



Emerging from the Pandemic: Recovery & Reinvention

Industry Sector: Energy

June 5, 2020



Executive Summary

Energy Sector Performance

The NY Metro Region's energy sector has continued to provide electricity, steam, natural gas, heating oil, vehicle fuels, and related services reliably to meet demands during the pandemic (from stay-at-home order initiation through today). Electric and natural gas utility pandemic response plans were executed without incident, moving on-premise workers to remote facilities and homes, including call centers staffs. Field crews paused work requiring personal interactions with customers and construction work requiring close personal contact with other contractors and personnel to comply with social distancing guidelines while continuing to address critical infrastructure needs outfitted with necessary personal protective equipment.

Beginning in April and continuing through mid-May, electricity sales in the NYC region fell 16 percent, vehicle fuel sales were down 33 percent, aviation fuel down 75 percent, and natural gas in the region was down 4 percent, while oil used for heating generally remained stable. Revenues for electric utilities, power generators, and vehicle fuel distributors fell over the same period negatively impacting cash flows. Except for the over 38,000 jobs lost due to the pandemic in the clean energy sector, including energy efficiency, distributed energy resources, and renewable energy, employment remained steady.

Electric and gas utilities provided relief to customers during the pandemic by discontinuing service shut-offs for those not able to pay their bills and communicated proactively with all customers through multiple media channels to provide information about power outages due to storm events and expected restoration times and contact information for emergency response service calls for gas leaks and medical equipment needs. In some instances, utilities also provided limited and temporary bill forbearance to small businesses.

The energy sector, like other sectors in the region, has personnel infected with COVID-19, including some fatalities. The sector is prioritizing internal projects to support the workforce, including grief counseling, and construction work is resuming with appropriate workforce safety equipment and precautions be taken. Energy sector personnel are wearing personal protective equipment as necessary and required and abiding by physical distancing requirements, as they continue the implementation of pandemic response plans.

Executive Summary

Importance to the Region

The need for energy is ubiquitous, with the sector being an essential and critical underpinning of a well-functioning and healthy economy, and necessary for societal well-being, and public health and safety. The NY Metro Region energy sector is home to some 222,489 jobs, mostly kept intact with exception of the 38,710 jobs lost in the clean energy industry. Electric and gas distribution utilities continue to meet energy demands reliably as the region reemerges from stay-at-home orders and returns to work. Sufficient infrastructure is in place and necessary equipment and supplies are available to meet energy demands. No immediate or near-term supply chain issues have been reported; except for temporary limited supplies of personal protective equipment and cleaning supplies.

Electric and gas utility capital budgets are sufficient to maintain high levels of reliability and performance. Adequate resources are available to support continued investment in energy efficiency, demand management, and distributed energy resource programs, including renewable energy and transportation electrification in support of state and NY Metro Region climate mitigation and energy policy goals. Energy sector balance sheets are absorbing temporary bill forbearance for small business and residential customers.

Longer-term supply chain challenges are likely to emerge in response to the White House Bulk Power Supply equipment Executive Order, which could disrupt the supply chain for critical electric infrastructure equipment and supplies. Managing the collapse in oil prices with current supply and demand imbalances, and near-full storage capacity for petroleum products could threaten upstream marginal oil and gas wells causing them to close. No near-term impacts are expected, but there is potential for longer-term implications as energy demand picks up with recovery and reinvention.

There is a need to ensure energy supplies remain affordable given the reduction in sales and revenues and bill forbearance with collectibles being set-aside for later recovery. Cash flows are negatively impacted, and regulatory uncertainty exists for electric and gas utilities requiring approval to pass through in rates, arrears and lost revenues from the pandemic in future years. Left unattended, and if recovery is delayed, energy sector balance sheets can be challenged with greater receivables and potential uncollectable balances negatively impacting the financial integrity of utilities.

Executive Summary

Emerging Ideas for Recovery & Reinvention

To reduce the energy burden on customers, energy suppliers are notifying and assisting small business customers in accessing federal stimulus funding, and low-income customers in accessing the \$28 million available to New York State from the \$900 million increase in LIHEAP funding through the Federal CARES Act 2020. Some industry leaders suggested electric and gas utilities consider using customer deposits to cover a portion of arrears to lower customer payment obligations and improve utility cash flows.

Utilities, with regulatory support, could expedite planned investments in critical electricity transmission and distribution infrastructure and grid modernization e.g., smart meters, controls and sensors, improved communications equipment, and the associated digital information technology (IT) and operations technology (OT) upgrades to create jobs and speed recovery. In addition, planned natural gas and steam leak detection and replacement, and compressor station upgrades to improve resiliency and create local employment can be accelerated with regulatory approval to speed recovery.

The state and NYC can jointly rationalize the approach and establish simplified one-stop-shopping for financial incentives available through existing funding programs from utilities and NYSERDA in support of existing state and NY Metro region climate and energy goals. Utilities can strengthen the local electricity distribution infrastructure with more localized distributed generation and microgrids to provide back-up service to first responder facilities, schools, hospitals, and emergency evacuation routes to improve resiliency. The energy sector in partnership with government should seek to prioritize and maximize available US Department of Energy, ARPA-E (Advanced Research Projects Agency - Energy), National Laboratory funding, and federal stimulus dollars to foster rapid recovery and reinvention of the NY Metro Region's energy infrastructure, as an epicenter of innovation.

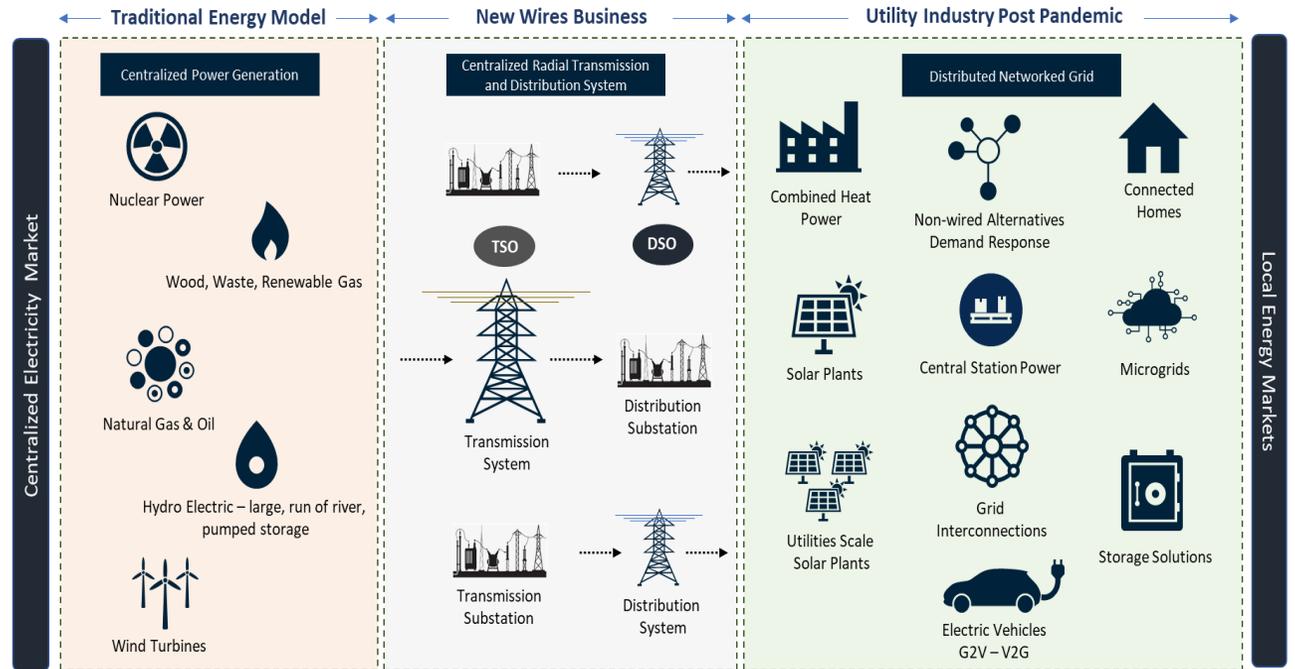
New York and the metro-region hit early and hardest by the pandemic should receive its fair share of stimulus funding.

Executive Summary

Reinventing the Energy Sector

The energy sector characterization and its response to the pandemic highlight the readiness of the sector and its workforce to continue providing a resilient, distributed, modern and sustainable energy infrastructure to future proof the region against similar events and weather-related disasters.

The sector has the capacity and access to capital markets to expedite planned capital investment to reinvent the way energy is generated, supplied, and used in the region by prioritizing and targeting available statewide and NYC programs and funding. The opportunity exists to rapidly scale clean energy programs targeted toward carbon mitigation and clean energy development consistent with the statewide Climate Leadership and Community Protection Act (CLCPA) of 2019 and NYC Local Laws addressing energy use and electrification of technology, including vehicles. Investing in energy infrastructure and creating economic activity will enable a more rapid transition from an industrial era electricity grid to a 21st Century grid as depicted here.



Source: West Monroe (2020)

TSO: Transmission System Operator || DSO: Distribution System Operator

Transition left to right can take years, and New York is well positioned and leading other states in progressing toward a new more dynamic and flexible grid architecture.

Opportunities for innovation and reinvention of this magnitude and scale are rare, and as we have seen time and time again, necessity is the mother of invention.

Executive Summary



Conclusion

The energy sector is capital intensive and has the ability with approval from regulators to expedite at least \$25 billion in capital investments planned through 2022 on transmission and distribution infrastructure, improving energy efficiency and demand management, further developing distributed energy resources, and electrifying transportation with potential to support substantial economic activity. Collectively, these investments can create or support between **130,000** to 180,000 jobs. Recovery and reinvention through public-private-partnerships focused on innovation in infrastructure and digitalization, including energy system operations and workforce and workflow management processes, has the potential to change the way customers source and use energy in furtherance of state and NYC energy goals.

New infrastructure projects to support expanded and more efficient deliverability of energy to the region, including natural gas, to support economic recovery and reinvention and broader ownership of distributed energy resources and renewable energy projects, can spur greater competition and foster innovation.

Efforts to consider direct ownership of distributed energy and renewable energy resources and electric transportation infrastructure by utilities, or through power purchase agreements with non-utility developers, can expedite the regions transition to a cleaner energy economy, consistent with state and NYC energy policy goals. Utility ownership of large-scale renewable energy resources or regulatory approval for procuring these resources from third-parties will further the region's clean energy goals, support creation of jobs, and improve air quality and land-use stewardship in environmental justice communities.

Given the energy sector's importance to the region, its access to capital, and through partnership with government and regulators, the sector can contribute significantly to the NY Metro Region's recovery and reinvention.

Executive Summary Highlight Call-Outs



2B

Ensure the region's stock of affordable and flexible housing and commercial real estate can meet future needs

- Electricity use is down 16 percent in NYC, while natural gas and heating oil use remained roughly unchanged, resulting in reduced near-term residential electric and gas bills.
- More stringent enforcement of NYC Local Laws related to building energy use benchmarking and building code compliance can significantly reduce energy use in buildings and improve affordability, especially for the ~165,000 affordable housing units in New York City, and continue to do so as part of NYC's Housing New York 2.0 initiative.
- Energy affordability can be improved if all new electricity, natural gas, and heating oil customer hookups required building receive an energy audit prior to, or shortly after occupancy. Additionally, cost-effective energy efficiency and DER investments can be made, including community solar for low- and moderate-income customers, by offering time-of-use rates to customers that when coupled with smart meter functionality, will provide an ability to better manage usage to reduce energy costs.

7A

Improve local supply chain resiliency

Focus: Energy

- There is no evidence of a short term (6 month) risk. If recent Executive Order does not go into effect within next 6 months, there is minimal exposure, but Energy Industry will need to re-evaluate sourcing strategy and inventory levels.
- Bulk chemicals are consumable items required to maintain the power production process.
- The sourcing of these items is critical to main reliability on the generation process. Oil base products, chemicals, and gases fall under this category.

7D

Double down on renewable energy and resiliency initiatives

Focus: Energy

- NY Tri-State Region utility investment in DER including renewable energy resources and state-sponsored renewable programs total **\$3.28 billion** through 2022, with **\$1.28 billion** in 2020, and **\$1.0 billion** planned for each of 2021 and 2022.
- Suggestion to fund administrators' advance projects more quickly, moving investment dollars up over the 3-year budget cycle.
- Consider regulatory approval for utilities to own directly or procure from third-parties, large-scale renewables and distributed energy resources to meet the region's energy policy goals.

See slides 23, 24, and 25 for a fuller explanation of these specific issues.

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This deck summarizes West Monroe’s characterization, analysis, findings, and suggestions for addressing COVID-19 related dislocations and impacts in the NY Metro Region energy sector in support of a more rapid economic recovery and reinvention. West Monroe relied on the most recent available data and information from energy industry reports, stakeholders, federal, state and local government, not-for-profit organizations, industry associations, and interviews with NY Metro Region industry leaders and nationally recognized energy experts.

Analysis and interpretation of results and suggestions to facilitate a more rapid economic recovery and reinvention are those of West Monroe.

Energy Sector Fact Base Research Findings and Analysis

Context Overview – Industry Characterization Fact Base

The Tri-State region (NY/NJ/CT) is home to 222,489 Energy Sector jobs, as reported prior to COVID-19¹:

- 76,042 in Electric Power Generation
 - 39,077 in Fuels
 - 107,368 in Transmission, Distribution, and Storage
 - 200,721 in Energy Efficiency
 - 58,209 in Clean Energy (incl. Renewables, Grid & Storage, Clean Fuels, and Clean Vehicles)
- Over \$58 billion in total asset value, across electric, gas, and steam operations in New York²
 - Over \$600 million in state and local tax revenue²
 - ~19.8 million New Yorkers served by NYISO, including 435 market participants, over 11,000 circuit miles of transmission, over 700 power generating units³
 - 47 New York municipal electric systems and four (4) rural electric co-operatives provided power by New York Power Authority (NYPA)
 - 1.6 million New York households consume 1 billion gallons of heating fuel⁵
 - 750 NYS home heating oil retail businesses employ 8,900 with a payroll of \$463 million
 - Home heating oil industry is a \$4 billion industry

38,710 Clean Energy unemployment claims filed in Tri-State region in March & April 2020—roughly 33 percent decline in clean energy workforce as of end of April⁴

The need for energy is ubiquitous with the sector being an essential and critical underpinning of a well-functioning and healthy economy, societal well-being, and public health and safety

Strengths

Pre-Pandemic:

- Reliable and resilient power grid
- Sufficient infrastructure and equipment and supplies to meet energy demands
- Capital budgets sufficient to maintain high levels of reliability and performance
- Sufficient resources necessary to support continued advances in energy efficiency and demand management, and distributed energy resource planning, including for renewable energy development and transportation electrification to support State and NY Metro Region climate mitigation and energy policies and goals

Post-Pandemic:

- Implemented existing Pandemic Response Plans seamlessly with little noticeable disruption to employees, customers or service reliability – expected to continue as stay-at-homes orders are loosened
- Well-trained and prepared workforce with back-office, mid-office, and front-office operations, including control room personnel to ensure continued confidence in the energy sector
- After brief pause, major capital investment projects back on track with no near-term concerns over supply chain

Challenges

Pre-Pandemic:

- Ability to demonstrate progress toward greenhouse gas mitigation and clean energy goals in compliance with the State’s Climate Leadership and Community Protection Act of 2019 (CLCPA)
- Industry challenged to meet growing demand for natural gas in the NY Metro Region
- Responding to greater frequency of power outages due to more severe weather-related events
- Jobs market tightness leading to a war for talent with aging workforce and loss of technical and industry expertise

Post-Pandemic

- Security and resiliency of electricity sector supply-chain given the President’s Bulk Power System (BPS) Executive Order threatening critical electric infrastructure equipment and supplies
- Managing oil price collapse with supply and demand imbalance and with inventories filling fast
- Need to ensure energy supplies remain affordable given reduction in sales, and bill forbearance for later collection, while continuing to invest in modernization and critical infrastructure needs

Context Overview Highlights – Energy Sector (2 of 4)

Impact on the NY Metro Region – Energy Sector Fact Base

Immediate Impact of COVID-19

Impact Through Year-End 2022

Energy Sector Reliability

The NY Metro region energy sector, including electricity, natural gas, steam, and petroleum products, continues to provide **reliable service to all customers** and all core reliability-related capital projects after a very brief pause to assess the COVID-19 pandemic situation, are proceeding with necessary health and safety measures and practices in place to protect workforce, customers and area residents.

Electricity, steam, and natural gas **supply and services**, and vehicle fuels and heating oil **are not expected to be negatively impacted by COVID-19**. Critical sector infrastructure projects are proceeding with necessary health and safety precautions– including transmission and distribution system and pipe and wire replacements and upgrades. Energy sector cash flows will be challenged as balance sheets hold more accounts receivable, and arrears while financing critical infrastructure investments.

Sector Revenues & Income

Electric and gas utilities experienced a significant reduction in sales (approx. 10-15% in NYC Region), revenues, and income from COVID-19 since mid-March, yet the sector remains **financially strong** and has access to capital markets. Vehicle fuel use and revenues are 20 to 30% lower while heating oil and natural gas use in heating buildings has remained unchanged.

Electricity and natural gas use and sales (commercial and industrial) are expected to rebound slowly as small businesses, hospitality, restaurant, and entertainment venue activity picks up, but sales are expected to remain below pre-COVID levels through 2020, continuing through most of 2021.

Sector Employment

Employment in Tri-State Region’s utility and petroleum industries **remains strong**, while the clean energy industry (renewable energy, energy efficiency, and demand management) lost over 38,000 jobs, representing roughly 33% decline in clean energy workforce in tri-state area. Workforce reduction in clean energy continues.

Through interviews with industry leaders, **estimates of up to 30% or 50,000 clean energy sector jobs losses** were cited as possible as result of COVID-19 based on observed trends. Industry leaders have contract commitments to assist clean energy providers with payments to shore-up cash flow to sustain employment and have workforce ready post-stay at home orders (making payments prior to milestones being met, helping business apply for small business payment protection programs, etc.).

Context Overview Highlights – Energy Sector (3 of 4)

Impact on the NY Metro Region – Energy Sector Fact Base

Immediate Impact of COVID-19

Impact Through Year-End 2022

Energy Bill Forbearance

Delayed receipt of energy bills, due to on-premise absence for small businesses and difficulty in paying, due to employee furloughs and job losses causing a reduction in bill remittance, and collections, causing utilities and oil distributors to consider periods of forbearance with collections being recovered later. **Energy supplier decisions to halt service disconnections for inability to pay will exacerbate the decrease in cash flow and increase in cost of this.**

Using energy supplier balance sheets to cover under-collections provides a near-term bridge loan to customers that will ultimately have to be repaid or written-off. **Electric and gas utilities require regulatory approval to create a regulatory asset for future collection, while oil heat dealers can do this on their own.** Per interviews with industry leaders, some bill remittance will be required by year-end 2020.

Sector Supply Chain

Little evidence of immediate impact on energy sector supply chains covering equipment, supplies, and materials is apparent, with the exception being for personal protection equipment (PPE) and cleaning supplies. Heating oil and vehicle fuel inventories are nearly at capacity.

Threat of closure of upstream independently-owned and low-margin oil and gas wells might impact supply availability post-2020 if demand quickly approaches pre-COVID-19 levels. Oil price volatility will continue as demand and supply remain imbalanced. **Potential for supply chain issues given uncertainty around the White House’s Executive Order** for sourcing electrical equipment supplies, solar panel acquisition, wind turbine equipment, and ethanol for gasoline blending.

Energy Affordability

Low- and moderate-income customers pay a higher percentage of income on energy, 3.5% for average income households versus 7.2% for low-income households. Weatherization Assistance and Low-Income Home Energy Assistance programs providing funding for energy efficiency improvements and covering a portion of their bills will help, but funding availability is insufficient to have any significant impact.

Federal funding is not sufficient to materially reduce energy burden on low- and moderate-income customers even with the additional \$900 million stimulus funding for LIHEAP through Sept. 2021. Utility Rate filings have been paused with an expectation that efforts will be made to reduce costs of service even while expecting to collect arrears and accounts in forbearance in future years.

Context Overview Highlights – Energy Sector (4 of 4)

Impact on the NY Metro Region – Energy Sector Fact Base

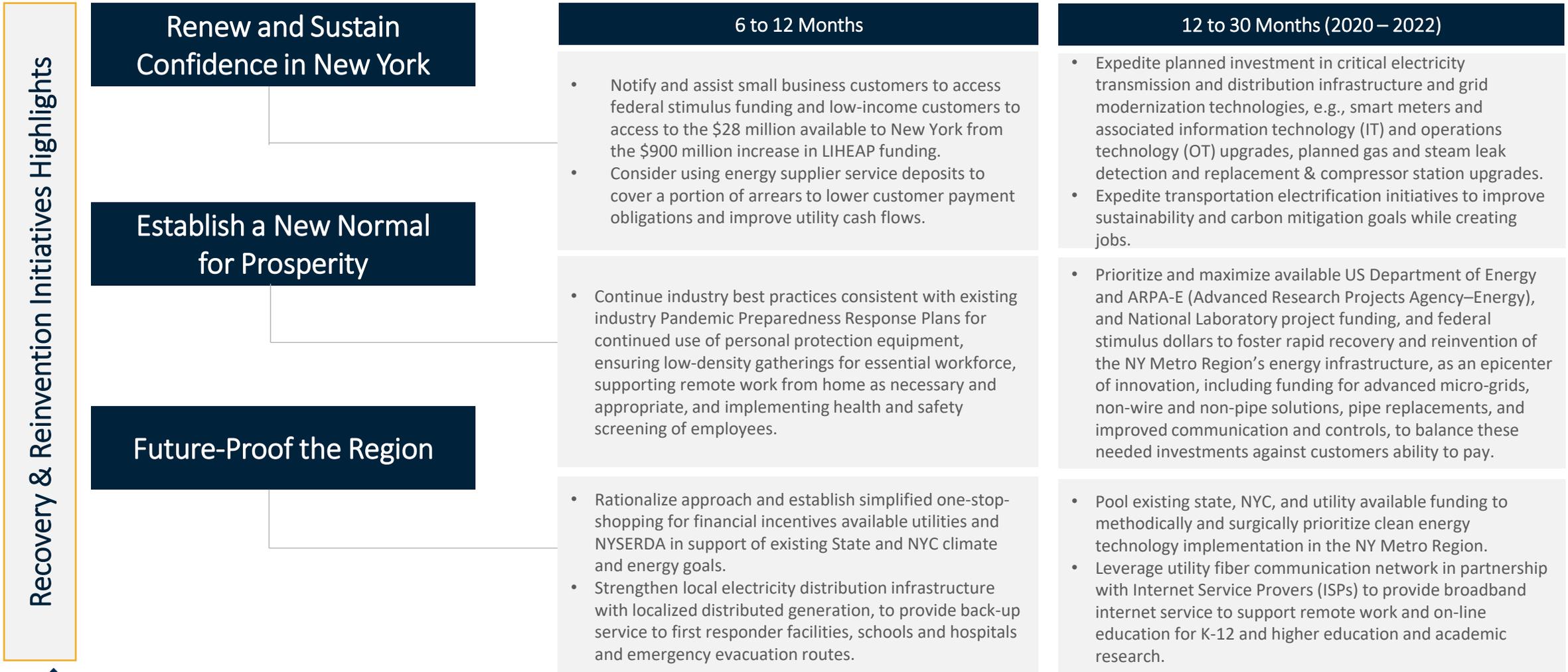
Industry Leaders Interview Themes (NY Metro Region)

1. Energy industry is functioning well and continuing to provide electricity, natural gas and steam services reliably while dealing with issues associated with demand destruction – petroleum products inventories, including heating oil, aviation and electric generation fuels, and vehicle fuels are filling fast as demand has fallen significantly. Minor storms impacting the region with isolated electrical outages (as occurred mid-March) have continued to be serviced as per usual.
2. Most of the electric and natural gas utility workforce is remote (upwards of 80%) with field crews, operations and call center staffs, and critical employees continuing to function and perform as per usual with necessary health and safety precautions being taken. Mental health and grievance resources being made available to workforce to due to COVID-19 fatalities and health concerns.
3. Safety precautions are being taken routinely to protect workforce (control room operators sequestered for weeks at a time are provided shelter, food, and medical care) – testing and contact tracing being used and looked at as necessary as the economy and workforce adapt to a new normal.
4. All necessary capital expenditure (CapEx) on infrastructure for electricity, steam, and natural gas are continuing, as workforce is deemed “essential” – a short pause to assess impact of COVID-19 and to put in place appropriate workforce health and safety protocols have ended.
5. Electric utilities and power generators executed a “mutual aid agreement” to share resources across most all operations (beyond just for storm restoration) – including investor-owned and public power.
6. Equipment and supplies for routine asset and system maintenance are sufficient – expect no near-term supply chain issues once recovery is underway (some interest in pursuing domestic and local suppliers) – longer term implications for Supply Chain impacts remain under review given the federal Executive Order having the potential to limit sourcing such equipment and supplies.
7. Currently an oversupply of petroleum products (gasoline, diesel, heating oil, and residual fuels for power generation) – expect no supply chain issues once recovery is underway (some concern over duration of current oversupply and potential threat of oil wells and gas wells closing or going out of business) – recent media reports indicting some discussions underway about the possibility of nationalizing the oil industry.
8. There is little the energy sector can do to speed recovery without regulator approval unless mandated by law – can support reinvention particularly if allowed to own large-scale renewable energy generation and distributed generation resources, electric vehicle charging infrastructure, and microgrids. Any additional federal stimulus dollars from an infrastructure bill will reduce the need for such investment to be recovered through customer bills.

Existing State and NY Metro Region *Public Policy* and
*Available Clean Energy Funding Provide a
Framework and Leveraging Opportunity* for
Expediting and Reprioritizing Energy Sector
Investment for Recovery & Reinvention

Emerging Ideas Overview – Recovery & Reinvention

Emerging ideas, highlighting highest priority items through 2022, to renew confidence, establish a new normal, and future-proof the region



Public-Private-Partnership Framework for Funding Emerging Ideas

Leverage Existing Funding Sources Consistent with State and New York City/Region's Energy and Climate Policies to Speed Investment

- **Statewide:** New York State's Climate Leadership and Community Protection Act of 2019 (CLCPA) requiring that 100% of the State's energy be from clean and renewable energy resources by 2050 has very aggressive goals and a Clean Energy Fund with billions of dollars to invest – technologies for PPP to deliver 70% renewable energy by 2030, and 85% reduction in greenhouse gas emissions include:
 - 9,000 megawatts (MW) of offshore wind
 - 6,000 MW of distributed solar
 - 3,000 MW of energy storage
 - New York State Energy Research and Development Authority (NYSERDA) as Statewide administrator of the state's clean energy programs has budgeted \$14.3 billion (2020-2023) to partner with electric and gas utilities and energy project developers to make progress toward achieving CLCPA goals.
 - Investor-owned electric and gas utilities have budgeted over \$17 billion over the same time period to support modernization of the electric and gas distribution systems, replace and repair pipes and wires, and to support technology investments.
- **New York City:** OneNYC 2050, calls for an all-electric New York City by 2050, requiring non-electric devices, systems or processes requiring energy need to be powered by electricity. OneNYC 2050 plans include:
 - Expanding community ownership of renewable energy infrastructure with the first renewable energy project sited on NYHA property.
 - Working with State Department of Health and NYC Human Resources Administration to promote air conditioning benefits and resources, including expanded Low-Income Home Energy Assistance Program (LIHEAP) assistance.
 - Expediting permitting for energy storage in NYC, consistent with FDNY battery storage rule 3RCNY 608-01 for outdoor stationary storage battery systems
 - NYC will track the electric vehicle share of new vehicle sales (1.4% in 2017), with a goal of reaching 20% by 2025 and share of electricity from clean energy resource of 100% by 2040, up from 27% in 2019
 - Local Law 84 (Benchmarking Law), and the buildings it covers are required to submit yearly data on energy and water usage whereas its companion LL87 requires building owners to carry out energy audits and retro-commissioning, enabling NYC to deploy targeted energy efficiency and emissions reduction measures in buildings.

Emerging Ideas Supporting Recovery – Analysis

Energy Sector: Key Investment Areas to Speed Up Recovery

Infrastructure Investment

12 to 30 Months (2020 – 2022)

- Increase energy sector capital investment to **\$6.3B - \$20.4 billion** over next 12-30 months to maintain high levels of safety, reliability and operational flexibility through infrastructure modernization with an opportunity to frontload investment to spur economic activity in NYC Metro Region.
- Grid Modernization (smart meters, distributed automation, asset optimization), transmission and distribution capacity enhancements, customer experience transformation programs bolsters effective management of available resources and help create direct and indirect jobs in the NYC Metro-region.

Distributed Energy Resources

- Statewide clean energy programs and sustainable environmental goals can push the energy sector to accelerate renewable energy and resiliency initiatives through investment(s) made by utilities and/or private, third-party providers on behalf of the utility. Industry estimates investments to the tune of **\$1.28B - \$3.28B** over next 12-30 months can act as a primer for the **rejuvenation of the clean energy industry** and compensate for the job losses in clean energy industry in the region.
- Continued and expedited renewable energy investment has potential for significant job creation, as US Bureau of Labor Statistics indicates the two fastest-growing jobs through 2026 are solar installers (105% growth) and wind technicians (96% growth).

Demand Side Management / Energy Efficiency / Demand Response

- A third of expected benefits (~35%) of statewide clean energy programs and initiatives are to **support disadvantaged communities**, focused on recovery and transition away from forbearance programs for immediate relief to focus on developing customer programs and affordable energy plans to **achieve carbon mitigation goals and provide safe, affordable and uninterrupted power supplies**.
- Industry estimates **\$0.6B - \$1.9B** capital investments over next 12-30 months in demand management and energy efficiency programs by the energy sector to meet or exceed clean energy, carbon mitigation goals and spur economic activity in the NYC Metro Region leading to job growth.

Transportation Electrification Charging Infrastructure

- Driving America Forward Act, S.1094, HR 2256 and State's Clean Energy Goals have made development of charging station infrastructure critical to ensure increase in electric vehicle adoption – the region needs transformative infrastructure growth to support over 850K+ electric vehicles by 2025.
- To support the EV growth by 2022, there is a need of additional 54,000 Nonresidential Level 2 chargers, and **1,140** DC Fast Charging Stations, requiring an investment of approximately **\$0.63B**.

Expediting Infrastructure Investment in Clean Energy Reinvention – The Innovation Economy

Emerging Ideas for Reinvention

Illustration 1 (Pg. 20)

Flexible Electricity Model with Decentralized Grid Enabling “Utility of the Future”

Transitioning the existing utility business model from an “industrial era” structure relying on central station stations for generating electricity and radial transmission and distribution infrastructures to a new model relying on more distributed generation resources and a more flexible, agile and nimble networked grid.

Illustration 2 – (Pg. 21)

Future Innovation Platform and Technology Spectrum

Enabling the Future Grid requires investment in new information technology (IT) and operations technology (OT) to support two-way power flows and communications with tighter governance, controls, cyber-security protections for connected grid-edge technologies.

Illustration 3 – (Pg. 22)

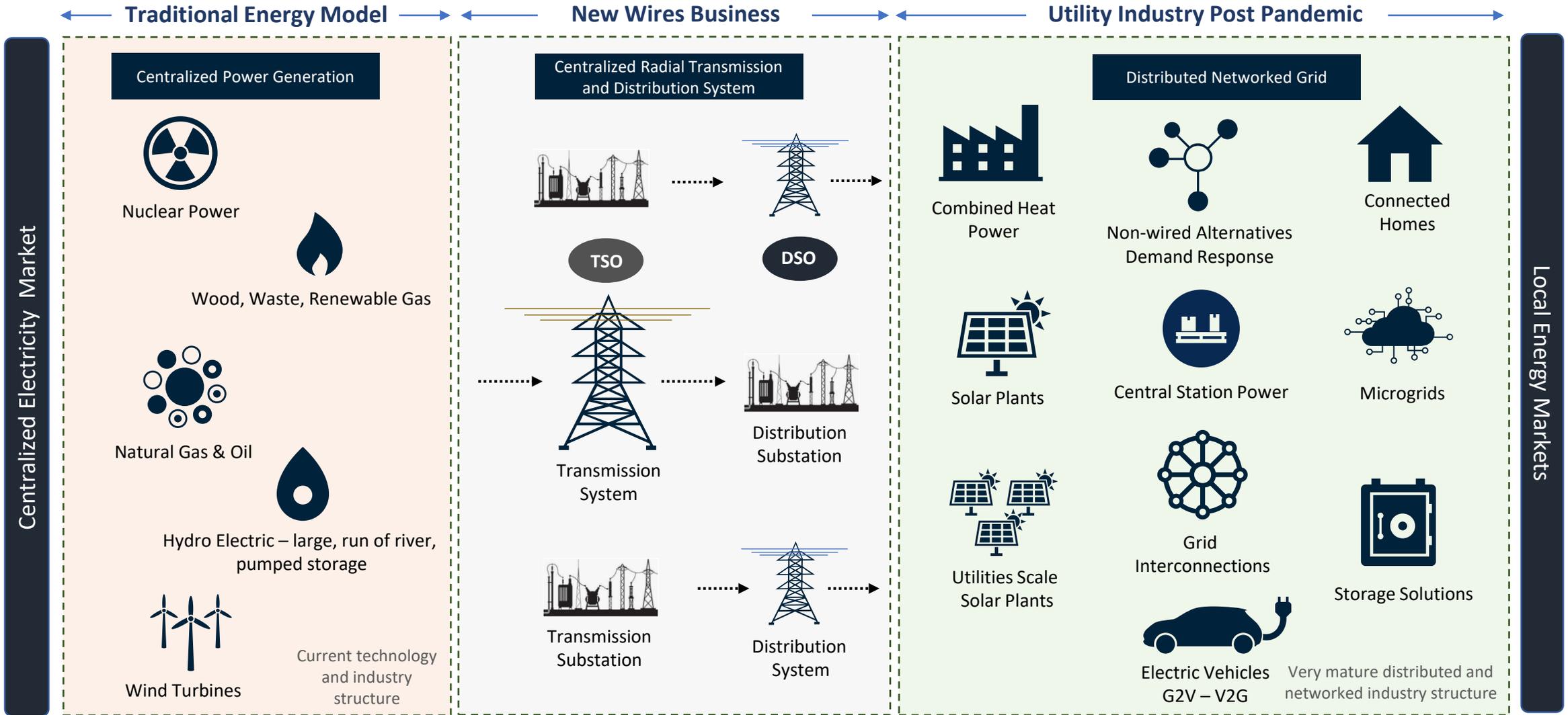
Utility Reference Architecture as Future Innovation Platform

Local distribution companies (utilities) serving as distribution system operators with many distributed grid-edge technologies connected to the grid require significant capital investment to provide utilities with the control mechanisms and software solutions in place to ensure they continue to have the “obligation to serve” as “provider of last resort” under existing regulatory requirements.

The following three slides depict and illustrate the technology and IT/OT infrastructure needs in support of Energy Sector’s Infrastructure Investment in *Emerging Ideas*

Illustration 1 (pg. 19) depicts the transition (left to right) from current state to future state industry and grid architecture which can take years. New York is well positioned and leading other states in progressing toward a new more dynamic and flexible grid architecture.

Flexible Electricity Model with Decentralized Grid Enabling “Utility of the Future”

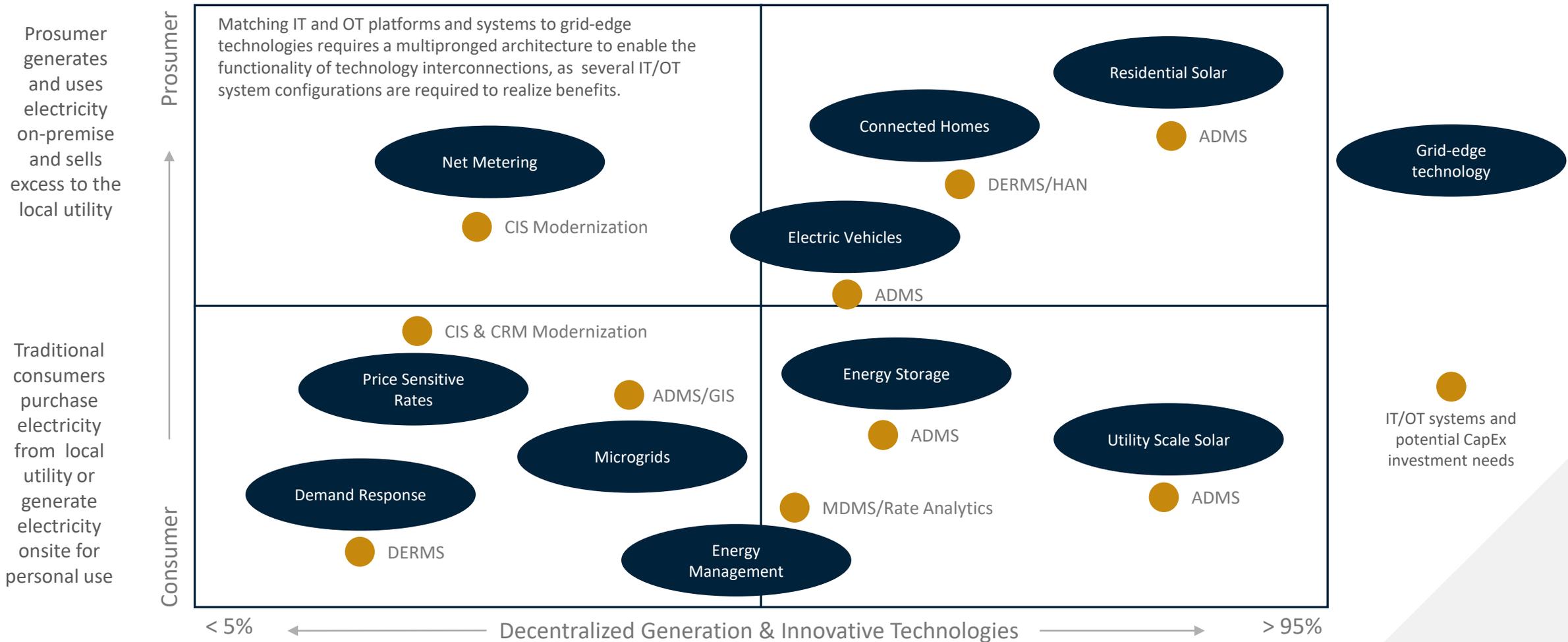


Source: West Monroe (2020)

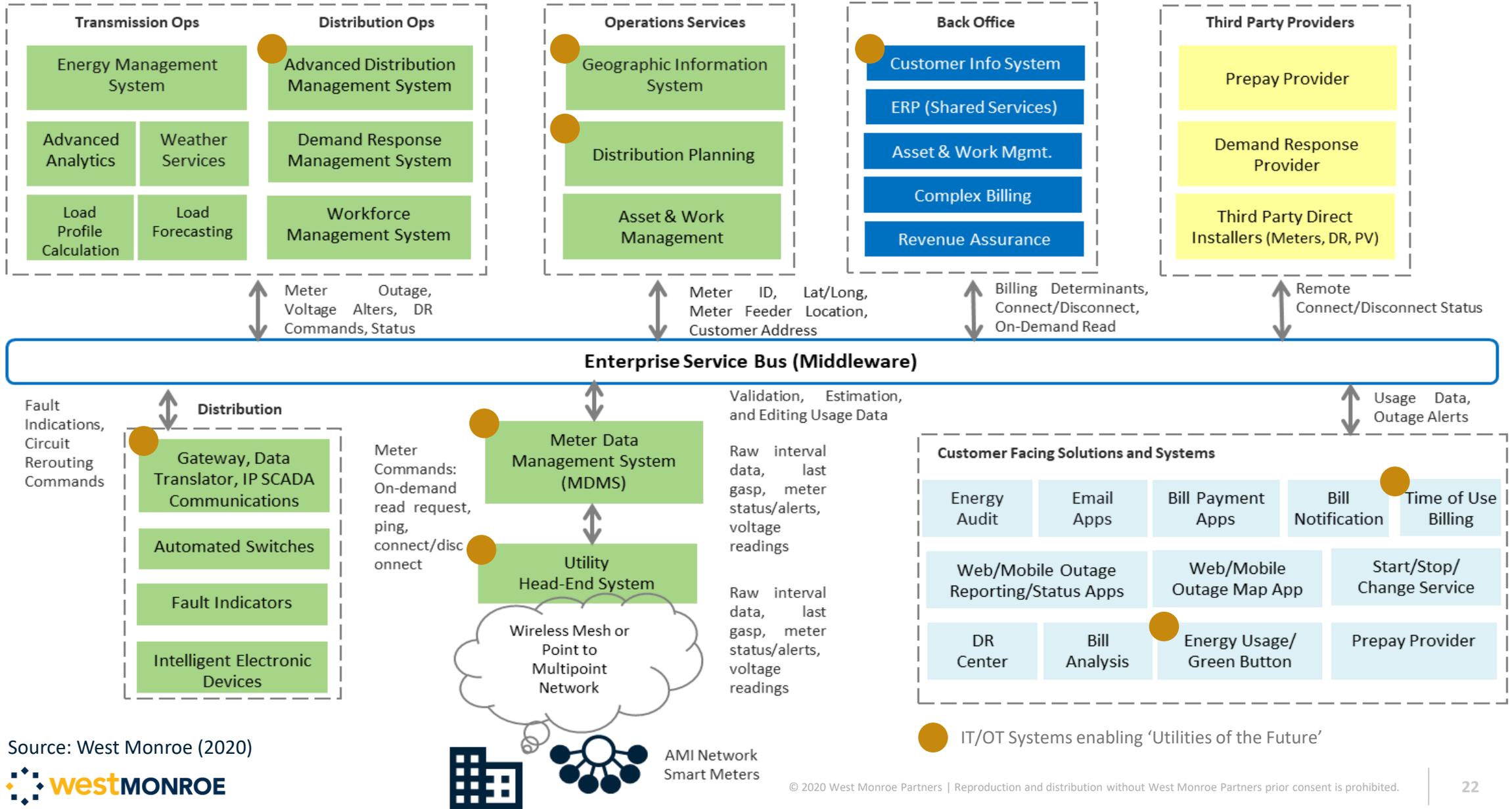
TSO: Transmission System Operator || DSO: Distribution System Operator

Illustration 2

Future Innovation Platform and Technology Spectrum



Utility Reference Architecture as Future Innovation Platform



Source: West Monroe (2020)



2B: Ensure the region’s stock of affordable and flexible housing and commercial real estate can meet future needs

	<i>Immediate Impact of COVID-19</i>	<i>Impact Through Year-End 2022</i>
Energy Affordability	<ul style="list-style-type: none"> • Electricity use in NYC is down 16% while natural gas and heating oil use remained roughly unchanged having the effect of reducing energy bills. • Energy providers are notifying and assisting small business customers to access federal stimulus funding and low-income customers to access to the \$28 million available to New York from the \$900 million increase in LIHEAP funding. 	<ul style="list-style-type: none"> • More stringent enforcement of NYC Local Laws related to building energy use benchmarking and building code compliance can significantly reduce energy use in buildings and improve affordability. • Energy use can be reduced, and affordability improved significantly if new electricity, natural gas, and heating oil customer hookups required buildings receive an energy audit and all cost-effective energy efficiency and DER investments are made, including community solar for low- and moderate-income customers, and by offering time-of-use rates to customers that when coupled with smart meters provide an ability to better manage usage to reduce energy costs.
Building Construction & Retrofit	<ul style="list-style-type: none"> • No immediate impact on affordability of housing or commercial real estate except for delays in construction and building code enforcement resulting from stay-at-home orders and inability to perform construction work or filed work for enforcement. • Likely to increase in building construction costs associated with pause and higher capital carrying costs. 	<ul style="list-style-type: none"> • Review and strengthen enforcement of the 2020 New York City Energy Conservation Code (effective May 12, 2020) for residential and commercial building codes in NYC. • Consider strengthening the Energy Conservation Code to ratchet up energy efficiency savings from cost-effective measures as soon as feasible.
Electric and Natural Gas Budget Billing and Heating Oil Cap Pricing	<ul style="list-style-type: none"> • No immediate impact on billing, however collections, as indicated earlier, are at risk. 	<ul style="list-style-type: none"> • Electricity and natural gas customers can enroll in budget billing plans to smooth prices post-pandemic though year-end 2020 and beyond. • Oil heating customers can lock in prices now for the 2020-2021 heating season through local dealers under Oil Cap Pricing mechanisms, while prices remain low due to over oil market imbalances.

7A: Improve local supply chain resiliency (e.g., by improving upstream-downstream coordination, boosting local supply chains, becoming a hub for critical goods)

	<i>Immediate Impact of COVID-19</i>	<i>Impact Through Year-End 2022</i>
Power Delivery and Transmission Materials	<ul style="list-style-type: none"> Based on Energy Leadership interviews and recent trends, there is no evidence of a short term (6 month) risk. If the recent Executive Order does not go into effect within the next 6 months, there is minimal exposure, but Energy Industry will need to re-evaluate the sourcing strategy and inventory levels. 	<ul style="list-style-type: none"> Impact on imported bulk power supply materials by the Executive Order will affect the sourcing and availability of supplies. This will re-shape the supplier footprint and will generate domestic manufacturing jobs. This an opportunity to conduct a holistic supply chain sourcing analysis for additional components to build resiliency, optimize inventories and sustainability, perhaps at the expense of cost.
Power Generation and Delivery Bulk Chemicals	<ul style="list-style-type: none"> Bulk chemicals are consumable items required to maintain the power production process. The sourcing of these items is critical to main reliability on the generation process. Oil base products, chemicals, and gases fall under this category. 	<ul style="list-style-type: none"> The need for these materials at close to the volumes required today will continue during this timeframe. There is an opportunity to look at manufacturing, transportation, and storage of chemicals in order to maintain both on-hand stocks and supply chain durability in the event of future pandemics or catastrophic events.
Personal Protective Equipment (PPE) and Cleaning Supplies	<ul style="list-style-type: none"> PPE and cleaning supplies have become essential commodities to ensure the industry is operational through workforce safety protocols. Access to PPE and cleaning supplies has been limited as these resources are competing against demand of other Essential Workers. This will lead to creative solutions and non-traditional vendors obtain such goods. 	<ul style="list-style-type: none"> In the long term, these supplies will be essential to conduct their business and shall be planned accordingly. High levels of inventory might be required as (domestic or international) production can be halted at any point if suppliers get impacted by the virus.

7D: Double down on renewable energy and resiliency initiatives



	<i>Immediate Impact of COVID-19</i>	<i>Impact Through Year-End 2022</i>
Identify sites suitable for commercial-scale renewable energy development	<ul style="list-style-type: none"> No immediate impact except pause in site identification efforts by developers. 	<ul style="list-style-type: none"> Statewide studies are underway by New York State Energy Research and Development Authority (NYSERDA) in support of the renewable energy siting bill passed earlier this year.
Provide renewable energy options for low- and moderate-income customers	<ul style="list-style-type: none"> No immediate impact except for pause in project administration. 	<ul style="list-style-type: none"> The statewide NY Sun program administered by NYSERDA provides for targeted solar energy projects in each utility service area, including Con Edison having its plan targeting up to 25 kilowatts of residential solar and up to 7.5 megawatts of non-residential solar. Suggested that the fund administrators' advance projects more quickly.
Invest in renewable and distributed energy resources (DER)	<ul style="list-style-type: none"> Pause in project construction, delivery, and funding for in-flight projects. Delay in starting planned projects or issuing solicitations for new DER and renewable energy resources. Further delay in expanding community ownership of renewable energy infrastructure with the first renewable energy project sited on NYCHA property. 	<ul style="list-style-type: none"> NY Tri-State Region utility investment in DER including renewable energy resources and state-sponsored renewable programs total \$3.28 billion through 2022, with \$1.28 billion in 2020, and \$1.0 billion planned for 2021 and 2022 – fund administrators can advance projects more quickly. Consider regulatory approval for utilities to own directly or procure from third-parties, large-scale renewables and distributed energy resources to meet the region's energy policy goals.



Industry Sector: Energy

Recovery Phase & Reinvention Supporting Analysis

Capital Projects by Investment Area and Projected Economic Activity (2020-2022)



Investments in capital projects were aggregated from regional utilities and energy agencies that service and operate within Greater New York metropolitan region. They are not all-inclusive of the of tri-state region. Projected economic activity calculated per capital investments and initiatives by NY, NJ, and CT utilities for (1) Infrastructure (transmission and distribution), (2) Distributed Energy Resources, (3) DSM/EE programs, and (4) transportation electrification (for New York only). The NYC Metropolitan Region includes capital investments of Consolidated Edison Company of New York, National Grid, and specific NYSERDA funding directed to New York City region.

Investment Area	Recovery			Reinvention	
	2020	2021	2022	Total (including NYC)	NYC Metro Region Only
1) Infrastructure Investment Programs	\$6.3B	\$7.8B	\$6.3B	\$20.4B	\$12.6B
2) Distributed Energy Resources	\$1.28B	\$1.0B	\$1.0B	\$3.2B	\$1.6B
3) Demand Side Management/Energy Efficiency	\$0.6B	\$0.7B	\$0.6B	\$1.9B	\$0.4B
4) Transportation Electrification Charging Infrastructure	\$0.16B	\$0.21B	\$0.27B	\$0.63B	\$0.19B
Total Investments by Year (Range)	\$8.38B (\$7 - \$10B)	\$9.62B (\$8 - \$11B)	\$8.18B (\$7 - \$10B)	\$26.2B (\$24 - \$30B)	\$14.4B (\$12B - \$16B)
Economic Activity (Ranges)**	45 - 60K Jobs	51 - 70K Jobs	44 - 58K Jobs	130 - 180K Jobs	77 - 103K Jobs

**Economic activity calculated for direct, supplier, and induced jobs using employment multiplier(s) for electric and natural gas utility industries in U.S., per \$1,000,000 in final demand (Economic Policy Institute, 2019). Calculation is cumulative range of jobs directly associated with the investment, supplier jobs related to capital services, and induced jobs from direct and supplier employment as well as from public sector employment supported by taxes. Calculation assumes \$1,000,000 of capital project investment is 1:1 for \$1,000,000 in final demand. Analysis and calculation are specific to the capital investment for projects and initiatives referenced in this research. It does not include indirect job creation. Capital numbers were aggregated from annual reports, investor relations presentations, rate case proceedings, and other publicly available documents to deduce ranges of economic activity using pre-pandemic economic variables to align with post-pandemic recovery investments in infrastructure.

Capital Investment (1 of 2)

** = project within Recovery Phase Capital Spending (6-12 months)

	CECONY ^{1,2}	National Grid ^{3,4}	PSE&G ^{5,6}	Eversource ^{7,8}	NYPA ^{9,10,13}	NYSERDA ^{11,12,14}
Infrastructure Investment Programs	<ul style="list-style-type: none"> • \$3.5 Billion yearly (2020-2022) for T&D, focused on new business, reliability improvements, and replacement of aging infrastructure • \$600 Million New York Energy Solution Project (54-mile Hudson Valley electric transmission line, via TransCo) to bring clean energy from upstate NY, expected operational in 2023 • Grid Modernization investment portfolio for 2020-2024 includes foundational systems and infrastructure for AMI, GIS, ADMS, IT/OT Integration, SCADA upgrade, Volt VAR Optimization, Cybersecurity 	<ul style="list-style-type: none"> • Metropolitan Reliability Infrastructure (MRI) Project to spend \$50 million in 2020 to complete Phase 4 sewer line crossing to create an operational transmission loop necessary for maintaining safe and reliable service to downstate New York customers** • KEDLY & KEDNY combined capital investment of over \$1.5 Billion in 2021 for pipeline replacement, storm hardening projects, new transmission pipe installation, and LNG facility upgrades 	<ul style="list-style-type: none"> • \$1.8 Billion yearly investment (2020-2022) in T&D focused on new business, reliability improvements, and replacement of aging infrastructure • ~\$431 Million yearly (2020-2022) for Gas Modernization Program provides replacement of 875 miles over five years, creating 750 jobs • \$60 Million for energy cloud AMI capabilities via accelerated ~2 million electric meter roll-out and supporting infrastructure (as part of Clean Energy Fund) 	<ul style="list-style-type: none"> • ~\$87M yearly investment (2020-2024) in CT Accelerated Pipe Replacement Program, aligning with sustainability strategy to replace miles of cast iron and steel pipe with safer, more durable material • Hartford-Area Transmission Projects and Greenwich substation projects expected to be completed by Q4 2020 	<ul style="list-style-type: none"> • ~\$281 Million yearly (2020-2023) capital commitment for Transmission activities to increase flexibility and grid resiliency 	<ul style="list-style-type: none"> • \$200 Million to upgrade New York’s port infrastructure to facilitate offshore wind development and support CLCPA goals
Distributed Energy Resources	<ul style="list-style-type: none"> • \$400 Million yearly (2020-2022) investment in renewable electric production projects 		<ul style="list-style-type: none"> • ~\$53 Million yearly (2020-2022) associated with grid-connected solar, solar loan programs and customer energy efficiency programs • \$10 Million for energy storage, allowing utility-scale systems to defer additional distribution investment, enabling more PV and improved resiliency (as part of Clean Energy Fund) 	<ul style="list-style-type: none"> • Additional investment in offshore wind business of approximately \$300 to \$400 million in 2020, to support 1,714 MW of offshore wind power capacity operational by the end of 2024** 	<ul style="list-style-type: none"> • NYPA undertaking critical transformation of key business processes—starting with procurement and ‘meter to cash’ processes—with expected benefits of \$20-\$40 million per year (2020-2025) 	<ul style="list-style-type: none"> • 21 large-scale solar, wind, and energy storage projects to incentivize \$2.5 billion in direct and private investments toward their development, construction and operation and create over 2,000 short-term and long-term jobs

Capital Investment (2 of 2)

** = project within Recovery Phase Capital Spending (6-12 months)

	CECONY ^{1,2}	National Grid ^{3,4}	PSE&G ^{5,6}	Eversource ^{7,8}	NYPA ^{9,10,13}	NYSERDA ^{11,12,14}
DSM / EE Programs	<ul style="list-style-type: none"> Per NYSPSC EE yearly budgets (2021-2025): \$13 million for electric EE programs; \$12 million for gas EE programs; \$15 million for heat pump programs Brooklyn Queens Demand Management program (BQDM) incorporates non-traditional solutions, including non-wire solutions, to meet growing demand with customer-side and utility applications with total cost of ~\$450 million through 2026 		<ul style="list-style-type: none"> \$2.5 Billion for EE to achieve NJ Clean Energy Act targets of 2% and .75% electric and gas savings requirements (as part of Clean Energy Fund) 		<ul style="list-style-type: none"> Finance and implement more than \$1.5 billion in energy efficiency measures throughout NY until 2025 at state, local and municipal government facilities, continuing to develop its program to \$300 million annually 	<ul style="list-style-type: none"> NYSERDA's investments in energy efficiency and heat pumps to total \$1.2 billion by 2025 Seeking to invest \$200 million in market development programs to support building electrification by leveraging utility incentive programs to create a statewide Clean Heating and Cooling market framework
Transportation Electrification	<ul style="list-style-type: none"> \$8 million available incentive funds remaining for 2020 for Con Edison and O&R for statewide DCFC Incentive program**10 Grid Modernization investment portfolio for 2020-2024 includes efforts to meet statewide goal of adding 850,000 PEVs by 2025 	<ul style="list-style-type: none"> \$9 million available incentive funds remaining for 2020 for statewide DCFC Incentive program**10 	<ul style="list-style-type: none"> \$30 Million for EV infrastructure within residential, workplace, multi-family, and travel corridors (as part of Clean Energy Fund) 	<ul style="list-style-type: none"> Plans to execute \$45 million effort to build 3,500 new charging ports, with expected completion by early/mid 2021 (MA / CT / NH) 	<ul style="list-style-type: none"> \$40 million in 2020 for three new initiatives: Interstate Fast Chargers (DCFC), Airport Charging Hubs, EV Model Communities** Committed to \$250 million through 2025 for EVolve NY, to invest in EV infrastructure, services, and consumer awareness 	<ul style="list-style-type: none"> Additional \$5 million investment in 2020 to Charge Ready NY, increasing overall budget to \$12 million, to reach statewide goal of 10,000 EV charging stations by end of 2021, and 800,000 ZEVs by 2025 EV Charging infrastructure costs is ~\$6 billion investment through 2030 to support over 2M EVs on the road

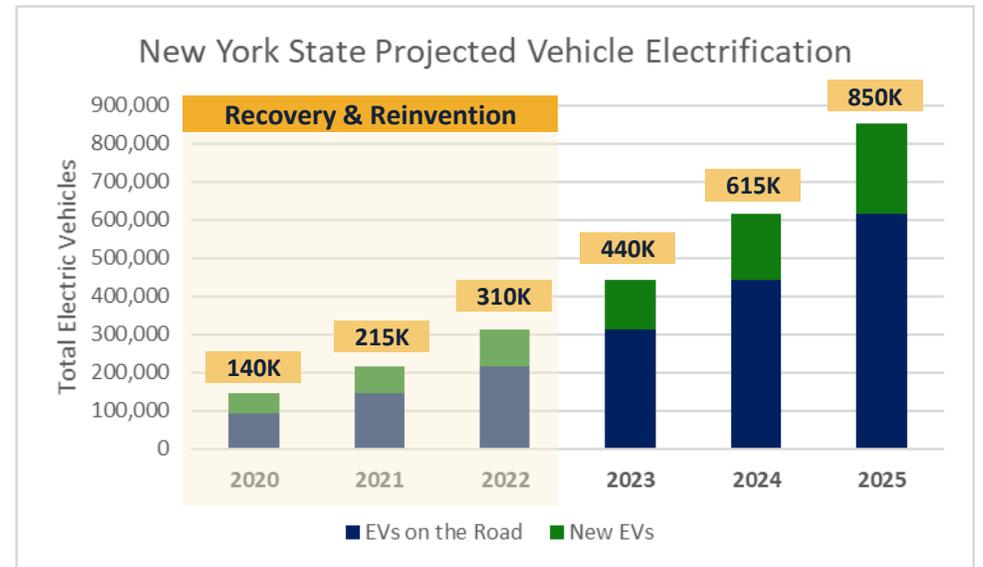


Industry Sector: Energy

Supporting Data, Information, and Analysis

Transportation Electrification Overview

- Charging infrastructure is a critical component to the success of the Electric Vehicles future adoption. The infrastructure is the backbone that will ensure that shoppers adopt to the value proposition since the system has charging flexibility in public and private locations at multiple speed rates.
- Based on NYSERDA’s cost and benefit analysis for the New York State¹, there are projections of approximately 850K EVs on the road by 2025
 - The analysis shows about 310K EVs by end of the Reinvention phase
- The analysis is based on whole New York State to compensate for the New Jersey and Connecticut counties in the Metro Region



Transportation Electrification Investments in Recovery & Reinvention Phase



	2020	2021	2022	Total
<i>Electric Vehicle Projected Sales</i>	52K	70K	95K	217K
<i>Transportation Electrification (BEV, PHEV)*</i>	\$0.15B	\$0.21	\$0.27B	\$0.63B
<i>Economic Activity (Range)</i>	750 – 1,000 Jobs	1,250 – 1,500 Jobs	1,500 – 2,000 Jobs	3,500 – 4,500 Jobs

- Transportation Electrification was based on New York State
- Data calculated for this analysis was interpreted from NYSERDA’s [Benefit-Cost Analysis of Electric Vehicle Deployment in New York State](#) (February 2019)
- Data was broken down and characterized into three regions which impacted costing: Upstate, Metro New York and Long Island
- The Capital Investment was derived on these factors and assumptions (all data was calculated from NYSERDA’s report):
 1. Infrastructure cost range by two scenarios:
 - a) Base Case Scenario: EV owners have flat residential rates and charge vehicles when it is convenient (lower penetration of chargers) - Total Infrastructure Cost up to 2030 is **\$5.3B**
 - b) High Infrastructure Case: increased deployment of Fast Charging equipment for owners to charge when they are on the road – Total Infrastructure Cost up to 2030 is **\$5.8B**
 2. Allocation approach on Infrastructure Cost based on EV Sales Growth
 3. **The Capital Investment calculations were updated to incorporate Projected EV Sales Growth pattern (higher investment is required from 2025 to 2030)**

Supply Chain Supplemental Slide – Executive Order on Bulk Power System as of 5/14/2020

Potential New Trend

- **The Executive Order is currently under development which consequentially is continually evolving. Key factors under consideration:**
 - Materials/equipment impacted: the objective is to prevent foreign actors being able to alter or circumvent the grid through back doors built into the equipment intelligence (likely targeting countries such as China, Russia, Middle East, and North Korea)
 - Timeline: more information should come out in 150 days – September – October time frame
 - Existing contracts: most current projects already have equipment on order that likely won't be impacted because the contracts are already in progress
- **What do we know so far?**
 - Solar panel industry is the most reliant on China. Other equipment manufacturers are Japan and countries in Europe
 - Other countries such as Japan have already sought to reduce reliance on China without major disruption
 - Bulk materials definition: commonly produced commoditized things (cable, wire, semi conductors, relays, etc.)
- **In preparation to the Executive Order implementation, these are recommendations that can be taken proactively to mitigate risks. These are also good practices for a durable and resilient supply chain:**
 - Review and evaluate risk on contracts, long term agreements and open procurement orders
 - Recognize that it can be a challenging time to develop, design or purchase Bulk Power Systems as sourcing regulations might change
 - Evaluate every suspected product and its components (final assembly could come from a non-adversarial source, but components are sourced from an adversarial vendor)

Energy Industry Leaders Interviewed by West Monroe (16 interviews completed)

Name	Company	Title	Interview Date	Supplemental Attendees or Notes
John McAvoy	Con Edison Company of New York	Chairman, President & CEO	4/23/2020	Frances Resheske (Sr. Vice President Corporate Affairs and Government Relations) PfNYC Executive Committee (and company membership)
John Bruckner	National Grid NY	President	5/01/2020	PfNYC Board of Directors (and company membership)
James Judge	Eversource	President, CEO	04/28/2020	James Hunt (Sr. Vice President, Regulatory Affairs & Chief Communications Officer)
Gil Quiniones	NYPA	President, CEO	4/21/2020	
Alicia Barton	NYSERDA	President, CEO	4/21/2020	Janet Joseph (Sr. Vice President Strategy & Market Development) John Williams (Vice President Policy & Regulatory Affairs) Charlie Wesley (Program Manager, Liquid Fuels & Natural Gas)
Rich Dewey	NYISO	President, CEO	4/22/2020	Focus on wholesale market operations, resource mix, and pricing
Gavin Donohue	IPPNY	President, CEO	4/22/2020	Looking at the pandemic from the generator's perspective, including operations and challenges and opportunities
Jamie Wimberly	DEFG, LLC	CEO	4/22/2020	A view from the utility and consumers perspective
Rocco J. Lacertosa	Empire State Energy Association	CEO	05/06/2020	Heating oil market impacts and customer experience
Matt Bauke	West Monroe	Senior Consultant	04/23/2020	Interview regarding Oil/Gas Supply Chain Impacts (ex-Shell Oil)
Mark Finley	Baker Institute Center for Energy Studies (CES),	Fellow	4/30/2020	Interview regarding Oil/Gas Supply Chain Impacts (ex-BP)
Anthony Natale	Consolidated Edison	Emergency Preparedness	4/24/2020	Interview re utility equipment supply chain interruptions/resiliency
Jonathan Monken	System Resilience and Strategic Coordination	Senior Director	4/24/2020	PJM Interconnection, interconnection re load curve, delivery and system balancing impacts from COVID-19
Adam Ruder	NYSERDA	Clean Transportation Program Manager	4/29/2020	Interview regarding Charge NY and ability to accelerate EV and EVSE adoption
Jamie Wimberly	Distributed Energy Financial Group LLC (DEFG)	Chief Executive Officer	4/22/2020	Interview regarding impact of COVID-19 on low/moderate income and disadvantaged populations
Richard McMahon	Edison Electric Institute	Senior Vice President of Energy Supply and Finance	5/12/2020	WebEx regarding Financial Implications of COVID-19

Endnotes

Page 9 (Context Overview)

1. U.S. Energy Employment Report by State – 2020
2. Consolidated Edison Company of New York, “Form 10-K, Annual Report for 2019”
3. New York Independent System Operator (NYISO) “2020 Strategic Plan”
4. BW Research, “Memo re Clean Energy Employment Impact from Covid19” (May 13, 2020)
5. New York Energy Coalition & NYSERDA Home Heating Oil Prices Dashboard

Pages 11-12

1. Interview(s) with Energy Industry Sector Leaders
2. U.S. Energy Employment Report by State – 2020
3. BW Research, “Memorandum re: Clean Energy Employment Impacts from Covid19 Economic Crisis (April 14, 2020)”
4. New York Dept. of Public Services, “Suspend Utilities from Cutting Off Service as a Result of COVID-19” (March 13, 2020)
5. Connecticut Public Utilities Regulatory Authority [Docket NO. 20-03-15] Interim Decision (April 29, 2020)
6. Executive Order on Securing the United States Bulk-Power System (May 1, 2020)

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1. “Driving America Forward Act” H.R.2256 - 116th Congress (2019-2020)
2. US Bureau of Labor Statistics, “Fastest Growing Occupations”

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1. Economic Policy Institute “Updated Employment Multipliers for the U.S. Economy” (January 23, 2019)

Pages 28-29 (Capital Investment)

1. Consolidated Edison Company of New York (2019) Form 10-K 2019
2. Consolidated Edison Company of New York, Electric Long-Range Plan (2019 – 2038)
3. Niagara Mohawk Power Corporation d/b/a National Grid, “Transmission and Distribution Capital Investment Plan” (January 31, 2018)
4. National Grid, “National Grid - Downstate NY Long-Term Natural Gas Capacity Supplemental Report” (May 8, 2020)
5. PSEG, PSE&G, and PSEG Power (2019) Form 10-K 2019
6. PSEG, “March 2020 PSEG Investor Update”
7. Eversource (2019) Form 10-K 2019
8. Eversource, “2019 Year-End Investor Call” (February 20, 2020)
9. New York Power Authority, “2020-2023 Proposed Budget and Financial Plan”
10. New York Power Authority, “EVolve NY”
11. New York State Energy Research and Development Authority, “Fiscal Year 2020-21 Budget and Financial Plan”
12. New York State Energy Research and Development Authority, “Governor Cuomo Announces Details for 21 Large-scale Renewable Energy Projects to Deliver Clean, Affordable Energy to New Yorkers” (March 13, 2020)
13. Joint Utilities of New York “Electric Vehicle DCFC Incentive Program”
14. New York State Energy Research and Development Authority, “New York State Launches Process to Upgrade Port Infrastructure to Support Expanding Offshore Wind Industry” (October 2, 2019)

Pages 31-32 (Transportation Electrification)

1. NYSERDA, “Benefit-Cost Analysis of EV Deployment in New York” (February 2019)

Supporting Source and Data Inventory (1 of 3)

Source	Document	Date
ACEEE	How Does Energy Efficiency Create Jobs - FactSheet	14-Nov-2011
Brattle Group	2020 04 14 Brattle Group - Impact of Covid on Energy Industry	14-Apr-2020
BW Research	2020 04 14 Memo from BW Research re Clean Energy Employment Impacts per Covid19	14-Apr-2020
BW Research	2020 05 13 Memo from BW Research re Clean Energy Employment Impact from Covid19	13-May-2020
City of New York	OneNYC 2050 - Full Report (April 2019)	1-Apr-2019
Consolidated Edison Company of New York	March 2020 Update & Q4 2019 Earnings Release Presentation	1-Apr-2020
Consolidated Edison Company of New York	CECONY -- Average Monthly Electric Bills 2010-2019	
Consolidated Edison Company of New York	2019 Annual Report - Form 10-K	20-Feb-2020
Consolidated Edison Company of New York	Electric Long Range Plan 2019-2038	
Consolidated Edison Company of New York	CECONY - March 2020 Update and 2019 Earnings Release Pres	1-Apr-2020
Department of Energy	President Trump Signs Executive Order Securing the United States Bulk-Power System	1-May-2020
E2. ACORE, Energy4TheFuture	Clean Jobs America - Repowering America's Economy	1-Apr-2020
Economic Policy Institute	Update Employment Multipliers for the US Economy	1-Jan-2019
EENews (Press)	2020 04 06 EENews - NY Lockdown Jolts Electricity Demand	6-Apr-2020
Energy Acuity	COVID-19 Energy Industry Impacts: Week of April 20th	16-Apr-2020
Eversource	2019 Year-End Review and 2020 Outlook -- Investor Call	20-Feb-2020
Eversource	2019 Annual Report - Form 10-K	
Eversource	2020 Q1 Investor Report	
FERC	2020 02 30 FERC [EL19-86-000] Order Denying PSC and NYSERDA Complaint	20-Feb-2020
IEA	Global Energy Review 2020 - Impacts of Covid19 on Energy Demand and CO2 Emissions	
ISO-NE	Energy Security Improvements: Creating Energy Options for New England	15-Apr-2020
National Grid	National Grid NY -- Long-Term Natural Gas Capacity Report	24-Feb-2020
National Grid	National Grid NY -- Detailed Demand Scenario Assumptions for LT Natural Gas Capacity Report	20-Mar-2020
National Grid	National Grid NY -- Customer Cost Supplement for LT Natural Gas Capacity Report	20-Mar-2020
National Grid	National Grid NY -- Technical Appendix to LT Natural Gas Capacity Report	1-Apr-2020
National Grid	National Grid - Downstate NY Long-Term Natural Gas Capacity Supplemental Report	8-May-2020
National Grid	KEDNY and KEDLI: 2019 Rate Review	1-Apr-2019

Supporting Source and Data Inventory (2 of 3)

Source	Document	Date
National Grid	National Grid dba Niagara Mohawk Five-Year Transmission and Distribution Capital Investment Plan FY19-FY23	31-Jan-2018
National Rural Electric Cooperative Association (NRECA)	Financial Impact of COVID19 on Electric Co-Ops	21-Apr-2020
NERC	2020 04 06 [Docket Nos. RM15-18] NERC Motion to FERC to Defer Implementation of Reliability Standards	6-Apr-2020
NERC	2020 04 17 [Docket Nos. RM15-18] Order Granting Deferred Implementation of Certain NERC Reliability Standards	17-Apr-2020
NERC	Pandemic Preparedness and Operational Assessment - Spring 2020	6-Apr-2020
New Jersey Board of Public Utilities (BPU)	NJ BPU -- Straw Proposal for NJ EE and Peak Demand Reduction Programs	1-Apr-2020
Newsday (Press)	2020 04 19 Newsday -- COVID-19 Wallops New York Green Energy Sector	19-Apr-2020
NY Public Service Commission	2020 04 01 [Case 18-E-0130] NY State of the Storage Report	1-Apr-2020
NY Public Service Commission	2020 03 09 [Case 19-E-0530] Joint Utilities Comments re Resource Adequacy Matters	9-Mar-2020
NY Public Service Commission	2020 03 19 [Case 20-G-0131] NY PSC Order re Ga Planning Procedures	19-Mar-2020
NY Public Service Commission	2020 04 27 [Case 18-E-0138] EV Industry Stakeholder Coalition Initial Comments EVSEI	27-Apr-2020
NY Public Service Commission	2020 03 16 [Case 18-M-0084] Joint Utilities NYS Clean Heat-Statewide Heat Pump Program Plan	
NY State	2020 04 03 NY Accelerated Renewable Energy Growth and Community Benefit Act	3-Apr-2020
NY State	NY State Letter to Clean Energy Industries re Support Through Covid19	1-Apr-2020
NY Times (Press)	Another Way to See the Recession Power Usage is Way Down	8-Apr-2020
NYISO	NYISO Presentation re Covid Impacts	6-Apr-2020
NYISO	NYISO -- 2020-2024 Strategic Plan	
NYISO	COVID 19 and the Electric Grid Load Shifts as NY Responds to Crisis	14-Apr-2020
NYSERDA	Benefit-Cost Analysis of EV Deployment in NY - February 2019	
NYSERDA	NY Clean Energy Industry Report	
NYSERDA	NY Clean Energy Fund Quarterly Perf Report Through Dec 31 2019	19-Dec-2020
NYSERDA	NYSERDA 2020-21 Budget and Financial Plan	

Supporting Source and Data Inventory (3 of 3)

Source	Document	Date
NYSERDA	Drive Clean Rebate Primary Statistics	
NYSERDA	Electric Vehicle Registration Map	
Ørsted	Q1 2020 Offshore Asset Book, updated as of 31 March 2020	31-Mar-2020
Ørsted	Q1 2020 Interim Financial Report	1-Apr-2020
PJM	2020 04 14 PJM Update on Recent Load Impacts per Covid-19	14-Apr-2020
PJM	PJM -- 5 Year Historical Load Comparison	1-Apr-2020
PJM	Best Practices for Control Centers to Limit the Spread of the Coronavirus	
PowerGrid International (Press)	Preparing for impact: How utilities and vendors should respond now to Trump's supply chain cybersecurity executive order	11-May-2020
PSE&G	March 2020 PSE&G Investor Update	1-Apr-2020
PSE&G	2019 Annual Report - Form 10-K	26-Feb-2020
Rocky Mountain Institute	Reducing EV Charging Infrastructure Costs	1-Jan-2019
S&P 500	S&P Global Ratings -- NA Regulated Utilities Face Additional Risks Amid Coronavirus Outbreak	19-Mar-2020
SEIA	COVID-19 & The U.S. Solar Industry	4-Apr-2020
U.S. Bureau of Labor Statistics	New York Area Economic Summary, as of March 23, 2020	23-Mar-2020
U.S. Bureau of Labor Statistics	Fastest Growing Occupations	
U.S. Department of Energy (DOE)	Income Trends Among US Residential Rooftop Solar Adopters	1-Feb-2020
U.S. Energy and Employment Report (USEER)	USEER Energy Employment by State 2020	
U.S. Energy and Employment Report (USEER)	2020 US Energy Employment Report (USEER)	
U.S. Energy Information Administration (EIA)	EIA April 2020 -- Short Term Energy Outlook Report	1-Apr-2020

Glossary of Terms

ADMS	Advanced Distribution Management System
ARPA-E	Advanced Research Projects Agency–Energy
CapEx	Capital Expenditure
CARES Act	Coronavirus Aid, Relief, and Economic Security Act
CECONY	Consolidated Edison Company of New York
CIS	Customer Information System
CLCPA	Climate Leadership and Community Protection Act
CRM	Customer Relationship Management
DER	Distributed Energy Resource
DERMS	Distributed Energy Resource Management System
DG	Distributed Generation
DR	Demand Response
DSO	Distribution System Operator
ERP	Enterprise Resource Planning
FERC	Federal Energy Regulatory Commission
G2V	Grid to Vehicle
GIS	Geographic Information System
HAN	Home Area Network
IP	Internet Protocol
IPPNY	Independent Power Producers of New York
ISO	Independent System Operator

ISP	Internet Service Provider
IT	Information Technology
LDC	Local Distribution Company
LIHEAP	Low Income Home Energy Assistance Program
M&A	Merger & Acquisition
MDMS	Meter Data Management System
MISO	Midwest Independent Transmission System Operator
NE-ISO	New England Independent System Operator
NYCHA	New York City Housing Authority
NYISO	New York Independent System Operator
NYPA	New York Power Authority
NYSERDA	New York State Energy Research and Development Authority
O&M	Operations & Maintenance
OpEx	Operating Expense
OT	Operations Technology
PJM	Pennsylvania, Jersey, Maryland Power Pool
PPE	Personal Protective Equipment
RTO	Regional Transmission Organization
SCADA	Supervisory Control and Data Acquisition
TSO	Transmission System Operator
V2G	Vehicle to Grid
WFH	Work From Home