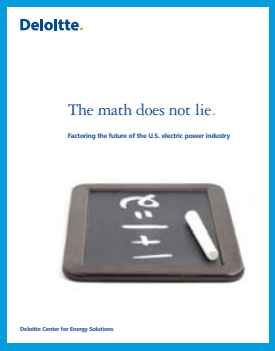
Deloitte.

The new math.

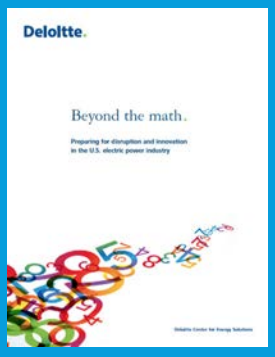
Solving the equation for disruption to the U.S. electric power industry

Deloitte Center
for Energy Solutions

Contents



www.deloitte.com/us/dothemath



www.deloitte.com/us/beyondthemath

The *New Math* is the third and final paper in a series from the Deloitte Center for Energy Solutions. The first two papers, *The Math Does Not Lie* (November 2012) and *Beyond the Math* (March 2013), are available at http://www.deloitte.com/us/dothemath and http://www.deloitte.com/us/beyondthemath, respectively.

Our goal in writing these three pieces is to assist electric companies' managements, their boards of directors, and their other stakeholders as they evaluate the rapidly changing U.S. electric industry landscape. This final paper examines the fundamental shifts that are already occurring in the electric industry's *license to do business* and in the field of players and new technologies that are providing electric services to U.S. business and residential customers. It also sets forth frameworks that are designed both to assist in analyzing and monitoring critical marketplace dynamics, and to serve as platforms for dialogue, consensus building, and the creation of new business models required to confront the challenges and seize the opportunities that lie ahead.

This paper is informed by a number of in-person interviews and discussions with electric company executives, leaders of clean tech companies, regulatory experts, and other stakeholders whose insights helped shape the vision of the *new math* that is emerging in the United States electric power industry. A full list of interviewees is provided at the end of the paper.

Introduction

Impending disruption to the traditional U.S. electric industry business model has been the topic of much discussion. Many believe profound change is inevitable and, in some respects, may well be self-fulfilling. However, many aspects of this subject continue to be debated:

- How fast will today's business model change?
- What will the new model(s) look like?
- Who will be the industry participants?
- What roles will technology, customers, and regulators play?

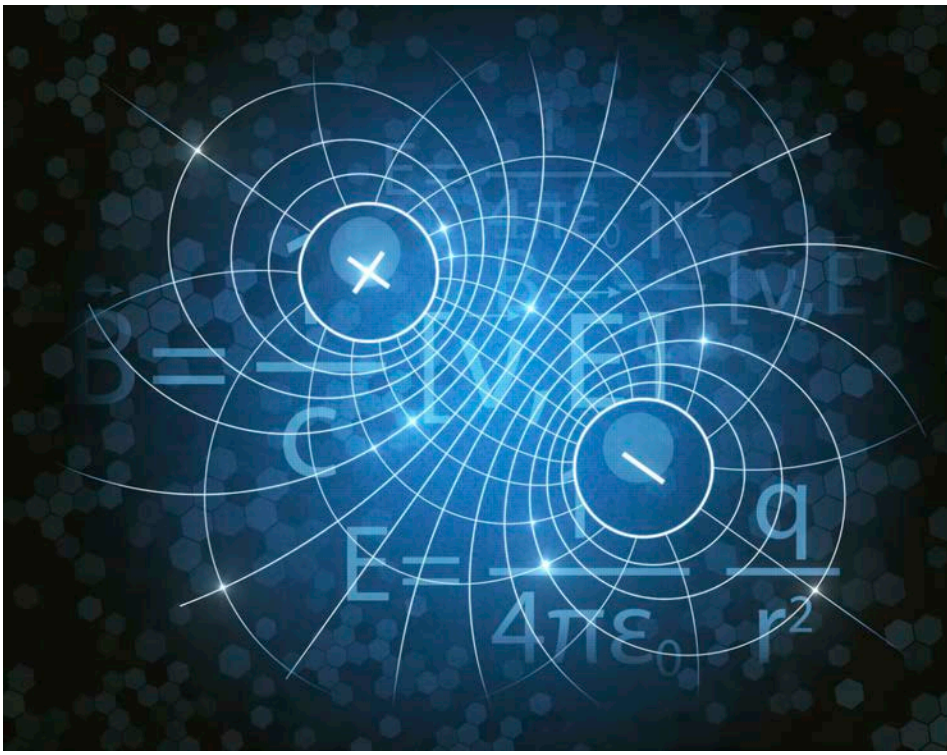
The sustainable U.S. electric business models of the future are simply unknown — and the same is true for the strategies that will ultimately be developed and executed by the successful participants.

As electric companies of all types confront this complex challenge, a dynamic framework will be required in order to:

- Assess the current landscape
- Determine the critical factors that will shape the future U.S. electric marketplace and develop points of view around those factors
- Monitor marketplace and policy trends and recalibrate business strategies in real time

This paper provides such a framework. It examines the major industry participants shaping the business models of the future and advances tactics for consideration, analysis, discussion, and debate. Finally, it suggests *game changers* that could quickly alter the path to the industry's future.

This paper does not advocate a particular strategy for addressing the coming disruption, nor does it suggest what business models will emerge as successful in the future. This paper will have served its intended purpose if it: 1) facilitates discussion and consensus-building among electric company managements and their boards as they address the challenges and opportunities presented by the changing landscape, and 2) serves as a catalyst and platform to advance the dialogue among the various stakeholders with roles in solving the equation.



A fundamental shift in the variables of the equation

The Math Does Not Lie[1] examined the implications of rising costs to generate and deliver a kilowatt hour (kWh) of electricity in an environment where future kWh sales are flat or declining for a sustained period of time — something the U.S. electric sector has never experienced.[2] As significant as this scenario is for the electric industry, two other changes in the industry's relationship to the marketplace may have equal or greater implications for the current electric business model — *the new license to do business* and the *new participants in the game* of providing electric services to customers.

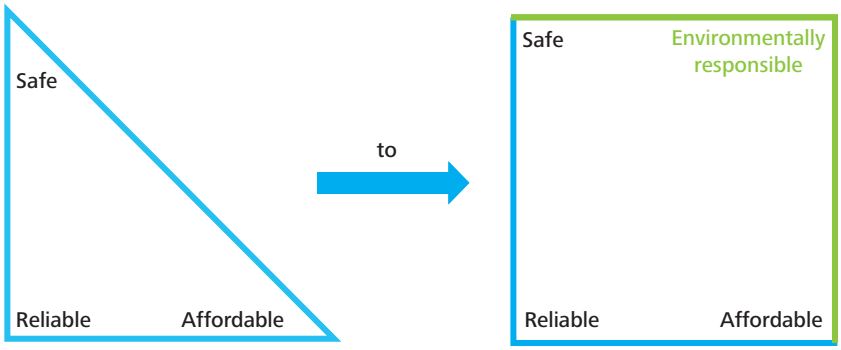
Environmentally responsible electricity is no longer an option — it is an imperative to doing business regardless of its cost and the associated price of the product. And, while some new technologies and products may come and go, new market entrants, or disruptors, are here to stay.

In a relatively short span of time, the traditional way of doing business has begun to change while, for the most part, the electric industry business model has stayed the same — setting the stage for disruption.

Disruption to the electric industry business model has been the topic of much recent discussion and debate. It is important to frame this topic in a way that allows it to be examined and discussed on a common basis among the various stakeholders. To that end, the next section provides a definition of disruption and explores how it could manifest itself across the U.S. electric industry.

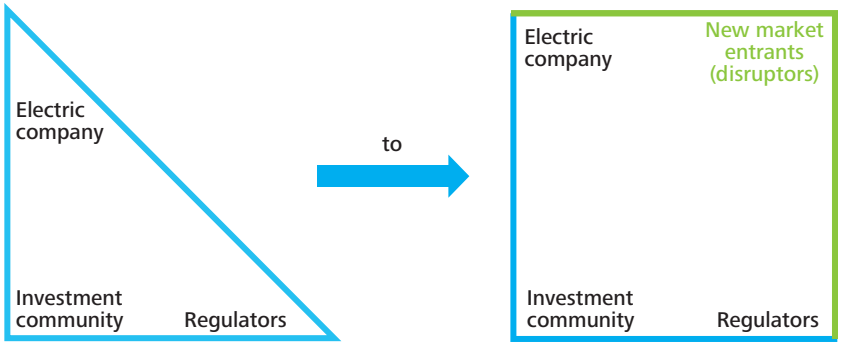
With this framework in mind, electric companies and stakeholders will be better equipped to assess the challenges and opportunities likely to confront them in the evolving electric industry landscape that is explored later in this paper.

License to do business



Traditional **New**

Participants in the game



Traditional **New**

[1] Deloitte Center for Energy Solutions, *The Math Does Not Lie – Factoring the future of the U.S. electric power industry*, November 2012, http://www.deloitte.com/us/dothemath

[2] From 2008-2012, U.S. electricity sales declined year over year in four out of five years, and are expected to show a slight uptick in 2013, according to the Energy Information Administration (EIA), *Electric Power Monthly* and *Annual Energy Outlook 2014 Early Release*, accessed February 2014, http://www.eia.gov/electricity/monthly/, http://www.eia.gov/forecasts/aeo/er/index.cfm

Modeling disruption in the U.S. electric power sector

What does disruption mean?

The Innovator's Manifesto describes "disruption" as a process of innovation by which entrants often displace incumbents in a wide variety of markets.[3] In the context of this paper, disruption to the U.S. electric business model refers specifically to those circumstances in which the traditional central generating station model ceases to function in its current role as the primary provider of safe, reliable, affordable, and environmentally responsible electric service to customers — both businesses and consumers. This is not meant to imply the near-term death of this business, but does suggest that its role in the marketplace diminishes over time as other business models evolve that better meet certain customer needs and expectations. The pace of this evolution will most likely dictate the magnitude of the disruption. The magnitude, in turn, will determine the alternatives and actions available to those companies with investments in the infrastructure underpinning the traditional U.S. electric business model.

Disruption across the U.S. electric power sector

While the nature and pace of disruption are the subject of much debate, there is general consensus that disruption in the U.S. electric sector will occur at different times and in different ways across the country. Consequently, the ability to explore the potential timing of the coming disruption provides a useful foundation for further examination of the new license to do business and new participants in the game.

In *Beyond the Math*,[4] Deloitte examined the dimensions of change that most likely signal if market forces are, in fact, accelerating disruption in the U.S. electric sector. Using this same framework, Deloitte has developed a predictive model to provide insights into the relative pace of disruption across each of the 50 states.

The model analyzes four specific dimensions of disruption at the individual state level and defines them as follows:

Dimensions	Definition of dimensions	Indicators of disruption
Demand	Demand for electricity from central generation assets — measured in terms of near-term changes from current levels of kWh sales	• Lowest electricity growth/largest decline in sales • Highest retail electricity prices • Lowest projected economic growth
Technology	Forecasted investments in new electric service technologies	• Highest projected level of renewables penetration • Highest projected level of smart meter penetration • Highest level of distributed generation penetration
Product	Customers' incentives to purchase electricity service (product) from other sources	• Highest level of major electricity outages • Highest projected household incomes • Solar price competitiveness
Policy & Regulation	Magnitude of policy and regulation promoting environmentally responsible electricity (including energy management)	• Highest level of renewable portfolio standards (RPS) targets • Highest level of energy efficiency investment as a percentage of electric sales • Highest concentration of state and local tax credits, renewable energy financing, and other incentives

Across each of these dimensions, the model identified and measured indicators of disruption. The objectives were to identify states across the United States with the highest likelihood of disruption and to determine which indicators were the most likely to signify the enhanced probability of disruption. In general, where the model's indicators are forward-looking, projections for the year 2016 were used when available.

[3] Michael E. Raynor, *The Innovator's Manifesto* (New York: Crown Business, 2011)

[4] Deloitte Center for Energy Solutions, *Beyond the Math – Preparing for disruption and innovation in the U.S. electric power industry,* March 2013, http://deloitte.com/us/beyondthemath

Overall findings from the model

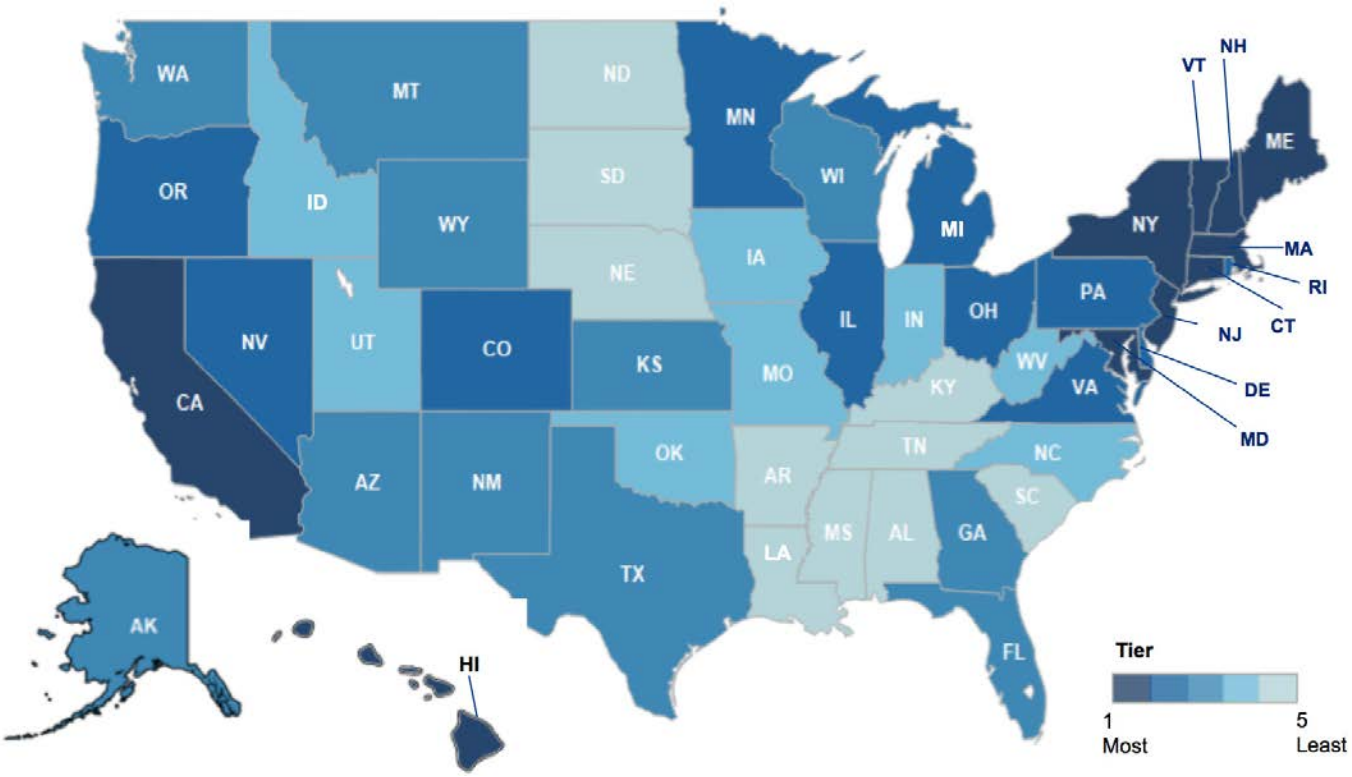
Based on the findings, the 50 states were divided into five tiers — from the tier with the highest likelihood of disruption to the lowest. The specific states where disruption is most likely to occur first (top-tier) are:

- California
- Hawaii
- Maryland
- Connecticut
- New Jersey
- Maine
- Vermont
- Massachusetts
- New York
- New Hampshire

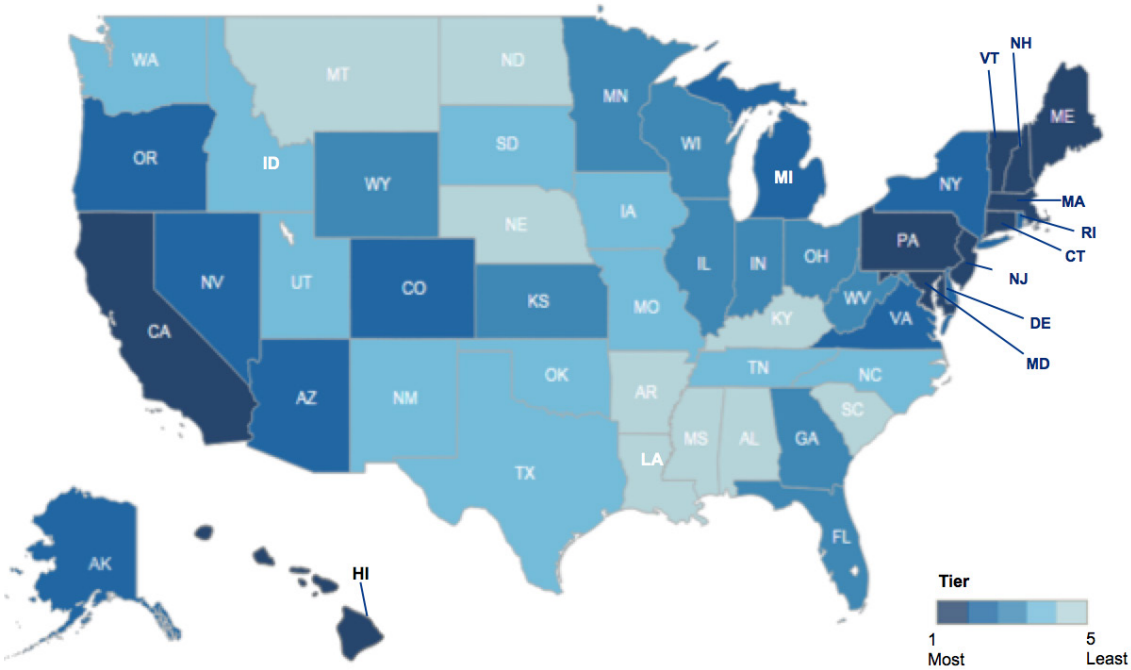
Through sensitivity analysis, the model also identified the following indicators as contributing the most to the top-tier ranking of the aforementioned states:

- Lowest electricity growth/largest decline in kWh sales
- Highest level of distributed generation penetration
- Highest level of energy efficiency investment

Potential electric industry disruption across the United States

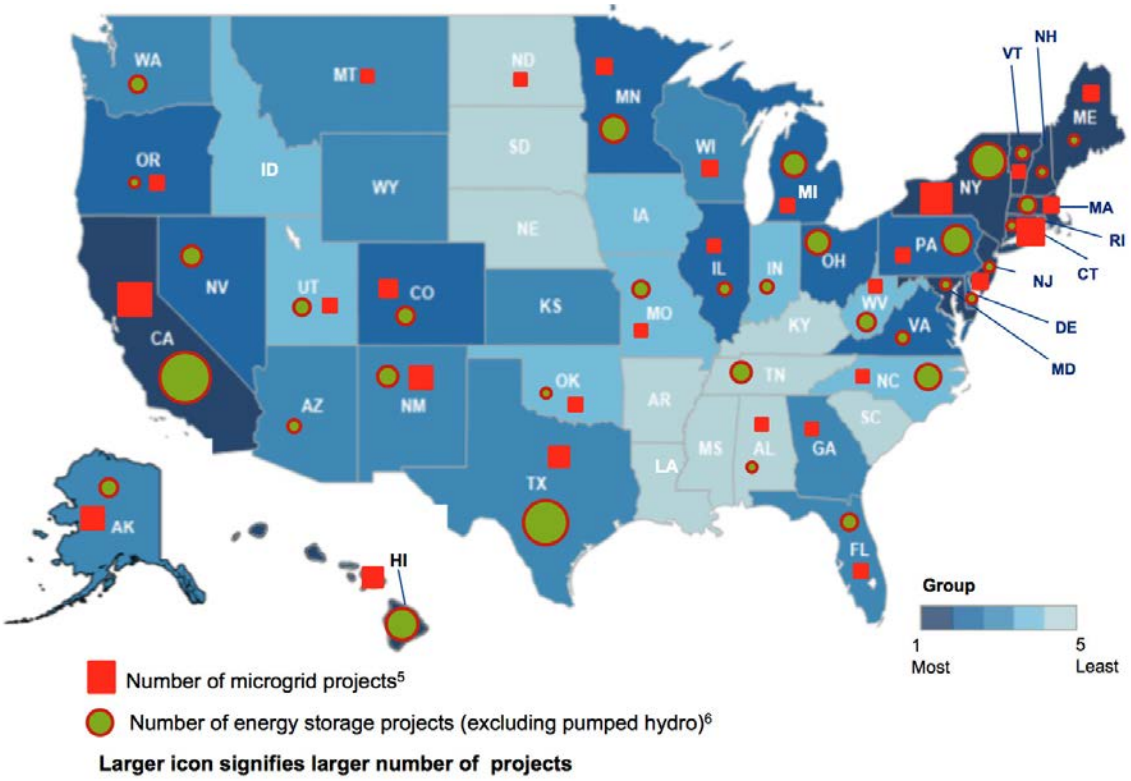


Potential electric industry disruption across the United States (excluding policy & regulation dimension)



Arguably, the demand, technology and product dimensions can be characterized as "market" forces, while policy & regulation is a "non-market" or political force. With that in mind, Deloitte ran the model without the policy & regulation dimension. This change minimally affected the top-tier, with the only difference being the substitution of Pennsylvania for New York.

Microgrid and electricity storage projects in the United States



In separate analyses, the model was used to examine other potential indicators of disruption. For example, an analysis was performed to explore the correlation of the top-tier states with the current geographic concentration of energy storage and microgrid projects. The correlation was high, as shown.

[5] GTM Research, a Greentech Media company, "U.S. Microgrids, Operational and Planned," March 2014

[6] U.S. Department of Energy, "DOE Global Energy Storage Database," accessed February 2014, http://www.energystorageexchange.org/

What can be concluded?

One might draw the following general conclusions from the model's findings. The first wave of disruption to the traditional electric business model is likely to occur across the northeast region of the United States. Additionally, disruption to the traditional U.S. electric model may already be underway in California and Hawaii, as suggested by the level of non-traditional electricity services currently available in these states. And perhaps more importantly, electric companies may wish to keep a particularly sharp eye on the forecasted levels of growth or decline in kWh sales, of distributed generation penetration, and of energy efficiency investment within their territories as potential signposts of impending disruption.

These findings have significant implications, regardless of an electric company's geographic footprint. In the short-term, the strategic priorities will likely vary locally depending on each electric company's situation. In the longer term, the solutions that emerge — whether technology or policy, or likely a combination of both — and the successful business models that evolve will simply have no geographic boundaries.

While the model is somewhat rudimentary, and the elements and their weighting are subject to debate, it serves as a platform to change the dialogue as companies in the electric sector confront the challenges and opportunities presented by both the new license to do business and the new participants in the game. Likewise, the model provides a framework to evaluate the emerging roles of new market entrants, to assess alternative future business models, and to align policy and regulation with the new electricity marketplace realities.

The California Public Utilities Commission has ordered the state's largest electric utilities to collectively procure a targeted 1,325 megawatts (MW) of energy storage by the end of 2020, with installation no later than the end of 2024[7] — enough storage to supply electricity to almost one million homes. On the Hawaiian island of Oahu, where the price of electricity is about 37 cents per kWh (triple the U.S. national average), residential rooftop solar penetration was 5.2% in 2012[8] and several neighborhoods are saturated with potentially more than 100 percent of the daily minimum load on circuits.[9] This has prompted the Hawaiian Electric Company (HECO) to ask its customers to confirm local circuit capacity, through HECO's website, before applying for a new solar connection. In some cases, an interconnection study or additional safety and reliability modifications will be required.[10]

The next section explores the emerging new market entrants and their role in the evolution of the electric sector business model.

[7] California Public Utilities Commission Decision Adopting Energy Storage Procurement Framework and Design Program, Docket #: R. 10-12-007, approved October 17, 2013, http://www.cpuc.ca.gov/PUC/energy/electric/storage.htm

[8] Solar Electric Power Association, *2012 SEPA Utility Solar Rankings*, June 2013, p. 17, http://www.solarelectricpower.org/media/8186/final-2012-top-10-report-v2.pdf

[9] Hawaiian Electric Company, "Locational value map for Oahu," accessed February 2014, http://www.heco.com/portal/site/heco/lvmsearch

[10] Hawaiian Electric Company, "To our valued customers," accessed February 2014, http://www.hawaiianelectric.com/heco/_hidden_Hidden/CorpComm/To-Our-Valued-Customers?cpsextcurrchannel=1

New market entrants

New market entrants can be described as businesses that provide electricity services formerly supplied by regulated utilities and power generators, or that offer services previously not available to electricity customers to a great extent. New market entrants can be divided into two general categories — those that provide services ***up to the meter*** and those that provide services ***behind the meter***.

The first category, *up to the meter*, primarily consists of generators of electricity from renewable sources (e.g., wind, solar, and biomass) and a growing number of businesses designed to enhance the value proposition of large-scale renewables. These businesses would include, among others, large-scale battery storage providers and sophisticated forecasters of day-ahead wind and solar capacity based on weather patterns.

The second category, *behind the meter*, consists of a variety of electric service providers that are leveraging new and improving technologies deployed under evolving, innovative business models. The breadth of activity behind the customer's meter, at both the business and residential levels, is astounding. While solar is the largest "new" source of self-generation (or distributed generation), fuel cell technologies and small-scale natural gas generation are receiving substantial attention, as is the feasibility of distributed electricity storage through advanced battery technologies. In addition, small, self-sufficient electricity systems with their own generation and delivery capabilities, called microgrids, are beginning to emerge as alternative electricity providers for entire neighborhoods.

In April, 2013, NRG Solar, a division of NRG Energy, launched a residential solar system with battery storage.[11] The system consists of a solar panel pergola (i.e., a landscaping structure that provides shade) combined with batteries that store excess solar electricity for use at night or for backup purposes during a power outage.

Opower is a software-as-a-service company that partners with electric companies to promote energy efficiency and customer engagement. Its software is designed to provide residential and business electricity customers with information about their energy consumption and ways to become more energy efficient. The company's mission is to help everyone, everywhere save energy. Its software products follow five design principles:[12]

- Design for how people actually behave
- Assume people do not care
- Always lead to action
- Aim for a long-term relationship
- Build for everyone…who receives an electric bill

Substantial developments are also taking place in the area of energy management. For instance, new technologies, combined with real-time data related to physical conditions and human behavior, are enabling businesses and consumers to significantly reduce their energy consumption, often with minimal incremental investment.

The ultimate role these new market entrants will play in the evolving U.S. electric business model is unclear. What is clear is that they are receiving considerable attention, as evidenced by the growing capital investments being made in them by a number of traditional electric companies. In light of this attention, some trends appear to be emerging that should likely be monitored and factored into the view of the changing electric landscape.

- **The changing role of the new market entrants.** Many of these businesses initially viewed themselves as disruptors that were "out to destroy traditional electric companies." Today, they largely see traditional players, particularly electric distribution businesses, as their channel to the marketplace on both sides of the meter. Many, in fact, describe their businesses as *enablers* of a smooth transition to future electric business models, and they are actively seeking to partner with traditional electric distribution businesses.

[11] Ucilia Wang, "NRG Rolls Out Solar Pergola to Target Residential Market," *Forbes.com*, April 2, 2013 http://www.forbes.com/sites/uciliawang/2013/04/02/nrg-rolls-out-solar-pergola-to-target-residential-market/

[12] Opower, "Opower's Design Principles," accessed February 2014, http://opower.com/company/design-principles

- **The maturity curve of new technologies**. There is a growing belief among market participants that substantial new technology breakthroughs are not a prerequisite for significant disruption to the electric industry. Instead, the maturation of existing technologies may be sufficient to effect major change. This is particularly perceived to be the case with large-scale renewables (i.e., wind and solar), distributed generation (i.e., solar), and battery storage. Many argue that the greatest disruption to the industry will be distributed solar, and that the last hurdle to overcome is the level of cost embedded in the solar value chain — namely costs related to customer acquisition, installation, billing and collection, and maintenance. They contend that economies of scale are the remaining critical factor in reaching cost competitiveness. Similar views are espoused regarding the current price to manufacture, install, and operate battery storage. As manufacturing volumes — largely associated with electric vehicles — increase in both the U.S. and China, battery prices are expected to decline.

In December 2013, Geostellar launched a website that enables residential consumers to compare the benefits of leasing versus buying rooftop solar, and to register to have a system installed. The website's key goal is to help installers and third-party financiers reduce customer acquisition costs. Geostellar's platform uses satellite data to build representations of neighborhoods and rooftops, and a simulation model to calculate the amount of sun a rooftop receives throughout the year. The website incorporates solar credits and other incentives, as well as local utility electricity prices.[13]

Google Inc. may be the largest new market entrant to date. The company acquired Nest Labs Inc. in January 2014. This deal effectively gives Google direct access to every utility customer in the United States through Nest's signature product, the Nest Learning Thermostat, and other smart devices, such as its smoke and carbon monoxide detector, Nest Protect. Of additional note, some electric companies have dipped into the smart home space through partnerships with Nest to supply thermostats to participants in their demand response programs.[14]

- **Solutions to the solar affordability barrier.** The large up-front cost of distributed solar, particularly to the residential consumer, has been a major impediment to its adoption. New financing models that share the incentives (i.e., tax credits and rebates) and the benefits (i.e., lower electricity bills) are emerging to create win-win scenarios for the homeowner, the system installer or owner, and the financing party. In those geographies where distributed solar is approaching cost parity, will affordability, in fact, lead to mass adoption over time?

Soft costs as percentage of total solar system cost (per watt)[15]

	2012	Department of Energy[16] SunShot Initiative 2020 target
Residential	64%	43%
Small commercial	52%	35%

As these trends suggest, the new market entrants are here to stay. They introduce a critical new variable in the evolving electric business model by serving as disruptors, enablers, or both.

[13] Nichola Groom, "U.S. online startup makes going solar as easy as booking travel," Reuters, December 2, 2013, http:www.reuters.com/article/2013/12/02/us-solar-geostellar-idUSBRE9B102V20131202

[14] Andrew Engblom, "Google's Nest Acquisition: Threat or opportunity for utilities?," SNL Energy, January 15, 2014, http://www.snl.com/InteractiveX/Article.aspx?cdid=A-26542692-11566

[15] Soft costs include installation labor, permitting, inspection, interconnection, customer acquisition, and financing. Percentages are out of total installed PV system costs per watt for each sector in first half 2012 and target costs for 2020. Source: Barry Friedman, Kristen Ardani, David Feldman, Ryan Citron, Robert Margolis and Jarett Zuboy, National Renewable Energy Laboratory (NREL), *Benchmarking Non Hardware Balance-of-System (Soft) Costs for U.S. Photovoltaic Systems, Using a Bottom-Up Approach and Installer Survey – Second Edition*, October 2013, p. 6., http://www.nrel.gov/docs/fy14osti/60412.pdf

[16] The U.S. Department of Energy's SunShot Initiative is a national collaborative effort to make solar energy cost-competitive with other forms of electricity by the end of the decade. http://www1.eere.energy.gov/solar/sunshot/index.html

Evolving electric sector business models

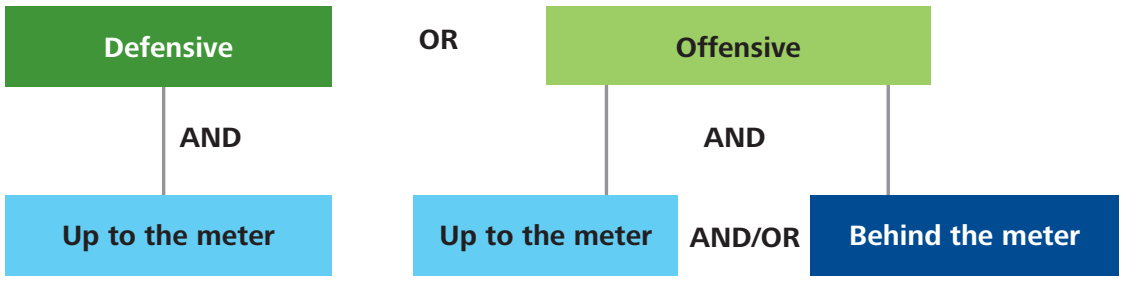
Much has been reported about the dramatic changes occurring in the traditional U.S. electric industry.[17] Electric companies will need to examine a host of potential strategies and associated business models in order to navigate these changes. To facilitate this process, potential strategies can be grouped into one or more of the categories described in this section.

Thinking of strategies in terms of these categories can be helpful in evaluating and debating the tactics, opportunities, and risks associated with each.

Defensive strategies

Defensive strategies can be characterized as those designed to effectively defend the status quo. By their nature, they are exclusively *up to the meter* strategies associated with electric generation, transmission, or distribution investments. These strategies take into account the new license to do business, which requires ongoing infrastructure investment to ensure both system reliability and environmentally responsible electricity. At present, growth in this area is largely associated with replacing generation plants or investing to ensure the reliability of the grid. As a result, companies pursuing defensive strategies often employ the following tactics:

- Keep costs — and prices — as low as possible to retain customers.
- Redesign customer rates to allow for better transparency and provide greater assurance of fixed cost recovery.
- Explore opportunities to increase kWh sales with minimal incremental investment, such as through economic development, electric vehicle penetration, and port electrification.



[17] See for example: Peter Kind, *Disruptive Challenges: Financial Implications and Strategic Responses to a Changing Retail Electric Business*, Edison Electric Institute, January 2013, http://www.eei.org/ourissues/finance/Documents/disruptivechallenges.pdf

In September 2013, Alliant Energy agreed to sell its Minnesota electric and natural gas distribution businesses. The electric distribution business will be sold to Southern Minnesota Electric Cooperative, a group of 12 electric cooperatives, while the natural gas business will be sold to Minnesota Natural Resources Corporation, a subsidiary of Integrys Energy Group, Inc. Alliant's operations in Minnesota represented less than four percent of its total customer base, suggesting these businesses might be of more value to other parties who are focusing more intensely on this geography. Commenting on the sale, the president of Alliant's Minnesota and Iowa utility noted: "Our Minnesota customers will be part of utilities with a significant, long-standing presence in the state."[18]

In addition, mergers and acquisitions may be evaluated as a mechanism to keep costs down through synergy savings or through realizing *in the money* optionality, whereby assets are sold because they are of greater value to another party.

Successful execution of these strategies is expected to result in predictable earnings, cash flows, and shareholder dividends. The associated risks are largely tied to the requisite investments in large-scale, long-lived assets. These risks are compounded in today's environment where new technologies are emerging, and where substantial investments in traditional infrastructure are often non-productive, in the sense they create little or no increase in kWh sales — or real growth.

Offensive strategies

Offensive strategies can be described as those designed to exploit opportunities created by the changing electricity landscape. They can be *up to the meter* or *behind the meter*.

Up to the meter strategies

These strategies are generally designed to take advantage of the environmentally responsible criterion of the new license to do business and most often leverage new technologies. Common examples of *up to the meter* strategies are:

- Investments in large-scale wind, solar, and biomass generation assets designed to meet RPS mandated by many states.

- Efforts to achieve greater efficiencies within traditional and renewable generation assets through technology investments aimed at improving load management and storage capabilities. Breakthroughs in grid-scale storage are often cited as a potential game changer as they would move intermittent wind and solar assets in the direction of becoming firm sources of electric power generation.

Up to the meter strategies are generally expected to be low risk because the revenues associated with these investments are largely contractual in nature, and the risks incurred are most often associated with the realization of the expected value of the assets at the end of the contract.

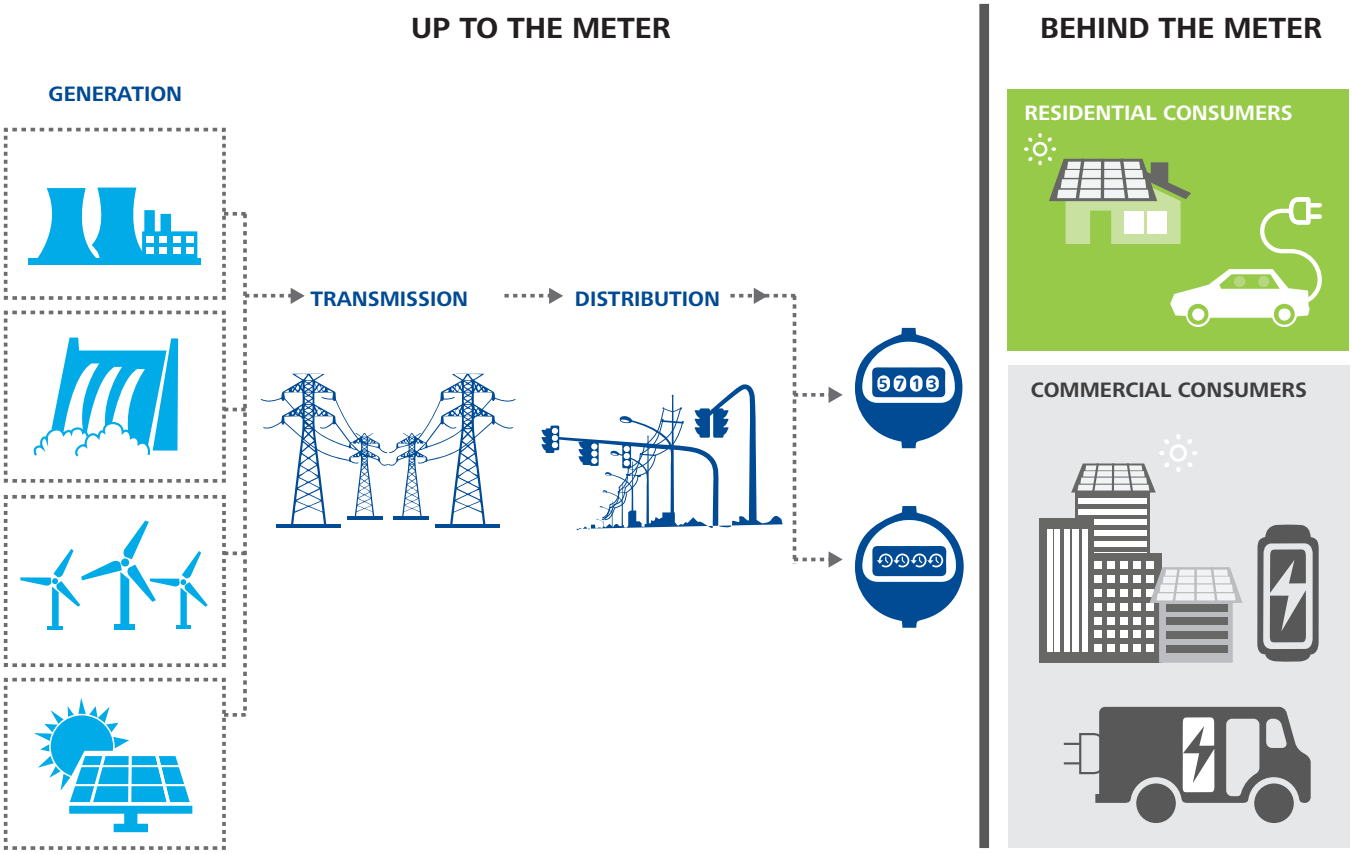
AES Energy Storage operates one of the largest fleets of battery-based, grid-scale energy storage resources in the United States, with 106 MW of operational projects and another 1,000 MW in development. The fleet is primarily focused on reserve and peak capacity, but provides other services, such as voltage regulation, fuel diversity, elimination of water usage, and deferred transmission benefits. The company's 40 MW project at Dayton Power & Light's Tait generating station in Moraine, Ohio, provides frequency regulation and grid stabilization services to the Pennsylvania, Jersey, Maryland Interconnection (PJM).[19] AES Energy Storage also delivers reserve and peak capacity for utilities, generators, or load-serving entities in New York Independent System Operator (NYISO), PJM, and Electric Reliability Council of Texas (ERCOT) markets under long-term contracts.[20]

[18] Alliant Energy Corporation, "Alliant Energy announces agreements to sell its Minnesota electric and natural gas distribution businesses," September 3, 2013, http://www.alliantenergy.com/AboutAlliantEnergy/Newsroom/NewsReleases/014894

[19] Eric Wesoff, "AES Surpasses 100 MW Grid-scale Energy Storage Milestone," greentechmedia.com, October 7, 2013, http://www.greentechmedia.com/articles/read/AES-Surpasses-100-MW-Grid-Scale-Energy-Storage-Milestone

[20] AES Energy Storage, "AES Energy Storage Services," accessed January, 2014, http://www.aesenergystorage.com/services.html

Up to and Behind the Meter



"Value is a function of risk and return – therefore, risk matters as much as return in generating value."

— Thomas Fanning, Chairman, President and Chief Executive Officer, Southern Company

Behind the meter strategies

Some believe *behind the meter* strategies represent the new frontier of opportunity and associated risk. Several factors underlie this belief, including a variety of developing technologies, distributed generation and storage, and the changing face of the electric customer. But that is not all. Another factor is also emerging and it may ultimately be the most important: the evolving *energy management mandate*. Energy efficiency in the past has largely been voluntary, as motivated customers sought out ways to lower their electricity bills and/or reduce their carbon footprints. Energy efficiency today, however, is becoming more of a mandate. Under the new license to do business, environmentally responsible electricity will come at a price — and the debate is just how high. Energy efficiency is widely acknowledged as a means — most likely an indispensable one — of making environmentally responsible electricity affordable as it enables businesses and consumers to do the same, or more, with less kWhs.

In January 2014, Integrys Energy Group, a utility holding company subsidiary of Integrys Energy Services, announced the creation of a residential solar finance fund through the CPF Market®, an online platform operated by Clean Power Finance (CPF) that facilitates electric company investment in residential solar. Partnering with CPF enables Integrys to expand its reach beyond its northeastern and midwestern customer base. Through the platform, the company first plans to make funds available to installers in California, Hawaii, and New Jersey markets, followed by New York, Maryland, and Massachusetts. The Integrys program comes on the heels of equity investments in CPF by Duke Energy Corp, Edison International, and Dominion.[21]

Many believe offensive, *behind the meter* strategies will be limited within an electric utility's franchised territory due to regulatory approval requirements. On the other hand, doing business outside of the franchised territory creates new challenges and associated risks. Both sides of this coin will need to be evaluated, with an eye toward balancing the risks and rewards of venturing into uncharted waters. The risks include:

- **Technology** – What advances are coming around the bend that might be better and cheaper?
- **Customer** – What happens to the customer relationship dynamic when a company is operating in its customers' parking lots, on their roofs, and in their living rooms?
- **Policy and regulatory** – Will the stroke of a pen create winners and losers, rendering customer and market trends moot?
- **Execution** – Competition for the customer's limited dollars will not only exist, but it may also be furious. Will a company be able to develop the superior programs, brands, and execution skills required to be successful?

Under these conditions, it is not surprising that most *behind the meter* strategies to date can be described as dip the toe, or perhaps the foot, in the water. Their overarching objective is to position a company to participate in *behind the meter* opportunities as the marketplace develops, with the main variables being timing and degree of investment. So what types of opportunities are companies pursuing to get their feet wet?

[21] "U.S. Midwest utility Integrys creating residential solar fund," Reuters, January 8, 2014, http://www.reuters.com/article/2014/01/08/integrys-solar-idUSL2N0KH28Z20140108

Nevada-based NV Energy, Inc., has collaborated with home energy management start-up, EcoFactor, to provide integrated demand-side management solutions to NV's customers. The program was launched under NV's mPowered brand using EcoFactor's patented, cloud-based energy services to analyze residential heating and cooling system information, thermostat settings, personal preferences, indoor temperatures, local weather, and other behavioral factors. By combining data analytics with smart thermostat capabilities, the EcoFactor solution is expected to provide significant energy savings to consumers and load reduction in the Las Vegas market.[22]

The greatest prospects *behind the meter* today appear to fall into two broad areas:

- Distributed generation — solar, small-scale natural gas generation, storage, and microgrids.
- Energy management technologies — both hardware and software.

Tactics to seize these opportunities and balance the associated risks include the following:

Product development companies

Companies are setting up programs or subsidiaries specifically charged with identifying, developing, field-testing, and launching products and services to customers *behind the meter*. A recognized subject matter expert hired from the outside often leads this "product development company," which operates with a degree of autonomy from the parent. A common challenge is to instill and maintain an entrepreneurial spirit in the new organization. This may require a combination, or all, of the following:

- Acquisition of start-ups or even established businesses
- Joint venture arrangements with new market entrants
- Compensation and incentive programs that are different from those of the parent
- New capital and/or ownership structures — including joint ventures, alliances, and public/private partnerships

Pilot programs

Pilot programs in franchised service areas approved by regulators are not new to electric utilities. However, the role they play may differ from the past. Today, electric utilities are using pilot programs to field-test potential products and services with the objective of launching successful ones at scale, most often beyond the company's franchise territory. Well-executed pilot programs offer several potential benefits:

- Proving the concept to management, the board of directors, and potential investors
- Building requisite skills and expertise, and identifying resource gaps
- Fine-tuning the business model
- Creating goodwill with customers and regulators

Importantly, pilot programs will be successful only if they are proposed and conducted in a win-win environment. Not only must the programs make sense for the utility, but regulators must see tangible benefits to customers. Even if future services are provided to customers by third parties or competitors, a proof of concept that benefits customers in the company's franchised territory can create this win-win by building goodwill with regulators while pointing to opportunities beyond the present service area.

"We are not pouring huge amounts of money in it, but we are trying to develop relationships and we are trying to develop products and joint ventures that will provide an income stream for growth."

— Thomas Farrell, Chairman, President and Chief Executive Officer, Dominion Resources

[22] EcoFactor, "NV Energy begins massive deployment of EcoFactor", November 13, 2012, http://www.ecofactor.com/nv-energy-begins-mass-deployment-of-ecofactor/

Distributed generation value chain

Much like the value chain to generate and sell an electron, a distributed-generation value chain is evolving and maturing. At a high level, its components include:

Electric companies, often through their product development companies, are examining this budding value chain in terms of its growth potential. Based on initial explorations, some believe growth opportunities exist throughout the distributed generation value chain as traditional utility skills and experience, in areas such as large-scale deployment, system monitoring, smart meter applications, and billings and collections, still apply.

Additional potential opportunity likely lies in enhancing the value of distributed generation assets by integrating them with storage and energy management tools, and growth opportunities may also exist related to the ownership structure and associated financing of the distributed system.

Leveraging natural gas

The emergence of abundant, low-cost natural gas has profoundly affected the electric industry, and the implications for the future are a constant topic of discussion. The central question here is: Can natural gas create incremental value to customers behind the meter — in areas such as small-scale generation, microgrids, and beyond?

The vastness and uncertainty surrounding the answer suggest that *behind the meter* strategies should include a point of view on future natural gas prices, and should factor in the sensitivity of these assumptions on the economics of new and existing business models. Also, close monitoring of emerging technologies that enable customers to use natural gas in more ways would likely be warranted.

Potential game changers

Much attention has been given to the role of technology in shaping the future of the U.S. electric sector on both sides of the meter, including the potential for breakthroughs that could substantially alter the economics of existing business models and their underlying assets. Even more, many industry stakeholders generally acknowledge that today's world is ripe for game changers that may not yet be visible.

Two potential game changers, however, have come into view, and they are the subject of much discussion: 1) the changing face of the customer and 2) broadband, which is already in almost every American home.

Changing face of the customer

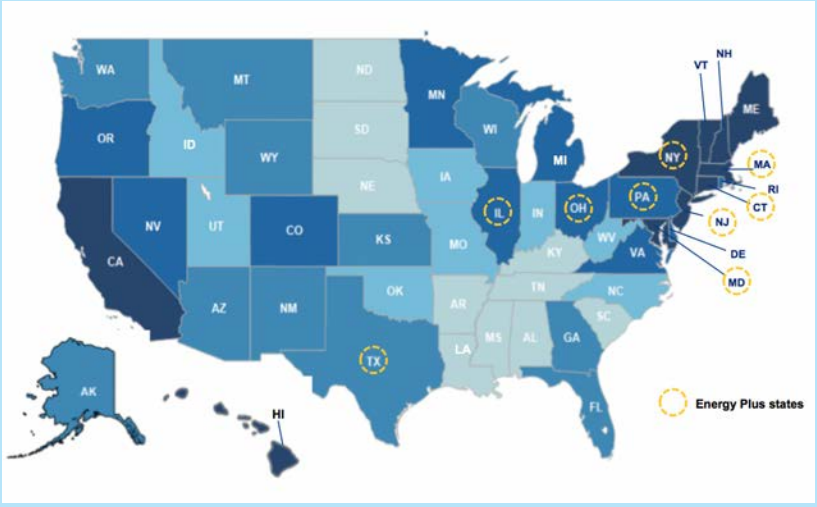
Annual studies conducted by Deloitte since 2011[23] have revealed the changing mindset of electric customers — both businesses and consumers. On the one hand, businesses have intensified their focus on all forms of energy management because they see opportunities to reduce costs, remain competitive, and increase earnings. On the other hand, consumers see energy efficiency as being resourceful on their part as opposed to sacrificing comfort, and they are willing to invest in associated products and services if energy management can be made easy.

The U.S. electric industry has traditionally segmented its customers based largely on how much electricity they consume, and not on the reasons they consume it. This generally stands for all types of customers — residential, commercial, and industrial. As customers' choices increase, particularly *behind the meter,* new customer segmentation models will likely be required. For commercial and industrial customers, segmentation based on business models will probably be necessary in order to understand customer needs — for that matter, who the real customer is. This will allow for redefining and bundling services that better meet the specific needs of manufacturers, big-box stores, hotels, colleges, hospitals, and other large energy consumers.

For residential consumers, demographic segmentation could have a similar effect. Grouping customers by age, income, education, and other demographics could greatly enhance a company's ability to package services in order to better meet changing needs. And, smart meters can substantially heighten the level of sophistication in employing this technique.

Residents of nine states have an added incentive to choose Energy Plus® as their electricity supplier. Once they sign up, they can earn rewards based on their energy consumption toward their favorite reward plans — including airline miles, hotel/rail points, retail rewards, cash back, or even contributions to a college savings plan. For example, American Airlines' AAdvantage® members can earn two miles for every dollar they spend on the supply portion of their monthly electric bill, plus 10,000 bonus miles after two months of active service as an Energy Plus® customer.[24] The nine states where residential customers have these opportunities are highlighted in the map below.

Energy Plus® Service Territory[25]



[23] Deloitte Center for Energy Solutions, *Deloitte reSources 2013 Study*, July 2013, http://www.deloitte.com/us/resources

[24] American Airlines, Inc., AAdvantage® program email "Your electric bill is worth 10,000 miles," received by AAdvantage program member December 12, 2013

[25] Energy Plus Holdings, "Service Areas," accessed February 2014, http://www.energypluscompany.com/service_areas/service_areas.php

Gateway behind the meter

Today, broadband is inside practically every business and home, providing services ranging from telephone, television, and Internet to security monitoring and home automation. As *behind the meter* strategies evolve, electric companies should analyze the potential risks and opportunities that broadband could create for electric services. The new *smart home*, with its diverse mix of broadband-enabled hardware and software components, opens the door for electric companies to partner with installers, maintenance providers, retailers, security system manufacturers, home automation companies, and others. Electric companies today appear to be well positioned to capitalize upon broadband as a *gateway behind the meter*. And, they can choose whether or not to participate in developing the "internet of things," where physical objects (i.e., smart appliances, alarms, thermostats, etc.) will have virtual identities and will be able to communicate with users and networks through a web of wirelessly connected devices.

Barriers to change

Barriers to change represent an important, and often complex, set of obstacles to the successful execution of both defensive and offensive strategies. That is because they are often institutional in nature or simply too costly to break down. To the degree these obstacles can be identified, addressed in advance and monitored over time, the associated risks can often be mitigated or managed. Barriers to change within the traditional U.S. electric sector can be generally grouped as follows:

- **Culture** – The culture of the U.S. electric industry has served it well for many years. It has allowed the industry to provide safe and reliable electricity throughout its history while reducing real electricity prices to consumers over 40 percent in the last 50 years.[26] It can be described as a culture that is risk averse and that does not tolerate mistakes — both of which would be expected to go hand in hand with safe and reliable electric service. However, as electric companies venture into new technologies and seek to exploit the changing marketplace dynamics *behind the meter*, accepting a higher level of risk and learning from mistakes are likely to be table stakes in order to participate in a meaningful way.

- **Expectations of owners** – Electric company shareholders are attracted to the sector for what it is expected to deliver — steady, predictable earnings and dividends, along with long-term growth in investment value consistent with the relatively low level of investment risk. There is an expectation there will be few, if any, "dry holes," and if they do occur, they will be small.

- **Regulation** – The old and new licenses to do business coincide with regulatory oversight that functions within boundaries set by policy and associated legislation. Regulation has evolved as the electric industry has evolved and has, for the most part, successfully fulfilled its role of overseeing the license to do business. In many respects, the regulatory system has become an institution; therefore, change will not come easy. But, in an environment of evolving marketplace dynamics and new technologies, particularly *behind the meter*, the existing regulatory construct is likely to be ill-equipped to support a smooth transition, and thereby constitutes a major barrier to change. Transforming regulation from a barrier to change to an enabler of it deserves additional examination.

[26] The 1960 price was 20.61 cents per kWh in 2013 dollars and the 2013 price was 12.2 cents/kWh. U.S. Energy Information Administration (EIA), *Short Term Energy Outlook, Real Prices Viewer, Residential Electricity Prices (annual, 1960-2013)*, Release date: January 7, 2014, http://www.eia.gov/forecasts/steo/realprices/

Changing face of electric regulation

An environment of regulatory certainty, where the risks and rewards of strategic alternatives and related investments can be analyzed, will need to exist in order for the U.S. electric sector to smoothly transition to new ways of doing business. The concept of regulatory certainty comes with the expectation of objective regulatory monitoring and evaluation of future outcomes, with realignment as required. The evolution of the regulatory frameworks at the state level, along with possible regional compacts, will be crucial given the disparate pace of disruption discussed earlier. At the state level, creating and sustaining a new era of collaboration among electric utilities, new market entrants, and regulators will likely be necessary as a foundation for addressing the collective challenges to, and opportunities for, creating real incremental value to electricity customers.

There are a few ways to establish and enhance the collaboration among the aforementioned parties. An ability to move the dialogue out of the rate case environment will be essential. And, the ongoing role of education should be addressed early on and over time. State regulatory commissioners' average tenure today is about five years.[27] This is particularly significant because few regulators come into the position with prior electric utility experience. Making sure both veterans and newcomers are knowledgeable about the current landscape and the critical factors shaping the future marketplace will help to sustain an environment of mutual interest, transparency, and collective trust. Likewise, ongoing customer education is of paramount importance. Where education of customers is viewed as a joint responsibility, collaboration will likely be enhanced.

A framework for assessing the new license to do business

As the electric sector evolves, the issues to be considered become increasingly complex and are often interrelated. Solutions may have multiple, and sometimes unintended, outcomes elsewhere in a business model. A useful framework for assessing the new license to do business is to examine the issues in the context of *up to the meter*, *behind the meter*, or both.

Up to the meter

Issues *up to the meter* are generally historical in nature. Thus, the process of examining and developing solutions for them may be less complex, and it may also be helpful in establishing a foundation for confronting the emerging challenges *behind the meter*. At least three issues *up to the meter* warrant attention.

Rate transparency – In order to understand the true cost of the electric grid today, it is essential to unbundle the components of current electricity prices to customers. Rate transparency is also necessary for examining the future price implications of 1) incremental investments to maintain or enhance grid reliability and 2) future changes in kWh sales. Smart meters, in many instances, are improving electric utilities' ability to disaggregate the costs of the grid into its component parts (i.e., frequency, voltage control, etc.) and to determine which customers are creating the costs, also known as *cost causation*.

[27] Janice A. Beecher, PhD, "Commissioner Demographics 2013," IPU Research Note, Michigan State University Institute of Public Utilities Regulatory Research and Education,March 2013, http://www.ipu.msu.edu/research/pdfs/IPU%20Commissioner%20Demographics%20(2013).pdf

Once the costs of the grid, the sources of such costs, and the prices charged to recover them and earn a profit are understood, the manner of compensating the owners of the electric grid for the services they provide must be addressed. At a high level, compensation for giving customers the ability to net meter must be considered, along with compensation for investments in programs designed to promote and support energy management. Companies will likely need to weigh the trade-off between greater certainty, which comes with compensating for the grid through fixed charges, and the potential, or lack thereof, for traditional earnings growth, which comes with maintaining the status quo of compensating for the grid largely through kWh sales. At a minimum, initial thresholds for recovering the costs of the grid through fixed charges should be established, along with a process for monitoring and adjusting rates as the marketplace evolves.

The cost of a reliable grid – For the first time in the history of the U.S. electric industry, investments in the electric grid often do not result in real economic growth. Investments made to maintain or enhance electric reliability, without associated growth in kWh sales, may result in increased earnings in the short term, but may be essentially uneconomic in the long term. In an environment where there is more distributed generation and an increasing focus on energy management, the situation may be exacerbated, and scenarios can be envisioned where portions of the electric grid are no longer essential to the reliable delivery of electricity. Against this backdrop, the possibility of stranded electric assets should be acknowledged by all parties and should become part of an ongoing dialogue designed to develop equitable solutions.

Diversification *up to the meter* – As electric companies grow their investments in large-scale renewables and storage, their expertise and experience can be valuable in fulfilling customer needs in their franchised service territories. Where third parties are also involved in fulfilling a portion or all of these needs, regulators should assess the incumbent electric company's ability and level of participation in order to provide equal opportunity for all marketplace participants.

Behind the meter

The various components of the distributed generation value chain were previously highlighted. As the role of distributed generation matures and the line between *up to* and *behind the meter* blurs, the owner of the grid, most likely the utility, may be well-positioned to participate in various aspects of this value chain, perhaps offering the greatest value to business or residential customers. Early discussion and examination of this possibility is warranted. Even though the role of the utility *behind the meter* is not yet clear, it will, no doubt, develop over time.

The regulatory clash

There has long been an inherent trade-off, at least at some level, between safe and reliable electricity and affordability. In an environment of rising costs to maintain a reliable grid and flat or declining kWh sales, this trade-off will become more acute. Introducing *environmentally responsible* as a requirement for the license to do business further suggests that a transition from economic to environmental dispatch may occur over time. A consequence of these converging forces is a clash of regulatory objectives that heretofore has not existed.

This situation implies the need to re-examine the definition of "affordable" — which has historically, for the most part, meant the lowest price to customers. Regulators and electric utilities may be well served to examine the license to do business linearly in its component parts, introducing the element of risk. That is, what is the maximum level of acceptable risk and what will it cost to ensure, or perhaps literally to *insure*, this level is not exceeded? This is not to suggest that similar analyses have not been performed in the past. However, the changing marketplace dictates the need for re-examination, discussion, and resolution.

The changing marketplace additionally presents an opportunity to evaluate the short- and long-term benefits of energy management in a new light. What role can energy management play in resolving the regulatory clash by mitigating, at least in part, the impact of rising prices on customers? When elements of energy efficiency and demand response (on both sides of the meter) are incorporated and the grid owner functions as a comprehensive network manager, the concept of "intelligent efficiency" emerges — where the goals of energy efficiency and demand response are simultaneously rationalized.

Basic analysis of the potential for, and objectives of, intelligent efficiency should start now as an integral part of determining the overall regulatory framework. As cost and rate transparency become prevalent, new light can be shed on the opportunities for exponentially increasing short- and long-term benefits to electricity customers by offering services such as time-of-day and dynamic pricing.

"Intelligent efficiency is different from demand response. It does not involve products that purposely respond to signals to reduce electricity usage. Intelligent efficiency involves implementing efficient systems and choices that are beneficial from a time and location perspective, and thereby support renewable power, lower electricity prices, and enhance reliability."

— Jon B. Wellinghoff, Partner, Stoel Rives, LLP, and past Chairman of the Federal Energy Regulatory Commission

Closing thoughts

"This is a genie you are not going to put back in the bottle."

— David Owens, Executive Vice President of Business Operations, Edison Electric Institute

Profound changes to the traditional U.S. electric industry are not just inevitable, they are already occurring. The question is no longer if, but where and how fast. This is clearly evidenced by the addition of environmentally responsible to the requirements for a license to do business, the emergence of proven new technologies, and the prevalence of established new market entrants with different models that are just waiting to scale their businesses.

Equally profound are the likely long-term economic implications of substantial investments in traditional electricity infrastructure for the sake of reliability, without the assurance of sustainable increases in kWh sales.

From a strategic perspective, the evolving electric industry will experience, maybe in a relatively short time frame, a blurring of the line between offensive and defensive strategies. To some, electric companies may even appear schizophrenic now and then based on the variety of tactics they employ. This blurring will likely occur primarily in the distribution system, as an increasing amount of electricity generation moves to distributed networks located in close proximity to the source of consumption — as close as the rooftop, basement, garage, or closet.

As a result, the distribution system's role may well transition to one of assuring reliability as a network manager, even at a local level. As the focal point for data, both *up to* and *behind the meter*, the distribution utility will be responsible for managing both variable supply and variable demand in a manner that achieves maximum energy efficiency. As such, the utility may well operate on both sides of the meter, continuing to own the transmission and distribution assets *up to the meter* and potentially the distributed generation and storage behind it. In many respects, the business model may look more like an information company than one that sells electrons.

In light of such profound changes, and considering the critical nature of electricity in Americans' everyday lives, a smooth industry transition is essential for electric companies, their shareholders, and consumers. But, getting there will require a concept of the end state in order for stakeholders to develop a flexible road map designed to achieve the paramount end objective — safe, reliable, affordable, and environmentally responsible electricity. The evolution of the U.S. electric industry set forth in this paper provides a foundation for discussing, analyzing, and modifying a vision of this end state — both within electric company managements and among managements, their boards of directors, and other stakeholders.

"We are talking about the inevitable marriage of megawatts and megabytes."

— Alexander "Andy" Karsner, Chief Executive Officer, Manifest Energy Group, former U.S. Assistant Secretary for Energy Efficiency and Renewable Energy

As the evolution progresses, it is useful to keep in mind that change will not take place evenly across the United States. Successful solutions developed and executed in a certain geography may be applicable and implemented elsewhere, thereby accelerating the overall pace of change to the electric business model. In formulating strategies to confront these changes and take advantage of new marketplace opportunities, successful companies will evaluate certain common elements and incorporate tactics for addressing the associated implications. These elements include:

- A point of view on the short- and long-term prices of natural gas, and the available options if these forecasts do not come to pass.
- The recognition of key barriers to change, including the strategic limitations imposed by non-negotiable barriers, and the identification of tactics to break down the negotiable ones.
- A road map for a paradigm shift in the regulatory compact to an environment of mutual trust and the shared objective to create win-win outcomes.
- An evaluation of the key game changers that could suddenly and dramatically alter a company's ability to successfully execute a given strategy, including the identification of tactics for managing this risk.

Finally, and perhaps most importantly, all successful strategies and their associated business models will have one constant overriding goal. The strategy must be designed with the objective to create incremental value to electric customers — in their eyes, regardless of the source of the electrons they consume.

Acknowledgements

This paper was enriched by a series of interviews and discussions with industry experts from across the electric power industry, new market entrant companies, and the legal/regulatory and academic communities. The author would like to express his sincere gratitude to the following people for sharing their valuable time, experience, and insights:

- Rajnish Barua, Ph.D., Executive Director, National Regulatory Research Institute
- Travis Bradford, Director, Energy and Environment concentration, Columbia University faculty – School of International and Public Affairs and Columbia Business School
- Matt Cheney, Chief Executive Officer, CleanPath Ventures, LLC
- Ryan C. Chin, Ph.D., Managing Director, City Science Initiative, MIT Media Lab
- David Crane, President and Chief Executive Officer, NRG Energy, Inc.
- Robert Curry, Jr., Senior Consultant, CRA; former commissioner, New York State Public Service Commission; Member, Electricity Advisory Committee of the U.S. Department of Energy
- Mark Derry, Vice President of Utility Planning & Performance, Exelon Utilities, Exelon Corporation
- Dr. Charles Ebinger, Senior Fellow and Director, Energy Security Initiative, Foreign Policy, Brookings Institution
- Thomas Fanning, Chairman, President and Chief Executive Officer, Southern Company
- Thomas Farrell II, Chairman, President and Chief Executive Officer, Dominion Resources
- Sunil "Sonny" Garg, Senior Vice President and Chief Information & Innovation Officer, Exelon Corporation
- James Hoecker, Senior Counsel & Energy Strategist, Energy & Natural Resources, Husch Blackwell; former FERC chairman and commissioner
- Joseph Householder, Executive Vice President and Chief Financial Officer, Sempra Energy
- Craig Husa, Chief Executive Officer, 3TIER Inc.
- Alexander "Andy" Karsner, Executive Chairman, Manifest Energy; former Assistant Energy Secretary for Energy Efficiency and Renewable Energy (EERE); Associate, Harvard Kennedy School; Visiting Fellow, Hoover Institution, Stanford
- Suedeen Kelly, Partner and Co-Chair, Energy Regulatory, Markets and Enforcement Practice, Akin Gump Strauss Hauer & Feld; former FERC commissioner
- Peter Kind, Executive Director, Energy Infrastructure Advocates, LLC
- Nat Kreamer, Chief Executive Officer, Clean Power Finance
- Sam Lee, Chief Executive Officer, Alta Energy, Inc.
- Daniel Leroy, Executive Vice President, EDF Inc.
- William Massey, Partner and Head, Energy Practice, Covington & Burling LLP, former FERC commissioner
- David Owens, Executive Vice President, Business Operations, Edison Electric Institute
- Joe Paradiso, Associate Professor, Responsive Environments Group, MIT Media Lab
- Alexander Perera, Director, Renewable Energy Initiatives, Markets and Enterprise Program, World Resources Institute
- Armando Pimentel, President and Chief Executive Officer, NextEra Energy Resources
- Dr. Richard Schmalensee, Howard W. Johnson Professor of Economics and Management, Emeritus, Dean Emeritus, MIT Sloan School of Management
- Daniel Shugar, Chief Executive Officer, NEXTracker, Inc.
- John Steinberg, Executive Vice President, Business Development, and Co-Founder, EcoFactor
- Tom Stepien, Chief Executive Officer, Primus Power
- Letha Tawney, Senior Associate, Markets and Enterprise program, World Resources Institute
- Bertrand "Bert" Valdman, Senior Vice President of Strategic Planning, Edison International
- Jon Wellinghoff, Energy Law Attorney, Stoel Rives LLP, former FERC chairman and commissioner
- Daniel Yates, Founder and Chief Executive Officer, Opower
- Michael Zimmerman, Founder and Senior Vice President of Business Development, BuildingIQ

About the author

Gregory Aliff
Vice Chairman and Senior Partner, Energy & Resources
Deloitte LLP
+1 703 251 4380
galiff@deloitte.com

Mr. Aliff is Vice Chairman and Senior Partner, Energy & Resources, Deloitte LLP. For 10 years, he served as leader of the firm's U.S. Energy & Resources Group, which is responsible for the coordination of Deloitte's audit, tax, consulting, and financial advisory services to the U.S. energy and resources industry.

A certified public accountant, Mr. Aliff has provided professional services in accounting and auditing, regulatory strategy development, rate case preparation, expert testimony on a variety of accounting and financial subjects, and acquisition due diligence services. He has testified as an expert witness before a number of state regulatory commissions and has also appeared before the Canadian National Energy Board and the U.S. Tax Court.

A member of the Board of Directors of the United States Energy Association, Mr. Aliff is co-author of the annually updated industry reference book *Accounting for Public Utilities*, published by Matthew Bender since 1983. His articles and commentary have appeared in *Electric Light & Power, Electric Perspectives, The National Interest and Public Utilities Fortnightly.* During his 36-year career, he has appeared on industry programs sponsored by organizations such as the American Gas Association, Edison Electric Institute, the National Association of Regulatory Utility Commissioners, and the United States Energy Association.

A graduate of Virginia Polytechnic Institute and State University, he holds both a Bachelor of Science in Accounting and a Masters in Business Administration.

Deloitte acknowledgements
This final *Math* paper would not have been possible without the diligence and insight of Suzanna Sanborn, Senior Manager, Market Insights, Energy & Resources, and the support of Jaya Nagdeo, Senior Analyst, and Jaideep Malik, Assistant Manager, Market Insights, Energy & Resources. Many thanks for their research and analysis of the *new math*.

Learn more
If you would like to discuss this paper in more detail, please contact:

Gregory Aliff
Vice Chairman and Senior Partner,
Energy & Resources
Deloitte LLP
+1 703 251 4380
galiff@deloitte.com

John McCue
Vice Chairman, U.S.
Energy & Resources Leader
Deloitte LLP
+1 216 830 6606
jmccue@deloitte.com
Twitter: @JMcCue624

Suzanna Sanborn
Senior Manager, Market Insights,
Energy & Resources
Deloitte LLP
+1 703 251 1930
ssanborn@deloitte.com
Twitter: @SuzannaSanborn

Deloitte Center
for Energy Solutions

About the Deloitte Center for Energy Solutions
The Deloitte Center for Energy Solutions (the "Center") provides a forum for innovation, thought leadership, groundbreaking research, and industry collaboration to help companies solve the most complex energy challenges.

Through the Center, Deloitte's Energy & Resources Group leads the debate on critical topics on the minds of executives — from the impact of legislative and regulatory policy, to operational efficiency, to sustainable and profitable growth. We provide comprehensive solutions through a global network of specialists and thought leaders.

With locations in Houston and Washington, DC, the Deloitte Center for Energy Solutions offers interaction through seminars, roundtables and other forms of engagement, where established and growing companies can come together to learn, discuss, and debate.

www.deloitte.com/energysolutions

Follow the Center on Twitter @Deloitte4Energy