THIRD WAY

REPORT *Published August 21, 2014 • 14 minute read*

Energy, Meet the Internet

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The hottest area of business development in energy technologies lies in the integration of technology in energy delivery and production. More than just making a dent in greenhouse gas emissions, innovative "IT energy" companies are creating and attracting significant investments and redefining what we think of as an "energy company." Smart government policies and partnerships between technology developers and energy providers can help the sector succeed faster. This paper outlines how the federal government can help by making energy information more transparent, accessible, and usable.

Think of a company in the energy industry.

What comes to mind—is it the utility that sends you a bill every month, the gas station you visit to refuel your car, or one of the large oil and gas companies? The traditional energy industry is removed from our daily lives, and we like it that way. We pay our monthly utility bill, fill up our car, and spend far more time comparison shopping for our next TV than our energy provider.

After all, energy is energy. But the qualities that make a TV desirable extend far beyond the one-dimensional price we use to measure gas or electricity.

This relationship is changing, though. Energy consumers have become more unique and dynamic, with a higher level of expectations and in some cases serving as energy producers themselves. The traditional energy sector is changing with them. Consumers are increasingly able to use information technology to shift their role from passive users to interactive consumers. Whether through smart thermostats, electric charging station apps, or remote building energy audits, the information we can both give and get about the energy we

use is recasting the relationship between consumers and the energy companies that service them.

The energy world we grew up in is changing fast. Businesses large and small sense the opportunity and challenges that lie in the vastly increased amounts of information available. In the midst of this change, the government has a role to play in creating opportunities to accelerate innovation. This paper outlines key opportunities for the government to foster entrepreneurship and create climate solutions in the process.

Energy and the internet: It's a thing

Consumers use energy IT solutions in their homes and cars—think Nest thermostats or OnStar navigation systems. But energy IT solutions also extend to commercial applications found in buildings, transportation, industry, and energy resources extraction. Whether in the consumer or commercial sector, energy IT can spark innovation in two fundamental ways. First, IT tools can give and receive energy-related information that helps individuals and businesses make smart, efficient energy decisions that generate value (and energy savings).[1] Opower sends utility customers messages about their energy consumption that incorporate behavioral tactics to encourage smarter decisions. Second, companies can build tools that process data, devise decision metrics, and make automate decisions.[2] That's the "set it and forget it" method smart thermostats use to change indoor temperatures based on preprogrammed rules. But it's also why warehouses, hospitals, or schools might connect lighting with motion detectors.

> **Transportation**
>
> *Intelligent transportation systems go beyond ride-sharing to parse information about a vehicle's surroundings and help make ours roads safer and cars cleaner. For example, a car with automatic brake*

systems will automatically break if it senses the car in front of it doing so, acting faster than a driver reacts. This not only helps avoid crashes, it helps traffic flow smoothly to reduce congestion and the unnecessary emissions traffic jams produce.

The sector delivers economic growth and energy savings

A recent report estimates that harnessing existing data sources in the electric, oil, and gas sectors, if publicly available, could create $580 to $1090 billion dollars of annual value. [3] This value reflects increased information exchange among existing companies, as well as emerging business models. In the electricity sector alone, the value of combining "open aggregate data" and increased consumer access to information can create $180 to $310 billion dollars of value per year. [4] This sub-sector—home energy management solutions, energy storage connected with smart analytical software, smart grid solutions, and more—is precisely what many IT energy companies target.

Renewable energy

DOE, IBM, and a host of other organizations want to use software to reduce the impact of renewables' intermittent nature. [5] Combining weather information with smart analytics can better predict when the sun will shine and the wind will blow. Power companies can use the forecasts to anticipate needs for their other power generation assets and grid operators can use the forecasts to better plan transmission line flows. Easing grid operations through software makes it easier to integrate renewables into our electricity system, boosting clean energy generation.

Collectively, these types of innovations can move the U.S. to a cleaner energy future. How much cleaner? Opower estimates that it has abated 6.4 billion tons CO2 and saved 4,000 GwH of electricity over eight years, saving customers more than $450 million in the process. [6] If 1% of U.S. households gave up car ownership in favor of shared vehicles, it would avoid nearly 10 million tons of greenhouse gas emissions. [7] When Microsoft implemented smart energy management across just 2.6 million square feet of buildings, it annually reduced costs by $250,000. [8] Extrapolate those type of IT enabled energy savings to new buildings and retrofits across the U.S., and in 2020 businesses could save up to $25 billion and 170 million mega tons of CO2. [9]

Smart grid

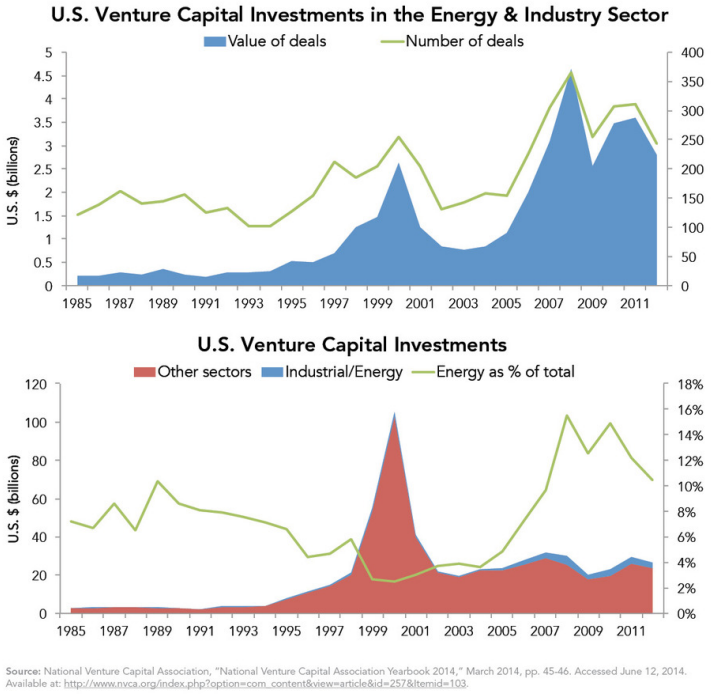
It looks like the contractors installed a big server in the basement, but it's actually a battery unit designed to save electricity. This is the practical side of what people call the "smart grid." This battery communicates with the electricity grid to anticipate peak demand. When peak demand for electricity across the grid hits and electricity prices rise in response, the building switches to battery energy for a short time. Companies like SolarCity and Stem Inc. compete in this space. [10] *Other utilities and companies offer similar services without the battery hardware. They sign up customers who agree to lower their energy use during times of peak demand. Enernoc, PG&E, and Comverge are leaders in this field.* [11]

This matters to emissions because lowering peak electricity demand means the grid needs fewer power plants in reserve to run on frigid winter days or hot summer afternoons. In many cases, these reserve power plants are inefficient and use polluting fossil fuels.

Investment is heading in this direction

Utilities are expected to invest nearly $200 billion over the next five years on improving and modernizing transmission and distribution infrastructure. [12] At the same time, venture capital investments in software-enabled energy technologies have picked up 55% since 2009 and attracted $2 billion through 2011. [13] Ridesharing, fleet monitoring, and private taxi services have captured an increasing share of venture deals in the transportation sector. Investors in hardware for the electric grid value the software components they come with. [14] Moreover, several companies who sell internet connected devices (think personal fitness wristbands, alarm clocks, or even trash cans) have successfully graduated from start-up to public company. Increasingly, the companies who are successful sell energy-related products. [15]

It's even more impressive that this action is happening against a backdrop of flat overall U.S. venture capital investments since 2008, and a falling share for energy venture capital investments. U.S. venture capital investment in the energy industry has fallen 40% since a peak of $4.6 billion in 2008. [16]



Source: National Venture Capital Association, "National Venture Capital Association Yearbook 2014," March 2014, pp. 45-46. Accessed June 12, 2014. Available at: http://www.nvca.org/index.php?option=com_content&view=article&id=257&Itemid=103.

The growth in the IT energy sector makes sense: internet energy companies are growing because they avoid many of the difficulties that challenge innovative energy infrastructure projects and pair nicely with the investments the energy sector is making on upgrading infrastructure to accommodate new technology. Internet-based energy solutions are more nimble and scalable; they avoid the long, expensive runway to commercialization that a biofuels or nuclear company needs. A smaller investment can determine whether or not a solution is successful in a shorter amount of time. Indeed, while the value of venture capital deals in energy in the U.S. declined 40% from 2008 to 2012, the number of deals declined only 33%—a possible indication these smaller investments focused on scalable, software-based energy companies. In sum, however you look at it—from an economic, energy, or investment perspective—energy IT makes great business sense.

The role for federal policy

The federal government can accelerate economic growth and energy savings in the energy IT sector, and not through the traditional role of funding or regulatory

enforcement. [17] Rather, it's about updating rules to make energy information more transparent, make it easier to exchange energy information, and make sure federal agencies manage energy information on public infrastructure and projects effectively.

This paper divides the role for federal policy into five distinct categories: policies that help **create** and manage more information, policies that **standardize** and format information for easier exchange, policies that enhance **access** to information, policies that increase information **transparency**, and policies that **evaluate** the use of information.

Create

Federal agencies have a responsibility to ensure they collect adequate information on public infrastructure—road networks, waterways, electric grids, public transportation networks, and public buildings. For example, since the 1970s underground roadway sensors have provided engineers with traffic information about the size, speed, and number of vehicles that pass the pavement above. Traffic engineers can use this to assess maintenance needs and plan future construction. Because 20% to 35% of roadway sensors in several states are now inoperative, state departments of transportation (DOTs) pay private companies to provide the information. [18]

Agencies in charge of public infrastructure should upgrade and repair existing sensor systems or adopt new methods of collecting information if they are found to be more cost-effective.

Standardize

Standards—digital communication protocols—allow smart devices to communicate with each other. This will benefit both consumers and companies seeking to operate in the emerging market of smart grid information. For example, an "open standard" that is developed and accepted industry-wide may allow an enterprising company to enter the emerging energy IT market with an innovative product more

easily than if the market uses individual, proprietary standards. Meanwhile, an accepted industry-wide standard allows consumers to invest in products that are compatible with products from other vendors.

DOE and the National Institute for Standards and Technology (NIST) should continue working with industry partners to design open standards for smart grid devices, building controls systems, and a wide range of consumer appliances. [19]

Access

Access and privacy are two poles policymakers always face when it comes to information. Unfortunately, citizens' own access to their energy information isn't always guaranteed. The Green Button Initiative, an effort the current administration spearheaded to create a standard by which utilities can communicate energy information to customers, [20] is often cited as a step in the right direction because it offers a standard by which consumers can access energy data. Many investor-owned and public utilities have already committed to implementing Green Button. [21] Some of these utilities, however, have not yet gone through and implemented the program, making additional incentives necessary. [22]

Congress should pass a bill sponsored by Sen. Mark Udall that creates an incentive program to encourage utilities to grant consumers access to energy information. [23]

This important initial step should be followed by policies that encourage utilities to make such information easily accessible and "actionable," either through additional proactive outreach to those customers on existing programs the utility may offer or through sharing energy information with partner organizations. By giving consumers not only the facts, but also the tools to save money by lowering their energy consumption, utilities can increase energy efficiency.

Energy information access issues extend beyond the utility sector. In the buildings sector, owners of multi-tenant buildings cannot easily access their commercial building

energy data. [24] This means they cannot tell how energy efficient or inefficient their buildings are, reducing the likelihood for building energy retrofits.

Congress should mandate that building owners should be allowed access the aggregate energy consumption information from their buildings.

Transparency

Energy information transparency varies across sectors. On the electric grid, the price utilities pay generators for electricity is tied to supply and demand. Yet this information is not communicated to consumers, who are charged a constant rate irrespective of demand on the grid at any given moment. A consumer gets a bill at the end of the month, long past the time he or she could have responded to higher prices by lowering use. Shifting consumers from constant to dynamic electricity rates can encourage consumers to conserve electricity in response to higher prices and higher demand, without increasing overall electricity costs. Similarly, consumers get a gas utility bill for heating or cooling their house at the end of the month, while they make consumption decisions on a daily basis.

- ***States should encourage public utility commissions (PUCs) to adopt dynamic electricity rates. DOE can support such efforts by providing examples of best practices.***

- ***The Federal Housing Administration (FHA) should require energy audits or previous energy usage disclosure for federally insured mortgages.*** [25]

Likewise, commercial building energy consumption and costs are also opaque. Benchmarking could help introduce transparency into this sector.

Congress should require all buildings over 25 000 square feet and all publicly owned or leased buildings to disclose their energy consumption. [26] ***More information on the market can help investors identify opportunities to gain returns on energy efficiency and can ensure federal funds to improve energy***

efficiency are spent wisely. The policy could save 0.2 quadrillion Btus per year in the U.S. by 2020 – eliminating the need for more than 13 very large coal fired power plants over the same time span. [27]

Building energy

The ventilation pipes in Building 65 are leaking. Before, the building manager might notice this months later, when the building was up for its annual audit. Now, an alert on the building controls system signals the manager immediately, who can send a worker over the same day and save 100 days of wasted energy (and a hundred days of money). It sounds obvious, but Microsoft and the Government Services Administration have only recently installed such technology and are considered pioneers in the field. [28]

Also on the rise are startups that offer remote building energy audits. [29] *Without even sending over a technician, it is possible to know how energy efficient your building really is and make plans for improvements that lower energy costs.*

The link between energy choices and cost is more transparent in the transportation sector. Consumers are highly aware of gasoline prices in U.S. But few cars inform drivers in real time about how efficiently they drive. Providing real-time guidance can change vehicle fuel consumption by 10 to 20 percent. [30]

- ***Federal agencies should encourage more automakers to incorporate real-time fuel consumption feedback in vehicles.***
- ***They should also work with local governments to design and implement effective information tools that encourage residents to match their transportation choice to the situation.***

The federal government should also take steps to make its own information or information produced using federal money publicly available and more transparent. The latest federal appropriations bill established an "open access" requirement on research produced with Department of Health and Human Services, the Department of Labor, or the Department of Education funding, but did not extend it to Department of Energy. [31]

DOE should make results published from energy-related research supported by federal agency funding publicly available.

Evaluate

The aforementioned policies all attempt to ease the exchange and availability of information to improve decision making, boost innovation, and lower energy consumption. The government must evaluate such policies to ensure that they are meeting these goals.

Agencies should evaluate their own data programs or allow outside researchers to do so. For example, if Congress requires all large buildings to disclose energy consumption information, it should incorporate an evaluation requirement to ensure that such disclosures do improve energy efficiency.

Conclusion

By updating rules and selectively directing investments, the federal government can unlock more energy savings and economic growth with energy IT. In particular, by tackling standardization, access, and transparency issues, the federal government can help set clear expectations for how it will regulate companies that operate neither wholly within the innovative technology industry nor the traditional utility industry. While innovative consumer products and smart phone apps can deliver energy savings alone, it is by working with utilities, automakers, and the real estate industry that innovative IT energy companies can generate maximum energy savings. This means they must interface with the Federal Energy Regulatory Commission, the National

Highway Traffic Safety Administration, and other federal and state agencies in their efforts to introduce innovative business models in these regulated sectors. A proactive stance from these agencies will accelerate growth in the sector.

TOPICS

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