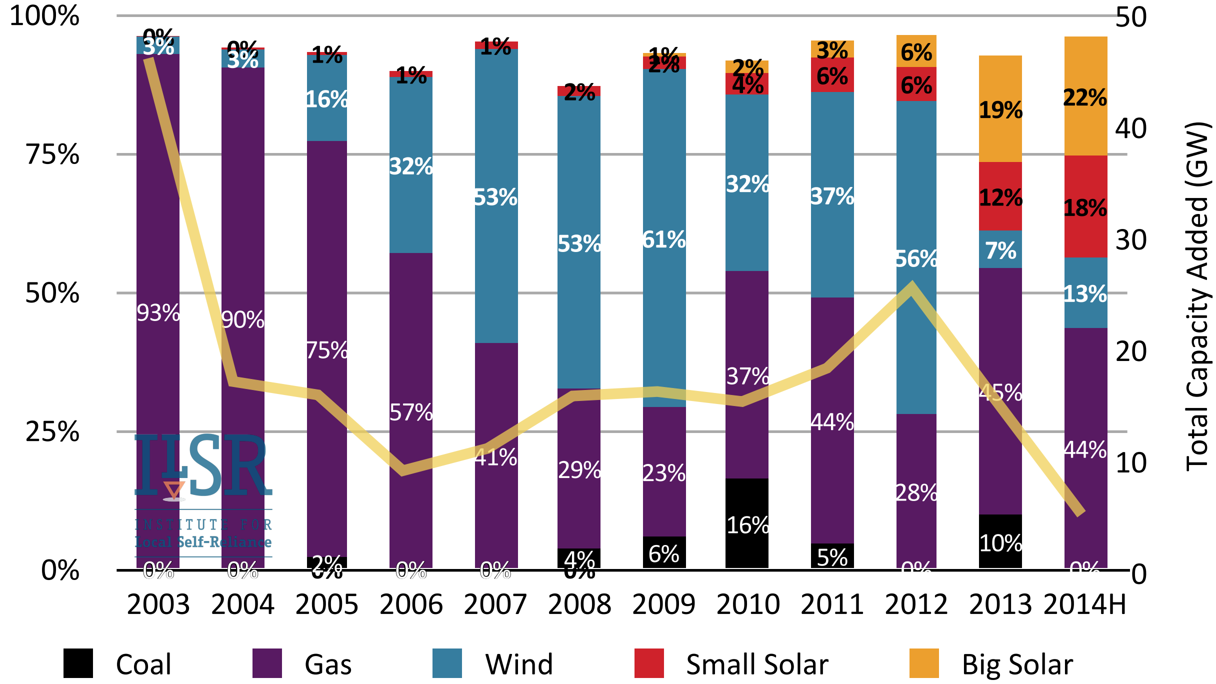
Sources: SEIA, AWEA, Geothermal Energy Association

Renewable energy can be a twin threat: to a utility's existing power plants and, increasingly, to its retail sales to ultimate customers.

Since 2006, 30% or more of new power plant capacity has come from wind or solar power. Since wind and solar have zero fuel cost (and in the case of wind, a federal production incentive), they can outbid any other power supplier on the market. Thus, new renewable energy can threaten existing utility power plant sales, especially with overall sales remaining flat. However, utilities can and do own wind farms and large-scale solar projects. Centralized wind and solar, in other words, can be built in harmony with the existing ownership structure of the grid.

Utilities are less able to accommodate an increasing share of renewable energy capacity from distributed, small-scale resources. The chart below shows that small solar (residential and non-residential installations) accounted for 12% of new power plant capacity in 2013, and 18% in the first half of 2014.[14] Rooftop solar has grown so much in recent years that "more than a half-million homeowners and commercial customers have installed solar PV."[15] By serving their own and their neighbors' needs, these on-site solar producers cannibalize utility retail electricity sales at the source.

U.S. Power Plant Capacity Additions, 2003 through 1st Half of 2014



Source: Energy Information Administration, 2014

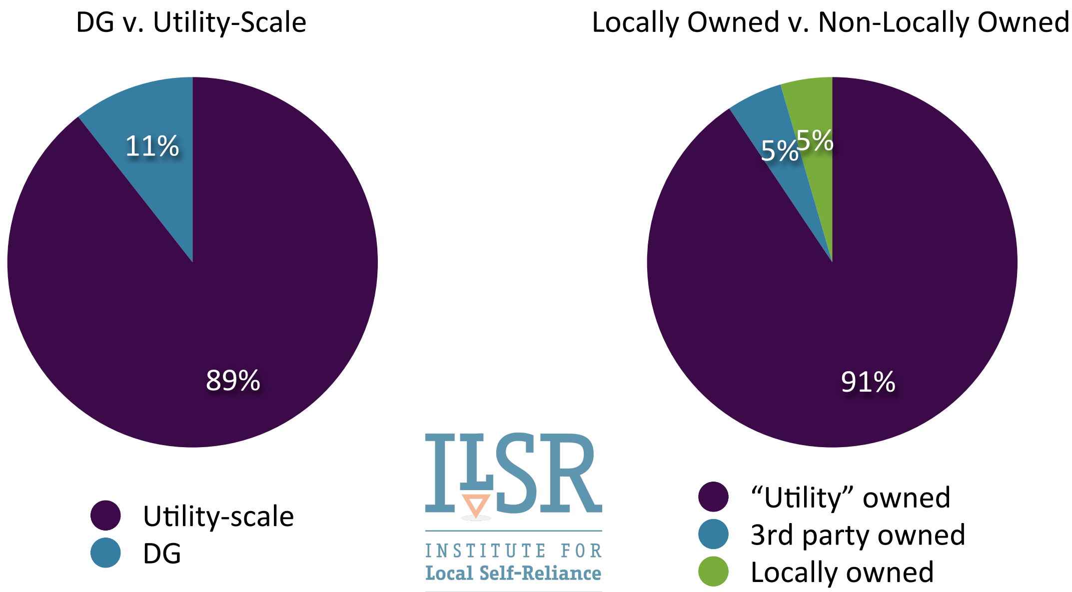
For most U.S. utilities, these challenges are largely theoretical. Distributed power generation has so far only posed a real threat in states with abundant sunshine or high electricity prices, e.g. Hawaii, California, New Jersey. But the price trends suggest that the threat will become broader very quickly, as shown in this solar parity map from ILSR.

Note: Wind power development has slackened since the expiration of the federal tax credit, but is picking up again. Over 1200 MW were built in the first three quarters of 2014 and over 13,000 MW are under construction.[16]

Scale and Ownership

Even with the technological advances in distributed generation, ownership has not shifted significantly to the customer. Through 2013, about 11% of the electricity from wind and solar power came from distributed generation (*see endnote for more on the size cutoffs for "distributed" energy*).[17] For local ownership of wind and solar, the fraction is also relatively small, about 10%, counting systems that are owned and leased.[18]

Distributed and Locally-Owned a Small But Growing Slice of U.S. Wind+Solar Power



Sources: SEIA, AWEA, Lawrence Berkeley Labs, California Solar Statistics

In wind power, the vast majority of projects are larger than 20 megawatts to capture economies of scale. The trend continues toward larger turbines, but a similar number of turbines per project (about 50).

For solar power, an inherently more distributed technology, the outlook is more promising. While large solar is also growing, distributed solar alone accounted for over one-quarter of new power generation in the first half of 2014, up from 1% in 2009. Local ownership accounts for about half of these projects and, with a shift away from leasing and toward ownership in the making, it may be a rising fraction in the coming years.[19]

Tensions

The flattening of electricity demand and rise in distributed renewable energy are causing tension in the utility business. Utilities continue to make investments in the grid as though these changes are not already happening, largely because their financial incentives remain tied to a Utility 1.0 business mode. As former utility executive Karl Rabago says, "utilities simply do not think things they do not own or control can be resources."

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The regulatory system is also poorly structured to adapt, with utilities arriving at hearings on a new business model prepared to fling verbal fists rather than flowers. Even investments that utilities have made in 2.0 infrastructure – e.g., smart grids – tend to reinforce the utility-centric paradigm of last century's electric grid (more on that later).

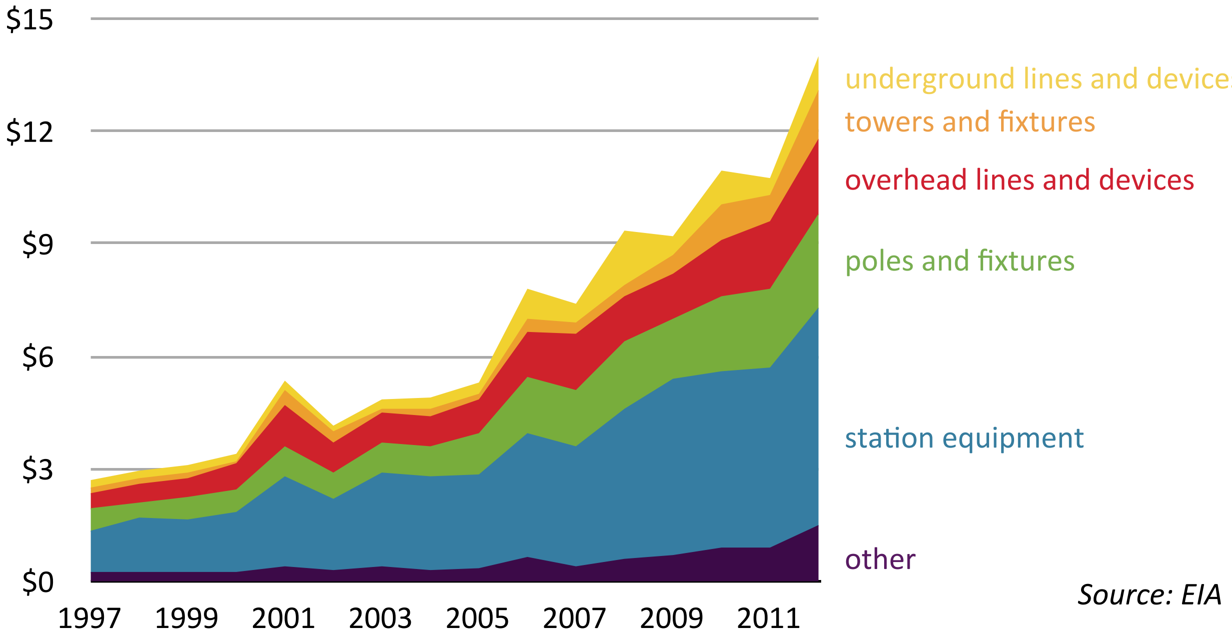
Utilities Invest in 1.0 Era Infrastructure [20]

One of the key distinctions between the 20th century and 21st century utility systems is the scale of power production and transmission. The distribution system, rather than the transmission system, is likely to be the hub of the 21st century electricity system, acting as a two-way network between power producers and consumers. Unfortunately, this system is aging badly.

The American Society of Civil Engineers estimates that utilities will have to spend $20 billion annually over the next several years just to replace aged distribution infrastructure and that, "America will see an investment gap in distribution infrastructure of $57 billion by 2020."[21] Not only that, but "the majority of the spending on distribution in recent years has been targeted at hardening the system against weather-related outages," and not in preparing for a two-way grid to support lots of distributed renewable energy systems.

On the other hand, utility spending on new and upgraded transmission lines has increased steadily since 2007 (not long after the 2005 Energy Policy Act increased the ease and financial return for doing so). "Investor-owned utilities plan to spend an additional $54.6 billion on transmission infrastructure [between late 2013 and] 2015."[22]

Actual Transmission Investment By Investor-Owned Utilities (1997-2012)[23]



The issue isn't that transmission infrastructure is useless, but that it may represent a 40- to 50-year bet against several alternatives:

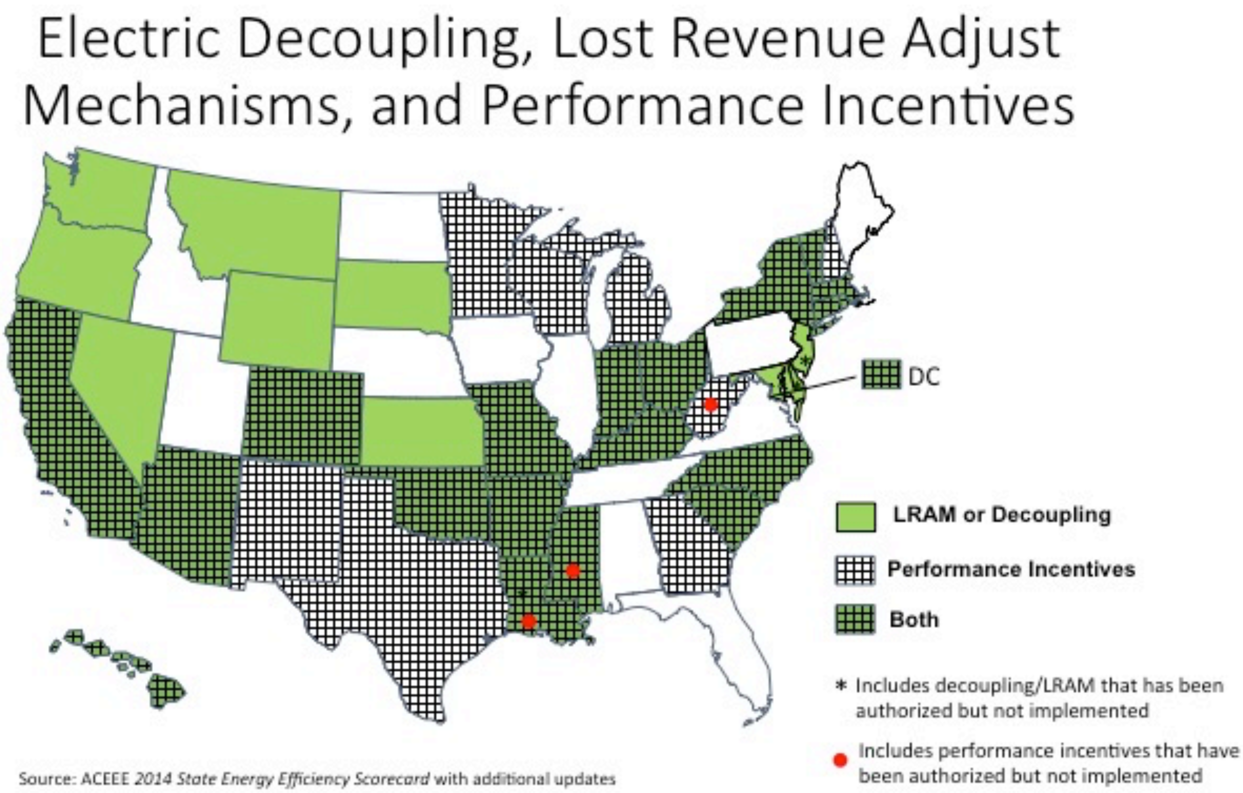
- non-transmission solutions like GridSolar's solar, demand response, and efficiency project in Maine, forecast to cost one-third what the original transmission proposal would have.[24]
- locally-generated and owned renewable energy, that even with a higher incremental cost will have greater local economic benefits.[25]
- the rise of cost effective electric vehicle to grid and distributed storage opportunities.

There will certainly be some centralized renewable energy development if the United States is to achieve a massive reduction in carbon emissions. Additionally, balancing supply and demand regionally with high-voltage transmission has advantages over accommodating calm or cloudy days locally. But as discussed later, the planning process for transmission projects lacks the transparency and objectivity for proper decision making.

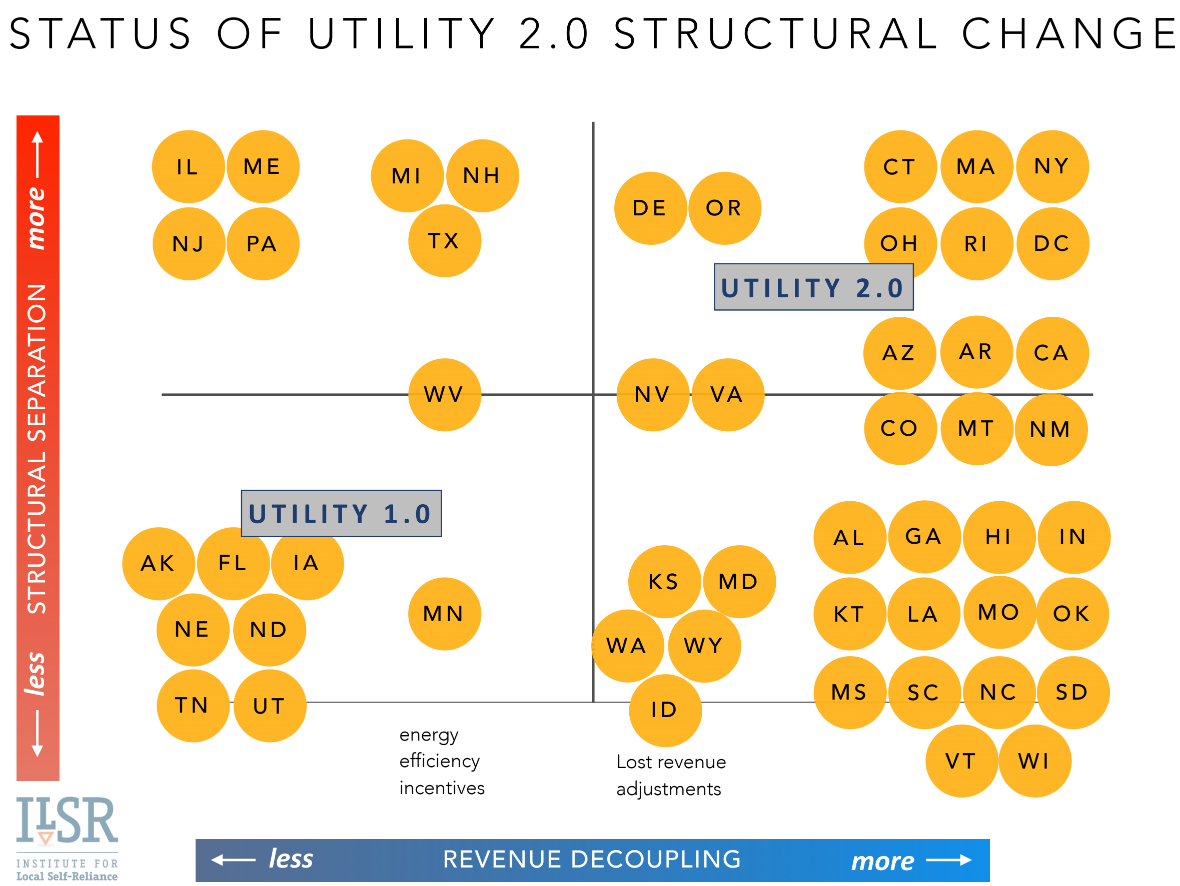
Utilities may also have too heavy a "1.0" perspective in their recent investments in natural gas power plants. From 2003-2011, 80% of new natural gas capacity was in the form of combined cycle power plants.[26] While substantially more efficient than simple combustion turbines, these power plants are not able to ramp output up and down as quickly, a crucial feature of a grid with large amounts of variable wind and solar power. Simple combustion turbines can ramp their output up and down by 22% of maximum capacity per minute. Combined cycle power plants are similar to traditional coal power plants, and can only ramp output by 2.5% per minute.[27] With a 40-50 year life, fossil fuel power plants being built now have to be ready to operate in a grid dominated by renewable energy resources.

Incentives Still Support Utility 1.0

The utility regulatory system of the 21st century has continued to struggle with how to layer renewable energy and distributed renewable energy requirements on a 100-year-old business model that still encourages building infrastructure and increasing energy sales. As the following graphic from the ACEEE shows, about 20 states have adopted "decoupling"or "lost revenue adjustment" – policies keeping utilities financially whole in the face of energy efficiency or other factors.[28] Utilities in other states may receive some incentives for investments in energy efficiency, but many do not.



In other words, many utilities still have an incentive to increase energy sales. The following graphic illustrates the position of state regulatory regimes on the basis of revenue decoupling for sales (on the bottom axis) and adds in another factor mentioned in the Prelude section, structural separation (vertical axis). The latter, which represents the degree to which power generation, transmission and distribution, and retail sales are separated into independent entities, is an important component of Utility 2.0, although it has a smaller impact on behavioral incentives. Utilities in the lower left quadrant are operating in what is largely a 1.0 business model, while utilities in the upper right are closest to a 2.0 model.



While revenue decoupling can reduce the pressure to increase sales, incentives to build new power plants and power lines are often stronger. Most decoupling policies only apply to energy sales, not to the utility's return on equity – averaging 10% in 2013 – from building new power plants.[29] As noted by Commission staff in New York: "[Rate of return] regulation may...encourage the utility to over-invest in capital spending, because earnings are directly tied to rate base."[30] Ultimately, utilities that win approval for their capital investments are rewarded by the market, with a better credit rating and lower cost of capital. In the case of interstate transmission, utilities may be rewarded by the Federal Energy Regulatory Commission with a bonus to their return on equity.[31]

This creates a unique tension in development of new power plants and transmission lines. Some new power lines, for example, are intended to allow centralized wind and solar power plants to deliver electricity from very windy or sunny locales to cities. Though these projects support the development of more clean energy, they are also an investment in a centralized transmission system that is a hallmark of Utility 1.0. The narrow measure of cost-benefit applied by a Public Utilities Commission may find that a clean energy transmission project delivers more benefits than costs.

However, such approvals don't necessarily weigh the competing interest of affected communities. Illinois residents might prefer slightly more expensive local wind power to imported power from North Dakota because of the attendant economic benefits. And the approval process for a power line may lack a robust exploration of potentially *more* cost-effective non-capital alternatives like energy efficiency or distributed generation.

A final incentive that hampers transition to a 21st century electricity system is that utilities have every incentive to operate existing and new capital assets for as long as possible. When the payments for construction are fully depreciated, the low operating costs of existing infrastructure makes utilities reluctant to shut down power plants or power lines when they can still earn revenue in operation, even when they are no longer in the public interest.

Public Regulation or Regulatory Capture by Utilities?

Many of the enabling statutes for state regulatory commissions expressly mention the preservation of the public interest. Despite this legal charter, in most states regulatory commissions tend to see themselves as arbiters between public interest advocates and utilities rather than an actual advocate for the public interest. Contesting utility interests is left to non-utility “intervenors” who must clear many hurdles:

- For one, they must have “standing,” meaning that the Commission believes they have a right to share their opinion and that their opinion is not represented by other intervenors. In Colorado, the Public Utilities Commission recently violated 40 years of precedent in dis-allowing utility watchdog Leslie Glustrom from participating in utility dockets.[32]
- The process also requires comprehension of legal language and an ability to construct comments in the same language. For example, see this paragraph from recent comments submitted to the Minnesota Public Utilities Commission by Xcel Energy:

  > *These comments respond to the Commission’s request that parties build the record regarding the design and use of an appropriate adder, if any, for use with the VOS in CSGs, consistent with the requirement that the program plan reasonably allows for the creation, financing, and accessibility of gardens.*

- There’s frequently a cozy relationship between regulated utilities and the state Public Utilities Commissions, meaning the arbiter of disputes may have many personal (and past or potential financial) ties to the incumbent utility or the utility representative may have formerly sat on the Commission.[33]
- Finally, utilities can use their customer revenue to finance their perspective before the Public Utilities Commission while independent intervenors typically have to self-finance several thousand dollars for their intervention. If independent intervenors do receive compensation for their work, it’s always after the fact.

In his farewell letter in 2014, former California utility commissioner Mark Ferron highlights the challenge of a Commission viewing its charter too narrowly and of the utilities’ increasing reliance on a confrontational strategy:

> *“The Commission will come under intense pressure to use [its] authority to protect the interest of the utilities over those of consumers and potential self-generators, all in the name of addressing exaggerated concerns about grid stability, cost and fairness.”*

> *"I am very worried about our utilities' commitment to their side of the regulatory compact. We at the Commission need to watch our utilities' management and their legal and compliance advisors very, very carefully: it is clear to me that the legalistic, confrontational approach to regulation is alive and well. Their strategy is often: "we will give the Commission only what they explicitly order us to give them".*[34]

Federal regulators also struggle to support the public interest, especially in rules for evaluating interstate transmission lines.

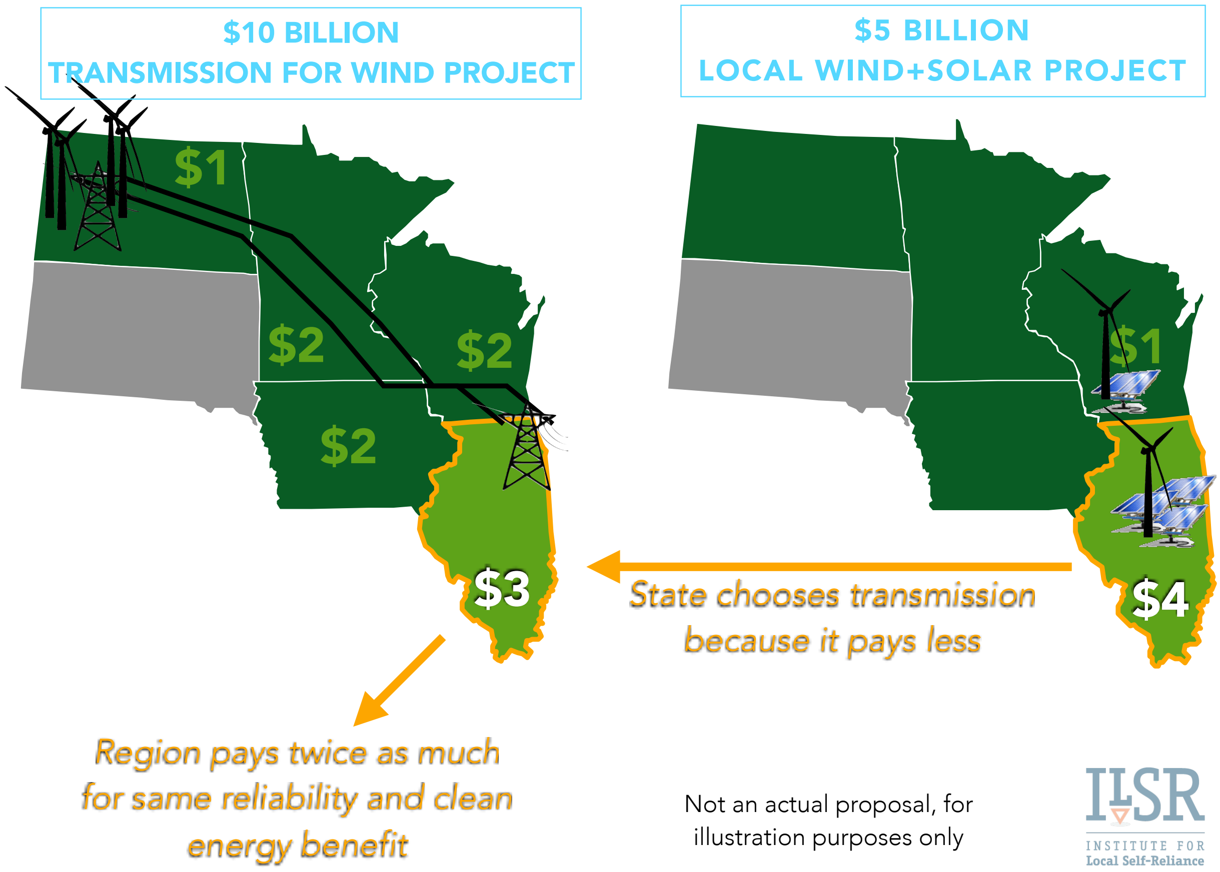
Photo credit: Jonas K, modified by John Farrell

One of the central governing rules of interstate transmission – FERC Order 1000 – was supposed to create a meaningful evaluation of non-transmission alternatives to new power lines. But the rule only requires that a utility *consider* alternatives proposed in the process, it does not obligate them to offer alternatives. In other words, to have a meaningful debate of alternatives requires a dedicated third party – a state agency, commercial or industrial customer, or nonprofit – to show up to contend with a utility's transmission line proposal on its own dime.

Participation by third parties is remarkably onerous. For an outside entity to offer a transmission alternative, they have to request access to data about grid operations that many utilities shield as "trade secrets," be able to competently model the grid impact of a non-transmission alternative without access to the same proprietary software package or trained engineering staff used by the incumbent utility, and then cast the alternative in the technical and legal language expected at a regulatory proceeding.[35]

Alternatives to transmission projects face another hurdle: compensation. While FERC has established rules for sharing the cost of transmission lines along the route they extend, non-transmission projects have no such cost allocation process. The following graphic illustrates how state regulators in Illinois, for example, would elect a more expensive regional transmission project rather than a less expensive localized non-transmission alternative, because the impact to their particular state is less (even if the economic benefit is greater).[36]

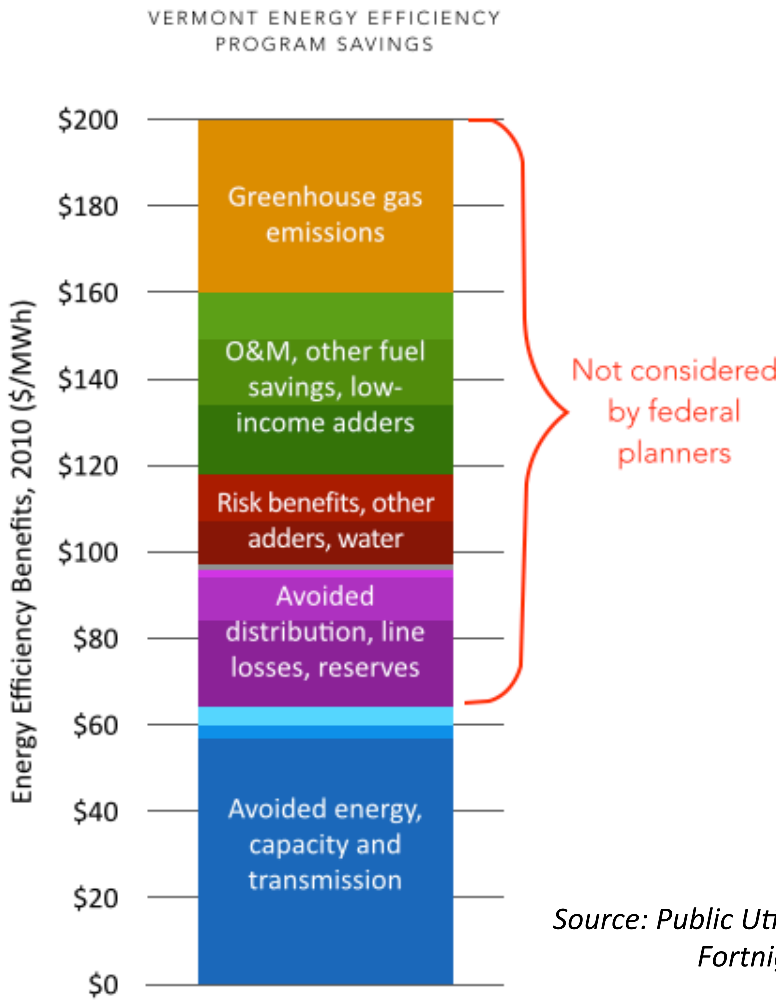
Regional Cost Sharing Means States May Favor Transmission Over Cheaper Alternatives



Not only is it difficult for non-transmission options to share costs, but utilities frequently receive federal incentives for high voltage transmission lines that cross state boundaries. The overseer of these bonus payments – the Federal Energy Regulatory Commission – has doled them out to 4 of every 5 requesting utilities, resulting in an average return on equity of 13%.[37]

Finally, the federal overseers of transmission projects don't consider any non-grid benefits that would weight a decision toward a transmission alternative for serving grid needs. For example, while Vermont state regulators consider a wide range of benefits in their cost-benefit calculation of energy efficiency improvements (shown in the following chart), only a small slice of the benefits (in blue) would be considered by federal transmission planners, even though energy efficiency can meet the same needs for reliability and grid capacity.[38]

State Regulators Consider Non-Transmission Projects Values That Feds Ignore



Source: Public Utilities Fortnightly

Local economic benefits are a key omission in both federal *and* state regulatory bodies. In 2009, ten governors of East Coast states raised objections to federal legislation to expedite regional transmission, because it would pre-empt their efforts to build more renewable energy capacity within their states.[39] Despite this and other evidence that states would prefer to make evaluations of new grid infrastructure on these broad energy and economic values, most regulatory bodies focus narrowly on benefits to utilities and utility ratepayers.

Utilities Fight to Retain Ownership of Renewables

Even when they appear to accept the technological shift toward renewable energy, utilities have clearly stated their intent to retain ownership and control over the production and distribution of energy, and their customers' energy dollars.

Xcel Energy in Minnesota is a potent example. After purchasing nearly all its wind power from independent developers, the investor-owned utility is shifting to building and owning wind farms (and getting a rate of return on its capital expenses).[40] It's also making the case, with a video advertisement, for utility-scale (and owned) solar and against small-scale solar.[41] Even municipal utilities in San Antonio, TX, and Palo Alto, CA have found purchases of utility-scale renewable power economical. In the case of San Antonio, it has not only purchased substantial amounts of large-scale solar via contract, but has also proposed reducing compensation it pays to small-scale solar electricity producers (who are, ironically, also the utility's owners).[42]

In Arizona, an investor-owned utility has gone a step further than resisting customer-owned power generation. Arizona Public Service began by imposing a tax on individual solar installations in late 2013. Just a few months later, they announced their intention to rent 3,000 of their customers' roofs to install 20 megawatts of utility-owned solar.[43] Their customer competitors – and the installation and leasing companies that serve them – didn't mince words:

> *Distributed solar companies say the utility's proposed move into rooftop solar amounts to a monopolistic market-grab, since APS would rate-base the initiative, spreading costs over all its ratepayers. "They don't have to think about whether they can do something profitably. It will be profitable because they can rate-base it," SolarCity's Bass told Utility Dive at the time.*[44]

Despite misguided support from the state's ratepayer advocate office, the commission staff have recommended killing the utility's initiative, and instead recommend the utility offer a solar rebate for customer-initiated solar installations.[45]

Duke Energy, the largest utility holding company in the United States, has also simultaneously proposed large-scale solar investment while trying to quash competition from smaller producers.[46] The utility has proposed owning or purchasing power from over 500 megawatts of solar power plants – earning a 10% rate of return on the plants it owns – while trying to reduce eligibility for third-party solar projects. Shawn LeMond, a former Republican North Carolina legislator says it's an anti-competitive move.

> *"Duke is putting $500 million into solar," LeMond said. "But what they are doing at the utility commission is stopping independent [developers] from building five times that. The market would build a lot more solar, but Duke is fighting it."*

In addition to contests between utilities and their customers, monopoly utilities have also tried to crowd out competition from other utilities and their subsidiaries. In Iowa, monopoly regulated utility MidAmerican successfully applied to the state's Public Utilities Commission (the Iowa Utilities Board) to build $2 billion worth of new wind power plants, despite noting in its application that the power would not be needed by its customers for at least 8 years (the utility was already selling 40% of its capacity into wholesale markets).[47] The utility's application also included a request for a guaranteed 12.2% return on equity for its investment.

NextEra, the second largest wind power developer in Iowa behind MidAmerican (and a parent company of another monopoly regulated utility, Florida Power & Light), offered an alternative.

"Buy the power from us at a lower price," they argued. NextEra ultimately sued to have the unfavorable Utilities Board decision overturned.[48] In particular, they objected to the monopoly utility getting a guaranteed return on investment for a project that could have been competitively bid (or at least competitive between two corporate wind developers). The state Supreme Court rejected NextEra's challenge.[49]

"Smart" Grid Upgrades Lacking Intelligence

Utilities have invested a great deal of money in the so-called smart grid (over $7.9 billion in projects partially funded by the 2009 federal stimulus),[50] but their investments have typically reinforced their dominance of the grid, not facilitated a new paradigm of democratic ownership.

Smart meters are the perfect example. Digital electric meters, linked with customer computers, smart phones, and tablets could give unprecedented power to consumers to see and manage their energy costs. But utility smart meters investments typically focus on a few narrow utility benefits, rather than customer benefits.[51] Of the 28 states that have installed new metering infrastructure, 16 simply provide automated reading functionality to replace manual meter readings (and meter readers).[52] Only 12 have so-called "advanced metering," and in a study called *Getting Smarter about the Smart Grid*, author Timothy Schoechle explains how these advanced meters have fallen short:

- Many don't allow for two-way communication
- Many don't provide data in real-time to customers
- Many don't allow for integration of software for home automation
- Many are poorly equipped for local demand response
- Utilities show little ability to effectively use the data

Most of the benefits have accrued to utilities, not utility customers. The *Grid Modernization Index* (source of the earlier data on advanced metering infrastructure), for example, ranks many important pieces of a modern grid, almost all which involve superior grid operations by the utility, and virtually none of which empower customer generators.[53] Even the Green Button initiative, meant to give customers access to their own utility data, has only been adopted by 10 U.S. utilities.[54]

Fortunately, not all smart grids are so un-intelligent. The one exception to the rule is owned and operated by a publicly-owned electric utility in Tennessee.

> "While other utilities have focused on remote meter-reading as their smart grid investment, Chattanooga decided to build a "Mensa grid," which would be much more intelligent."

One Actual Smart Grid: Chattanooga
In the mid-1990s, the municipal electric utility serving Chattanooga, TN, decided to create an "advanced intelligent distribution system."[55] They built out a partial fiber optic network to improve electric service. Eventually, the utility offered telecommunications services on its network, including phone and internet service.

In 2007, the utility laid out a 10-year plan for a full fiber optic network. "While other utilities have focused on remote meter-reading as their smart grid investment, Chattanooga decided to build a "Mensa grid," which would be much more intelligent."[56] Two keystones of the system were intelligent sensors that could detect and route around grid outages, and remote meter readings that would be shared instantly with ratepayers in real time.

The electricity system network (different from the broadband network) didn't offer fiber optic connections to every premise, but fiber to neighborhood nodes, with wireless networks to the meter. Built atop a robust fiber optic network, the wireless network provides many advanced smart grid features and big cost savings:

- Smart sensors minimized the spread of electricity outages, saving 5 million customer minutes (30 min. per customer) from mid-2011 through mid-2012.
- Some business customers are able to forgo redundant electric feeds because of high reliability.
- Smart meters let the utility know when outages have been resolved, saving 680 man hours in just two weather events.
- The utility is able to notify customers about spikes in their own energy demand.
- The smart grid is likely to provide the city $300 million in economic benefits over 10 years. According to the electric industry's Electric Power Research Institute, "the stated value for this benefit appears to be hard, reasonable, and perhaps a little low.""

As hinted above, the Electric Power Board decided to extend its fiber network as a telecommunications service and now offers fiber optic connections to all residential and commercial buildings in Chattanooga, with some of the fastest and inexpensive internet speeds in the country.

The municipal utility has recently gone a step further, inviting local entrepreneurs to sift through the enormous amount of (anonymized) data collected on Chattanooga's smart grid, including "a range of voltage, power quality and asset health information." The local businesses may be able to help devise ways to make the grid more efficient and effective for customers.

Perhaps nothing sums up the local utility's smart grid better than this statement from Danna Bailey, vice president of corporate communications: "[As a municipal utility, we have] some freedom to do some things that we think are really great for this community. In fact, we think that's our job."[57]

Adapt or Die

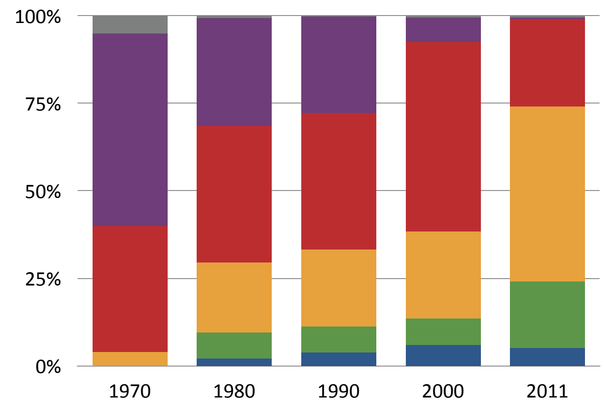
The rise of distributed renewable energy and customer ownership is a clear disruption of the utility business model, but utilities have largely responded to these disruptions as Mahatma Gandhi suggested entrenched institutions would:

"First they ignore you, then they ridicule you, then they fight you, and then you win."

For years, utilities could afford to ignore and ridicule distributed generation as on the margins. But a slew of reports in the past three months suggests that's no longer possible.

In an August 2014 piece in Public Utilities Fortnightly, former FERC Chairman Jon Wellinghoff suggests, "The traditional electric distribution monopoly model is increasingly out of sync with prevailing electricity market trends and rapidly expanding [distributed energy resource] adoption."[58] A September study by by Lawrence Berkeley National Laboratory found that as customer use of net metering ramps up, the impact on utility shareholders was going to substantially exceed the impact on other utility customers.[59] Also in September, investment bank Barclays downgraded their outlook on U.S. electric utilities, part of a multi-decade trend in lower credit ratings for U.S. utilities.[60]

Evolution of Credit Ratings of Electric Utilities, 1970-2011
(S&P Credit Ratings for U.S. Shareholder-Owned Electric Utilities)



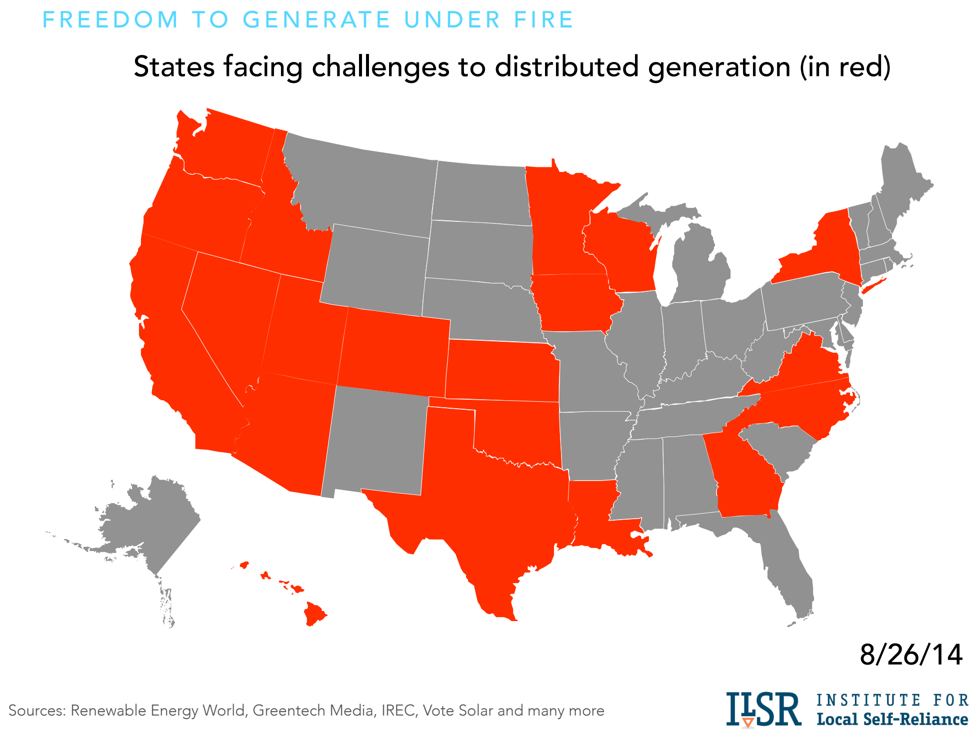
Source: Peter Kind

These recent assessments reinforce a January 2013 report for the utility trade organization, Edison Electric Institute, suggesting that utilities are past ignoring and ridiculing distributed generation and energy efficiency and have recognized the existential threat.[61]

Given this threat to their bottom line, utilities have chosen to fight.

The following map illustrates the states where utilities have initiated legislative or regulatory fights against customer ownership of power generation.[62] Their strategies are wide-ranging, from constraining when and how projects connect to the grid, capping the amount of customer-owned projects, or substantially reducing compensation for customer-owned power generation.

State Battlegrounds over Net Metering and Value of Distributed Energy



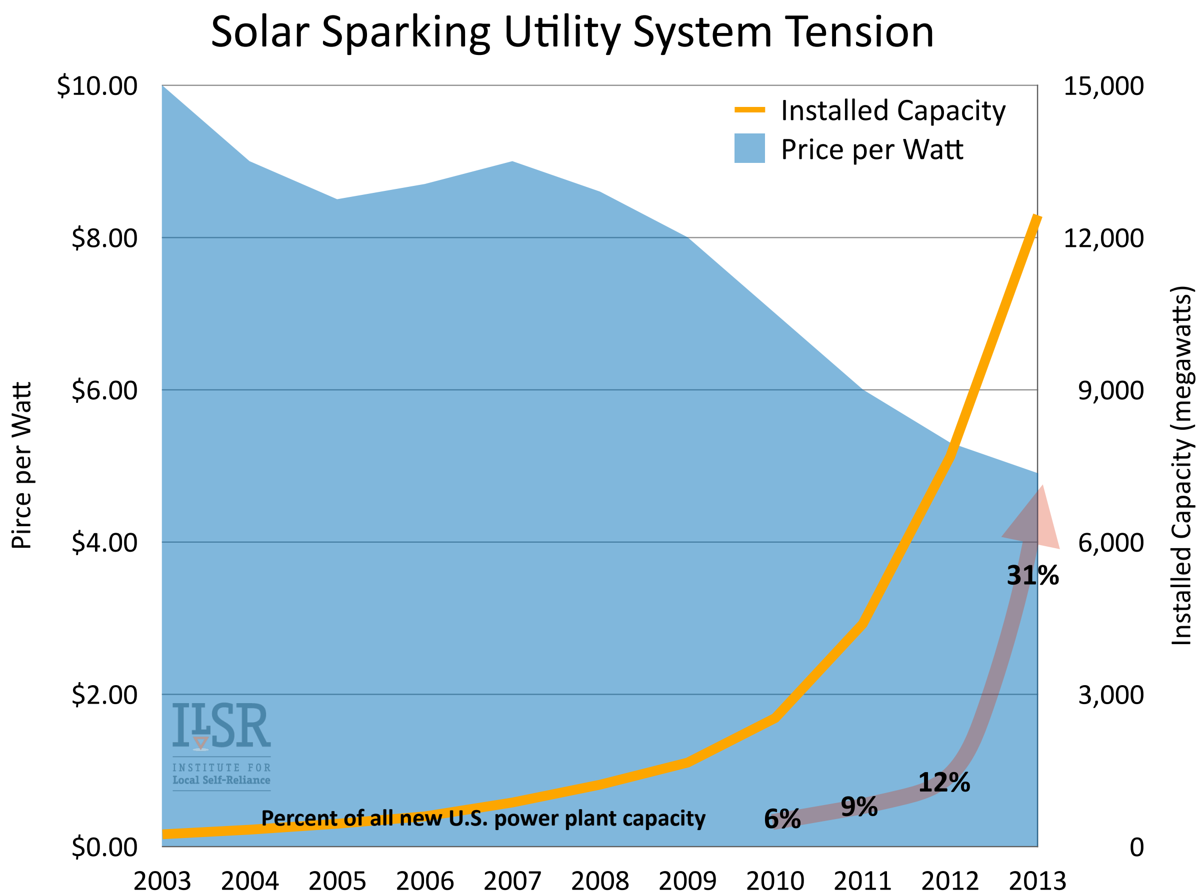
The problem for utilities is that fighting isn't likely to prove effective in the long run. For one, they're facing a tidal wave of technological innovation (e.g. batteries and microgrids combined with smartphones and distributed computing) and increasingly cost-effective alternatives to utility-provided electricity (e.g. solar). For another, winning this battle means completely alienating their customers.

This means that the utility of the future can't look like the utility of the past or present, but must take a new form to remain relevant in a democratized energy system.

The Future

Unfortunately for utilities, new technology and commercial opportunities in the coming years will only increase the threat to the 1.0 business model.

Solar energy is growing exponentially as costs have fallen 28% per year from 2009-2013, and electricity from rooftops is approaching or passing parity with utility prices.[63]



Energy storage, mostly via batteries, already allows utility customers to do "arbitrage" – storing electricity when it's cheap and minimizing purchases from the grid when electricity is expensive. Commercial customers can use storage to cut demand charges, a substantial portion of their bill. Batteries are even being packaged with rooftop solar arrays by companies like SolarCity.[64]

Take storage a step further and folks could "cut the cord" by having their own independent power system, or with the ability to separate from the larger grid as a "microgrid." It's already happening, influenced by major disasters like Superstorm Sandy in 2012. Many East Coast communities got a firsthand taste of the weaknesses of a centralized, Utility 1.0 system. Power outages lasted for days and hit an unprecedented number of people: "8.5 million people [were] without power in twenty-one states."[65] Notably, many microgrids or backup generators were able to remain online throughout the storm and aftermath, including microgrids at a USDA facility in Maryland and a cogeneration plant at New York University.[66]

Electric vehicles, becoming popular because of much lower mileage costs than gasoline, will become another potential tool for individuals and microgrid operators to manage their electricity use.

From a widely circulated industry study in 2013, it's clear that utilities now recognize distributed power as an existential threat.[67]

Fortunately, the future utility business model, commonly called Utility 2.0, is already in development. Below, we explore the most common principles and polices for shaping the 21st century electricity system – Utility 2.0 – and examine its track record in the few states that have begun implementation.

We also illustrate how Utility 2.0 could come up short of the potential for an economic transformation of the energy system, and how Energy Democracy (or Utility 3.0, if you prefer) adds a few crucial principles that enable the continued rise of customer-owned power generation and control of their energy future.

Principles, Structure, and Policies of Utility 2.0

Although the future of utilities encompasses many smaller issues – rooftop solar, energy storage, energy efficiency – the fundamental question of Utility 2.0 is, "how can we incentivize the electric utility to do what we want?"

"What we want" varies, but most of the utility and energy policy thinkers exploring a version 2.0 electric utility add the following **principles** to the basic ones of reliable, affordable electricity service:

- Reduced energy consumption, through efficiency and conservation
- Reduced carbon emissions, through a switch from fossil fuels to renewable energy
- Increased grid efficiency via a two-way, networked smart grid that uses demand response, local power generation, and other local resources
- Increased grid flexibility to integrate large quantities of variable (distributed and utility-scale) renewable energy

Notably, these principles do not align with current financial incentives for most investor-owned utilities (or the typical business practices of most utilities; private, public, or cooperative). Furthermore, the principles are indifferent to the economic opportunity. That is, they can be implemented with utility control of the grid and its benefits or with a massively decentralized and democratized electricity economy.

The proposed **structural changes** to meet these Utility 2.0 principles vary in detail, but they have two common themes:

- Planning that integrates local and regional level resources. In other words, ensuring that when planning for new power plants or power lines, utilities (or grid managers) consider how needs can be met with local solutions including rooftop solar, energy storage, electric vehicles, and even non-capital measures like controllable, smart appliances.
- Independent, neutral operation of the distribution system. In other words, removing the conflict of interest that causes incumbent utilities to prefer building new infrastructure to conservation, efficiency, or local power from competitors or even utility customers.

Prominent proposals include proactive system planning (addressing the first point) in Hawaii[68] and New York's Reforming the Energy Vision (which addresses both).[69]

The key element of structural change to Utility 2.0 can be summed up by this excerpt from *America's Power Plan*: "This new kind of distribution system needs a new kind of management."[70]

Should Incumbent Utilities be the New Distribution System Operator?

When Pope Julius II wanted the Sistine Chapel's ceiling painted, he didn't hire the house painter. He went for the best. Somewhere out there is a Michelangelo of distribution system design and operation. It might be the local utility. We won't know unless we look.

Scott Hempling, June 2014

Underneath these structural changes are the core policies of a Utility 2.0 framework: separating utility financial health from energy sales (a concept typically called decoupling) and separating utility profits (for investor-owned utilities) from building and owning infrastructure.

Decoupling precedes the recent focus on Utility 2.0, having already been adopted in 7 states (with a dozen other states either piloting decoupling or using alternative policies with similar outcomes). This policy breaks the connection between electricity sales and utility revenue, to remove the dis-incentive for energy efficiency. Some ten states have gone further, completely removing energy efficiency program responsibility from the utilities to a third party.[71] However, regulators in New York warn that while decoupling makes utilities indifferent to sales losses from energy efficiency and distributed generation, it does not shield ratepayers from the risk of widespread revenue loss should distributed generation grow substantially.[72]

The other substantial policy change is shifting from shareholder returns based on infrastructure investments to performance-based returns; returns based on a flexible, low-carbon, efficient electricity system. Some states, like New York, have layered financial penalties for non-attainment on top of the existing return on equity formula. In other words, for-profit utilities can lose money when they fail to accomplish objectives related to clean energy. But as of yet, no U.S. state has transitioned to a business model that rewards utilities solely for their ability to meet Utility 2.0 benchmarks.

Rising Utility 2.0 Models?

A few states have begun moves toward a new utility business model and their experiences are instructive. We include one international example, since it's illustrative of the open distribution marketplace that many Utility 2.0 advocates desire.

New York

It's rare that a report from the Department of Public Service can become a banner for the transformation of the energy system, but the April 2014 release of "Reforming the Energy Vision" (REV) from New York's Department of Public Service has set the standard for the meaning of Utility 2.0.[73]

The report is notable because it challenges two of traditional paradigm's core principles: "that there is little or no role for customers to play in addressing system needs...and that the centralized generation and bulk transmission model is invariably cost effective, due to economies of scale."

The REV report is clear that while it prioritizes expansion of a distributed energy system, "it is not intended to replace central generation, but rather to complement it in the most efficient manner, and to provide new business opportunities to owners of generation and other energy service providers."

The regulators of New York's electricity system have already made many moves toward Utility 2.0 and have learned several lessons.[74] Commission efforts include basic Utility 2.0 strategies like revenue decoupling and performance-based rates (with penalties for poor performance), as well as incentives for energy efficiency and distributed renewable energy, demand response, simplified interconnection, robust net metering, and a Green Bank to finance advanced energy projects.

Some lessons from these reforms indicate that the transition to Utility 2.0 isn't without its challenges. For one, it's been hard to determine, in advance, if utilities are spending enough money on grid maintenance, with utilities and regulators having to come back for supplementary rate cases when estimates have been inaccurate. Additionally, the performance-based incentives need to be improved with more frequent re-evaluation, higher penalties that are sufficient to win compliance, and some allowances to encourage learning through trial and error.

Utility regulators have also realized that removing the link between utility revenue and energy sales (decoupling) is not sufficient. Utilities often retain an incentive to build and own their own infrastructure at the expense of alternatives such as customer-owned solar. Without new policy, "in the long term, utilities still have an incentive to maximize their capital expenditures, and little incentive to optimize system efficiency to reduce capital needs."[75]

New York's efforts toward a Utility 2.0 model aren't alone. The state has also been leader in many energy democracy policies like net metering, a set-aside in its renewable energy standard for customer-sited energy, and incentives for distributed solar power. It's performance is middling, ranking 11th in state wind power capacity, and 9th in solar (despite having the third largest population).[76] In energy efficiency, ACEEE ranks New York 7th in the nation.[77] It may begin climbing the ranks, however, as the governor recently announced a $1 billion commitment to distributed solar energy development.[78]

Hawaii

With oil-fired power plants reliant on costly oil imports, Hawaii's electric utilities are on the front lines of the threat to the 1.0 business model. They sell the most expensive electricity in the United States, causing utility customers to stampede to less costly rooftop solar. In 2013, more than 1 in 5 of distribution feeders (neighborhood power lines) already had more than 15% of peak demand provided by distributed solar.[79]

Prior to the crush of customer solar, the state had already implemented decoupling to insulate the utilities' bottom line from the loss of sales. However, the utilities planned poorly for the surge in distributed renewable energy installations and responded with caps on customer-owned power generation.

State regulators intended that to change with a stakeholder process in early 2013 that proposed the islands' largest utility, Hawaiian Electric Company, adopt a proactive approach to planning. The new process meant to integrate the utility's interconnection and distribution planning functions, requiring the utility to forecast distributed solar growth and to plan infrastructure upgrades to the distribution grid accordingly.[80] Despite the proposed changes, permits for new rooftop solar installations fell by 44 percent from 2013 into 2014.[81]

In May 2014, the state's Public Utilities Commission took further steps. Issuing a white paper on the future of the state's electricity system, Commission orders also required Hawaiian Electric Company to re-do its resource plan to improve its planning for distributed generation, to "expeditiously" retire older power plants, and increase grid flexibility with demand response and storage. The Commission also specifically ordered the Maui-based utility to stop curtailing renewable energy generation in favor of power purchases from its own fossil fuel power plants.[82]

The Commission orders are already making a difference. In October 2014, Hawaiian Electric, Maui Electric and Hawaii Electric Light released a revised integrated resource plan to achieve 65% renewable energy by 2030; and for the island of Hawaii specifically, 92% renewable energy by 2030.[83] The plan also allows for a tripling of rooftop solar installations.

These improvements are not final, as the dockets and Commission orders are still open for review.

Maine

In 2009, the Maine legislature got a jump on New York's *Reforming the Energy Vision* by initiating an investigation by the state's Public Utilities Commission into a "smart grid coordinator." The proposed entity would manage utility and non-utility distributed generation and infrastructure to achieve many of the Utility 2.0 principles, including:[84]

- Increased use of digital information and control technology...and provision to consumers of timely energy consumption information and control options
- Deployment...of [distributed] renewable capacity resources
- Deployment...of demand response technologies, demand-side resources and energy-efficiency resources

- Deployment of smart grid technologies, including real-time, automated, interactive technologies
- Deployment and integration into the electric system of advanced electric storage and peak-reduction technologies, including plug-in electric and hybrid electric vehicles

In 2012, the PUC approved the launch of a pilot project by distributed generation company GridSolar to implement a local alternative to a new transmission line serving the coastal community of Boothbay Harbor.[85] Using energy efficiency, rooftop solar, and battery storage, GridSolar says their non-transmission alternative cost one-third what a new transmission line would have. In 2014, they returned to the PUC to take their project statewide, as the envisioned "smart grid coordinator."

Despite the purported success, the incumbent utility is pushing back against the notion. In April 2014, Central Maine Power returned to the PUC to request a redesign of electricity rates that would penalize rooftop solar producers.[86] Fortunately the Maine Public Utilities Commission rejected the substantial standby fees and fixed charges proposed by Central Maine Power, and deliberations over the smart grid coordinator are ongoing.[87]

The Netherlands

The vision of a massively decentralized energy marketplace (the second prominent structural change of Utility 2.0) is already in place in the Netherlands, according to the Rocky Mountain Institute:

"A Dutch company called 'Van de bron' ('From the source') allows Dutch consumers to see which solar, wind, combined heat and power, or other energy source exists in their vicinity and buy their energy from there. Balancing services are provided by the network operator. No traditional retailer sits between the consumer and the producer. Energy generation becomes as sharable as lodging through AirBnB or cars through Lyft."[88]

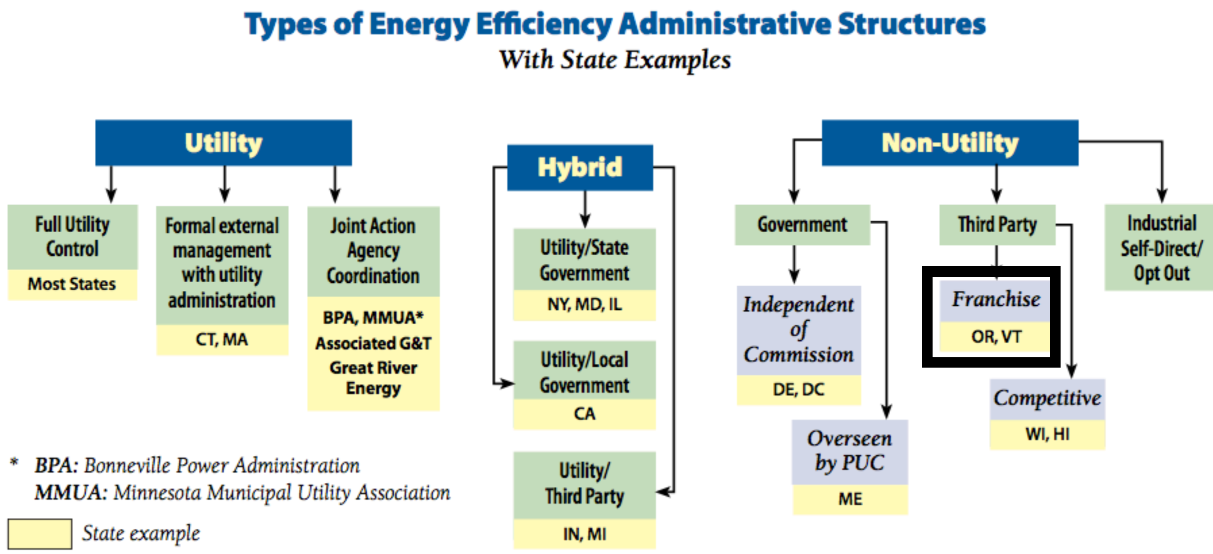
Vermont: Utility 2.0 in Action?

Vermont's regulatory environment most closely approximates many Utility 2.0 principles, with the exception of largely retaining utility control over the distribution system. Although the state has shifted toward this new utility model over 15 years, recent policy moves were triggered by the anticipated 2014 closure of the Vermont Yankee nuclear power plant that has supplied 35% of the state's electricity.

Energy Efficiency

In 1999, the state's Public Service Board awarded the first energy efficiency utility contract to the Vermont Energy Investment Corporation. This new initiative pooled the energy efficiency investments of all the state's utilities into a single and single-purpose entity to save energy, Efficiency Vermont. In 2013, Vermont was one of seven states with a non-utility manager of the state's energy efficiency programs, as shown in this graphic from the Regulatory Assistance Project.[89]

Energy Efficiency Program Structures (Regulatory Assistance Project)

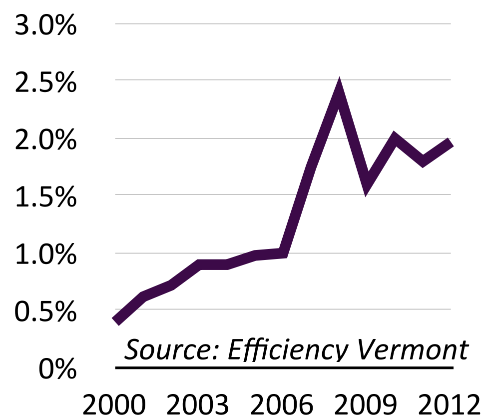


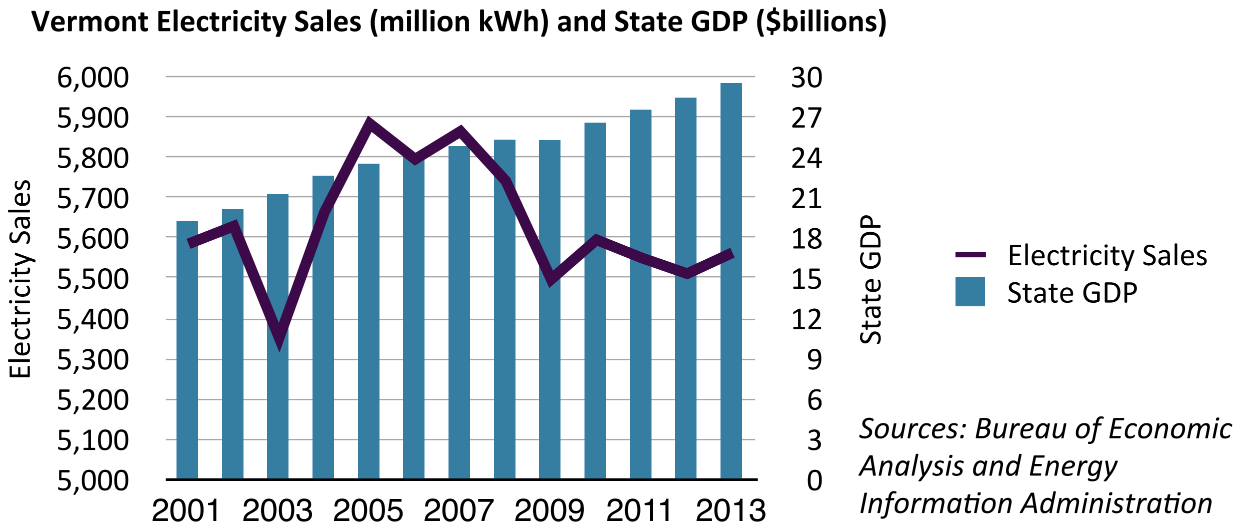
Note: This figure refers to types of administrative structures for consumer-funded energy efficiency programs. State examples refer to the primary administrative structure existing in each state.

Over time, the savings from the agency's efficiency programs have risen steadily, to approximately 2% of electricity sales.[90]

In 2007, Efficiency Vermont successfully saved enough energy to drive total energy sales down for the first time, and the energy efficiency utility has maintained that high level of savings in the years since. Cumulatively, since 2000 energy efficiency has supplied 12.3% of electricity services, contributing to flattening electricity demand.[91] The chart below shows how Vermont's relatively stable electricity demand hasn't hampered economic growth.[92]

Savings from Efficiency Vermont (% of statewide sales)





Integrated Planning

In 2003, the Vermont Electric Company requested a permit for the first new high voltage transmission line to be built in Vermont in 30 years. Although the project received its permit in 2005, "the Public Service Board (PSB) concluded that...with earlier planning, the reliability problems in question might have been addressed with less costly, non-transmission solutions."[93]

Thus the Vermont System Planning Committee was formed (with members of distribution utilities, the public, and energy efficiency suppliers like Efficiency Vermont) to identify alternatives to transmission to meet grid reliability needs. The Legislature enacted changes to Vermont law requiring the Vermont Electric Co. to produce a long-range transmission plan and update it every three years.[94]

The Committee has already had notable success. In 2011, the regional grid planner ISO-New England identified a "Central [Vermont] deficiency." A 2013 study by the state's Planning Committee found that distributed generation and energy efficiency are closing the reliability gap, removing the project from the regional ten year plan, and saving ratepayers $157 million in transmission upgrades.[95]

Standard Offer Program for Distributed Generation

In 2009, the Vermont legislature adopted a standard offer or "feed-in tariff" program to encourage small-scale renewable energy generation. The program provides 15-to-25-year contracts for power generation from biomass, wind, hydro, landfill and agricultural methane, and solar energy. The program originally had fixed and published prices, with a total program size of 50 megawatts (MW), and projects limited to 2.2 MW or smaller.

Subsequent changes (in 2012) to the program have raised the program cap to just over 127 MW (11-12% of year 2008 peak electricity demand),[96] but changed the pricing mechanism to a reverse auction that favors the largest size projects that fit under the cap. With a 5 MW annual limit on new capacity, this has resulted in just 2-3 projects developed per year, largely by out-of-state developers.[97]

So far, the program has resulted in 39 MW of new distributed renewable energy generation, 75% from solar, 13% from farm-based methane, and the remainder split between hydro, biomass and landfill methane. By the end of 2014, the total is expected to rise to about 45 MW.[98]

Net Metering & Value of Solar

Adopted in 1997, Vermont's net metering law allows individuals or groups of utility customers to offset their energy use with a 500 kilowatt or smaller renewable energy system. Solar producers receive an "adder" to their net metering credit, sufficient to award them 20¢ per kilowatt-hour.

Until recently, the net metering program was capped at 4% of the state's energy sales, but with the support of the largest electric utility, Green Mountain Power, the program cap was recently raised to 15%. "Green Mountain Power was confident that it can both encourage distributed solar and maintain a healthy financially strong utility,"[99] because solar is a "hedge against increased transmission costs; and as insurance against costly spot-market purchases during summer spikes in demand"[100]

Green Mountain Power isn't the only Vermont utility benefitting from net metering. Darren Springer, deputy commissioner at the Vermont Public Service Department, says "net metering allowed the Vermont Electric Power Company (VELCO) to avoid a $250 million transmission line upgrade."[101]

Not all Vermont utilities support net metering, because of differences in their electricity demand. While Green Mountain Power has its peak energy demand in the summer (when solar production also peaks), other Vermont utilities have their peak demand in the winter.

The recently raised net metering cap also launched a net metering 2.0 stakeholder process to assess how customer-generated power will work technically and economically in the utility of the future.[102] It also includes an estimate of the "value of solar" where the Public Service Board will annually review the "costs and benefits incurred as a result of any single net metering installation installed in 2015 or a later year" to ensure the policy remains a good deal for ratepayers.[103]

Rate Decoupling

Vermont instituted partial decoupling policy for its two largest investor-owned utilities in the mid-2000s.[104] As in many other states, it has helped insulate these utilities from the substantial energy savings produced from energy efficiency programs.

Summary

Vermont has a mix of Utility 2.0 policies, particularly decoupling, integration of distribution and transmission planning, and the separate oversight of energy efficiency programs. It also has two key energy democracy policies – net metering and a feed-in tariff – that are among the most ambitious in the country (as a percentage of potential load and peak demand served). In contrast, its renewable energy requirement is remarkably weak in contrast with other states, showing a greater dependence on distributed generation to achieve renewable energy growth.

Vermont may have traveled farther along the path toward Utility 2.0 than most states (excepting Hawaii or California, perhaps), but the regulatory model falls short on some key structural changes. The distribution system remains firmly in control of incumbent utilities, far from the independent distribution operator envisioned by New York's *Reforming the Energy Vision* and others.

On the other hand, the state is achieving many of the principles of the 2.0 electric utility system. Its energy efficiency achievements rank among the best in the country. Close to 15% of its electricity comes from renewable energy in 2013, putting it among state leaders. It even has elements of energy democracy because the combination of the net metering and feed-in tariff programs mean as much as 25% of the state's peak energy demand will be met by distributed generation, far more than most other states.

Vermont is definitely a state to watch.

Principles, Structure, and Policies of Energy Democracy

Energy democracy can best be described as an electricity system that empowers the individuals and communities that have the energy resources of the 21st century (e.g. wind and solar) to economically benefit from their use. It shares the principles of Utility 2.0 – an efficient, low-carbon, and flexible electricity system – and adds two more key **principles**: local control and equitable access.

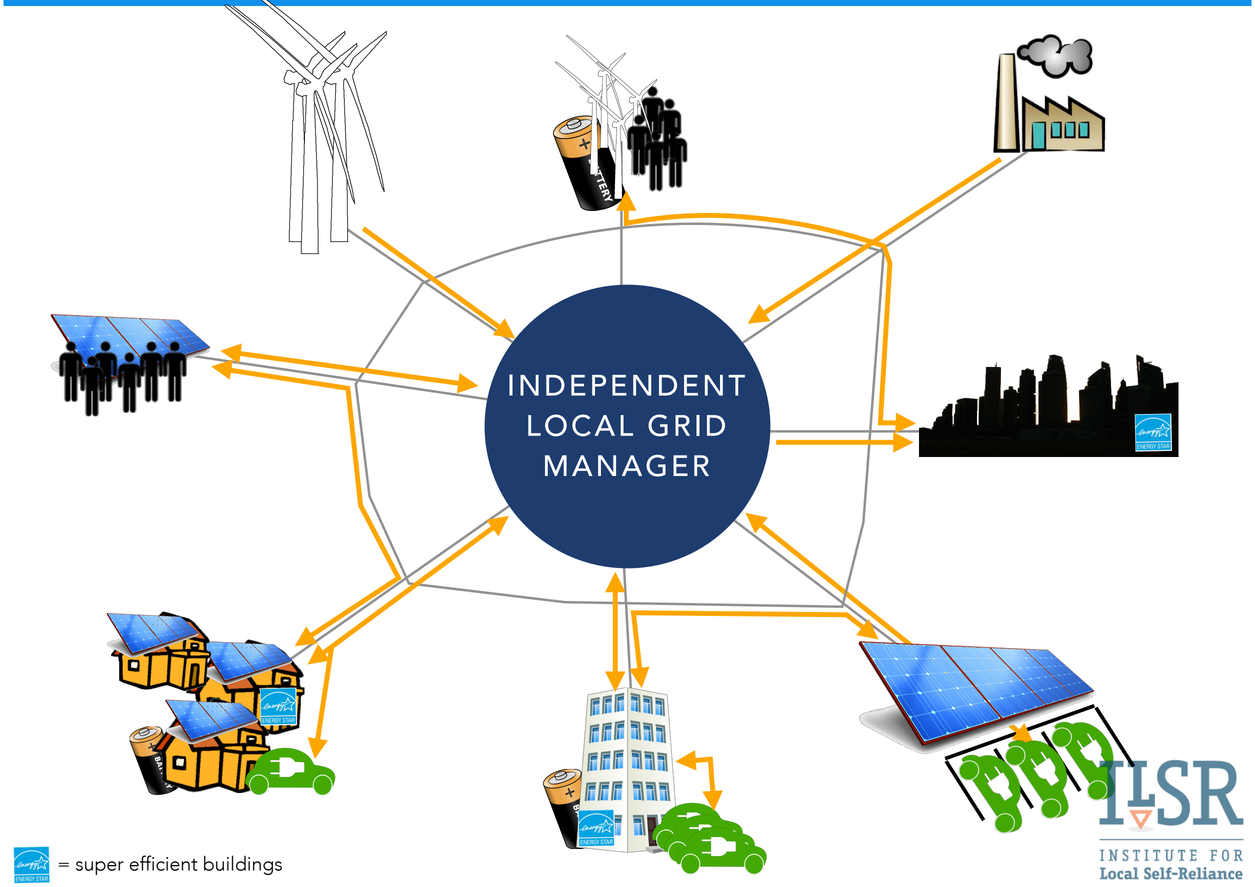
- Local – communities should have authority to make decisions about their energy economy, with weight given to economic benefits not just energy costs. As ILSR's research has shown, local ownership of renewable energy systems has a substantially higher local economic impact, sufficient to outweigh marginally higher production costs.[105]
- Equitable – all individuals should have access to ownership and authority over the grid, even if they don't own property or have substantial wealth. Since the resources of a 21st century electricity system (wind and sun) belong to everyone, all residents of a community should share in the wealth generated from them.

The **structural** center of a democratized electricity system is grid management that cannot discriminate against its users, similar to management of roads. Road networks don't differentiate between the Postal Service or UPS, and the distribution grid should be similarly open to resources from any provider. The grid manager should not have a financial interest in building new wires or power plants at the expense of its competitors. The rules of the grid should also enable peer-to-peer transactions via equal access and transparent pricing (for energy, voltage and frequency response, ramping, etc). This would mean that a wind farm on a Native American reservation can sell power to a solar-dominated microgrid in Minneapolis, and vice versa.

In this, energy democracy mostly overlaps with New York's Utility 2.0 debate, except for the former's more explicitly political perspective. Shifting to an independent electricity network manager can resolve the continued economic and political conflict of interest that has public utilities lobbying in front of legislators and utility commissions against policies supporting rooftop solar, energy storage, and other decentralized sources of electricity.

The following graphic illustrates the energy democracy concept, with widely decentralized and renewable energy production, individual and community ownership, super energy efficient buildings, and peer-to-peer provision of energy services. The grid operator would coordinate these resources to match energy supply and demand and maximize grid efficiency. Not pictured is the role of the grid operator or manager in prioritizing "software" solutions to energy needs, e.g. shifting when smart appliances do the laundry or wash dishes instead of building new power plants.

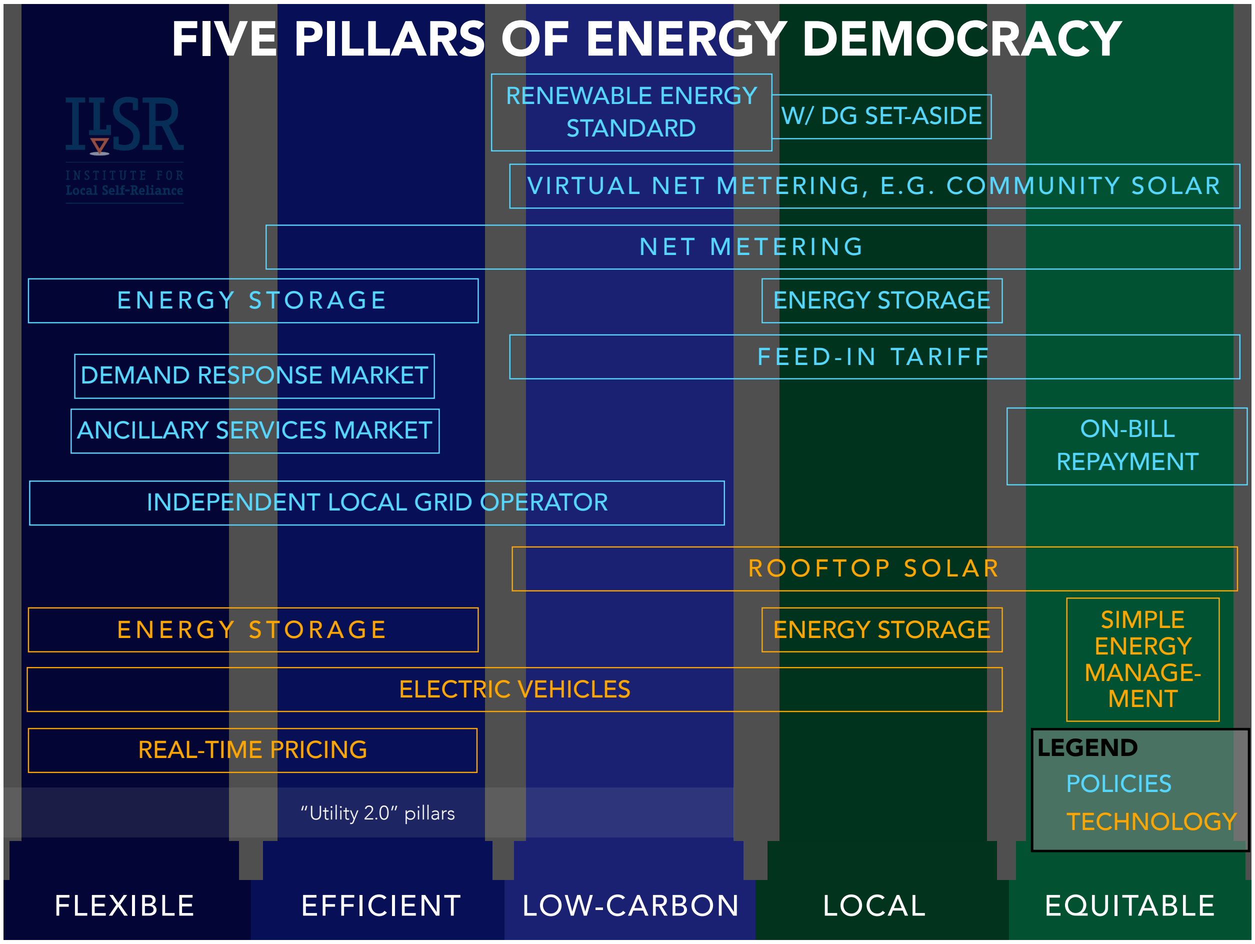
ENERGY DEMOCRACY IN ACTION



We won't have to look far for the **policies** to support energy democracy, because many of the them are already in place. Net metering and streamlined interconnection, for example, enshrine the basic right of an electricity participant to generate energy from their own resources and for their own needs. These and policies like value of solar or feed-in tariffs build on and complement net metering by emphasizing the importance of being able to share excess electricity production with the grid at a fair price. Community energy projects or "shared renewables" (via virtual net metering) further expand the opportunity to be a power producer beyond those with property or a sunny rooftop, and reinforce the notion that a community can secure more of its energy dollars collectively, not just individually.

Energy democracy also relies on equitable access to capital and financing, access that has been sorely lacking. On-bill repayment and financing that eschews credit scoring are crucial to expanding the economic benefits of the 21st century electricity system to all.

The following graphic illustrates the types of energy policies and technology that will play a role in a 21st century electricity system, and how they overlap with the Utility 2.0 and 3.0 (energy democracy).



Although it's not expressly a policy, energy democracy requires community organizing and good management. Ensuring equitable access to the energy economy, for example, means substantial outreach and organizing in cities and even neighborhoods to educate and empower all grid customers about their opportunities. Energy democracy also requires the same smart energy management policies and tools of Utility 2.0. Vehicle-to-grid rules should enable electric vehicles to operate as components of community microgrids, providing balancing, ramping, and other services as well as absorbing excess renewable electricity production. Standardized, smart appliances and tools (like Nest thermostats) should enable electricity consumers to manage their energy use (production, consumption, and storage) in response to real-time grid signals, without real-time attention.

Achieving a local and equitable energy economy means adopting the principles, structure, and policies that make grid participation accessible to everyone: upper class and working class folks, whites and people of color, etc. Whether a user wants to just manage use, produce energy, or operate a microgrid, intelligent devices (e.g. WeMo switches or smartphone apps) should provide people with simplified energy management options accessible anywhere. The interface should automatically integrate real-time grid pricing and smart household appliances to provide participants with simplified choices. Managing energy should be as easy as managing a mutual fund by selecting a "moderate" or "aggressive" portfolio. And these tools have to be ubiquitous and affordable – perhaps provided freely like CFL bulbs – to ensure access.

Both Utility 2.0 and energy democracy (or Utility 3.0) will mean substantial changes to utility business models. Both will lead to an efficiently managed grid that relies much more heavily on low-carbon resources. Both will fundamentally change the relationship between incumbent electric utilities and customers. But only energy democracy will create an equitable energy economy, one that aligns the technological opportunity of a widely distributed, renewable grid with the economic opportunity for communities to seize control of the $364 billion market for electricity.

Energy democracy has one further advantage over Utility 2.0: the creation of a self-interested movement for clean, local power. The thousands of Americans empowered to control their energy use and become "prosumers" will also be proponents of policies that expand their access and economic opportunity. And, insofar as these opportunities involve low-carbon generation of electricity, energy democracy can be a faster path toward meaningful action on climate change.

Conclusion

Already, utilities and regulators across the United States are trying to adapt the rules of the electricity system to the new paradigm of distributed and renewable technology. It's a crucial opportunity: will the rules reinforce utility hegemony or give rise to a democratic energy system?

We don't yet know.

So far, the rules have changed incrementally, layering the principles of a version 2.0 utility on top of a 20th century system that largely secures a utility monopoly over the use of and profit from the electricity grid. Renewable energy and energy efficiency standards have wrought enormous change on the technology and use of energy. Decoupling and restructuring have introduced competition and reduced perverse incentives. But no policies have completely challenged last century's paradigm

In some sense, the smallest rules have had the biggest impact. Net metering, feed-in tariffs, and other tools empowering customer-generation have contributed to exponential growth in distributed solar. These energy democracy policies have created an entire class of increasingly self-reliant customer (and businesses to serve them) interested in challenging the utility dominance of the grid. They've had their taste of ownership and control over their energy future, and they're not interested in turning back.

The rise of community power suggests that the discussion of Utility 2.0 falls short as a technocratic or financial discussion about the sustainability of the utility business. The new energy owners aren't likely to be satisfied with a 2.0 utility that remains in control of $364 billion in annual electricity revenue.

Energy democracy is the answer.

While the 21st century electric utility will have incentives driving it toward a clean, efficient, flexible grid, energy democracy ensures that the benefits of this transformation are widely shared with utility customers. It means that customers wield substantial decision making power over their own and their community's energy economy. It means that all utility customers will have access to ownership and authority, especially those that have disproportionately paid for the externalities of the 20th century grid. It means that technology should make participation in a networked, transactive energy system simple for utility customers whether they are amateur engineers or "just pay my bill"-ers. It means shifting more of the $364 billion spent on energy from centralized, monopoly utilities to their value-building customers. It means a self-interested political movement for decentralized energy and local climate solutions.

It will be an exciting time.

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[1] *For more on this convergence, see the Third Industrial Revolution by Jeremy Rifkin*

[2] *See*:

- The Edison Electric Institute's Disruptive Challenges report. And this year, author Peter Kind, "has come to realize the inevitability of technological change—neither large utilities nor state regulators can stop the wave of innovation in energy efficiency, demand response, and clean energy."
- This New York Times story saying "a reckoning is at hand" (Sun and Wind Alter Global Landscape, Leaving Utilities Behind)
- This survey of North American utility executives, with 82% saying, "future energy needs will be met by a mix of traditional centralized generation and distributed generation, which feeds power from a mix of sources."
- APS, an Arizona utility, trying to subvert customer generation of solar by leasing residential rooftops and owning the solar itself.
- David Crane, head executive of utility company NRG has said repeatedly that, "The distributed, residential is going to end up swamping the big-scale projects."

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Previously I've described distributed renewable energy resources as those that interconnect to the distribution or low-voltage electricity system. Since that kind of interconnection data is difficult to find, I approximate by using 20 megawatts for wind projects and 1 megawatt for solar projects.

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For wind power, we assume that local ownership is nearly universal for small wind turbines (100 kW and smaller), but it's quite rare among large scale wind projects. We assume that one-quarter of wind projects 20 MW and under are locally owned (about 300 MW), and none of larger projects.

The total is about 3300 MW (4.5%) of locally owned renewable energy, with another 4.9% produced locally from leased solar arrays.

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