



# The Clean Energy Promise

Accelerating the Transition to a Decarbonized Economy and Rebuilding Opportunity for America's Working Families

By Dean Seavers

nationalgrid





# The Clean Energy Promise

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With the world seeing more and more evidence of the negative effects of climate change, **how do we take advantage of emerging clean energy opportunity?**

## John Pettigrew

John Pettigrew is CEO of National Grid plc, an energy company that transmits and distributes electricity, natural gas, and clean energy solutions to customers, large and small, in the UK and northeastern US.

[Click here for a copy of "Northeast 80x50 Pathway"](#), National Grid's blueprint for drastically reducing greenhouse gas emissions 80% below 1990 levels by 2050.





## Foreword: The Clean Energy Promise

By John Pettigrew

Recently I had a glimpse of what tomorrow's energy system might look like. It was early June 2017 in the UK, a day after torrential rains and 70-mile-per-hour winds from a strong Atlantic weather system swept across the country, causing widespread power outages in several southwest counties.

When the sun rose the next morning, and with winds still howling, something remarkable and unprecedented happened. Large-scale solar, wind, and nuclear power began meeting more than half of Britain's energy demand, generating more electricity than conventional coal and gas combined, for the first time ever.

Record output of carbon-free energy was one of three records broken that day.

*John Pettigrew,  
CEO, National Grid*





The second was the longest period of negative energy pricing in UK history. Wholesale prices plummeted on the sudden glut of power generated by renewable sources, much of which wasn't needed and couldn't be stored. The third was that, for the first time, incentives were offered to increase customer demand rather than decrease that expanded generation, which reduced the risk of system overload.

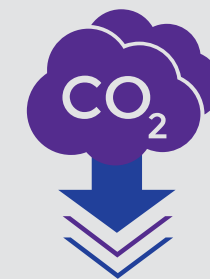
Yes, that's right. Electricity distributors were paid to have their customers, large and small, use more electricity, the antithesis of energy efficiency.

Even to casual observers, it's obvious that our energy industry is in the midst of unprecedented change.

What's less obvious — for regulators, policy makers, industry partners, and customers — is how to manage the move to a cleaner energy future.

### Carbon reduction targets

**40%**  
DECREASE BY 2030



**80%**  
DECREASE BY 2050

In other words, with the world seeing more and more evidence of the negative effects of climate change, how do we take advantage of the emerging clean energy opportunity?

If we're going to begin approaching ambitious

carbon reduction targets — a 40 percent decrease by 2030 and 80 percent by 2050 — all policy makers, industry partners, and customers will need to embrace and incentivize all solutions, proven and unproven.





**“ Doing the right thing and finding a better way are values we exercise every day. ”**

In short, if we act now, with greater commitment to a range of solutions, then we can hold off the global warming increase of two degrees centigrade that climate scientists call the “game over” threshold.

To have any hope of hitting aspirational emissions targets, we need scale, speed, and

a diversity of ideas. The good news is most large energy companies have all three, plus a healthy appetite for experimentation.

Most importantly, our electricity companies have a social contract with every customer and community that requires them to act. And act we must.

National Grid is taking action. In the following pages you will find stories that bring to life our passion for energy and our communities. Doing the right thing and finding a better way are values we exercise every day. This book demonstrates “The Clean Energy Promise,” on every page.

The stories that follow are about the clean energy challenges and opportunities we see in the US, especially in the states we service — Massachusetts, Rhode Island, and New York.

What I find most promising about what I’ve been seeing is that the promise of clean energy creates a nexus of infrastructure investment, local economic growth, and social mobility.

All of which, of course, engender network decarbonization and long-term environmental health.



**And that’s really what it’s all about — doing the right thing and finding a better way. And, I might add, leaving it all better than we found it.**

**Enjoy the book and join us in this great challenge. ◇**



# Extreme Weather's Less-than-Extreme Solutions





**Let's suppose, for argument's sake, you question whether climate change is real, or whether it will really affect you. You're not alone.**

More than a third of Americans say they don't worry much or at all about global warming and a third say it's exaggerated in the news. More than half say it won't pose a serious threat in their lifetimes, and 12 percent say it will never be a threat.

Still, amid the devastation left by Hurricane Florence and past hurricanes, extreme weather is a little tougher to question or ignore. Extreme weather has its origins, of course, in extreme temperatures. The four hottest years globally on record? That would be the last four, in this order: 2016, 2017, 2015, and 2018.





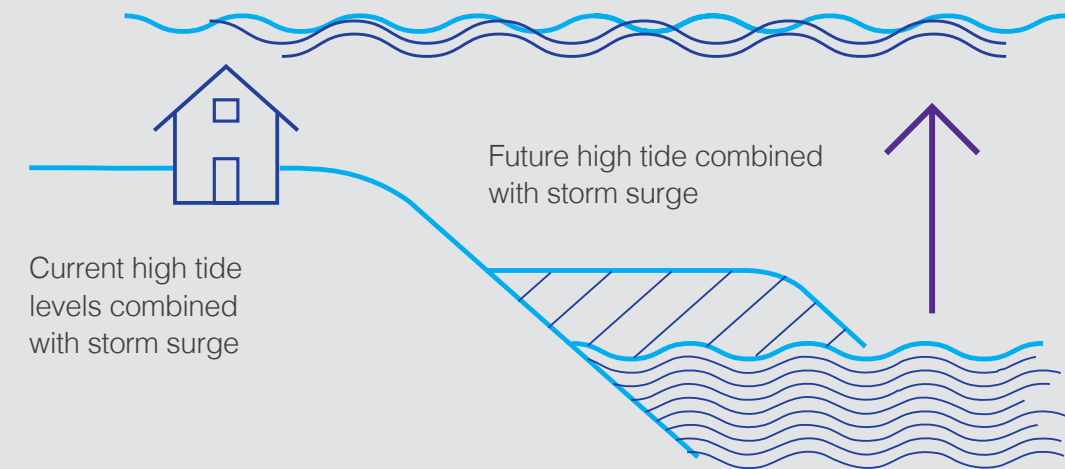
National Grid employees in Puerto Rico during Hurricane Maria restoration

Water levels have also been rising along our coasts, and we can expect a four-foot increase by the end of the century if we don't phase out excessive use of fossil fuels by 2020. That means at high tide, with a stiff wind blowing into shore, you'll be able to swim to your home. Don't worry, you won't be alone. Not with 30 percent of the US population living and working in communities within 50 miles of the coast.

Why do so many Americans believe climate change won't

affect them personally? It is conceivable they didn't know any of the millions of Americans touched by the record number of hurricanes — and record intensities — in recent years: Katrina, Sandy, Irma, Harvey, Jose, and Maria, to name but a few. Or the four back-to-back nor'easters that hit New England in spring 2018. Or the destructive heat waves, floods, tornadoes, and wild fires that have run roughshod across North America in the first part of this century.

## Sea Levels in 2100



“ We need to better prepare for the predictably “unexpected,” adapting and creating more resilient communities in the face of catastrophic weather. ”

The National Oceanic and Atmospheric Administration reported the 2018 hurricane season produced 15 named storms, including eight hurricanes of which two were killer Category 3 to 5 hurricanes. Whether we believe extreme weather events are the result of climate change or not, we have opportunities to improve how we cope with them.

We need to better prepare for the predictably “unexpected,”

adapting and creating more resilient communities in the face of catastrophic weather. We also need to recognize that energy infrastructure is fundamental to disaster preparedness and enduring economic health and safety. (See the devastating effects of Hurricane Maria on Puerto Rico in 2017.) Finally, we need to continue the transition to clean energy infrastructure that's already under way.



## It makes a lot of sense to manage these challenges holistically.

To do that, here are four policy recommendations that should help position us for success.

### ONE

Let's create tax incentives and other enhancements for all parties touching the energy supply chain to encourage higher risk and capital-intensive public-private partnerships. We'd all benefit from this change, allowing us to evolve the old utility paradigm of only supporting predictable, risk-free cost recovery.

### THREE

More seed funding is needed for energy infrastructure planning with a range of community stakeholders. Sounds logical (it is), but few cash-strapped cities and lean utilities set aside funding for work that seems like a luxury until the generous economic development returns are understood and realized.

### TWO

The same goes for innovation. Customers and businesses need incentives to encourage the quick discovery and adoption of solutions that include heating oil conversions, neighborhood rooftop solar programs, small- and large-scale energy storage, heat pumps, EV infrastructure, and renewable natural gas. This is especially true for smart green transmission, to get the large-scale clean energy (hydro, wind, solar) from where the energy is cheaply produced to population centers where it's consumed at scale.

### FOUR

Of super importance, everything should now be designed for a very different landscape, where extreme weather is the new normal. That means more investments — both public and private — to build greater resilience into network designs, where automation and digitization are the new standards, where substations are flood-proof, and where microgrids are the norm and not the exception.

**Large companies like National Grid need to put their balance sheets to work on these challenges, and regulators and policy makers need to offer shrewder risk-reward formulas to benefit both our investors and customers.**

Only with this clear-eyed approach will we see real progress on the ground when, not if, the next extreme weather event hits. Need more evidence to support this call to action? Turn on the Weather Channel. The evidence is there, almost every day. ◇



# It's Time to Put a Price on Carbon — With Customers in Mind





As lawmakers take their oaths of office and begin to set policy agendas for the coming year, **establishing an economy-wide price on carbon** should be at the top of their lists.

Everything I read and hear about carbon pricing rarely shares the customer's point of view. That's a shame. I'd argue that the only way we'll likely see success with enacting an economy-wide carbon price is evaluating all policies through a customer lens.

Over the last decade, the Northeast has meaningfully reduced the power generating sector's carbon emissions by participating in the Regional Greenhouse Gas Initiative (RGGI), a market-based construct that incorporates a moderate price on carbon.

National Grid continues to support RGGI and recommends that policy makers build upon its success by applying a carbon price to fossil fuel use to lower carbon emissions beyond just the power generation sector, but in the transportation and heating sectors too.



### Carbon Pricing Key to Achieving 80x50

In June, we released our [Northeast 80x50 Pathway](#), a detailed blueprint of ways for New York and New England to achieve their goals of reducing greenhouse gas (GHG) emissions 80 percent below 1990 baselines by 2050 (80x50), with an interim goal of a 40 percent emissions reduction by 2030.

“ Our study shows that by 2030, the power sector will need to be **67% zero-carbon** and effectively a carbon-free system by 2050 — with renewable energy playing an important role. ”

The [Pathway](#) identifies specific milestones in power generation, transportation, and heating that the region will need to achieve on the road to a cleaner energy future. These three milestones can be supported by carbon pricing:

#### ONE

Our study shows that by 2030, the power sector will need to be 67 percent zero-carbon and effectively a carbon-free system by 2050, with renewable energy playing an important role.

Carbon pricing would provide long-term price signals for cost-effective clean energy investment and funding for energy efficiency, renewable deployment incentives, and research development and deployment (RD&D) for new clean energy options.

#### BY 2030

**100%**  
light-duty vehicle (LDV) sales will need to be electric

#### BY 2050 100% LDVs

**must be electric**

#### TWO

The transportation sector has quite the hill to climb, but it's doable. By 2030, 100 percent of light-duty vehicle (LDV) sales will need to be electric, and by 2050, 100% of LDVs on the road must be electric.

New zero-carbon options will be required for medium- and heavy-duty vehicles, as well as non-road uses such as ships, railroads, and aviation. Carbon pricing would make the total cost of ownership for electric vehicles (EVs) competitive with traditional internal combustion engine vehicles, and carbon revenue could fund incentives for EVs and charging stations.

#### THREE

Home and business heating is also a significant challenge especially in the Northeast. To meet a 40 percent target of decreased of carbon emissions by 2030, the Northeast would require a doubling of energy efficiency retrofits, tripling the rate of oil-to-gas conversions, and up to ten times the current oil-to-electric conversions.

By 2050, the heating sector would need sustained efficiency investment and conversion to heat pumps; steady decarbonization through renewable natural gas, hydrogen and synthetic fuels; and the conversion of many natural gas homes to hybrid natural gas-heat pump configurations.

Carbon pricing would improve the attractiveness of oil-to-gas and oil-to-electric heating conversions for customers, cut energy efficiency costs, and fund deployment incentives and low-carbon heating RD&D.





To achieve the 80x50 targets while avoiding customer bill shocks, carbon pricing should be phased in, becoming steadily more aggressive. We should use the resulting revenue for the following: funding for transportation electrification infrastructure and vehicle rebates; direct customer bill impact mitigation; funding for economical electrification of oil and propane heating; and funding for RD&D related to gas network decarbonization. Investing in these priorities will realize a dual benefit from carbon pricing.

There are various mechanisms that could dampen high bills for our customers. For example, consider lump-sum rebates (e.g., per capita or per household) or offsets of existing taxes with new carbon tax revenue. Should carbon pricing increase net tax receipts, the new funds should be put to use to further policies.




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**“ Further bolster popular support by cutting/reducing customer bills, plus reducing (more) emissions. RGGI provides a model, as proceeds are considered revenue positive, with most revenue targeted towards energy efficiency programs. ”**

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The same goes for the heating sector. Revenue from fuel oil and natural gas should fund lump sum bill credits for customers or similar remedies. A particular focus on mitigating bill impacts for low-income customers and energy-intensive, trade-exposed large customers is critical. Additionally, a portion of carbon revenue from heating fuel use should fund electrification of oil and propane heating for customers who are remote from the gas networks.

Finally, the nation’s heating infrastructure should be upgraded and improved with a portion of carbon revenue from heating fuel used to fund technology RD&D and other programs related to gas network decarbonization (e.g., renewable natural gas, hydrogen, syngas, hybrid electrification).

**No Customers Left Behind**

While further analysis on the preferred price and mechanism of an economy-wide carbon price is needed, existing studies have shown that assigning

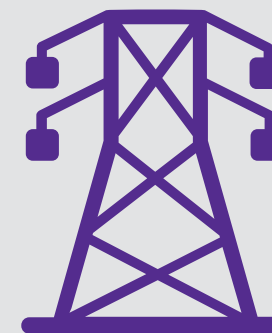
a price to carbon is an effective tool for emissions reduction. We must build new partnerships that bridge local, state, political, and economic borders to find the most effective manner of deployment that ensures that no customer is priced out of a clean energy transition.

The most economically vulnerable individuals are often the most vulnerable to the effects of climate change and least able to afford clean energy solutions.

***We must work collaboratively to ensure that all people benefit from pricing carbon and, through it, our clean energy future. ◇***

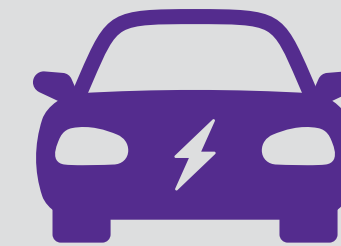
## What difference can carbon pricing make?

Applying a carbon price to fossil fuel use will help lower carbon emissions in the power generation, transportation, and heating sectors so the Northeast can hit these critical milestones:



**67%**

The power sector will need to be 67% zero-carbon by 2030 and effectively carbon-free by 2050



**100%**

100% light-duty vehicle (LDV) sales will need to be electric by 2030

Must be 100% electric LDVs on the road by 2050



**10X**

Doubling energy efficiency retrofits, tripling the rate of oil-to-gas conversions, and a scale-up of 10X the current oil-to-electric conversions



# Getting Up to Speed on EVs







**I see some big obstacles to overcome before we see a societal conversion to EVs. Awareness is top of the list.**

Here's a concerning fact: less than half of Americans know what a zero-emission vehicle is. There isn't widespread understanding of what it means to drive electric, or what electric vehicles (EVs) even are. And you can't embrace what you don't know.

Switching away from the gasoline pump can be confusing. Countless misconceptions surround EVs on topics ranging from their cost to their convenience. Many drivers aren't aware of the total benefits they could be reaping by going electric. And most struggle to stack up the costs and benefits of an EV versus a gasoline-powered vehicle, factoring in fuel costs and emission levels.

How do you figure out the actual overall cost of driving a particular car? Does driving an EV really save money?



The need for more EV education has never been greater. Transportation emissions have been virtually unchanged since 1990 and are the largest source of emissions in the Northeast today. While emissions from electricity-generating plants have decreased by almost 50 percent since 1990, emissions from transportation have remained largely unchanged, pumping 40

Let's look at some of the steps we are taking to get people in the know about EVs.

First, we're encouraging our employees to go electric. In April 2018, we launched an innovative pilot that motivates our employees to adopt EVs and smart-home technologies such as solar, battery storage, and home energy monitoring.

**“ We believe we're close to a tipping point when EVs will become mainstream and options will be available for every price point and type of vehicle. ”**

percent of carbon every year into the atmosphere. Drastically reducing emissions by 2050 will require a major transformation of the transportation sector.

To make this happen, how can we get more people up to speed about EVs and their many benefits? At National Grid, we believe we need to lead by example and back our words with concrete action.

Through education and incentives, we're making EVs more accessible and affordable for them. This includes using shareholder money to offer employees a \$5,000 incentive for the purchase or lease of a battery electric vehicle (BEV) or a plug-in hybrid electric vehicle (PHEV) of their choice.

We launched EV Central, an employee EV program, last



### The Journey of an EV Convert

I wouldn't consider going back to gas. My Mitsubishi Outlander Plug-in hybrid electric vehicle (PHEV) saves me the cost of filling up regularly. It has a four-cylinder engine so it's good on gas. It's bigger and roomier than my old CRV. It's so quiet. It can handle the hills and snow and is also great running errands in the city. It's such a sweet ride — so much more enjoyable to drive. You get hooked once you drive a PHEV.

It's a totally different driving experience. I drive down the street knowing I've taken my car to the next level while I'm doing something good for the environment.

—Rita, an EV convert





year, and more than 300 of our colleagues bought or leased an EV. To put that number in perspective, those 300 EVs represent 4.7% of management employees, and have led to a reduction of approximately 1.5 million tons of CO<sub>2</sub>.

It also includes building a charging infrastructure, and to date, we have installed, and manage, 150 publicly accessible EV charging stations in Massachusetts, Rhode Island, and New York. We have filed to build more than 10,000 non-residential EV charging ports by 2025 in

our states to reduce emissions in the transportation sector.

To make converting to an EV easy and seamless, we created an online portal that houses educational tools, incentives, and partnership discounts in a single place.

In the initial months of the program, hundreds of our employees made the jump to electric, using words like quiet, efficient, powerful, clean, responsive, and fun to describe their new driving experience. This is only the

beginning. The pilot is paving the way for a broader incentive program that we're planning to roll out to National Grid customers in the future.

Our goal is two-fold: to empower our own community to do what they can to help us hit our emissions targets and to use our employees as proxy customers and to learn more about EV-use customer behaviors in real time.

We're also making sure people have a place to get clear, reliable answers so they can make informed decisions about their next car.

In June 2018, we launched [National Grid Cars](https://cars.nationalgridus.com) ([cars.nationalgridus.com](https://cars.nationalgridus.com)), an easy-to-use online marketplace that helps car shoppers understand the cost and benefits of EVs when making their next car purchase.

Using side-by-side comparisons, you can see a straightforward snapshot of your favorite car model's fuel efficiency, available incentives and rebates, emission levels, and total cost of ownership. And you can tailor

your search to your specific requirements — driving habits, fuel costs, and more.

Thanks to our partnership with Enervee, National Grid Cars is a real-time marketplace, using market and product data that's refreshed daily. Every car is given an Enervee Score® — a 0-to-100 number that reflects the vehicle's efficiency. The closer a score is to 100, the lower the fuel costs, the fewer the emissions, and the better the choice when compared to all other cars of the same performance. It's as simple as that.

We believe we're close to a tipping point when EVs will become mainstream and options will be available for every price point and type of vehicle. That's the only way we can dramatically reduce transportation emissions.

***By shining a light on EVs — and encouraging our employees and customers to lead the way by going electric — we can all work together to tip the scales and speed the transition to a clean energy future. ◇***



## How much can you save with your next car?

National Grid Cars is an easy-to-use online marketplace that helps car shoppers understand the cost and benefits of EVs when making their next car purchase.

[www.cars.nationalgridus.com](http://www.cars.nationalgridus.com)

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Enervee Score®— a 0-to-100 number that reflects the vehicle's efficiency

**\$30,513**

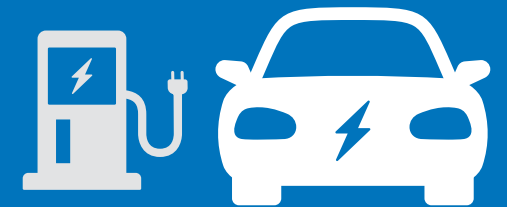


**- VS -**

90

Enervee Score®— a 0-to-100 number that reflects the vehicle's efficiency

**🏆 \$23,802**



Volkswagen 2018 Jetta 1.8L

MSRP	\$23,245
Fuel Cost (5YRS)	+ \$7,268

Nissan 2018 LEAF

MSRP	\$29,990
Electricity Cost (5YRS)	+\$3,412
NY EV Purchase/Lease Rebate	- \$100
\$2,000 In State Rebate and Up to \$7,500 in Credit:	- \$9,500



# An Elegant Solution in Energy Storage







**I have always been a fan of the elegant solution, when the best outcome is achieved with **the smallest, or simplest effort.****

I believe our new battery energy storage system (BESS) project on Nantucket Island is a classic example.

Thirty miles off the coast of Cape Cod, Nantucket is a fairly small island, but its energy needs have grown rapidly in the past 10 years, particularly during the summer season, when its population increases five-fold. The challenge for National Grid has been to keep ahead of this growth, which is only projected to continue increasing into the foreseeable future.

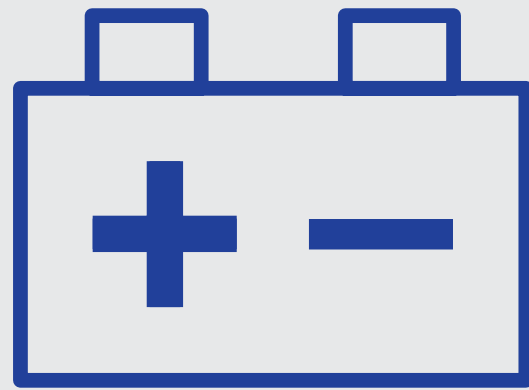
For the past few decades, Nantucket's electricity infrastructure has consisted of two underwater cables from the mainland, backed up by an aging diesel generator. An infrastructure upgrade clearly was needed to accommodate the island's growing demand for reliable electricity. At the same time, we wanted to defer, if possible, the need for a third submarine cable, which would be costly to install.



Our team realized that this situation lent itself to a potentially unique solution incorporating energy storage, which would enable us to cut the required amount of on-island generation in half. But we didn't know if battery storage costs had decreased enough to make energy storage economically viable.

The team's further analysis confirmed that energy storage would be a viable and cost-effective solution. The team addressed all generator and energy storage requirements and conducted a competitive request for proposal to ensure the lowest cost for the solution.

When it is fully installed in spring 2019, the BESS will be the first large-scale battery installation in New England. When combined with a new upgraded onsite combustion turbine, also expected for completion in spring 2019, the BESS should supply the island with all the electrical power it needs should one of the two existing submarine cables experience an



“When it is fully installed in spring 2019, the BESS will be the first large-scale battery installation in New England.”

outage, or on peak summer days when air conditioners put extra strain on the infrastructure.

And, perhaps more importantly, the BESS could well delay the need for a third submarine cable for an additional 15 to 20 years beyond the current forecast by supplying electricity to supplement the cables during times of peak usage in the summer.

Looking back on this project, I realize that we very well could have chosen to



add another, larger, back-up generator on the island and been done with it — a challenge faced and overcome.

But what we really wanted was to identify an elegant solution. And yes, we've certainly come up with a solution that we think is innovative, simple, adds value, and minimizes long-term costs.

***At the same time, I believe we've also created a solution that is more environmentally friendly, that is directly responsive to our clean energy aspirations, and that puts our National Grid customers first. ♦***



# Turning Organic Waste into Renewable Energy







**Roughly 1.3 billion gallons of wastewater go down the drain every day in New York City. That's more water than can fill a billion above-ground swimming pools.**

Now, try to imagine the amount of organic waste generated every day in the same city — waste that would likely be sent to landfills.

This isn't just happening in New York City. No matter where we live, we all generate some amount of organic waste.



**What if we could reduce the amount of organic waste sent to landfills, while producing a reliable source of clean, affordable, greener energy and, in the bargain, reduce carbon emissions and improve air quality?**

I'll start by telling you about renewable natural gas and its role in this exciting project. National Grid is embarking on a renewable gas project at the Newtown Creek wastewater treatment plant, located in Brooklyn's Greenpoint neighborhood, which is the largest of New York's 14 such facilities.



Roughly 330 million gallons of sewage come daily into the Newtown Creek plant. Our project will use biogas, a by-product of the wastewater treatment process, to create renewable sources of energy. New York officials estimate that the Newtown facility produces more than 500 million cubic feet of biogas annually. Again, consider the extraordinary scale of these amounts.

Biogas contains approximately 60% methane gas and 40% carbon dioxide. Typically, when isolated from the wastewater treatment process, about 40% of this biogas tends to be reused in fueling boilers that provide heat for plant buildings

and eight huge stainless-steel receptacles known as "digester eggs," where the solid materials are incubated. The excess biogas would then be ignited, or "flared" into the atmosphere.

In late 2013, National Grid joined with the City of New York and environmental solutions giant Waste Management to create a first-of-its-kind renewable energy project, a project that had been in the works since 2009.

As National Grid's part of the public-private partnership with the City, we plan to purify that excess biogas by means of a technology that allows us to





“ New York City has mandated that food waste can no longer be shipped off to landfills. ”

generate pipeline-quality renewable natural gas on-site at Newtown and inject it into the local gas distribution network to heat residential and commercial properties.

Remember, this comes from a feedstock that before would have been “flared” off into the atmosphere, doing absolutely nothing to reduce greenhouse gas emissions.

New York City has mandated that food waste can no longer be shipped off to landfills. Through its participation in this partnership, Waste Management began processing organic food waste collected from local schools into a liquefied feedstock and delivering it to the Newtown Creek

plant, where it would be added to the wastewater sludge to produce additional biogas.

There are many individual “wins” that have come from this innovative partnership between National Grid, New York City, and Waste Management, not the least of which is a more reliable source of clean energy.

***The possibilities for this very scalable solution are limitless. Think of all the sewage treatment plants in municipalities in the Northeast that rely on natural gas for heating. Shifting to renewable natural gas while decarbonizing a community’s water treatment operation would be an extraordinary win-win. ◇***

Newtown Creek  
Renewable Natural Gas  
Facility at bottom right



# Power-to-Gas: A Strategy for Storing Renewable Energy







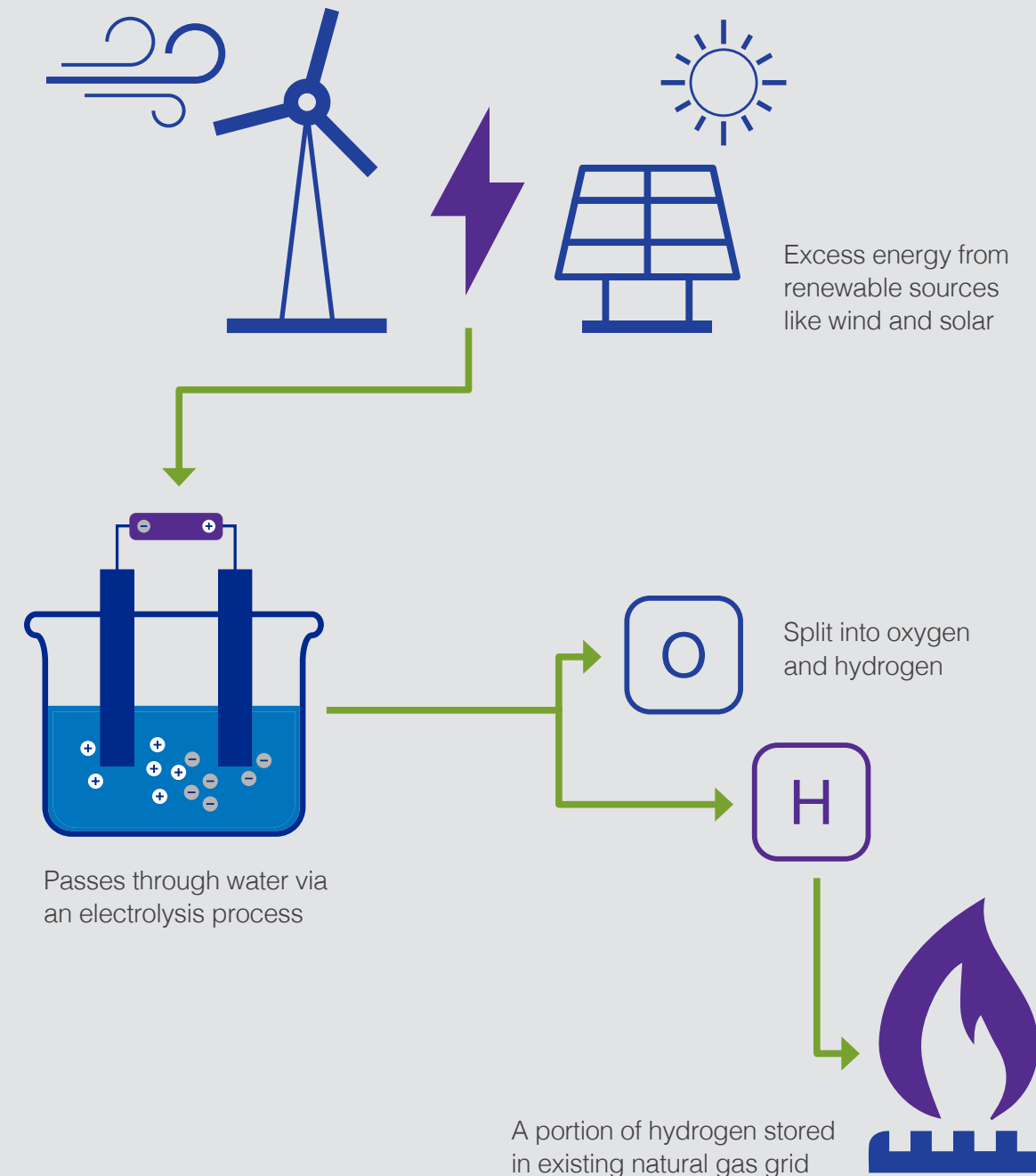
**Our industry has made great strides with wind and solar power, but we've as yet fallen short of delivering these clean energy resources at the scale needed to satisfy growing customer demand.**

One of the issues in this supply and demand shortfall is that we've not yet come up with an economically viable method for storing large amounts of excess wind and solar power — that is, the power that is generated when demand is low and otherwise goes to waste. Battery storage has come a long way, but it has miles to go to achieve the requisite commercial scale, to say nothing about the cost.





## Renewable, carbon-free electric power can be converted into renewable natural gas and stored indefinitely.



The fledgling technology I see that may hold some promise in providing a large-scale, cost-effective solution for storing excess energy is called “power-to-gas,” or P2G.

P2G involves taking excess energy from renewable sources like wind and solar, converting it to hydrogen, and storing it as methane in the existing natural gas grid. The U.S. Department of Energy’s National Renewable Energy Laboratory is now working with a Southern California

utility to test the commercial viability of this innovative P2G technology. And I can tell you that we are very interested in their conclusions, especially given National Grid’s commitment to renewable natural gas.

While our renewable gas project at the Newtown Creek wastewater treatment plant in Brooklyn, NY uses bio-mass to create renewable gas, P2G has the potential to be another strategy towards the same goal.



Imagine the Block Island wind farm on a mid-summer's night. The turbines are busy generating electricity, but the demand for that power in the wee hours of a Rhode Island morning is minimal. What happens to the excess electricity? Absent a viable means of storing it, that power simply goes to waste.

That's one P2G approach. Another is to combine the remainder of the isolated hydrogen with a source of carbon dioxide (perhaps from a wastewater treatment plant or a power generation facility), which can be biochemically processed into methane and water. With minor filtration, this synthetic

“ The fledgling technology I see that may hold some promise in providing a large-scale, cost-effective solution for storing excess energy is called “power-to-gas,” or P2G. ”

P2G would take that excess electricity and pass it through water by means of an electrolysis process that splits the water into its component parts — hydrogen and oxygen. A portion of the captured hydrogen (perhaps as much as 10%) can then be blended into the natural gas infrastructure. In this way, by “blending hydrogen,” we can reduce the fuel's carbon footprint by an equivalent amount.

methane meets pipeline quality standards and can be fed into the existing natural gas grid. In short, this amounts to converting renewable, carbon-free electrical power into renewable natural gas, which can be stored indefinitely and used in a number of ways — from electricity generation to transportation to running home heating appliances.



What I find so exciting about this technology is its potential for integrating renewables. By converting excess renewable electricity into renewable natural gas, we are magnifying the carbon-reduction effects of both.

***And as these alternative energy sources continue to proliferate — as our industry builds more solar and wind power capacity, and as we perfect and scale up P2G — our fight to decarbonize energy sources and help solve the challenges of climate change can only gather greater momentum. ◇***



# Harnessing Earth's Stored Thermal Energy







**Many of us here in the Northeast are fortunate enough to have direct access to natural gas, a fuel that many today **consider a cleaner, affordable alternative for heating our homes.****

But I am acutely aware that not all of our neighbors are so fortunate. They must rely on higher-carbon fuels such as heating oil, propane, or kerosene to run their homes.

In our New York State service territory, for example, we estimate there are about a half-million residences without immediate access to a gas network. That's a lot of homes that have no other reasonable option than to tap into high-carbon-emitting energy sources.





Decarbonizing our energy sources for heating homes and businesses is still a quandary in the Northeast, where winter temperatures can routinely drop into the single digits and lower. I wish there were a simple answer, but there isn't.

As part of our multifaceted, long-term effort to help reduce carbon emissions, National Grid is exploring how we might be able to offer more clean and low-cost energy options to customers off the gas grid.

A key initiative in this search began recently at the eastern tip of Long Island, where we've undertaken an innovative REV (Reforming the Energy Vision) demonstration project to test the feasibility of using the Earth's own heating and cooling properties to provide a clean alternative energy source to off-the-grid customers.

The process, known as geothermal heat transfer, uses hyper-efficient geothermal heat pumps (GHPs).

### Geothermal option

In the Northeast, the average annual ground temperature found more than 20 feet below the Earth's surface remains at a constant level. At our geothermal demonstration site in Riverhead, NY, that underground temperature is roughly 55 degrees Fahrenheit.

Using an underground piping system, GHPs harness the near-constant temperature of the Earth either as a source or as a sink for heat. In summer, just like in your home's refrigerator — which removes heat from its interior and transfers it into your kitchen — a GHP transfers heat from your home into the ground. Conversely, in winter, the pump moves heat from the ground into your home.

The technology that harnesses these natural geothermal properties has been around for only a few decades. But heat pump systems are expensive to install so far and their penetration of the heating/cooling market has been minimal.



*Geothermal REV Demonstration Project in Downstate New York*

What we are doing at our Long Island demonstration project is to test whether a broad-scale "utility" approach to geothermal systems is feasible and cost-effective.

I am very optimistic about this technology. We just need to find a way to make it affordable and adopted by working families across NY, MA, and RI.

Our demonstration site is within Glenwood Village, a retirement community of more than 500 homes at the eastern end of Long Island. We have built a shared geothermal well system that encompasses 10 individual homes.



The shared system is a closed-loop geothermal heat exchanger that comprises 20 boreholes (an incoming and outgoing conduit for each home). It uses high-density polyethylene pipes

Organization, the Geothermal Heat Pump Initiative, and the Long Island Power Authority.

Our company is partnering with NYSERDA, which will be collecting and analyzing data

“ The U.S. Environmental Protection Agency recognizes geothermal systems as the most environmentally friendly heating and cooling technology available today. ”

configured in a coil-like pattern placed at an average vertical depth of 225 feet. In all, this system uses approximately 9,000 feet of pipe, with the GHP circulating water through the underground piping to move heat from point to point.

This project — the nation’s first test-and-learn heat pump initiative led by a utility — was developed in cooperation with a number of interested parties, including the New York State Energy Research and Development Authority (NYSERDA), the New York Geothermal Energy

from the 10 homes to determine the overall effectiveness of such systems and whether geothermal is a cost-effective alternative for those with no access to natural gas.

The potential benefits to be tested could be numerous and substantial. For example, even the most efficient conventional heating solutions can only deliver up to 98 percent efficiency. Geothermal systems are all-in-one solutions known to achieve up to 500 percent efficiency for heating, saving

**Geothermal systems** are known to achieve **up to 500% efficiency** for heating

**- VS -**

The most efficient conventional heating solutions can only deliver **up to 98% efficiency**

Saving residents **up to 70% off** heating costs and **up to 30% off** cooling costs



residents up to 70 percent off heating costs and up to 30 percent off cooling costs.

Because ground source heat pumps only require electricity to operate the compressor and pump mechanisms, there is no onsite combustion or fuel storage. Longer equipment life is also expected.

The U.S. Environmental Protection Agency recognizes geothermal systems as the most environmentally friendly heating and cooling technol-


ogy available today. In fact, geothermal is a renewable energy source and thus can help reduce greenhouse gas emissions substantially.

**An innovative heating solution in lower carbon emissions could be at hand, just below the surface.** ◇



# Substations Switch to Digital





**If there's one takeaway I hope you'll get from this collection of clean energy stories, it's a fuller appreciation of the fact that our energy landscape is experiencing very rapid change.**

Indeed, the landscape must change, and we with it, not only to help reduce our carbon footprint on the planet — a critical goal — but also so that we adapt to the long-term needs of a consistently growing base of energy consumers.

When the electrical grid was initially built, it did not anticipate the emergence of two-way flows. It was a one-way system that delivered electricity from a centralized generation plant through transmission substations and our distribution networks to the customer.





Today, many of our customers have solar panels on their roofs and are feeding power back into the grid. The grid was not designed for this, which has presented a significant challenge in how we as an electric utility manage the in-flows and out-flows of power.

For example, what happens when a cloudy day or a windless afternoon results in lower in-flows of customer-generated electricity? And what if that situation occurs during a period when hot and humid weather

creates higher demand for electricity? How does the supply/demand equation get solved?

The support of that balance between supply and demand is the transmission substation, which serves as the center controlling the flow of power into and out of the grid. Here in the Northeast, National Grid operates almost 400 transmission substations throughout New York and New England.

Within each of these control houses, supply and demand decisions are made

mechanically through a complex system of switches that comprise hundreds of copper control cables, each communicating discrete values of action that can be taken to ensure the safe and reliable flow of electricity over the network.

Though not designed for two-way flows, the current system works. At the same time, however, as the electricity network becomes more complex, this method will not be particularly efficient or cost-effective. This naturally concerns us, as we strive to create agile and secure transmission grids that deliver maximum long-term value to our customers and communities.

Digital technology, of course, holds the promise of a much better control infrastructure. By digitizing substations — that is, by replacing copper cable with fiber-optic cables and thereby enabling digital control of the switching mechanisms — the power industry and its customers will recognize substantial benefits. Those benefits are threefold.



First, the cost of deploying or upgrading substations would be reduced, as digital stations require as much as 50 percent less space for the control house, making them less costly and easier to build.

Second, the maintenance and testing of digital substations can be done remotely and less frequently, thus reducing operating costs.

And last, a digitized substation will help ensure that changes in flow control settings are made in real time as the electricity mix becomes more dynamic. Subsequently, power customers will continue to receive reliable, safe, and affordable electricity



while doing their part to create a clean energy future.

National Grid is deeply engaged in advancing the digital substation agenda. Other utility

configurations before they are built, train engineers and field workforce, and assist with future troubleshooting.

It is our intention to place 40

“ Other utility companies have begun to adopt current industry standards to modernize their substations, but we are the first to commit to digitizing our entire substation network. ”

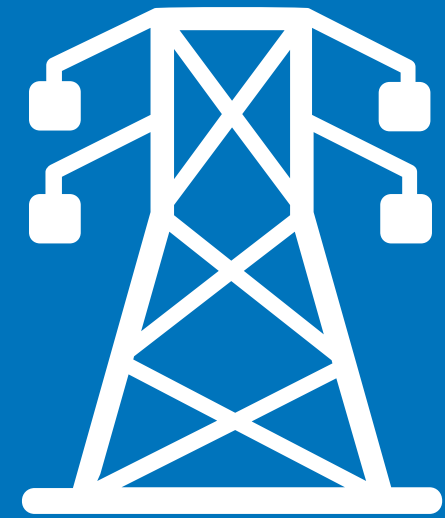
companies have begun to adopt current industry standards to modernize their substations, but we are the first to commit to digitizing our entire substation network. This strategy is not only beneficial to our customers but also one that is directed at aggressively reducing greenhouse gases.

To jump-start this commitment, we have built two new U.S. laboratories — one in Massachusetts and another in New York — to help verify system functionality, test substation

fully digital substations in service within the next 10 years.

***We hope to lead the charge by working with neighboring utilities to understand and learn from their experiences with the new technology. We can then help influence digital component manufacturers, industry standards committees, and regulators toward driving the greatest value for our electricity customers. ◇***

## What are the benefits of digitizing substations?



**Reduce overall operating costs**



**Faster and easier to build**



**Manage flow settings in real-time**



# Empowering Our Cities







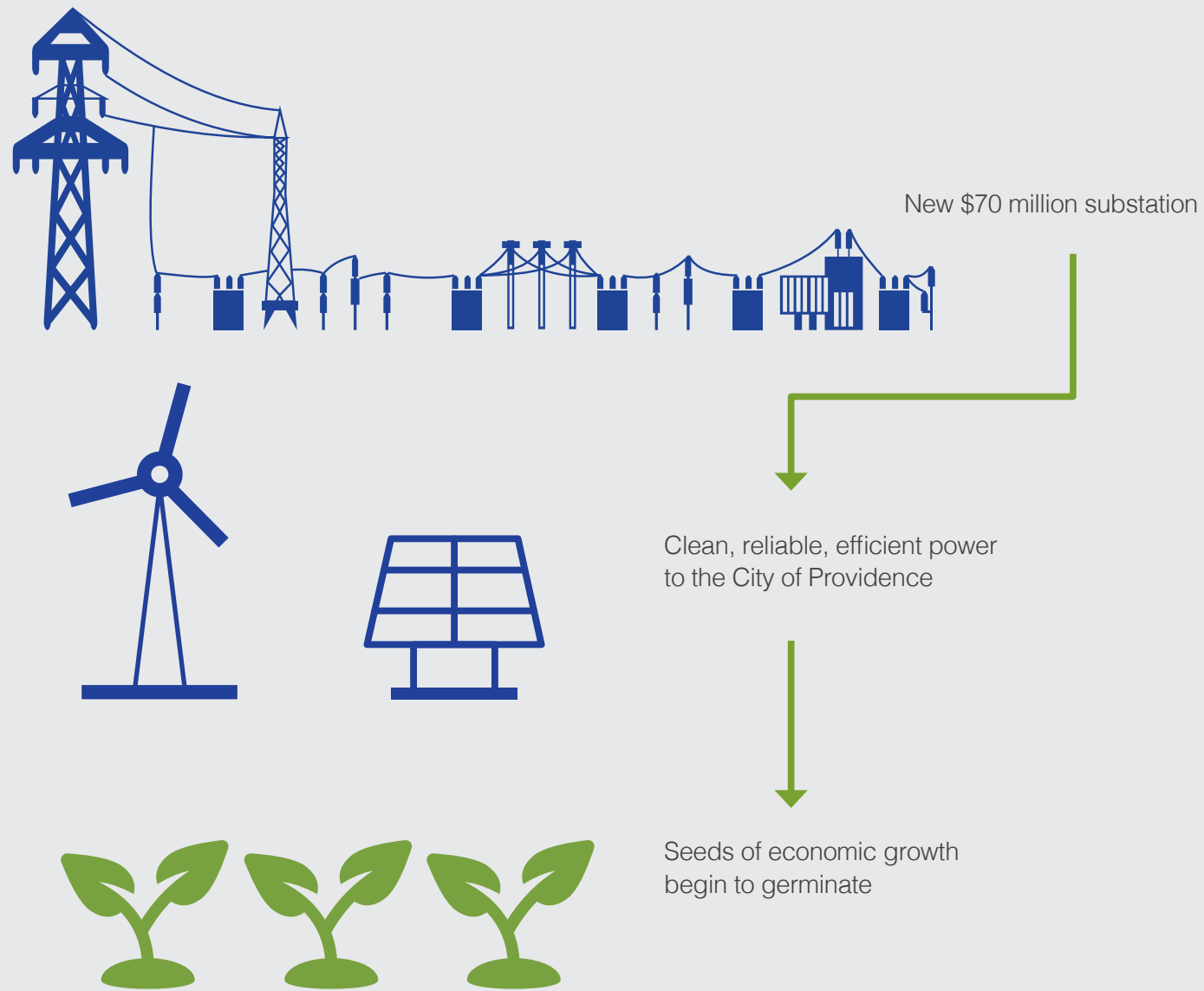
**In the early-to-mid 20th century, Providence, Rhode Island's Jewelry District was a thriving, prosperous neighborhood.**

Nearby, Narragansett Electric's South Street Power Station was part of that active landscape.

Built in the mid-1920's, the station hummed contentedly — coal burned, boilers hissed, and steam turbines whirred. In an attached substation, workers in a control room, sitting at metal desks, facing a massive wall of switches, kept a vigilant watch over the city's power supply.

I had the opportunity to tour the station one day and imagine what a different world it was almost a century ago.





“ I had the opportunity to tour the station one day and imagine what a different world it was almost a century ago. ”

The district enjoyed economic vitality until construction of a major interstate in the 1960s separated the Jewelry District from the rest of the city’s neighborhoods. Bereft of an important economic blood supply, the area eventually became stagnant, its heyday long forgotten. Eventually, operations ceased in the power plant, and though we still operated the substation, it became hauntingly outdated.

And then, a chance for a comeback.

In 2013, the state relocated Interstate 195, reconnecting the Jewelry District to downtown, and also creating 26 developable acres of land along the Providence River. The move

signaled an opportunity for the economic resurgence of a neighborhood and city that craved more.

It was natural that developers would see the potential in our historic riverfront property. The grand idea was to turn the 58,000-square-foot, classic revival building that housed the old substation into an office and academic space.

Ultimately it was an ambitious plan that was stymied by three obstacles. The first was that the above-mentioned substation was still an active substation, helping to power much of Providence. And while we had planned to replace it over time, that likely wouldn’t happen in the immediate future.

The second hurdle was that the new facility and surrounding properties were lacking adequate parking.

Third, the state’s plan called for a pedestrian greenway that invited more people down to



the riverfront. Not only was there a need for more space for that greenway, but there was also concern that the current 115 kV transmission lines on the pathway would obstruct views of the river.

Recognizing the importance of the substation as one of the most important pieces of energy infrastructure for Providence and the surrounding communities, meeting these challenges was going to take ingenuity, patience, and cooperation from multiple parties, including us.

First, we expedited construction of the new South Street substation by five years.

We redesigned the substation layout on a smaller footprint and made the land needed to accommodate a desired parking garage available to the developers.

Lastly, we facilitated the undergrounding of the transmission cables and future removal of a transmission tower for the con-

struction of a greenway path that will allow access to the river from the former power plant.

Meanwhile, Brown University, the University of Rhode Island, and Rhode Island Community College made plans to build the Rhode Island Nursing Education Center in the newly restored substation. In 2018 we began energizing the new \$70 million substation, and four days after Thanksgiving, we made the final switch that de-energized the 99-year-old South Street substation. The new station is providing clean, reliable, efficient power to the City of Providence, and this year we will begin demolition of the former generating plant that is still attached to the former power plant.

The seeds of economic development are already beginning to germinate in that neighborhood. A \$160 million innovation center and a hotel are already being built across the street.



We are proud to help move forward the communities in which we live and work. The South Street Substation is a catalyst for economic vitality. Once again, the Jewelry District is becoming a thriving section of Providence, as it was meant to be.

***Energy — and investment in its infrastructure — are fundamental to any community's sustained prosperity. Providence is no different. And our neighbors in the Jewelry District are witnesses and partners to a new future. ◇***



# Powering Healthier Local Economies







**At National Grid, we live, work, and play in the communities we serve. That's 15,000 employees serving the energy needs of more than 20 million customers in New York, Rhode Island, and Massachusetts.**

Our shared sense of community has taught us that today's customer is savvy, forward-thinking, and deeply mindful of the environment. I'm convinced that we all want the same thing — to keep our communities healthy and prosperous. And, I believe we can do it together, by solving for the greatest challenge of our time — climate change — while delivering innovation and economic development.



This makes our next steps as an energy provider straightforward: we need to ensure that our energy becomes cleaner, more efficient, affordable, resilient, and reliable — and with more customer choices.

That can only happen when we look ahead and invest in the future of the communities we serve. The investments we are making with our community partners in upstate New York (UNY) are a great example of this.

The goal of our five-year, \$3 billion investment in the region's energy networks is straightforward: making changes to our grid today that will support healthy economic growth for decades to come.

How do we create infrastructure that accounts for new energy needs while leaving room for future growth and new opportunities?

We do what we did in Western New York.

Two years ago, we rebuilt a substation in West Seneca to

address three major issues: asset condition, capacity improvements, and configuration issues.

Today, the Gardenville Substation supplies the area with approximately 750 MW of load, moving hydro from Niagara Falls and Ontario and wind from the south, from Wyoming, Cattaraugus, and Chautauqua counties. One way to get a good grasp of its power is to envision the ecosystem it has enabled for customers throughout the area.

Take the Tesla/Panasonic plants at RiverBend, residing on what was once a steel plant and brownfield. It is one of the largest solar panel and solar roof tile manufacturing plants in the world. As their employment level grows, the assurance of reliable service is vital. The new substation is supplying it with 35MW of electricity per day.

Another example is over in Buffalo's Fruit Belt neighborhood, where New York State's Reforming the Energy Vision (REV) has enabled us to pursue an



*Ken Kujawa, manager, Community & Customer, at the Gardenville Substation*

innovative demonstration project that addresses affordability and renewable energy.

Traditional solar installations generate electricity for only one resident or business that can afford it. Through our Fruit Belt Solar project, we've brought rooftop solar to an entire city section.

We aggregate the power from more than 100 neighborhood solar installations and share the benefits with low-to-moderate income customers who

otherwise might not be in a position to install on their own.

The Fruit Belt project is generating 500 kW. A total of 150 customers are hosting a rooftop solar system, including residential homeowners, two churches, and two not-for-profit organizations.

These customers receive a monthly credit, as do approximately 50 other residential accounts, selected at random from a pool of customers who could not take advantage of the



solar installations for various reasons. National Grid installs and maintains the solar systems.

Ford's Buffalo stamping plant is also part of that clean energy ecosystem. The plant manufactures sheet metal stampings and welded parts for the automotive car and truck assembly plants. It also competes for jobs with other Ford plants.

In the midst of building additional space — to allow for more work and to stay competitive — there's one thing the Ford facility does not have to worry about. Gardenville is supplying safe, reliable, and affordable energy.

New businesses will benefit as well. Currently, an advanced pharmaceutical company is building a high-tech manufacturing facility in Dunkirk. It will offer approximately 400 new jobs in a community thirsting for an economic jumpstart.

We know that the plant's energy needs will exceed those of most other businesses we are serving, but we are confident

that the transmission lines from Gardenville will handle it all.

While the Gardenville Substation is opening doors, it has also played a part in closing a couple. Both the Huntley and Dunkirk coal plants are no longer necessary. This enhanced transmission configuration has allowed the region to bypass those high-carbon, obsolete energy generators.

Every solid and growing economy needs affordable and reliable power. To help attract and retain businesses to a region, drive job creation, and build a vibrant economy, we know we need to provide reliable electric service today, while also anticipating the needs that will emerge tomorrow.

***The new Gardenville Substation is a glowing example of partnering with customers and local communities to help grow new clean energy infrastructure, adopt new technologies, and use energy more efficiently. We will continue to lead by example. ◇***

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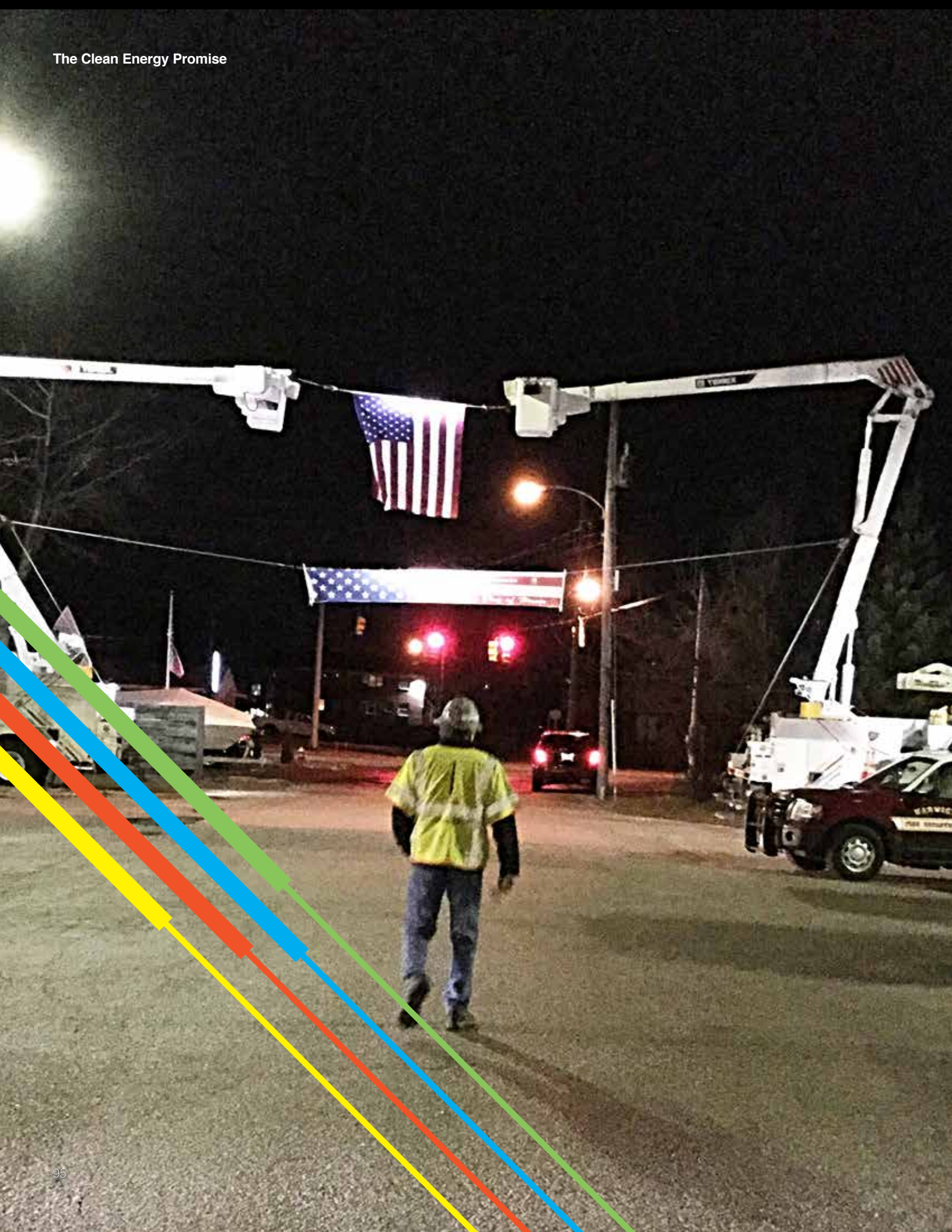




# How Our Veterans Energize National Grid







## Two years ago I sat down for a Veterans Day breakfast with about 100 National Grid employees **who had served in the U.S. Armed Forces.**

I was struck by two insights that morning that spoke to the wisdom of hiring veterans.

The first was that an employee from Buffalo drove halfway through the night to attend the 8 a.m. breakfast in Boston — and was one of the first to arrive. She said there was no way she'd miss getting together with her fellow veterans.

The second was that employees throughout the company jumped at the chance to honor their colleagues by contributing home-baked goods for the breakfast and turning the morning meal into a real celebration of community and thanks.

Like many U.S. energy companies, National Grid is at the forefront of a clean energy transition that is dependent on advanced technology, automation, and STEM capabilities.





Wanda Fournier is an Air Force veteran and proud member of our veterans resource group.

Forces like digital disruption, market-based pricing, and renewable energy alternatives mandate that we focus on the evolution of job skills. As our workforce transitions — we estimate one-third will retire in the next ten years — it's crucial that we recruit for the skill set we require and the values that underpin the way we work.

We currently employ more than 700 veterans and have committed to hiring more veterans in years to come. Veterans come to us with field experience and

skills — particularly STEM — that are easily transferable.

In many instances, veterans are taking on the same type of role they had while in the service. Now at National Grid, they are executives, analysts, engineers, managers, and technicians. They work in emergency planning, data management, electric and gas operations, customer service, finance, and many other areas.

More importantly, I don't know of another demographic that more

emphatically embodies commitment, teamwork, and focus. Again, this ready-made leadership makes for a natural transition to our team. When I talk to veterans about our intent to begin and end every interaction with the "customer" in mind, they get it!

We know that hiring veterans is smart and the right thing to do, and we partner with some great organizations to make it happen. We work closely with Troops to Energy, Helmets to Hardhats, and Military Officers Association of America, among others, in our recruiting efforts.

Inside the company, we also have an active veterans employee resource group that boasts close to 500 members, many of whom are not veterans. The group supports several veterans' organizations within our service territory through volunteering and fundraising.

Last year, our vets group held a camouflage hard hat campaign, and sold more than 6,000 of

these one-of-a-kind hard hats to employees.

The money raised went in part to train and provide service dogs for veterans suffering from post-traumatic stress disorder; to cover the costs of war veterans visiting war memorials in Washington D.C.; and to support organizations dedicated to the families of veteran suicide victims.

Wanda Fournier is an Air Force veteran and proud member of our veterans resource group. She says being a veteran at National Grid has taught her two things: "One, leadership skills never go out of style; and two, the energy industry offers a natural transition for those that want to lead by change."

***Our pathway to a clean energy future will make for a bumpy ride at times. But with a dedicated workforce in place, we will get there with an abundance of leadership, thanks in many ways to the U.S. veterans in our ranks. ◇***



# Policy for a Clean Energy Future







## When it comes to addressing the challenge of climate change, talk can be cheap.

We've all heard the alarm about emissions and rising temperatures for decades, but only recently have the general public and private industry accepted the evidence and started to take action.

I am convinced now, more than ever before, that we all need to be leaders in setting aggressive policies that will help achieve our common goal of combating climate change.

Over the past decade, National Grid has been transitioning into a new kind of company. While we were once focused solely on keeping the lights on and the gas flowing, we've evolved to address new priorities, including the wants and needs of our 21st century customers and communities.

Our new energy company model merges utility basics with innovation, technology, and clean energy to address concerns around energy conservation, air quality, climate change, and other social and environmental concerns.





National Grid is one of the world's largest investor-owned utilities focused on transmission and distribution activities in electricity, natural gas, and clean energy.

We serve the energy needs of 20 million people in the Northeast U.S. which puts us on the front lines of the climate change challenge. It's a responsibility we take earnestly and why we are developing a wide range of clean energy programs and climate change initiatives, and

upgrading infrastructure to deliver clean energy.

Addressing climate change is now National Grid's "north star," and our goal is to help the states in which we operate achieve an overall 80 percent reduction in greenhouse gas (GHG) emissions below 1990 baselines by 2050.

To achieve this 80x50 goal, we have to make meaningful progress in electrifying our transportation sector and deploying large-scale renewables — all while delivering our

core electric and gas business and integrating new technologies and innovations.

Earlier this year, we released the Northeast [80x50 Pathway](#), a deep-dive analysis into how the Northeast and New York (two areas that encompass our service territories) can achieve their interim and long-term emissions' reduction goals.

In addition, we were one of the first energy companies to support the Regional Greenhouse Gas Initiative, and continue to do so today.

We've been committed to renewables for years. We connected the nation's first offshore wind farm in Rhode Island, and are playing a key role in developing large-scale renewable generation at unprecedented levels.

To make an even greater impact in our service territories we've included more than \$200 million in regulatory filings for transport-related initiatives (includes approved and filed plans) such as charging infrastructure, customer outreach/education, and

grid integration — all over the next five years in all three states.

As we transition to a clean energy future, our traditional gas business will also play an integral role. Natural gas

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**“ We have filed to build more than 10,000 public EV charging ports by 2025 in our states to reduce emissions in the transportation sector. ”**

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will continue to be the primary method for heating and electric generation in our service territories for the short term as it provides low-cost, reliable, low-carbon heating and electric generation options, as we explore longer-term decarbonized solutions for heat.

We've partnered with groups including the Environmental Defense Fund, ULC Robotics, and the federal EPA to reduce gas emissions, from wellhead to burner tip.



We understand that a commitment to 80x50 requires a hard look at any fossil fuel. The carbon footprint of natural gas is not static; in fact, it's declining. Renewable natural gas (RNG), hydrogen blending, and power-to-gas solutions all provide a path forward for this critical resource in a clean energy transition.

In the near term, we are dedicating ourselves to developing RNG that will cover customers' growing demands for the next five years. This will ensure any natural gas infrastructure growth is at least carbon neutral in the next decade.

We are already establishing ourselves as a leader in RNG. In Newtown Creek, New York, we are partnering with the City of New York to convert their largest waste water treatment plant into a clean energy source that will produce enough RNG to heat 2,500 homes and reduce emissions by the equivalent of taking 3,000 cars off the road. We have initiated similar RNG projects in Batavia, NY, and Utica, NY.

And while RNG generation is an important first step, we must also lead in transmission. So, we've begun a collaborative effort in New York State to develop revolutionary RNG interconnection guidelines that specify gas quality standards and streamline the process of connecting RNG projects to the gas distribution network. These standards, once finished, will be a blueprint for RNG facilities across not just our service territories, but the entire country.

The emissions reduction challenge by 2050 is significant, and large-scale renewables (LSRs) must also be a central pillar of any pathway to achieve state goals.

Relative to other new, zero-emitting resource types, LSRs provide unmatched value for customers in meeting the challenge at speed and scale. They possess several advantageous characteristics when compared to other zero-emitting resources such as distributed generation, mainly low costs, speed of deployment, and reliability.



Because of these advantages, LSRs will be a critical, irreplaceable component of any cost-effective pathway to achieve state goals.

We have been grappling with how we will deliver clean energy to our customers and communities in a changing climate for the better part of the decade, and we still haven't found all the answers. To get there, we need inclusive discussions that span multiple organizations, industries, and agendas to forge the way forward.

Take for example the non-binding resolution, the Green New Deal, recently introduced into the U.S. Congress. The Green New Deal outlines goals in the event the U.S. does not achieve certain greenhouse gas reductions by 2030 and net-zero emission by 2050. It calls for new jobs, infrastructure investment, and clean air and water, all linked to increasing social justice, and income equality.

As noted throughout this chapter and book, we introduced our own climate "deal" last year, the





[Northeast 80x50 Pathway](#), supporting aggressive climate change mitigation. The experience is teaching us a lot, including that decarbonization efforts generally are large-scale and challenging and involve numerous discrete policy problems. Therefore, it is not surprising to me that a number of public policy experts and lawmakers have opined that the Green New Deal's timeline and targets are overly aggressive and implausible. At the same time, I am gratified that the clean energy conversation is getting more ambitious, louder, and more insistent — and I applaud those aspiring to a New Green Deal and other transition plans and

emissions targets. The solutions, and our commitments to them, can't get here soon enough.

So, let's build relationships — within our communities, state, region, and nationally — that foster innovative planning. Let's work with public and private partners to achieve the clean energy future we envision.

***Let's invest in a smarter energy infrastructure that will create smarter local economies with higher-skilled, better-paying jobs, and a more resilient, flexible, and agile energy grid. And let's redouble our efforts now. ◇***







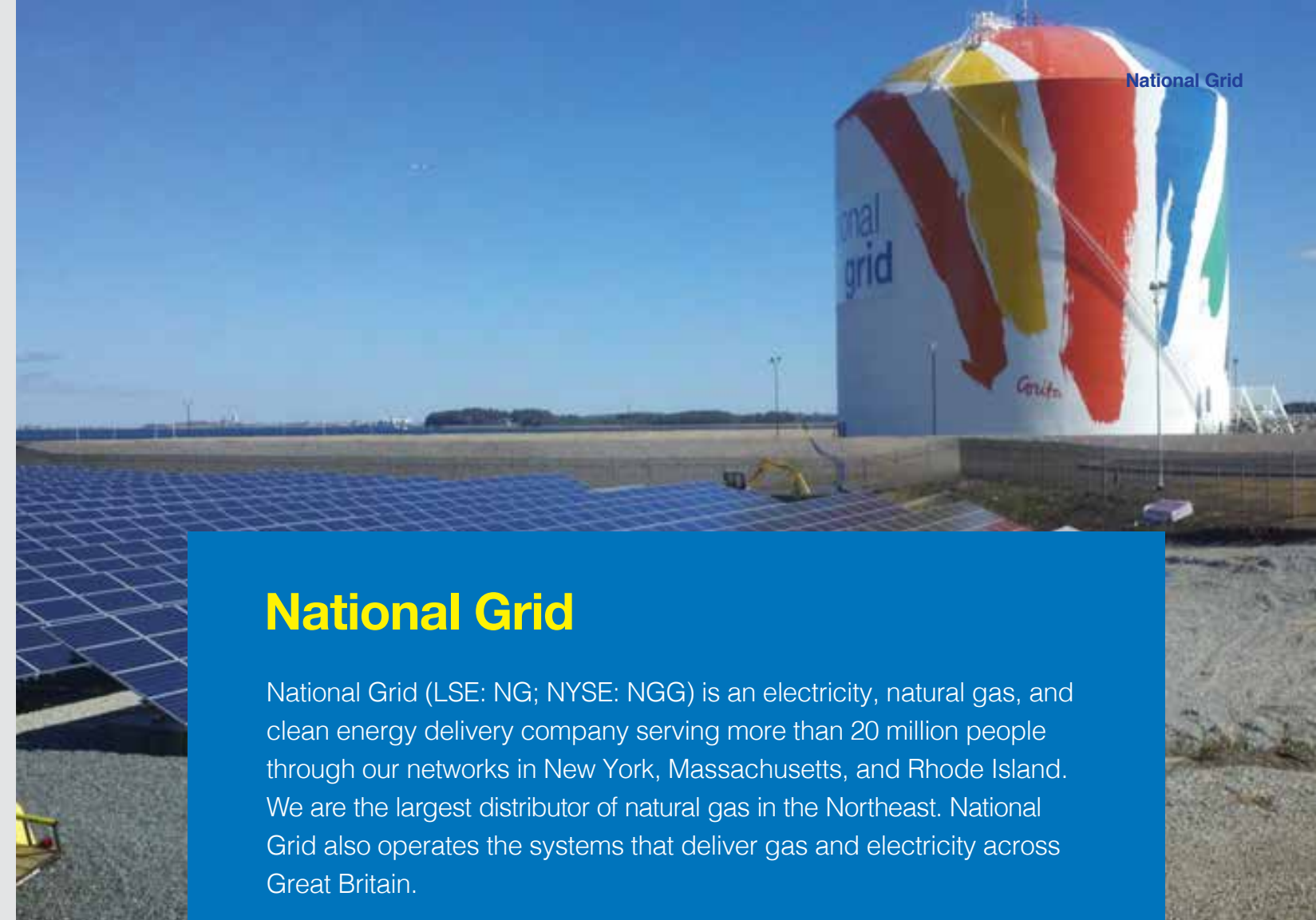
## About the Author

Dean Seavers joined National Grid in 2014 as U.S. President of National Grid. Dean's career as a value creator has included leadership roles at GE, United Technologies, and Tyco. He led GE Security, a \$2 billion product and technology group, and he also led a \$4 billion global services portfolio for United Technologies. Dean was a founding partner of Red Hawk Fire & Security and led its emergence as the second largest independent fire and security platform in the U.S.

Dean is a strategic leader with a background in team building, performance improvement, and

operational leadership. At National Grid, his focus is on continuing the performance progress that underpins the company's \$7 billion business in the U.S. while driving its clean energy transition agenda of building the advanced natural gas and electricity networks that are necessary for our 21st century digital economy.

A native of Sandusky, Ohio, Dean graduated summa cum laude with a bachelor's degree in business from Kent State University and earned an MBA from Stanford University's Graduate School of Business.



## National Grid

National Grid (LSE: NG; NYSE: NGG) is an electricity, natural gas, and clean energy delivery company serving more than 20 million people through our networks in New York, Massachusetts, and Rhode Island. We are the largest distributor of natural gas in the Northeast. National Grid also operates the systems that deliver gas and electricity across Great Britain.

National Grid is transforming our electricity and natural gas networks with smarter, cleaner, and more resilient energy solutions to meet the goal of reducing greenhouse gas emissions by 80 percent by 2050. Our [Northeast 80x50 Pathway](#) is an industry leading analysis for how to reach that goal in the states we serve, focusing on the power generation, heat, and transportation sectors.

Read more about the innovative projects across our footprint in [The Democratization of Energy](#), an eBook written by National Grid's U.S. president, Dean Seavers.

For more information, please visit our [website](#), follow us on [Twitter](#), watch us on [YouTube](#), friend us on [Facebook](#) and find our photos on [Instagram](#).