Austin Tucker

IDC 4010

Professor Zarnoch & Professor Engle-Friedman

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The Growing Necessity of Transmission

Introduction:

New York State will begin entering a critical period of time outlined by years of legislation and push towards its renewable energy goals. On June 20th, 2019, Governor Andrew Cuomo and the New York State government initiated *The Climate Leadership and Community Protection Act*. This historic law put New York State on the path towards reaching net zero greenhouse gas emissions. After about three years of organizing, the CLPA established targets for reducing greenhouse gas emissions and increasing forms of renewable energy. The idea is to strengthen these two objectives while creating economy-wide solutions and addressing several environmental justice components.

Along with enhancing New York's clean energy initiative through "accelerating the development of wind and solar power", increasing energy efficiency, and "facilitating the growth of energy storage technology", the act has four major provisions and separate strategies for each (Farmer). These include Net Zero Emissions, Ambitious Targets for the Electric Sector, The Climate Action Council and the Scoping Plan, and Disadvantaged Communities and the Climate Justice Working Group. The summation of these four targets sets the goal of achieving net zero emissions while maintaining and pursuing a responsible course of action to fight against climate change.

In this paper, I will primarily be discussing the Ambitious Targets for the Electric Solar provision of the act. I will be highlighting the need for certain alternatives and how New York City will be affected as well as how the city should plan and act accordingly alongside these provisions. New York City creates a challenge for the CLPA in that it is the financial capital of the world, has a high population density, numerous community wealth gaps, and an already lack of accessible space for clean energy infrastructure. One of the solutions is increasing the capacity and technology of state-wide transmission lines connecting up-state New York with Manhattan and the surrounding boroughs.

Ambitious Targets for the Electric Sector

One of the main aspects of the CLCPA is to increase its use and capacity for renewable energy. The state wants to be a world-wide leader in the renewable efforts through enhancements to the already existing Clean Energy Standard. The state placed specific targets into law, thereby defining the next decade as a shift in the effort against climate change. These specific targets include:

> "70 percent of the state's electricity must come from renewable energy by 2030, and 100 percent of the state's electricity supply must be emissions free by 2040. 9,000 MW of offshore wind must be installed to serve New Yorkers by 2025. 6,000 MW of solar energy must be installed to serve New Yorkers by 2035. A statewide goal of reducing energy consumption by 185 trillion British thermal units (BTUs) from the state's 2025 forecast through energy efficiency improvements. 3,000 MW of energy storage capacity must be installed to serve New Yorkers by 2030." (Farmer)

These targets are guided and measured efforts to effectively power the existing needs of consumers across the state including residents of New York City. While these targets are ambitious, the question isn't if they are achievable but rather how to achieve them. New York already has a blueprint to follow by in upstate New York. This area of the state "already gets 88 percent of its electricity from zero-carbon resources, mostly hydropower but also significant amounts of onshore wind power"(John). Furthermore, the Natural Resources Defense Council, created a full procurement schedule by which the state will follow that sets a timetable to achieve 70 percent clean energy by 2030 and an "annual target of 4,500 gigawatt hours annually". Possibly the most important measure in this process is included in the tier 4 program that was approved for "renewables that are located in or are directly interconnected into New York City" (John).

Transmission

One of the more under discussed elements of renewable energy is transmission. It is important to understand the difference between creating machinery and technology to produce energy and actually getting that energy to where people are. The most effective way to get power to high-demand areas, particularly cities, is through wires, whether in the air or under the ground. While technologies for producing emission-free energy have experienced a decade of high-growth, development of transmission technology has lagged behind. New York State, specifically, has an aging transmission structure. It is important to ensure that this transmission structure is "upgraded and enhanced to move this renewable electricity to demand centers" (John).

Transmission is one of the key elements to unlocking a greener future. It makes creating a green grid and future easier by alleviating the burden of placing generating technology near major metropolitan areas. The majority of people don't typically live near areas of low-cost generation; therefore, bringing that energy to them is vital. Although this is the main benefit, there are plenty other reasons to expand and upgrade transmission systems. Firstly, transmission makes it more efficient to electrify other sectors, such as electric powered vehicles or home solar rooftops; making it easier for more people to gain access to that energy supply. Secondly, due to interstate markets for electricity, transmission reduces all electricity costs for consumers. This is because the state can place low-cost generating facilities in isolated areas and purchase materials at a cost-effective price; then, transmit that energy to areas of the state where it is needed such as New York City. Also, we can reduce the curtailment of renewables due to increasing the ability to carry more power and by sharing that energy with our neighbors. Additionally, VCE, or Vibrant Clean Energy, found that updating transmission actually increases "storage and DER integration" (Clack). This is inverse to what was commonly believed, but VCE found that storage capacity and transmission pair with one another, reinforcing their efforts and creating a stronger grid.

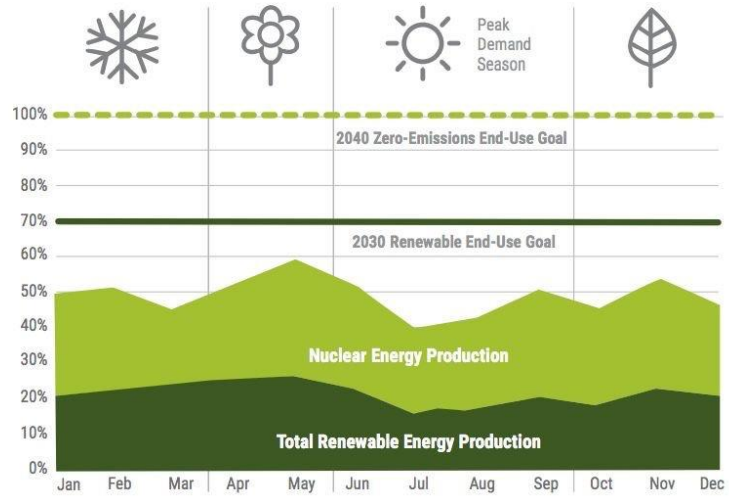
Problems Unique to NYS

Particularly with New York State, there needs to be strong effort in upgrading the foundations of our current transmission system to cope with this increase of green energy. Although wind and solar farms are important, transmission lines unlock the key to the future energy grid to deliver energy efficiently, without bottlenecks. Where wind and solar exists is not typically where people live, this means that there is a market for interstate electricity. With more

space available upstate for wind and solar farms as well as an already successful renewable energy agenda in place, New York State should be focusing on streamlining that energy down into New York City.

By 2030, the state will need to increase its electricity from renewables by 26.8%, thus requiring "new transmission to carry upstate wind and hydro to downstate markets, plus a wave of new batteries and other balancing agents to balance the state's increasingly intermittent renewable mix" (John). These renewable resources will be used in New York City and downstate population centers as these represent areas of peak demand and energy use. With such a short time span to reach 70 percent renewable by 2030 and 100 percent renewable by 2040, this "leaves a massive gap to be filled by clean energy, since more than half of the state's carbon-free emissions today come from nuclear power" (John).

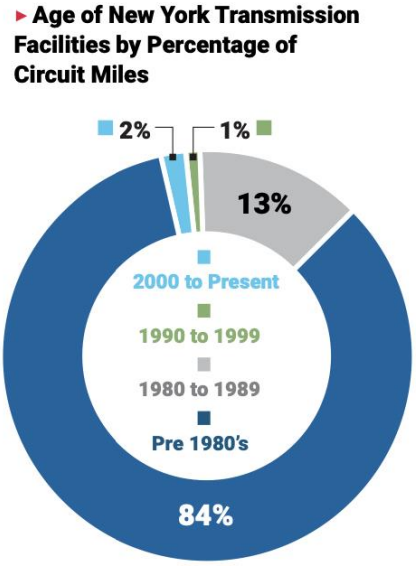
Figure 12: **Production of In-State Renewables and Zero-Emission Resources Relative to 2019 Load**



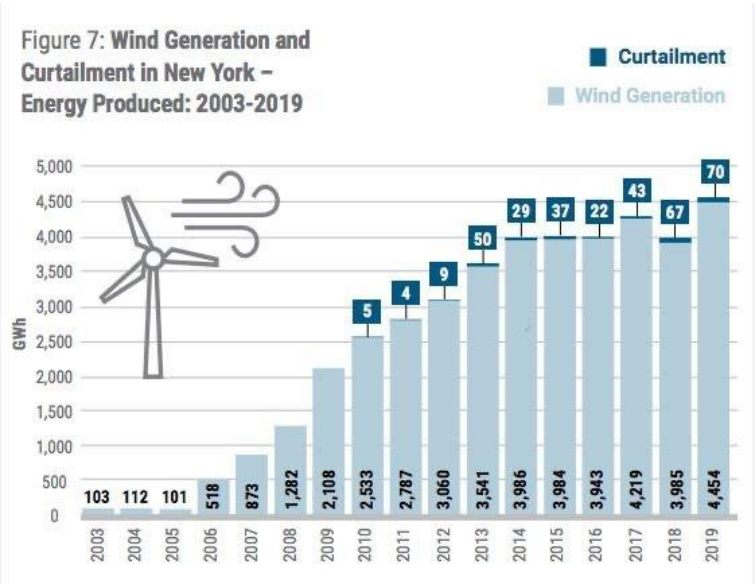
Only 29 percent of downstate's resources are zero-carbon, and most of that comes from nuclear power plants, including the Indian Point reactors which are set to close on April 29th, 2021. NYISO is the "independent system operator that manages New York state's bulk power system and wholesale energy market" and the company has been pushing for increased transmission to carry upstate clean energy into New York City (John).

At the moment, the biggest issue is that the state needs to upgrade its transmission lines. The majority of the transmission lines are not up to date. According to NYISOs *Power Trends*

2020 report, 84% of New York transmission facilities have been built pre-1980s. Multiple problems ensue from this. The first is that the state will be increasing its renewables substantially in the next decade. These transmission lines and facilities are not equipped to handle an increase in energy as well as transmitting that energy into downstate locations. What develops from this are two problems.



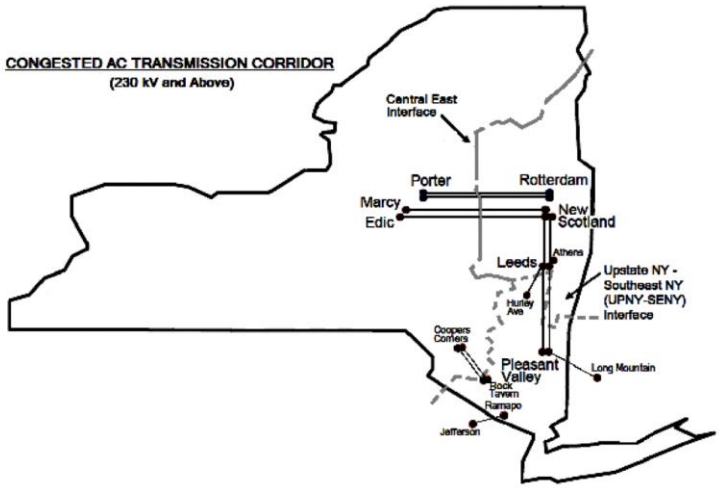
First, because transmission is lagging behind renewable sources in terms of development, we are already experiencing curtailment of clean energy generation. In upstate New York, Wind Generation has experienced a dramatic high-growth period. Due to the "lack of available transmission capacity", rural-sited renewable projects have experienced an increase in curtailment. The demand for renewable energy has already increased recently due to an accelerated use in urban areas. Although this is great, because our transmission facilities are outdated and are undeveloped, there isn't enough transmission capacity for all of this extra energy output. While we are producing more wind energy, we are curtailing more as well.



Second, the state is already experiencing congestion. This concept is very similar to traffic congestion such as when there are too many cars on the road. Energy congestion "occurs when the demand for electricity to be delivered over a line, or group of lines, exceeds the capacity of the transmission facilities leading to a 'bottleneck'" (DPS).

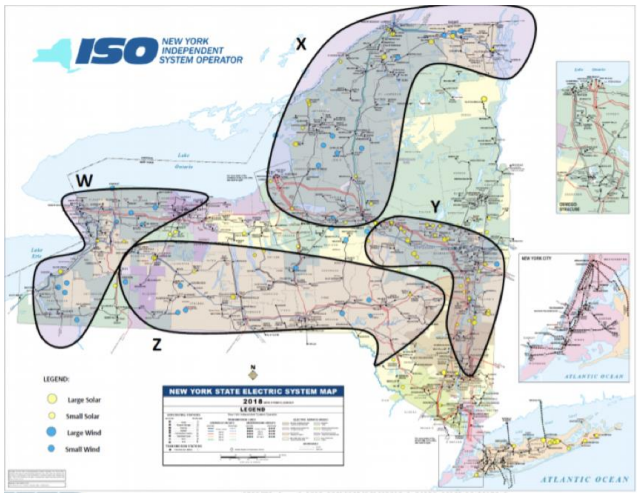
To understand better, the electric transmission system is designed "to move electricity from power generators" such as solar farms, wind farms, hydropower plants, or natural gas plants, "to load centers, such as cities and major metropolitan areas" (DPS). When there are insufficient transmission lines in place to move energy from generation to major load centers, congestion occurs. Currently, there is one major bottleneck in the New York State transmission system. It occurs between the Mohawk Valley (Utica) and lower Hudson Valley Areas, leading directly to New York City. The congestion "first appeared in the mid-19990s and has been increasing over the past 20 years as demand has grown throughout the state" (DPS). These lines run from Marcy substation and to the New Scotland substation outside of Albany. The energy then follows both sides of the Hudson River down to Fishkill Area and Sullivan, Rockland, and Orange Counties then further down connecting into New York City.

Congestion Map:

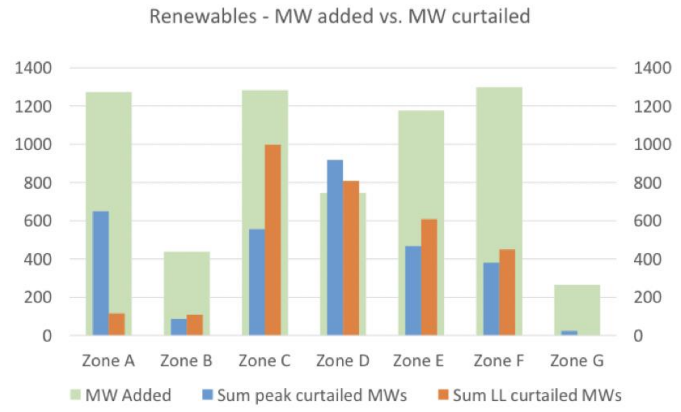


Bottling has three potential impacts: "(1) the curtailment (non-production) of a portion of the possible energy, (2) the strong depression of market price that is paid for the un-curtailed

portion of the possible energy" and (3) the possible extended use of alternative inefficient sources of energy such as natural gas facilities, which have undesirable consequences on our environment (ACENY). These risks, being on the rise, are at the moment "delaying the development of many hundreds of megawatts (MW) of renewable energy projects" (ACENY). In 2018, NYISO did a study that identified "areas of potential bottling with curtailment of existing and new renewable sources in the State, the area covered almost the whole of Upstate New



York" (ACENY). Overall, upgrades could potentially unbottle over 2,000 MW of energy, demonstrating the need for additional transmission investments. The figure below is from the same study, showing "extensive curtailment of renewables in selected upstate zones during summer peak hours and light load hours projected for the year 2030" (ACENY). In some zones, the curtailed MWs exceeds



the MWs added to the grid. This sheds light onto the current and future transmission system of the state and just how inadequate it is to handle the future energy demand and increase of renewable energy.

An impact of this system is "increased renewable energy credit prices". When renewable resource developers bid into REC auctions, "the developers forecast revenues from the market they would receive for their project's and then determine the residual money they need to meet

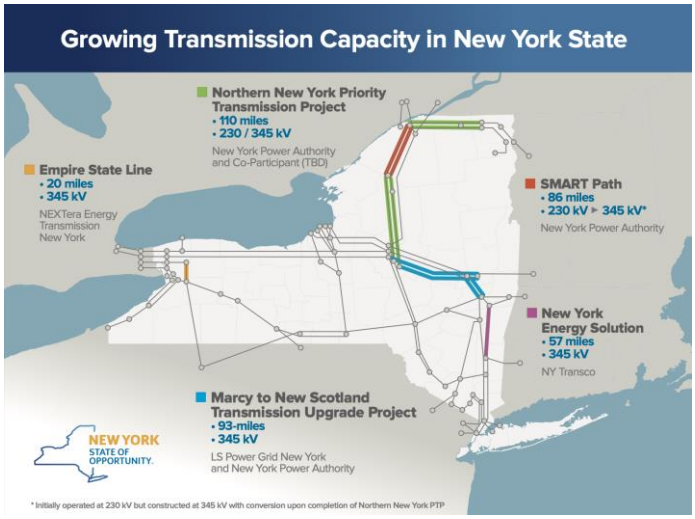
the hurdle rates for their investors" (ACENY). With increased forecasted levels of bottling, these bid prices will increase; thus, in turn, increase the prices that consumers will have to pay as well. With an upgrade in transmission projects, specifically to reduce bottling, it "would help lower REC prices, benefit consumers, and help generators better compete" (ACENY).

Solution

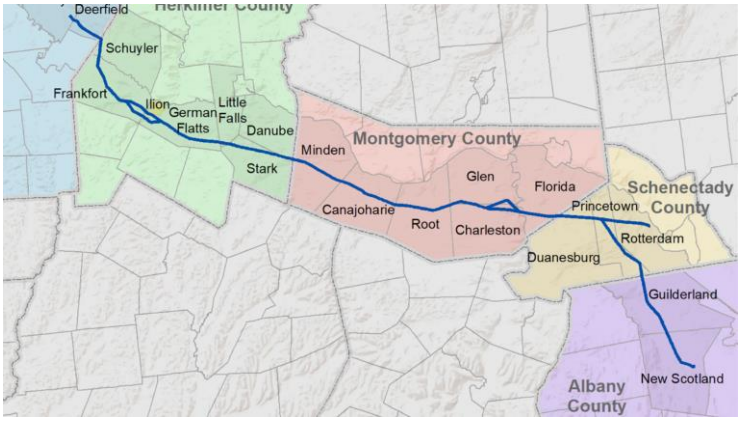
The Governor of New York has announced plans, addressed in his 2021 State of the State, to upgrade "existing electric system facilities" and rebuild "aging existing transmission lines" (T&D). This consists of a package of "transmission projects across the state that will form New York's Green Energy Superhighway" (NYS). These transmission projects consist of 5 projects and more than 250 miles of transmission lines. It includes upgrading substations, towers, and transmission lines, some of which are "more than 60 years old" (T&D). The entire project is projected to cost up to $2.5 billion to foster a "green economy" in the state. Understanding the importance of removing bottlenecks from the transmission lines, Governor Cuomo stated that "supercharging the new transmission superhighway will be vital to completing New York's nation-leading green economic recovery and accelerating renewable energy development programs" (Meyer).

The state's plan consists of $2 billion in transmission line upgrades as well as the possible introduction of a "green energy superhighway", bringing Canadian hydropower down into New York City. To begin, the state has started construction this year on five major projects

to upgrade current transmission lines. These projects are expected to be complete and in service between 2022 and 2025, respectively. These lines include the Northern New York line, the SMART Path, New York Energy Solution, Marcy to New Scotland, and the Empire State Line. The New York Power Authority, a government agency, is a leader in this project, managing the operations of three of the transmission line upgrades.

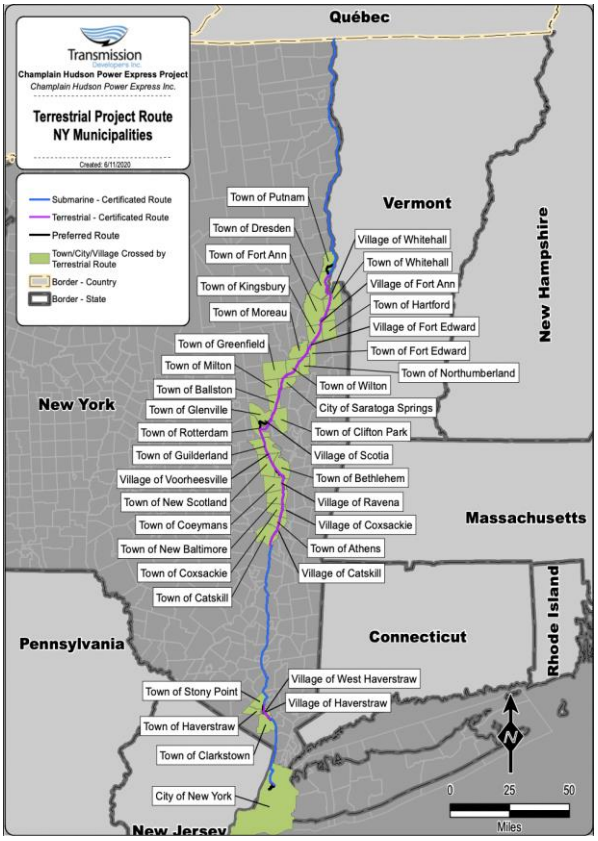


Possibly the most important upgrade in this series is the Marcy to New Scotland transmission upgrade project. Construction began on February 25, 2021, and the total project cost is $854 million. This will upgrade energy transmission along 93-miles 345-kilovolts (kV) in the Mohawk Valley and Capital Region. This then feeds into the New York Energy Solution line that supports transmission lines and substations into the city. The project also includes construction of "two new substations between NYPA's central transmission hub in Marcy in Oneida County and New Scotland in Albany County" (NYS). Already "existing electric transmission corridors" will remain, while "aging and outdated transmission towers" will be replaced with the latest technologies to increase efficiency. This transmission line is the specific line with a major



bottleneck that jeopardizes national security, creates widespread reliability problems, and "creates the risk of significant consumer cost increases in electricity markets that could have serious consequences for the national or a broad regional economy" (Dyer). Unlocking this transmission line could lead to a more efficient energy system for the entire state, not just Albany or New York City.

One idea that has been floated around and has been considered by the governor is creating a "green energy superhighway" that runs from hydropower plants in Canada all the way to New York City. Governor Cuomo's claims that the superhighway will be a key component in the state's energy transformation by lowering greenhouse gas emissions, creating jobs and generating billions of dollars in new transmission in New York's economy. The current project being discussed is the Champlaign Hudson Power Express (CHPE) that would run from the borderline of Quebec to the City of New York, passing through numerous counties along the way. The line would finish in Queens in a substation near Astoria, Queens. The project will use buried HDVC cables that have many benefits. They minimize the impact on the environment including "protecting New York's scenic landscape", they avoid visual impact of overhead transmission lines, and buried cables experience less energy loss in comparison to "traditional overhead HVAC transmission lines" (CHPExpress). The project will run 338 miles



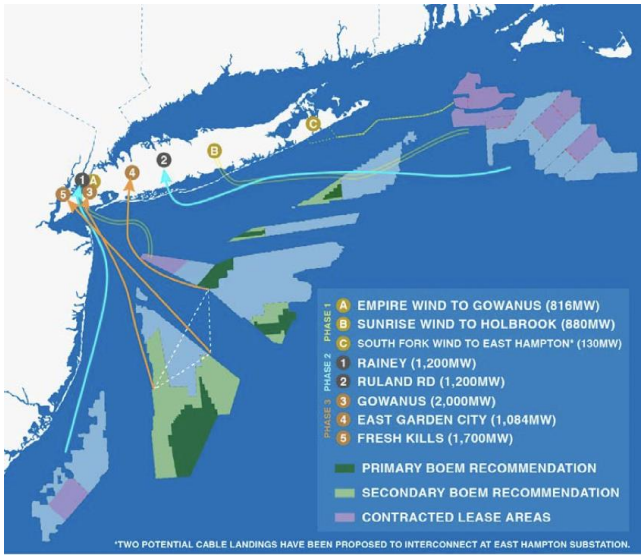
with “60% in waterways and 40% buried underground” and will carry approximately 1,000 - 1,250 MW of power, enough for “more than one million New York homes” (CHPExpress). The importance of this project relates to the goals set by the state for 70% renewable energy by 2030. While new and expanding generating facilities will be constructed, this project will deliver the remaining 20% of generation needed to meet the 2030 renewable energy targets. With bottlenecks currently being experienced along the other transmission lines within the state, the “CHPE bypasses mid-state transmission congestion that is currently impacting upstate wind and solar development”. Furthermore, hydropower is one of the more reliable methods of renewable energy. The power generated from hydro facilities is dependable, regardless of weather and time of day. In terms of possible damage of buried cable lines, HDVC cables are liquid and gel-free, meaning in the unlikely event that a cable is damaged, there are no dangerous chemicals to leak into bodies of water or environmentally sensitive areas. Currently, the CHPE “has received major permits from the New York State Public Service Commission, the United States Department of Energy and the U.S. Army Corps of Engineers” (CHPExpress). The project is waiting on further approval from the New York State government before beginning construction of their green energy superhighway.

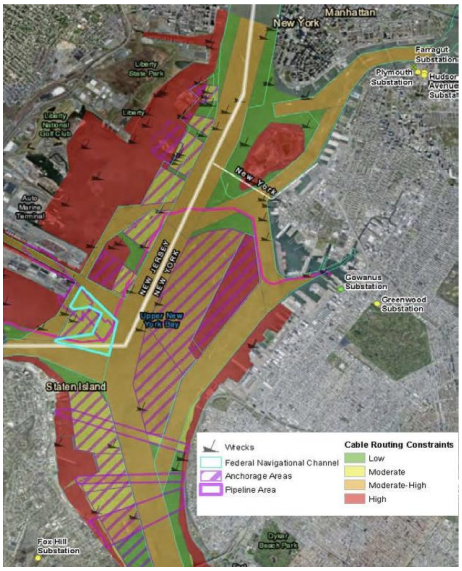
New York Offshore Wind

A significant portion of New York State’s 70% renewable energy mandate is the 9,000 MW of offshore wind. New York is leading the nation in this initiative and given the close proximity of this project to downstate areas such as New York City and Long Island, it would alleviate some of the congestion issues currently impeding the “flow of Upstate renewable

generation to Downstate load centers" (ACENY). However, offshore has its own transmission challenges that could affect the outcome of this project.

The area extends from New Jersey up to Massachusetts and the ocean space has already been leased out to public companies. They will be providing clean energy to New York City and Long Island, which are the two biggest consumers of energy in the state. There are issues at the moment that are unique to New York. First, there are "a limited number of robust POIs for connecting offshore wind to the onshore grid and limited access routes to these POIs" (ACENY). There is also the risk of limited landing sites; as companies look to build separate transmission lines, viable landing sites and cable routes will become constrained. The "clearest example of this is he cable approach route through the Narrows to reach POIs in New York Harbor" (Pfeifenberger). Based on a study conducted by the Brattle Group, "Narrows likely has space for only four cables" and they suggest that "maximizing utility of route is key"(Pfeifenberger). According to the study, the major constraints to routing through the Narrows and the Upper Bay "are physical width of suitable seabed, federal navigation projects (FNPs) (channels and anchorages), cable spacing requirements, and competing uses" (Pfeifenberger). If plans aren't





produced where transmission is not utilized effectively in these high constraint zones, then there is increased risk limiting the "ability to cost-effectively route offshore wind transmission into New York City and meet climate goals without large costs" (Pfeifenberger). Also found in the study, future energy curtailments could be high in regions of high demand. In preliminary analysis, high curtailments (~18%) could be experienced if "more than ⅓ of 9,000 MW of offshore wind is connected to Long Island" (Pfeifenberger).

There are solutions to these issues as long as the planning is efficient and responsible. In terms of difficulties related to the Narrows and Upper Bay of New York City harbor, maximal transmission capacity "may be achieved most efficiently by using HVDC technology to connect clusters of offshore wind farms to a grid that has been extended offshore" (Pfeifenberger). For curtailment issues, "future networking of HVDC cables into an offshore grid to move offshore wind injections to less congested POIs (which also reduces the risk from transmission outages)" (Pfeifenberger). This meshed approach of transmission networks is recommended as well in the January 2021 NY Power Grid Study, which also identifies the need for significant storage.

Conclusion

As of 2021, Governor Cuomo stated plans for "green energy projects across the state that will create thousands of jobs and reduce the state's carbon emissions" (McKay). This is the follow up to the state's proposal: *The Climate Leadership and Community Protection Act*, signed in 2019, putting into law the state's desire to move towards renewable energy. While the state plans for major success, Gavin Donoghue, the president of Independent Power Producers of New York, holds reservations over the actions taken thus far. He stated, "the success of what the governor has promised over the years and today will be shovels are in the ground and

projects are actually being built… I think the governor freely admitted that were taking way too long to build these initiatives" (McKay). The problem here is that the state cannot afford to wait "too long" any longer.

In terms of current development, it seems the importance of building new renewable generating facilities far out ways the importance of updating and creating new transmission lines. The state is already increasing its solar and wind farms in upstate New York, as well as currently developing 9,000 MW of offshore wind energy by 2035. The current state of the transmission capabilities will not be able to transport this much energy and the state will be left with similar problems of bottlenecks and congestion leading to energy curtailment and increased consumer energy costs. Demand for energy is expected to grow greatly due to a complete shift to renewables from coal and natural gas. With an increase in total expected energy demand, this energy needs to be delivered to consumers efficiently.

New York City and other metropolitan areas within the state are in a predicament. They are the peak demand centers in the state with little resources to have major renewable generating technologies within the city. Therefore, the future of the city's energy consumption directly corresponds to the development and upgrade of transmission lines and future capacity. The city will need massive battery storage units and the ability to direct thousands of megawatts of energy to its consumers. There is no other option or course of action. These two technologies are critically important and undermining the need for transmission upgrades is a major mistake and will be a major setback for New York State's 2030 goal.

New York City could be facing years of climate changes and troubles that will ultimately be dependent on the success of *The Climate Leadership and Community Protection Act*. There will be challenges of wastewater treatment, flooding, coastline erosion, community

evacuation, the possible increase of superstorms, etc. The success at which the city is able to deflect and deal with these changes will all be dependent on the energy that the city is able to consume. If transmission lines aren't capable of transmitting multiple thousands of MW of energy into the city, then there will be future problems. The problems will be seen on multiple levels from economic to mental health to future pollution and one of the more important ways to mitigate these risks are by upgrading and increasing our ability to transport energy into areas of need. While *The Climate Leadership and Community Protection Act* offers a promising vision of the future, the energy that is generated and transferred to areas of the state, including the city, needs to be reliable and dependable; transmission is the answer.

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