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Innovating a New Business Model for Electric Utilities:

Consolidated Edison's Brooklyn & Queens Demand Management Project

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Introduction

Damian Sciano[1] pored over the papers on his desk, so absorbed in his work that he did not notice the wailing sirens and honking horns in the busy Manhattan street below. As Director of Distributed Resource Integration at Consolidated Edison ("Con Edison"), a publicly held utility that distributed electricity and natural gas in New York City and nearby Westchester County, New York, Sciano was responsible for the planning and operations related to integrating distributed energy (on-site or near-site power generation, including rooftop solar panels and systems that recycle heat for power generation) into the grid that connects power plants to the electrical sockets in millions of homes and businesses.[i]

In the past, electric utilities were responsible for power generation, transmission, and distribution end-to-end, giving them total operational control of, and accountability for, meeting the demand for electricity. Now, with the year 2018 coming to a close, new technologies and social priorities, in addition to company-led initiatives, were upending the traditional utility business model. These changes would affect not just operations, but utilities' profitability and attractiveness to investors.

Although he was responsible for developing new and innovative sources of electric power, Sciano knew that the company's priority was ensuring an adequate, reliable, and affordable supply of energy to all of its customers. He was scheduled to meet with a management committee in a few hours to discuss upcoming distributed energy projects. Con Edison was still learning to balance the operational uncertainties of distributed energy resources – which it did not control – with the concerns of the company's utility engineers, whose priority was ensuring a reliable energy supply.

In recent years, Con Edison had faced challenges finding more energy efficient, affordable, and environmentally sound ways of distributing energy to New Yorkers, driven by policy shifts, technological advances, and changing customer preferences. In response, it launched several distributed energy projects, including its crown jewel, the Brooklyn and Queens Demand Management Project ("BQDM"), which included a portfolio of distributed resources not controlled by the company. While some Con Edison managers initially expressed concerns about the riskiness of the project, it was now hailed as a tremendous success, having reduced energy demand by over 40 megawatts (MW) in the project area. Still, the company had much to learn and a long way to go to meet the state's ambitious energy goals.

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[*]In this case study, Damian Sciano represents the many members of Con Edison's team who were involved in the conception, implementation, and strategy surrounding BQDM. While he is the Director of Distributed Resource Integration, he did not join BQDM until the initial steps for the project were already underway.

This case study was written by New York University Stern School of Business graduate students Angus Chan, Gregory Gangelhoff, and Amy Klopfenstein under the supervision of Chet Van Wert, Senior Research Scholar, NYU Stern Center for Sustainable Business. It was prepared solely as the basis for class discussion. It is not intended to serve as an endorsement, source of primary data, or illustration of either effective or ineffective management.

The company now wanted to use BQDM as a model for new initiatives that would keep it on track to meet ambitious state-mandated goals and improve the sustainability of its electric power business. It hoped that BQDM's success could be repeated in a variety of similar projects. These initiatives were referred to as 'non-wire solutions,' because they utilized resources other than traditional electric power lines strung between poles or laid underground.

To develop these non-wire solutions, Con Edison needed to cultivate a large network of vendors, known as distributed energy resources (providers who actually install distributed resources at thousands of customer locations). This required the company to learn to manage the uncertainty inherent in third-party solutions. In other words, it had to give up a degree of control while still ensuring that adequate power was available whenever a customer turned on a light, an appliance, or a piece of commercial equipment – all while ensuring that the electricity distribution system was safe and reliable.

With numerous new programs under development, Sciano wondered whether Con Edison could replicate its successes with BQDM on a broader scale, and what this meant more broadly for the future of the electric utility industry. As a manager in a publicly traded company, he realized that distributed energy initiatives like BQDM would transform the traditional utility business model. And as its business model evolved, Con Edison's key stakeholders – investors, customers, and government regulators – might reassess their view of the company.

About Con Edison

Con Edison was created by the 1884 merger of six gas and light companies serving New York City. By 2018, the company had evolved into a regulated utility supplying electricity and natural gas to roughly 10 million residents of New York City and Westchester County, New York (Exhibit I). As of 2017, Con Edison's regulated utility business generated an annual net income of over $1.5 billion and operating revenues of more than $12 billion from over $48 billion in assets.[ii]

Con Edison had once been a vertically integrated power generator and distributor. In the late 1990s, the state unbundled the three major components of the electric utility business: power generation, transmission, and distribution. The power generation business was deregulated, introducing competition with the goal of realizing lower energy prices for customers through competition. Regulated monopolies were preserved in power transmission and distribution, where the duplication of power lines and other transmission infrastructure would be inefficient and costly.

As part of deregulation efforts, utilities like Con Edison were required to divest most of their energy generating facilities and focus primarily on energy delivery. By 2018, the majority of the energy generated in the state was produced by independent power producers and sold via public market exchange or, in some instances, directly to utilities through power purchase agreements.

Albany's Edict

In April 2014, the state government announced a set of ambitious policy and regulatory initiatives called Reforming the Energy Vision (REV). REV aimed to integrate more clean energy resources into the grid, while spurring the development of distributed energy markets and clean energy innovation.

REV included another bold initiative: making management of customer demand an important resource that energy companies could tap to manage in the energy system.[iii] Through an emphasis on reducing energy demand, rather than increasing supply, REV aimed to encourage solutions that would simultaneously increase energy efficiency, reduce its environmental impact, and decrease customers' energy bills over time.

Clean and distributed energy was already on the rise as a topic for discussion and planning within Con Edison, but REV required a step change in the utility's approach. Reflecting on the forces behind the development of the BQDM project, Sciano said:

> "The regulatory desire to have cleaner and more distributed energy sources was really the driver of the BQDM project. Even though solar, batteries, and other distributed energy resources were becoming increasingly cost-effective, the traditional infrastructure solution was extremely predictable, reliable and affordable. Without that policy direction from Albany, along with a willingness to innovate within Con Edison, we might not have initiated a project like BQDM, with the risks it represented, at the time."

Reforming the Energy Vision (REV)*

In 2014, New York Governor Andrew Cuomo formally launched the Reforming the Energy Vision (REV) policy. The policy articulated multiple targets linked to the overarching goal of making "a clean, resilient, and more affordable energy system a reality, while actively spurring energy innovation, bringing new investments into the State, and improving consumer choice."

REV outlined the following targets, to be achieved by 2030 (In 2018, the target date for these milestones was advanced five years to 2025):

- Reduce greenhouse gas (GHG) emissions by 40% from 1990 levels
- Generate 50% of electricity supply from renewable energy sources (solar, wind, hydropower, biomass)
- Increase statewide energy efficiency by 600 trillion BTU from 2012 levels, which represents a reduction of more than 16%

And the following, to be achieved by 2050:

- Decrease total carbon emissions by 80%

* State of New York, "REV – What You Need to Know." https://rev.ny.gov/about/. For more information, see https://energyplan.ny.gov/

Within this bold new regulatory landscape, BQDM gave Con Edison's leadership an opportunity to reevaluate its operations thoughtfully, in a kind of controlled experiment.

The BQDM Project

BQDM: The Plan (2014)

The opportunity to develop a pilot project that would demonstrate Con Edison's ability to meet REV goals became clear soon after REV was announced. New York City's boroughs of Brooklyn and Queens had both experienced rapid growth and needed new utility solutions to meet the energy needs of their expanding pool of customers (Exhibit II). With the region's current infrastructure reaching its carrying capacity, Con Edison realized that it had two options for meeting the increased demand: construct a new substation and related infrastructure – the traditional wire-based solution, which would cost approximately $1 billion – or implement an untested and, some believed, risky portfolio of projects that would reduce energy demand, making it possible to defer construction of the new substation.

Deferring construction of the substation appealed to Con Edison for a number of reasons:

- The New York City real estate market was notoriously expensive. Constructing and operating the substation in the middle of the busy, congested city would be extremely costly. In addition, there were challenging logistics, costs, and disruptions associated with running several miles of electric lines through highly trafficked streets to supply the substation.
- Customers also increasingly preferred more control over their energy consumption (and energy bills). Some alternatives to building the substation would give consumers more control, in turn allowing them to better manage their energy costs.
- The company wanted an opportunity to innovate and test the impact of non-wire solutions.

The plan Con Edison developed, the Brooklyn and Queens Demand Management project, or BQDM, comprised three different elements: Demand Response ("DR"), Demand Management ("DM"), and utility-side solutions. While DR and DM were relatively new ventures, they were steadily becoming more prevalent throughout the United States, though enrollment and capacity varied from state to state (Exhibits III and IV). DR and DM were referred to as customer-side solutions, because they were mainly under customers' control. In contrast, utility-side solutions comprised traditional grid technologies, as well as non-traditional solutions like a utility-side 2 MW lithium-ion battery. This portfolio of solutions was needed in order to provide the significant demand reduction necessary to offset the need for the substation. The customer-side solutions were most challenging for long-time utility engineers.

Demand Response: DR involved tactics that would reduce electricity demand during peak hours (the hours when customers used the most energy) to prevent the energy system from becoming overloaded and failing. Peak hours were defined differently for different customers and rate programs. In the BQDM area, they ran from noon to midnight, with highest demand in the late evening.[iv] Under Con Edison's voluntary time-of-use rate, customers could choose variable rates that were higher during peak periods, but lower at off-peak times – saving money by reducing their electricity use during peak periods.

Generally, DR was triggered either voluntarily by the customer, as a response to the price premium during peak hours, or automatically by the electricity grid operator. DR typically lasted 1 to 4 hours and included actions such as turning off or dimming banks of lighting; adjusting heating, ventilation, and air conditioning (HVAC) levels; or shutting down a portion of a manufacturing process.

Demand Management: DM emphasized energy efficiency. DM measures included lighting retrofits, building automation upgrades, HVAC improvements, and variable frequency drives that regulated energy consumption in appliances such as air conditioners. DM measures also included newer solutions, like fuel cells. These measures were intended to produce permanent energy savings, in contrast to DR, which was a very short-term solution.

To incentivize customers, particularly businesses, to participate in BQDM, Con Edison also created an auction. The premise was that Con Edison would pay the auction winners a set rate for reducing energy use through the peak periods during summer months. Participants could employ a variety of DR and DM tactics to meet their agreed-upon energy reduction targets, from installing energy efficient appliances to turning down their air conditioners during peak hours.

BQDM: Results (2018)

The initial cost-benefit analysis for the entire portfolio of BQDM tactics projected that, through 2026, Con Edison would need to spend about $200 million on the BQDM program to defer the construction of the $1 billion substation for eight years. Taking into account the time value of deferring the investment, and assuming that construction could be postponed for eight years, the initial projection suggested a net operating benefit of $45 million over the long term.

By the third quarter of 2018, the program had exceeded its goal, achieving an estimated 52 MW of demand reduction at a cost of only about $150 million. The remaining $50 million in the budget was allocated for future BQDM projects. As important, BQDM demonstrated Con Edison's ability to innovate in response to ambitious REV goals.

The company had grown more confident in its ability to rally thousands of customers, a portfolio of external vendors, and a range of new technologies to achieve energy demand reduction targets. It used a variety of online and offline marketing channels – primarily direct mail, in-person (door-to-door) canvassers, email, and social media – to reach the thousands of customers it needed. Coordinated multi-channel campaigns reduced the average number of customer touchpoints to conversion. In particular, direct mail and email efforts improved consumer receptivity to in-person canvassing.

By the end of the third quarter of 2018, DR and DM successes were measured as follows:

- Over 6,900 small businesses produced 11.8 MW of peak demand reduction;
- 1,770 multifamily buildings produced 4.87 MW of peak demand reduction;
- 24,049 one- to four-family residences produced 3.5 MW of peak demand reduction;
- 18 public housing buildings produced 1.6 MW of peak demand reduction;
- Several large commercial customers had installed fuel cells offsetting 6.1 MW of demand; and
- A variety of other commercial properties in the BQDM area offset additional demand.[v]

Not surprisingly, some of the experiments failed. For example, a thermal storage method, which used a frozen salt water solution to reduce electricity demand for refrigeration, had failed to produce the expected energy savings. In addition, a large number of planned projects that involved on-site batteries to store electricity and deliver it during peak hours were never implemented; the NY City Fire Department would not issue permits because of concerns that the batteries might overheat.

Four years after the initial announcement of REV, BQDM was viewed as a success within Con Edison and a flagship project for demand management. Although the company had initially planned BQDM as a relatively short-term project, Con Edison decided to renew and continue BQDM. The project had gone so well, and demand growth projections had moderated enough, that the plans for the new substation had been permanently deferred.

A Changing Business Model

An Accelerating Timetable

Con Edison's success with BQDM was recognized at the same time that more ambitious goals were being set by political leaders. In an address tied to Earth Day in 2018, Governor Cuomo committed New York State to achieving the energy efficiency targets outlined in REV five years earlier than planned, with a new interim target year of 2025. As part of this more aggressive timetable, the Governor's office explicitly stated that, "New York's investor-owned utilities will also be called on to achieve significantly more in both scale and innovation through their energy efficiency activities."[vi] This seemed to raise the stakes for Con Edison, and for Sciano's team in particular.

New Technologies

Con Edison planned to apply the BQDM model to a host of similar, sustainability-related projects.

New Technology Solutions: Some projects sought to employ additional new technologies as part of a portfolio of innovative solutions, including:

- Shared Solar, which aimed to install solar panels on Con Edison facilities and use the savings to benefit low-income consumers;
- Smart Home Rate Demonstration, which allowed Con Edison customers to more actively manage their energy use by setting up time-based rates; and
- Smart Meters, which communicated directly between residences and Con Edison, and gave customers daily updates about their energy consumption.

Non-pipeline Solutions for Natural Gas: Con Edison also distributed natural gas to commercial and residential customers for heating, cooking, and small-scale local power generation. In 2018, the company projected a shortage of as much as 9% of total projected demand by 2023. In response, it began developing a number of projects designed to reduce natural gas demand under the umbrella of 'non-pipeline solutions.' These projects incorporated the company's BQDM experience with non-wire solutions and were expected to provide varying levels of natural gas demand reduction.

These new projects offered Sciano's team the opportunity not only to oversee and implement innovations in energy distribution, but also to broaden Con Edison's involvement in the sustainable energy sphere. However, they also posed a new set of challenges. Replicating the success of BQDM's portfolio approach in new arenas like natural gas, solar power, and smart meters would require additional time, resources, and risk, not to mention additional innovations in Con Edison's ever-evolving business model.

A New Operating Model

Thinking about the $1 billion substation deferred by BQDM reminded Sciano that cost effectiveness would continue to be one of the three key metrics by which future projects were evaluated, in addition to reliability and environmental impact. However, BQDM's savings were achieved in an environment that was not typical. Building a traditional substation in the middle of New York City was extremely expensive. If future projects were evaluated in less costly locations, could they also show a financial benefit? If not, could the environmental and other benefits be quantified in a way that would garner the support of political and company leaders, not to mention customers and investors?

Sciano agreed wholeheartedly with the goal of decreasing greenhouse gas emissions associated with the electricity supply chain and he believed that BQDM provided proof that these goals were achievable. A whole portfolio of technologies and capabilities, including DR and DM, would have to be part of the solution. But he was less confident that all of the solutions in the portfolio could produce a positive financial return.

Managers at Con Edison were always acutely aware of the priority of maintaining a reliable energy supply. Ultimately, initiatives like BQDM meant that Con Edison was underwriting the development of independent energy resources and taking responsibility for integrating them into the grid. How could this be accomplished with an acceptable level of risk? How could the risks and benefits of DR, DM, and distributed energy be quantified?

Some of the larger challenges were still in the future. For example:

- As automobiles transitioned from gasoline power to electric power, they would be a major and difficult-to-project factor in forecasting electricity demand. They would draw power from the grid to charge their batteries. However, they also represented mobile/distributed battery storage units that could *supply* power *to* the grid when needed to meet peak demand. Con Edison did not yet have accurate ways to model the impact of electric vehicles, nor a reliable projection of the adoption rate of electric vehicles by consumers.
- Heating of homes and commercial buildings offered a similar forecasting challenge. Most homes and many commercial buildings were heated by furnaces burning fossil fuels (natural gas or fuel oil). Meeting goals like those embodied in the REV would require most buildings to convert to electric heating systems powered by clean energy sources.

- Another wild card was the integration of advanced information systems and machine learning with energy systems. These technologies had enabled major energy users like Google to dramatically reduce their energy consumption.[vii]

In other words, BQDM was just the beginning. Sciano compared all of these challenges to the operation of an aircraft carrier:

> "The old utility model was like the Navy. The Navy builds and manages aircraft carriers, trains the personnel, and controls the planes. This makes it possible to land a plane on a postage-stamp sized boat floating in the ocean. Now we want to move to the commercial airline model, where we don't control the runway and we don't control the planes, but we still have to enable them to land safely, reliably, and affordably. So we've got to have a longer runway. That loss of control requires more margin for error, and is a real challenge for utility engineers."

Sciano and his team were now faced with the daunting challenge of ensuring reliability to consumers while simultaneously letting go of many of the previous controls they had over energy distribution. They faced the prospect of working with a pool of unknown vendors, none of whom had the same level of investment in the project as Con Edison. If anything failed, the responsibility would fall squarely on Sciano and his team.

A New Financial Model

The Upside-Down Financials of Traditional Utilities

A typical company that produces widgets seeks to maximize the price it receives for those widgets, minimize the costs of production and distribution, and retain as much net profit as possible. Within this structure, the company's income statement properly reflects revenue (sales) as the 'top line' of reported information, while the rate of return for any investor in the company is determined by the 'bottom line' of net income. However, because the typical electric utility is a regulated monopoly, the regulatory authority overseeing it approves and, thus, *guarantees* the utility a specific rate of return (with some, usually performance-driven, variations) on its 'rate base.'

The rate base is the cumulative, undepreciated investment that a utility makes to deliver electricity to its customers – primarily the cost of building, maintaining, and operating assets like the electric grid. The rate of return the utility is entitled to earn on those assets, the rate base on which that return is calculated, and the pricing structure are all approved by a regulatory authority. Because these items, which are normally at the bottom of the income statement, determine the utility's top line of revenue (instead of the other way around), utility financial statements are sometimes referred to as 'upside down.'

When the New York Public Service Commission or other regulatory authority authorized a utility to include a DM program in its rate base, it was referred to as the creation of a 'regulatory asset.' The utility was authorized to earn a specified rate of return on its investments in DR and DM, just as it earned a return on traditional infrastructure. However, BQDM contributed less to Con Edison's rate base than the traditional substation would have.

Given its approved budget of $200 million versus the $1 billion the company would have spent on the traditional substation, BQDM required a much smaller investment, but also gave the company a smaller rate base for future earnings, compared with the traditional approach of building a centralized asset like a substation. Did this foreshadow lower profits as Con Edison succeeded in managing demand and empowering third-party distributed energy producers?

Utilities as an Investment

Many investors historically preferred investing in utility stocks because of the stable income they offered in the form of dividends. Utilities' uniquely stable dividend payments were supported by two factors: their regulated rate of return and the relative inelasticity in energy demand (even in an economic downturn, consumers continue to turn on lights and use appliances). While the upside potential for equity appreciation was limited, so was the downside, protected by the steady and dependable return of quarterly dividends. Con Edison, for example, boasted a 44-year history of consistent annual dividend increases (Exhibit V). This consistency attracted risk-averse, income-oriented investors.

As Con Edison's business model evolved, with a focus on reducing energy demand and a reliance on third-party resources, the confidence of utility investors might be jeopardized. Would utilities like Con Edison be able to continue raising their dividend payments every year as they succeeded in reducing overall energy demand? Would their future profitability be limited? In other words, would their attractiveness as investments change?

One Con Edison engineer described the traditional utility business model as a "set it and forget it" model. Energy efficiency measures also contain elements of "set it and forget it" – for example, energy efficient light bulbs passively generate an on-going stream of savings without any intervention. However, distributed resources and other dynamic technologies require more active management on the part of the utility, forcing it to behave more like a multiplayer platform than a vertically integrated one-stop shop for electricity.

If utilities like Con Edison no longer operated in a "set it and forget it" mode, would investors also decide that they were no longer "set it and forget it" investments?

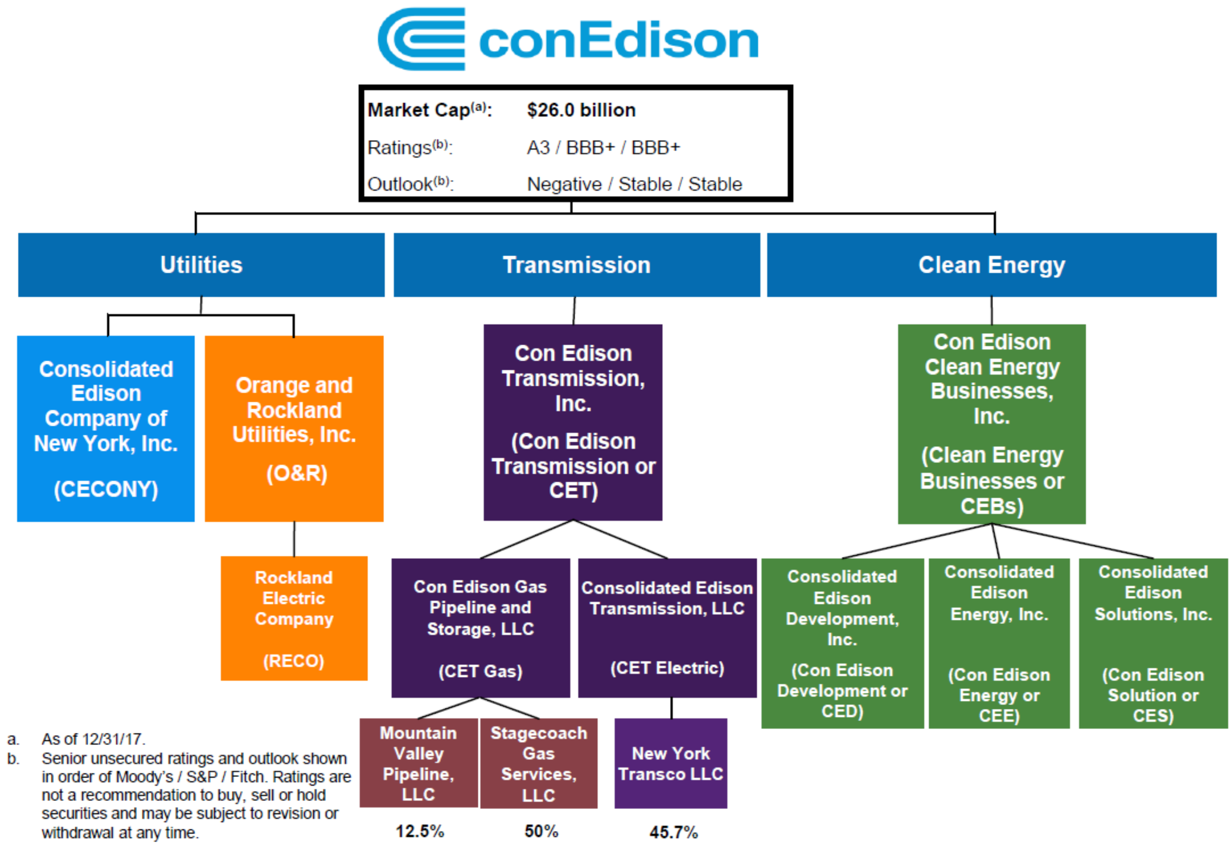
The Future of Sustainability at Con Edison

Sciano reviewed his notes a final time, took a deep breath, and prepared to meet with the senior management team. With the company's DR and DM activities expanding, he wondered about both the risks and the opportunities facing Con Edison. The success of BQDM encouraged him to think that the company had proven its ability to innovate, reinvent itself, and serve the diverse needs of all of its key stakeholders … so far. But there were lots of unanswered questions.

Some of the questions that most concerned Sciano included:

1. How would the company manage the transformation of its business model, learning and course-correcting over the coming years, while retaining the confidence of the investors, customers, and government regulators who controlled its destiny?
2. Did the BQDM project provide a convincing enough proof-of-concept to lessen the uncertainty about Con Edison's future among each of these groups of stakeholders?
3. What lessons learned from BQDM could improve the outlook for the myriad of new projects?
4. With New York City's burgeoning population, wild cards like the electrification of automobiles and building heating systems, and continued regulatory pressure, how could Con Edison ensure reliability while expanding its work with independent, distributed resources?
5. Moving forward, who should be the ultimate guarantor of the reliability and stability of the electric grid for the benefit of energy consumers: Con Edison, a regulatory body, or some new entity yet to be created?
6. As a publicly held business, Con Edison had to offer its shareholders a reliable and growing stream of income. How could it balance that need against REV's edicts to reduce both energy use and consumer costs?
7. Would regulators and consumers be willing to pursue energy efficiency and sustainability solutions where the projected financial cost exceeded that of traditional options? Could the environmental benefits be quantified in a way that would justify the financial cost?
8. Should the company urge caution among those seeking to accelerate the deployment of new technologies and the reformulation of the utility business model? Or would this precipitate a loss of confidence in the company's ability to navigate a changing world?

Exhibit I. Consolidated Edison Organizational Structure

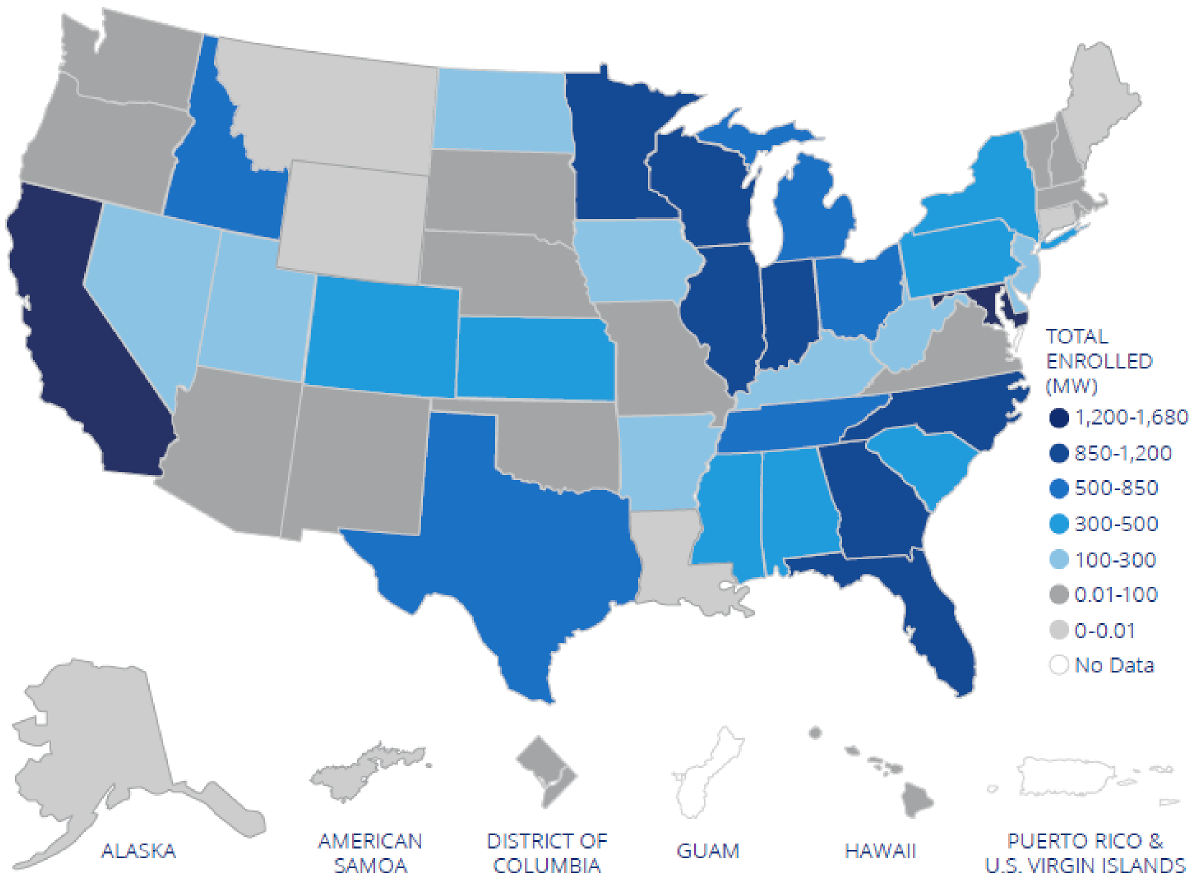


Source: "Company Update." *Presentations and Websites Archive*, Consolidated Edison Company of New York, Inc, Mar. 2018, phx.corporate-ir.net/External.File?item=UGFyZW50SUQ9NjkwMDk5fENoaWxkSUQ9NDAwNTEzfFR5cGU9MQ==&t=1. Accessed January 13, 2019.

Exhibit II. Brooklyn Queens Demand Management (BQDM) Program Area

Source: "Brooklyn Queens Demand Management Demand Response Program." *Business Opportunities*, Consolidated Edison Company of New York, Inc, www.coned.com/en/business-partners/business-opportunities/brooklyn-queens-demand-management-demand-response-program. Accessed January 13, 2019.

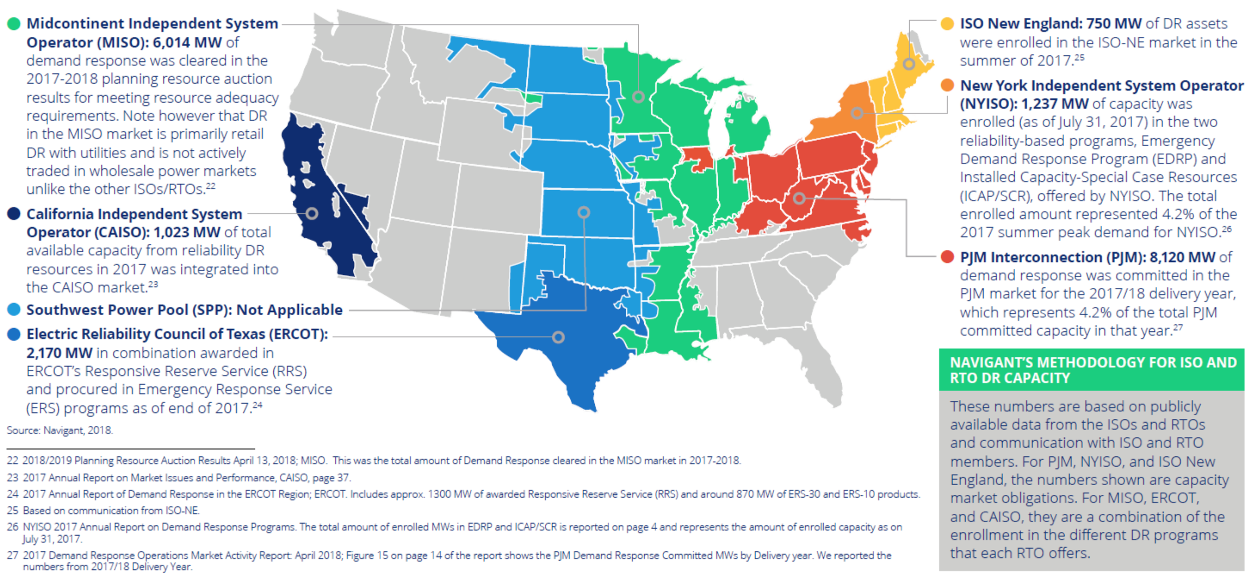
Exhibit III. Total 2017 Enrolled Demand Response Capacity by State



Source: Smart Electric Power Alliance, 2018. (Note: This map represents total capacity collected in SEPA's Annual Utility Survey for calendar year 2017. Results are based on responses from 155 utilities. See Methodology in the appendix for more details and a list of participants.)

Source: *2018 Utility Demand Response Market Snapshot*. Smart Electric Power Alliance, Sept. 2018, sepapower.org/resource/2018-demand-response-market-snapshot/. Accessed January 13, 2019.

Exhibit IV. Demand Response Capacity by Regional Transmission Organization and Independent System Operator



Source: *2018 Utility Demand Response Market Snapshot*. Smart Electric Power Alliance, Sept. 2018, sepapower.org/resource/2018-demand-response-market-snapshot/. Accessed January 13, 2019.

Exhibit V. Con Edison's Dividend History: 44 Consecutive Years of Dividend Growth

Year	Dividend *
1977	$0.50
1978	$0.55
1979	$0.61
1980	$0.67
1981	$0.74
1982	$0.84
1983	$0.94
1984	$1.06
1985	$1.20
1986	$1.34
1987	$1.48
1988	$1.60
1989	$1.72
1990	$1.82
1991	$1.86
1992	$1.90
1993	$1.94
1994	$2.00
1995	$2.04
1996	$2.08
1997	$2.10
1998	$2.12
1999	$2.14
2000	$2.18
2001	$2.20
2002	$2.22
2003	$2.24
2004	$2.26
2005	$2.28
2006	$2.30
2007	$2.32
2008	$2.34
2009	$2.36
2010	$2.38
2011	$2.40
2012	$2.42
2013	$2.46
2014	$2.52
2015	$2.60
2016	$2.68
2017	$2.76
2018	$2.86

** Consolidated Edison annualized dividend payments per share adjusted for stock splits.*

Source: "ConEdison Inc. Dividend History," *Investor Relations Intelligence*, NASDAQ, http://phx.corporate-ir.net/phoenix.zhtml?c=61493&p=irol-dividends. Accessed January 16, 2019.

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