nationalgrid

Natural Gas Long-Term Capacity - Second Supplemental Report

for Brooklyn, Queens, Staten Island
and Long Island ("Downstate NY")
June 2021

Summary

1. Introduction

On February 24, 2020, National Grid ("National Grid" or the "Company") released the Natural Gas Long-Term Capacity Report (the "Original Report") for its service territories in Brooklyn, Queens, Staten Island and Long Island ("Downstate NY"). The Original Report provided a detailed analysis of the natural gas capacity constraints in the region and the available options for meeting long-term demand. In addition, National Grid held a series of six public meetings and received thousands of written comments on the Original Report and the options.

After reviewing the extensive feedback and public engagement on the Original Report and compiling additional detailed content, National Grid published the Natural Gas Long-Term Capacity Supplemental Report on May 8, 2020 (the "Supplemental Report"). In that report, the Company responded to the public's comments on the Original Report, including on the options presented to address the long-term capacity constraint, and recommended two solutions as the best among all the options presented — an interstate pipeline option or a portfolio of targeted distributed infrastructure and non-gas infrastructure options. Soon thereafter, the state permit applications for the large-scale pipeline project ("Option B") were denied, and National Grid has been executing the other recommended solution — identified in the Supplemental Report as "Option A: LNG Vaporization and Iroquois Gas Transmission System, L.P. ("Iroquois") enhancements to existing infrastructure, combined with incremental energy efficiency (EE) and demand response (DR)."

National Grid is focused on implementing this "Option A" solution, which has been augmented since first introduced. This solution now involves an even more aggressive set of incremental demand-side management ("DSM") programs to help customers reduce their natural gas usage, the size of which is unprecedented in New York. The Company is also developing additional portable compressed natural gas ("CNG") capacity and has continued to progress development and seek permits for the proposed LNG vaporization enhancements at its existing Greenpoint facility. The Company is also supportive of the Enhancement by Compression ("ExC") project being pursued by the Iroquois Gas Transmission System.

Altogether, these programs, projects and additional contracts are collectively referred to as the "Distributed Infrastructure Solution" throughout this report ("Second Supplemental Report").

National Grid has also made significant corporate commitments that align with New York's ambitious climate change goals as laid out in the Climate Leadership and Community Protection Act ("CLCPA"). In October 2020, National Grid refined its plan to achieve New York's net zero greenhouse gas ("GHG") emissions by 2050 goal ("Net Zero") via its "Net Zero by 2050" plan and updated its Responsible Business Charter to include those ambitions.[1] Measured against these goals, National Grid believes its Distributed Infrastructure Solution is consistent with the CLCPA goals, the Company's Net Zero plan, and a clean energy future.

Despite all the progress National Grid has made on its Distributed Infrastructure Solution, permitting delays have created risks to the infrastructure projects' in-service dates. The DSM programs also face implementation challenges in terms of the need for regulatory approval and funding and the execution risk from the extraordinary magnitude and ramp up of these programs and the unpredictable nature of customer participation. These challenges create a real risk of

[1] https://www.nationalgridus.com/media/pdfs/our-company/netzeroby2050plan.pdf and https://www.nationalgridus.com/media/pdfs/our-company/usnationalgridresponsiblebusinesscharter2020us.pdf

National Grid not being able to meet future customer demand, requiring an updated assessment of potential impact and consideration of alternatives if components of the Distributed Infrastructure Solution fall short.

Given the ongoing challenges of meeting customer gas demand in Downstate NY, the purpose of this Second Supplemental Report is as follows:

- Frame the Downstate NY gas capacity needs and National Grid's Distributed Infrastructure Solution in the context of New York's CLCPA Net Zero commitment, the Company's Net Zero plan and the long-term demand forecast.
- Provide an update of the Company's long-term demand forecast for Downstate NY and the status of its existing capacity and operational constraints. The 2021 Adjusted Baseline Demand Forecast shows a higher level of demand compared to the 2020 forecast despite the disruption of the pandemic, leading to a slightly higher near-term design day demand-supply gap between the forecast and capacity.
- Provide an update on National Grid's progress in implementing its Distributed Infrastructure Solution to solve the design day demand-supply gap, which the Company continues to believe is the most viable solution, and explain the risks to finalizing implementation of the Solution.
- Lastly, present an updated set of options in the event National Grid's Distributed Infrastructure Solution is significantly delayed or not fully implemented, evaluate the cost and implementation feasibility of those options and explain the future risks to customer connections and uninterrupted service.

As with the Original Report, we invite readers to provide feedback on this Second Supplemental Report and the recommendations contained herein. In addition to filing the Second Supplemental Report with the New York Public Service Commission, we will be publishing this report on our website and will deploy other options for sharing the report with stakeholders, including a reader friendly summary, web content, and a virtual meeting.

2. Executive Summary

2.1. National Grid provides safe, reliable and affordable energy to more than 1.9 million customers in Downstate New York.

From hard-working families to small businesses, National Grid's customers throughout Brooklyn, Queens, Staten Island and Long Island ("Downstate NY") depend on National Grid to deliver safe, reliable and affordable natural gas to their homes and businesses — especially on the coldest of days when customer gas demand is at its peak. National Grid must meet this profound energy obligation even as we plan for a future where traditional natural gas demand may decline as a result of new policies to reduce greenhouse gas emissions.

2.2. National Grid strongly supports New York's goals to reduce greenhouse gas (GHG) emissions economy-wide and reach the goal of net zero emissions.

On July 18, 2019, Governor Andrew M. Cuomo signed into law the Climate Leadership and Community Protection Act ("CLCPA"), one of the most ambitious climate laws in the United States, requiring New York to reduce economy-wide GHG emissions 40% from 1990 levels by 2030 and to achieve net zero ("Net Zero") greenhouse gas emissions by 2050 (with emissions reduced by no less than 85%, and remaining emissions eligible to be offset to achieve the Net Zero goal). National Grid is fully committed to a clean energy future and helping New York achieve its energy and environmental goals under the CLCPA and has designed our Distributed Infrastructure Solution in a manner that is consistent with these Net Zero efforts.

As part of its commitment to building a cleaner energy future for New York, National Grid published in October 2020 our "Net Zero by 2050" plan[2] and updated our Responsible Business Charter[3], affirming our commitment to: (i) reduce GHG emissions from our direct operations by 80% by 2030, 90% by 2040, and to net zero by 2050; (ii) reduce GHG emissions from the gas we sell to customers by 20% by 2030, and further reduce these emissions beyond 2030 consistent with New York's targets as laid out in the CLCPA; and (iii) prioritize ten major focus areas to achieve Net Zero for our US operations and the energy we deliver to customers. Among those ten major focus areas, five specifically involve the Company's gas network:

- Reduce gas demand through energy efficiency ("EE"), demand response ("DR"), and non-pipeline alternative ("NPA") solutions;
- Decarbonize the gas network with renewable natural gas and hydrogen (i.e., reducing the carbon intensity of delivered gas);
- Reduce methane emissions from our own gas network and the entire value chain;
- Integrate innovative technologies to decarbonize heat (e.g., electric heat pumps, hybrid gas-electric heating systems, and geothermal district energy systems); and
- Invest in large scale carbon management.

2.3. National Grid has taken action to reduce GHG emissions in New York.

Across every community we serve, National Grid is deeply committed to the goal of Net Zero and has a long track record supporting the reduction of GHG emissions. We have helped New York to rank in the top five most energy-efficient states in the nation through our existing EE and DR programs several years in a row, and these programs continue to grow. Under the state's New Efficiency: New York ("NE:NY") transformation of utility energy efficiency programs, National Grid's annual gas energy efficiency savings targets grow by more than three-and-a-half-fold from 2020 to 2025. By 2030, the Company also anticipates being able to reduce the methane emissions from our infrastructure by 80% against a 1990 baseline through pipe replacement programs and leak detection and repair advancements. And, just last year, the Company exceeded customer enrollment targets for our demand response programs for the winter 2020/21.

In addition, we are continuing to advance and invest in cleaner fuels by reviewing requests from developers who have new supplies of renewable natural gas ("RNG") and seeking new supply sources, as demonstrated by the new RNG facility at the Newtown Creek Wastewater Treatment Plan and our standardized interconnection process for new RNG facilities. To help drive the next clean energy innovation, the Company has also partnered with entities like the

[2] https://www.nationalgridus.com/media/pdfs/our-company/netzeroby2050plan.pdf

[3] https://www.nationalgridus.com/media/pdfs/our-company/usnationalgridresponsiblebusinesscharter2020us.pdf

New York State Energy Research and Development Authority ("NYSERDA") and research universities, including Stony Brook University, to advance additional ways to decarbonize the gas network through hydrogen blending and other sources of RNG.

National Grid collaborated with Con Edison and the NYC Mayor's Office of Sustainability on a multi-year project to study strategies that could help New York City meet its energy and climate goals and to develop insight into key decarbonization options. The study, entitled "Pathways to a Carbon-Neutral NYC," (the "NYC Decarbonization Study") was published in April 2021[4], and it made several key findings, including the need for rapid adoption of energy efficient and advanced heating equipment, the need for greater building electrification with the support of 100% zero-emission electricity, and the need to transform the gas network into one that delivers low carbon gas (from hydrogen and RNG) for buildings that do not electrify to reduce their net carbon footprint. The NYC Decarbonization Study notes how the gas distribution infrastructure system will continue to play an enduring and critical role in achieving our shared goal of decarbonization.

Currently, the CLCPA-established New York State Climate Action Council is in the process of creating a scoping plan for the CLCPA's emissions reductions, to be filed with the governor and legislature at the end of 2022. The Council's advisory panels have recently made their recommendations, which include, among other things, future prohibitions on both new gas customer connections and gas equipment replacement, with these changes phased in over time starting in 2025. National Grid continues to evaluate this evolving policy landscape as we plan to meet our customers' needs.

2.4. National Grid is ensuring critical energy reliability during the coldest periods when demand is at its highest while empowering New York's transformation to a Net Zero energy system.

With more than 1.9 million customers in our Downstate NY service territory and with a sustained trend over the last 10 years of adding roughly 12,000 customers per year, National Grid must forecast our customers' future natural gas demand and ensure that our portfolio of natural gas supply, gas distribution network infrastructure, and demand-side management programs can meet our diverse customers' energy needs even under challenging conditions.

To this end, we design our gas distribution system and plan our natural gas capacity to meet forecasted customer demand on a "Design Day" (i.e., the coldest winter day that brings the highest daily customer demand for which the Company plans) and under "Design Hour" conditions (i.e., the peak hourly demand on such a Design Day). Importantly, we do this with zero contingency, or reserve margin, in the event that actual peak demand is higher than projected Design Day demand (because of more severe weather or the uncertainty inherent in the demand forecast) or in the event that there is an unexpected disruption to gas supply, gas infrastructure, or demand-side resource availability.[5] National Grid models the Downstate NY gas supply and distribution requirements based upon a Design Day average temperature of 0° Fahrenheit in Central Park (i.e., 65 Heating Degree Days). Since the Supplemental Report, National Grid commissioned an analysis by Marquette Energy Analytics of Downstate NY weather conditions (accounting for both temperature and wind that drive peak gas demand for heating) that corroborates our Design Day standard as consistent with the gas utility mainstream for Design Day standards in terms of likelihood of occurrence.

Given the reality of extreme weather conditions, the consequences of having insufficient natural gas capacity to meet peak customer demand under extremely cold winter weather conditions can be severe. Insufficient gas capacity under such peak demand leads to lower pressure conditions in the gas distribution network that can cause heating and other end-use equipment to stop working for customers and create safety risks. The only way to properly ensure the safety of customers and communities under such conditions is to curtail (i.e., shut off) large customers and to potentially curtail service to entire sections of the gas network, affecting many households and businesses, with restoration of service potentially taking a week or longer. Given the importance of providing energy reliably and safely, even during the most demanding of periods, National Grid believes we must do everything possible to ensure the gas network maintains enough pressure and operates safely. In addition, the energy service interruptions that occurred as a result of the February 2021 winter storm in Texas serve as a powerful reminder to all of us of the importance of working together to develop a clear energy strategy that plans for the inevitability of severe weather conditions given the magnitude of potential economic and health impacts to customers from loss of heating during extreme cold.

[4] https://www1.nyc.gov/assets/sustainability/downloads/pdf/publications/Carbon-Neutral-NYC.pdf

[5] "Zero contingency" means that the plans for balancing gas demand and supply have no supply contingency or reserve margin — in other words, they are designed to balances supply and demand assuming forecasted peak demand is not exceeded and that all available gas capacity resources will be available at 100% with no disruption when needed.

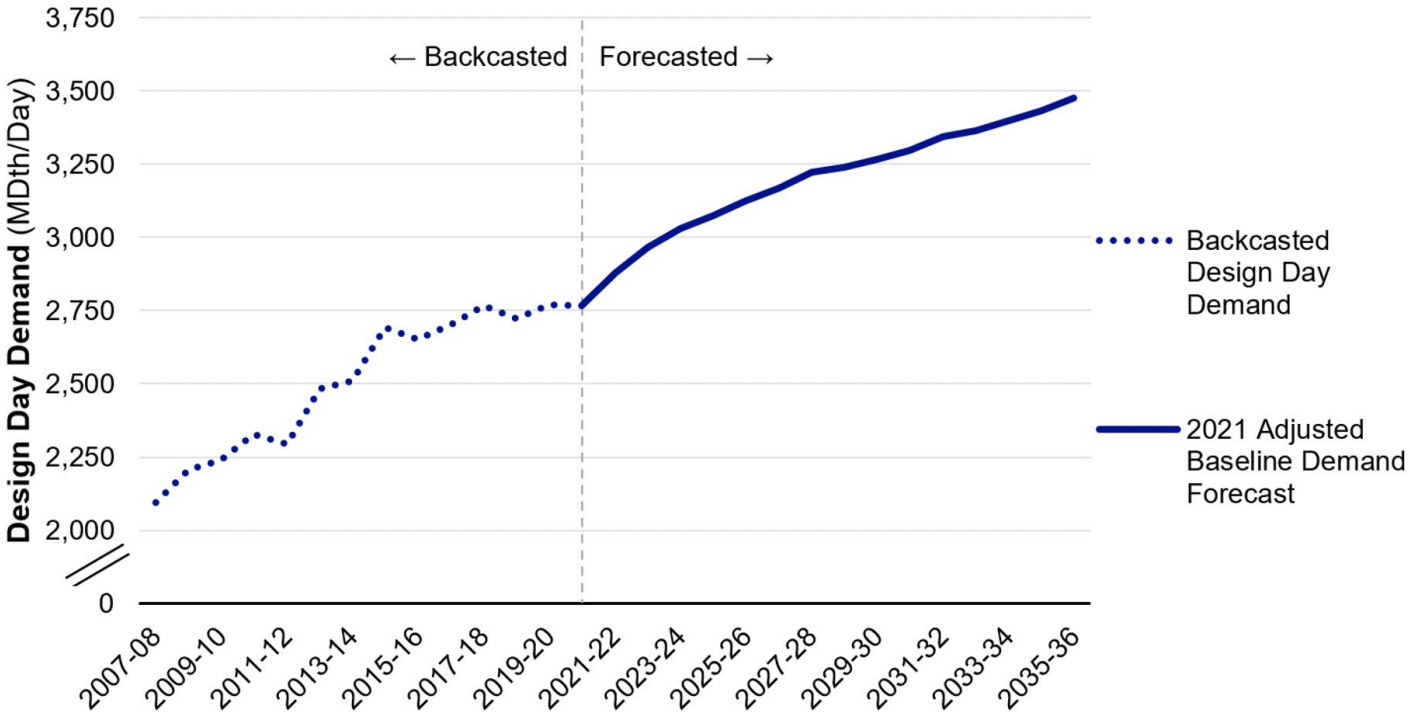
2.5. Consistent with prior years' forecasts, National Grid projects continued gas demand growth in our latest annual long-term gas demand forecast, even after accounting for the impacts of the COVID-19 pandemic and New York's currently enacted, ambitious energy efficiency and heat electrification programs.

We forecast our customers' gas demand taking into account all relevant factors, including historical usage and independent economic projections (reflecting the latest view on the effects of the COVID-19 pandemic), heating oil versus natural gas price differentials, and adjustments for factors such as energy efficiency, demand response and heat electrification programs. Based on those factors, our latest forecast projects that Downstate NY Design Day gas demand will increase approximately 1.5% per annum, from 2,766 MDth/day[6] in winter 2020/2021 to 3,430 MDth/day in the winter of 2034/2035.

Growth in the baseline demand forecast adjusted for energy efficiency, demand response, and heat electrification (the "Adjusted Baseline Demand Forecast") is significantly less than the average growth rate experienced over the historical period, which was 2.2% per year from winter 2007/2008 to winter 2020/2021. However, Design Day gas demand is expected to grow much faster than even the historical rate over the next three years, averaging 3.1% per annum from winter 2020/2021 to winter 2023/2024, due to the strong economic rebound forecast for Downstate NY after the COVID-19 pandemic. Figure 2-1 below shows historical (i.e., backcasted)[7] and projected growth for Design Day gas demand.

Reflective of the latest independent economic forecasts, National Grid's latest Adjusted Baseline Demand Forecast is slightly higher than the 'High Demand' forecast provided in the May 2020 Supplemental Report and the subsequent long-term gas demand forecast presented in the "National Grid Supply and Demand Analysis Related to Service Areas with Known Supply and Constraint Vulnerabilities" filed by the Company with the New York Public Service Commission (the "Commission" or the "NY PSC") on July 17, 2020, in Case 20-G-0131. The 2021 Adjusted Baseline Demand Forecast is higher in each year by an average of 40 MDth/day (or 1.3%) than the 2020 Supplemental Report High Demand Scenario over the next 10 years (see Figure 2-2 below).

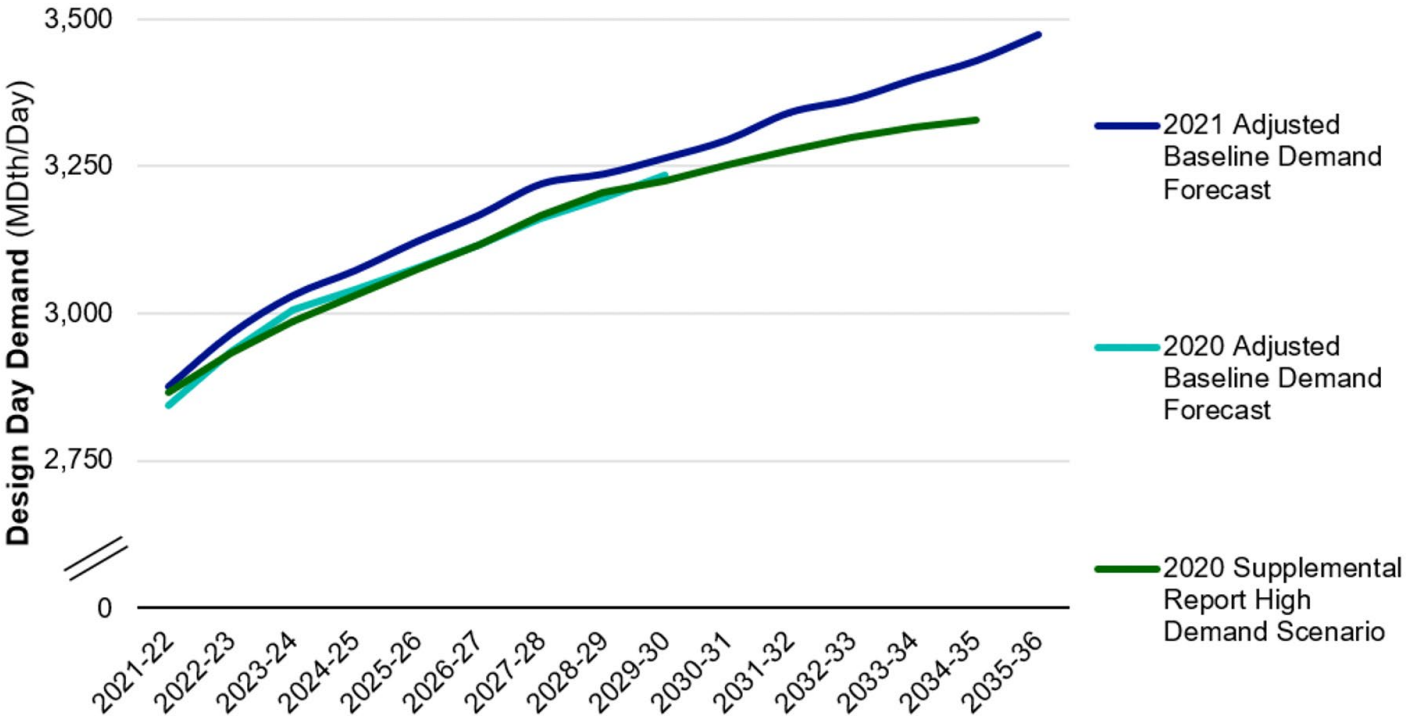
Figure 2-1: Historical Period (Backcasted) and Forecasted Downstate NY Design Day Demand



[6] MDth=Thousands of Dekatherms. One dekatherm is equal to one million British thermal units (Btu). The energy content of 1,000 cubic feet of natural gas measured at standard conditions is approximately equal to one dekatherm.

[7] The backcasted (historic) period is determined as follows: each year, the Company uses regression equations to weather normalize the sendout data and the estimated demand at the Design Day standard, estimated using respective year's regression coefficients, gives the back-casted Design Day demand for that year.

Figure 2-2: Comparison of 2021 and 2020 Adjusted Baseline Demand Forecasts and 2020 Supplemental Report High Demand Scenario



Note: Y-axis is broken to focus on changes at the margin

2.6. Based on the updated Adjusted Baseline Demand Forecast, National Grid projects that a gap between total Downstate NY customer peak gas demand and available gas capacity emerges in the winter of 2022/23 and grows thereafter, before accounting for planned gas capacity projects and incremental demand reductions under the Distributed Infrastructure Solution.

National Grid has delivered every on-system supply project in our operations plan, including constructing new and expanded compressed natural gas ("CNG") transfer sites capable of delivering up to 62 MDth/Day by winter 2021/2022, and has secured additional long-term contracts for capacity on existing interstate pipelines. The total portfolio of available gas capacity (the "Existing Capacity") now stands at 2,957 MDth/day by 2022/2023 as shown on Table 2-1 below (as compared to 2,939 in the Supplemental Report).

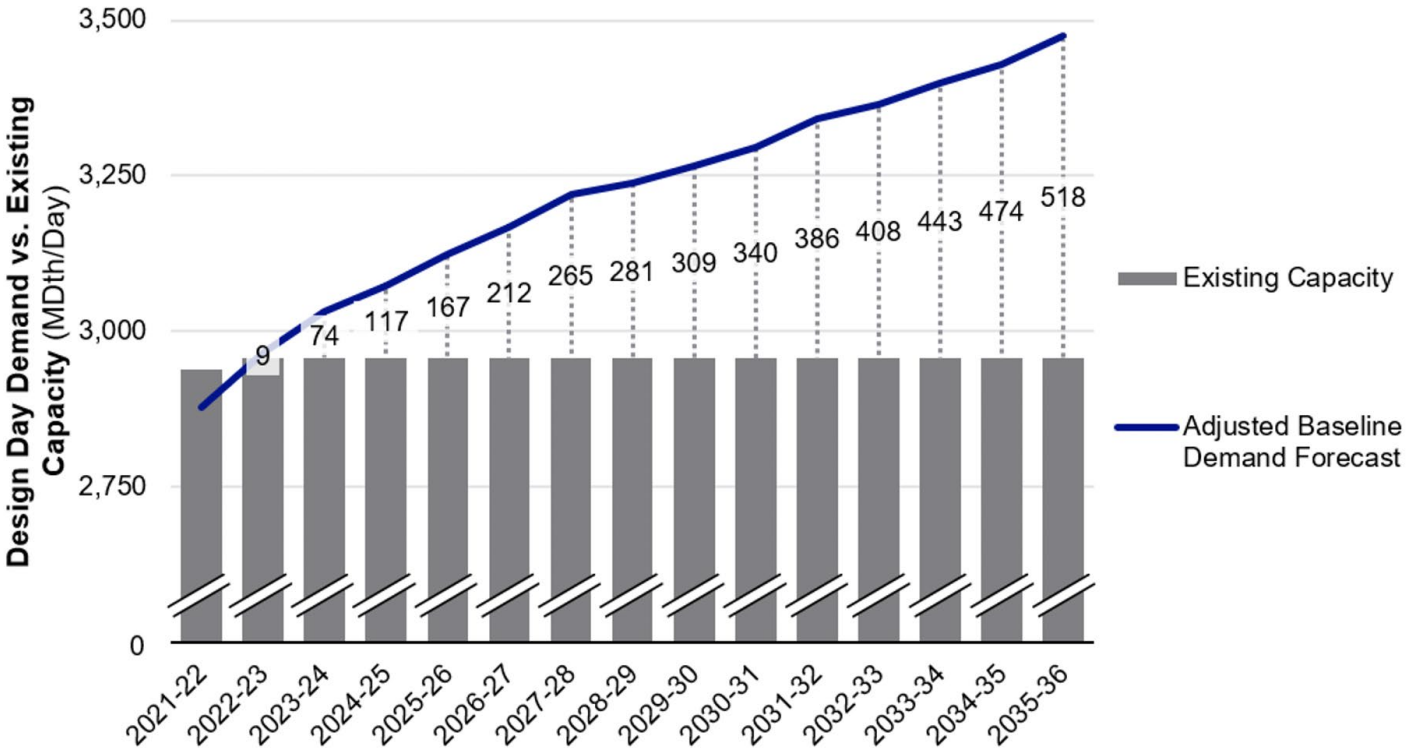
Table 2 1: Existing Capacity

Supply Stack (MDth/day)	2022-23
Long-Term Fixed Pipeline & Storage	2,377
LNG	395
Short-Term Contracted Peaking & Cogen	123
CNG	62
RNG	1
Total Gas Capacity	2,957

However, this Existing Capacity only meets customer demand through 2021/2022. Absent implementation of the Distributed Infrastructure Solution, we anticipate seeing a gap between peak period gas demand under the Adjusted Baseline Demand Forecast and Existing Capacity (the "Demand-Supply Gap") starting at 9 MDth/day in winter 2022/2023 and continuing to grow up to a gap of 518 MDth/Day in 2035/2036, as illustrated by Figure 2-3.[8]

This Demand-Supply Gap is slightly larger and starts earlier than the projected in the 2020 Supplemental Report, even with the increased long-term gas capacity the Company has secured. This results from the shift upward in the 2021 Adjusted Baseline Demand Forecast compared to the 2020 Supplemental Report's demand forecast ("High Demand Scenario"). The first projected Demand-Supply Gap is a year earlier (2022/2023) than in the 2020 Supplemental Report High Demand Scenario; moreover, whereas the 2020 Supplemental Report High Demand Scenario projected a Demand-Supply Gap starting in 2023/2024 of 44 MDth/day, the latest projection puts the 2023/2024 Demand-Supply Gap at 74 MDth/day. This is depicted in Figure 2-4 below.

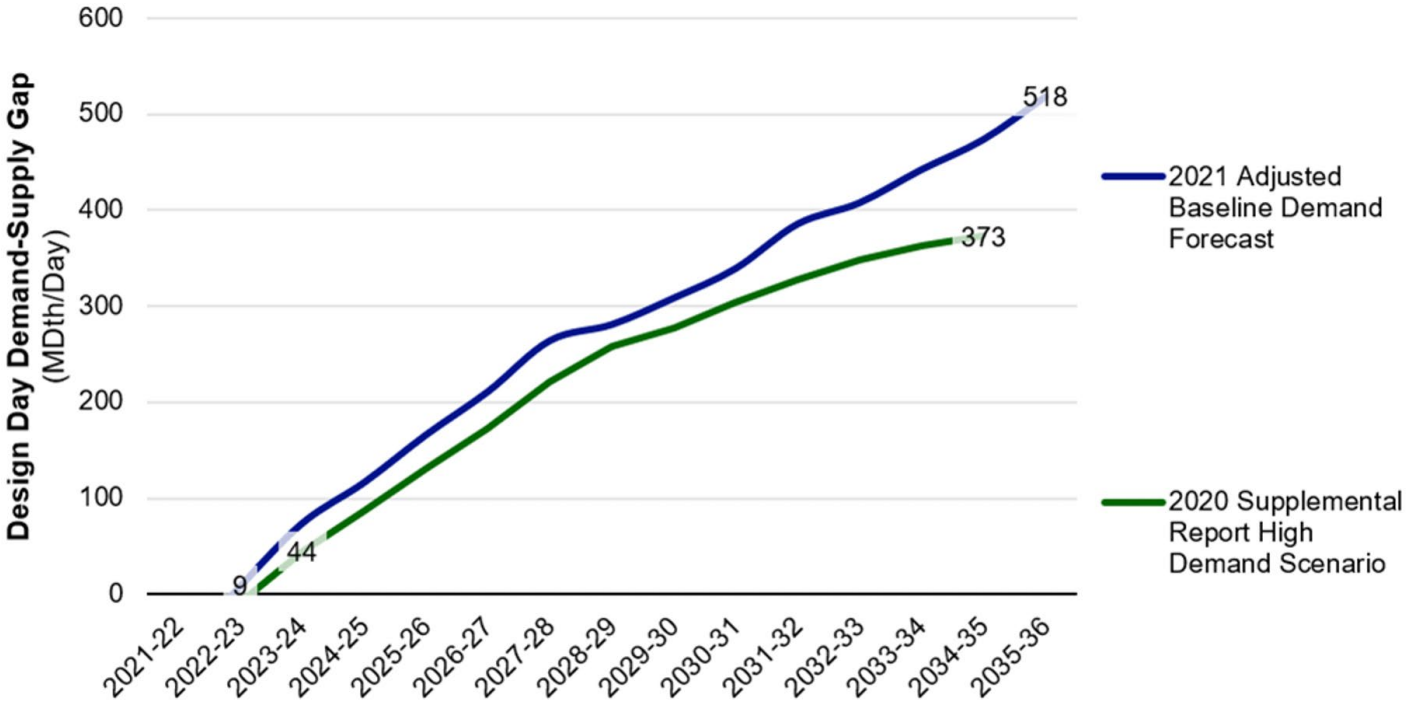
Figure 2-3: Projected Demand-Supply Gap before Distributed Infrastructure Solution Implementation



Note: Y-axis is broken to focus on gap at the margin

[8] This Demand-Supply Gap assumes that all existing pipeline capacity is re-contracted. Moreover, this report compares total gas supply capacity against aggregate Design Day demand for the Company's customers in Downstate NY to assess whether the Company faces a gas capacity constraint. However, the Company also must conduct detailed hydraulic modeling of its gas network jointly with Consolidated Edison annually to understand actual projected gas flows and any locational constraints or low-pressure concerns.

Figure 2-4: Demand Gap Comparison between 2020 and 2021 Forecasts



Note: in the Supplemental Report it was implicitly assumed that expiring city gate peaking and cogen capacity could be re-contracted indefinitely. That re-contracted capacity is netted out of the gap shown here to compare on a like-basis with the Supplemental Report.

2.7. Last year, National Grid determined that the Distributed Infrastructure Solution — a combination of incremental EE and DR programs and distributed infrastructure projects that expand the capacity of existing gas infrastructure — best balanced cost, reliability, and feasibility to address the projected Demand-Supply Gap. This conclusion remains unchanged.

In last year's reports, the Company presented several options to close the projected Design Day Demand-Supply Gap and, after extensive public engagement and feedback, recommended two solutions. Following rejection of the permit applications for the large infrastructure solution, National Grid focused on implementing the other of the two recommended solutions — the Distributed Infrastructure Solution.

Specifically, for the Distributed Infrastructure Solution, National Grid recommended combining: (1) incremental demand side management ("DSM") programs comprising an aggressive set of incremental EE over and above the growth in demand reduction required by NE:NY as well as new gas DR programs; (2) the LNG Vaporization Option ("LNG Vaporization Project"), which adds two additional LNG vaporizers at National Grid's Greenpoint Facility; and (3) the Iroquois Enhancement by Compression option ("ExC Project"), which involves the construction of additional compression facilities to increase capacity on the Iroquois Gas Transmission System.

Since the Supplemental Report, the Company has updated this solution with a plan to add incremental portable CNG capacity, further expanding the largest CNG operation of its kind in the United States, which takes advantage of the maximum potential for National Grid to expand portable CNG in light of siting, operational and market constraints. National Grid also further refined the EE, DR and heat electrification components of the incremental DSM part of the Distributed Infrastructure Solution. Collectively, all of these components now make up the Distributed Infrastructure Solution as set forth in Table 2-2.

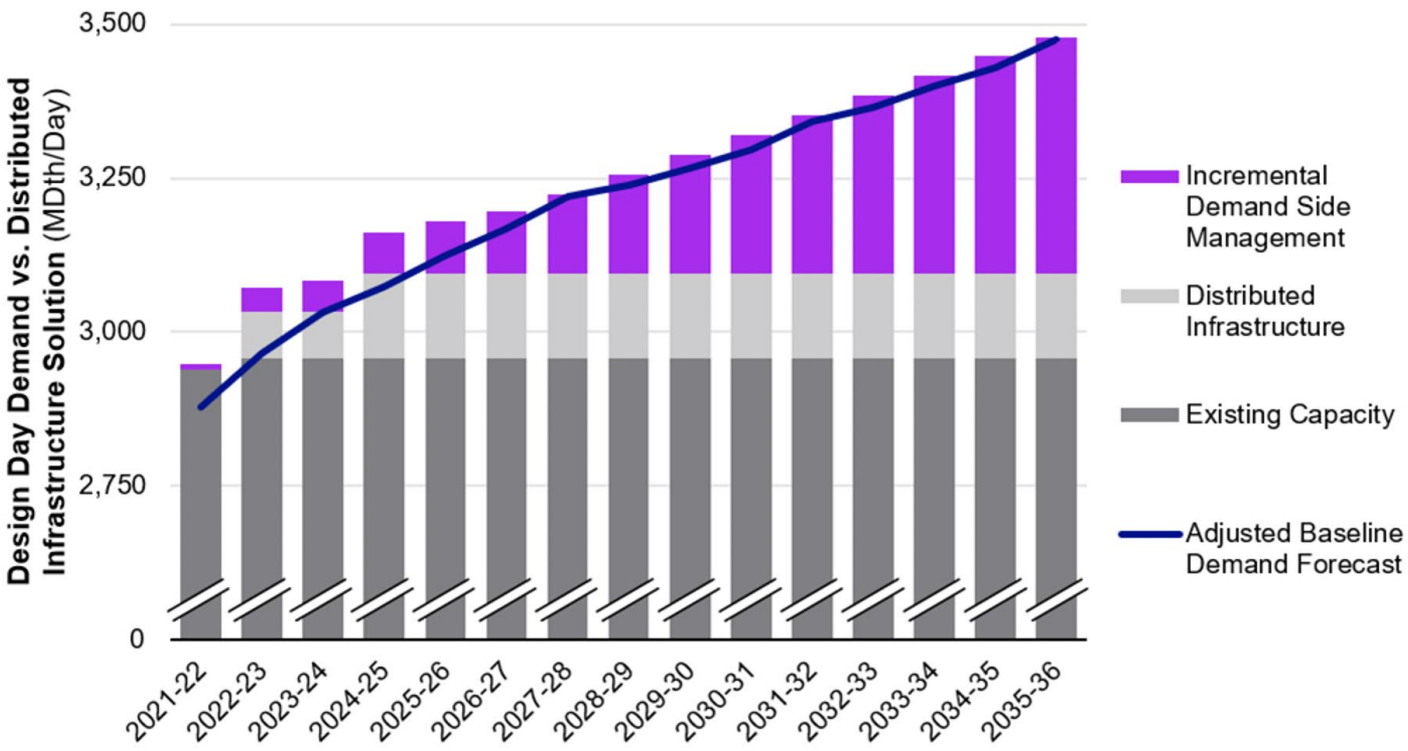
Taking into account the latest Adjusted Baseline Demand Forecast, the Existing Capacity, and the alternatives to current Distributed Infrastructure Solution components this report re-confirms that the Distributed Infrastructure Solution is the most cost-effective and lowest risk solution to our Design Day Demand-Supply Gap amongst the available options.[9] Figure 2-5 demonstrates how the combined components of the Distributed Infrastructure Solution resolve the projected Design Day Demand-Supply Gap.

Table 2-2: Distributed Infrastructure Solution Components

Component	Gas Capacity / Demand Reduction (MDth/day)
Demand Side Management Programs	
Incremental EE	Grows to 64
Incremental DR	Grows to 37
Heat Electrification and NPA Market Solicitation	Grows to ~300
Enhanced Infrastructure Projects	
LNG Vaporization Project	59
ExC Project	63
CNG Facilities	Grows to 80 total

[9] This solution is dependent on National Grid continuing to maximize existing contracted pipeline capacity and peaking capacity.

Figure 2-5: Distributed Infrastructure Solution Comparison to Supply-Demand Gap



Note: Y-axis is broken to focus on changes at the margin

2.8. National Grid's Distributed Infrastructure Solution relies on the distributed infrastructure projects to close the Design Day Demand-Supply Gap in the near term; after the winter of 2025/2026, the Distributed Infrastructure Solution only deploys incremental Demand-Side Management ("DSM") programs to address the Demand-Supply Gap.

In the near term, the distributed infrastructure components of the Distributed Infrastructure Solution are the biggest components of the solution and are critically important to meeting gas demand over these next few winters as incremental DSM programs ramp up.

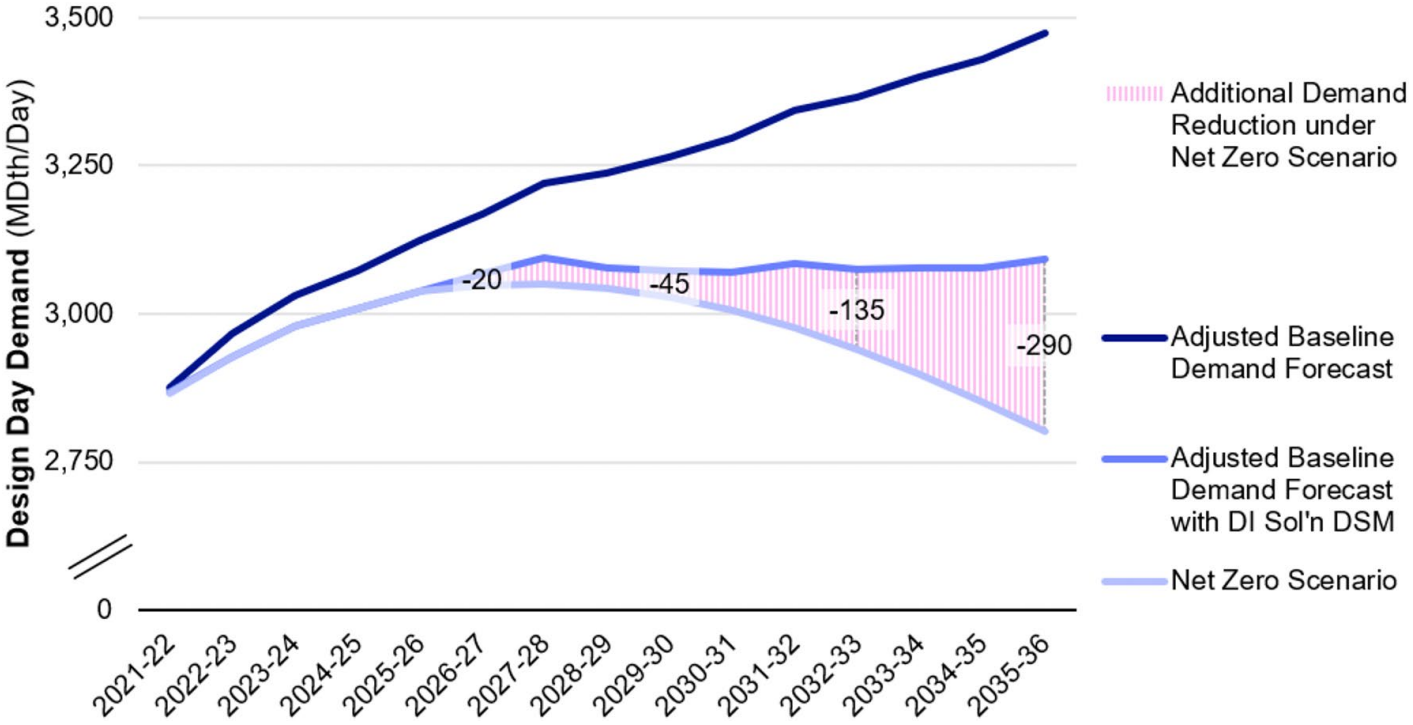
Nonetheless, incremental DSM programs are essential to the Distributed infrastructure Solution, which relies on gas demand reduction to meet three quarters of the projected Demand-Supply Gap in 2035/2036. In fact, the Distributed Infrastructure Solution includes no expansions of gas supply capacity after 2024/2025 and relies on incremental DSM components to offset all projected Design Day gas demand growth after 2027/2028, effectively keeping the Design Day gas demand constant thereafter (see Figure 2-6 below) such that no additional infrastructure projects beyond the LNG Vaporization Project and ExC Project would be needed.[10]

[10] This report assumes all demand reduction against the Adjusted Baseline Demand Forecast is from programmatic energy efficiency, demand response, and heat electrification; however, some may also come from new codes and standards or other policies.

2.9. National Grid tested the Distributed Infrastructure Solution against a 'Net Zero Scenario' demand projection that assumes aggressive new policies are adopted under the CLCPA that slow, stop, and reverse the projected growth of gas demand. Measured against this scenario, the Distributed Infrastructure Solution is consistent with New York's Net Zero goals by meeting near-term customer gas demand growth while offering the flexibility to right size National Grid's gas capacity portfolio over time.

The Company leveraged work done as part of the NYC Decarbonization Study to inform a scenario in which demand for gas follows a trajectory aligned with that study's "Low Carbon Fuels" pathway.[11] This scenario (the "Net Zero Scenario") assumes new policies and programs under the CLCPA and other laws are implemented such as future gas connection bans. Under this Net Zero Scenario, after taking into account Distributed Infrastructure Solution incremental DSM, Design Day demand growth slows relative to the Adjusted Baseline Demand Forecast after 2025-2026 (taking into account implementation lag from those new CLCPA policies and programs), stops around 2027-28, and then reverses (see Figure 2-6).

Figure 2-6: Design Day Demand Scenario Comparison

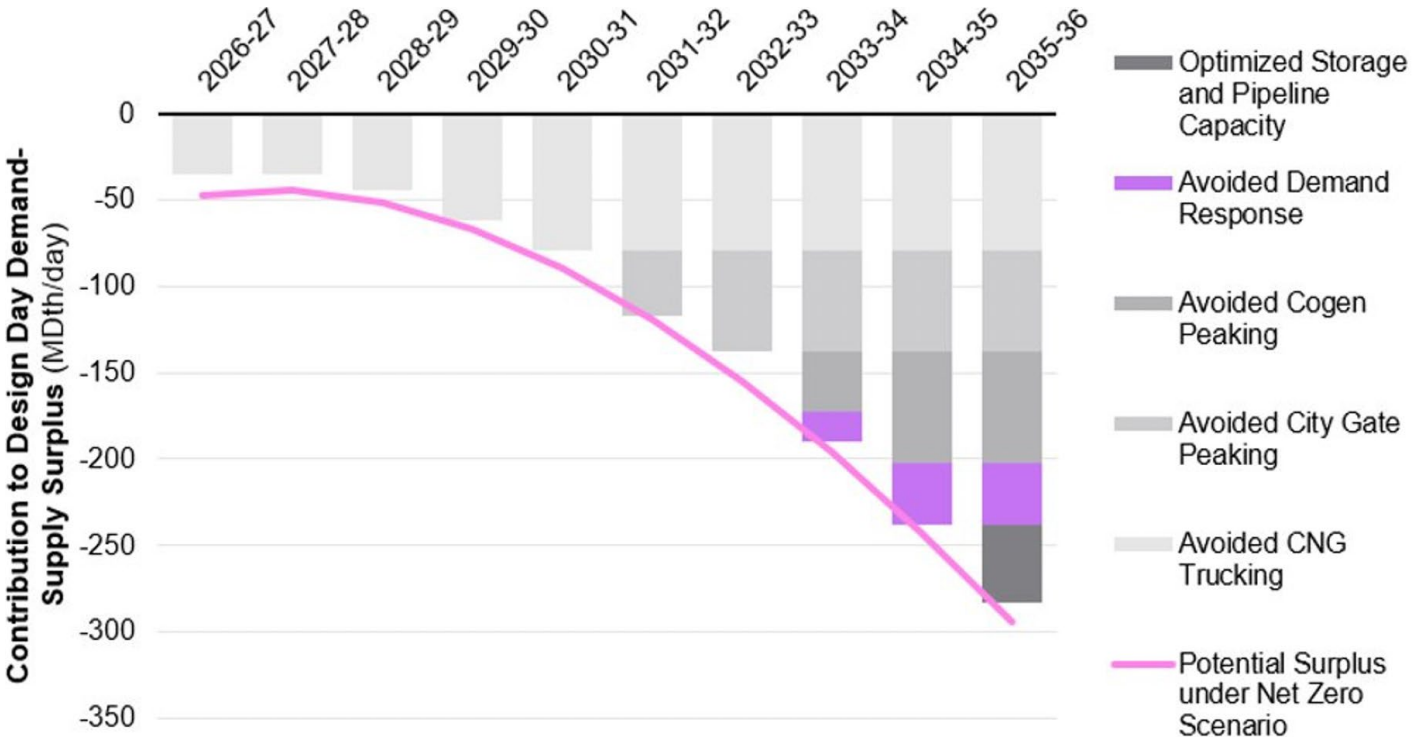


Testing the Distributed Infrastructure Solution against this Net Zero Scenario demonstrates how this solution helps enable the clean energy future by meeting customer energy demand reliably in the next several years via projects that expand the existing gas infrastructure capacity to meet customer demand and pairing those with incremental DSM programs that scale up to offset projected future gas demand growth.

The Distributed Infrastructure Solution also allows the Company to right-size natural gas supply capacity if gas demand begins to decline. As an example, in the Net Zero Scenario, the Company would be able to reduce reliance on CNG sites which would both provide cost savings and lessen reliance on a more GHG-intensive fuel. Figure 2-7 depicts an example of how components of the Distributed Infrastructure Solution and today's Existing Capacity could be right sized.

[11] The Low Carbon Fuels Pathway reduces emissions by reducing the use of fossil fuels through energy efficiency and some electrification and replacing remaining fossil fuels with low carbon alternatives in the buildings and transportation sectors. See https://www1.nyc.gov/assets/sustainability/downloads/pdf/publications/Carbon-Neutral-NYC.pdf (page vii).

Figure 2-7: Illustrative Gas Capacity Portfolio Right-Sizing under Net Zero Demand Scenario



Note: Potential surplus under Net Zero Scenario refers to a combination of Additional Demand Reduction under the Net Zero Scenario and any small surplus that was embedded in the Distributed Infrastructure Solution due to imperfect timing of supply and demand matching.

2.10. National Grid has made substantial progress implementing the Distributed Infrastructure Solution components, including the incremental demand-side programs and distributed infrastructure projects.

Since the May 2020 Supplemental Report recommended the Distributed Infrastructure Solution, National Grid has made extensive progress on implementation, including innovative program design for our DSM solutions, resulting in what will be one of the largest and most aggressive DSM programs in the State upon full implementation. The Company also quickly implemented the planned CNG sites from the last report, has advanced the LNG Vaporization Project and is supporting the Iroquois ExC Project, where Iroquois, the interstate pipeline company, is responsible for project implementation. Table 2-3 summarizes the progress the Company has made in designing and refining the Distributed Infrastructure Solution, and the current status of each component.

Table 2-3: Distributed Infrastructure Solution Progress

Segment	Progress & Status
Energy Efficiency	Designed new incremental EE programs, specifically new intensive weatherization programs and a new "Energy Efficient Connections" program to facilitate EE at the point of new demand coming on to the system — to be filed later in 2021 with the New York Public Service Commission.
Demand Response	Includes three new programs focused on daily reductions in gas consumption and more targeted and pronounced hourly reductions in peak demand; filed in mid-June 2021.
Heat Electrification and NPA	Pursuing a collaboration with electric distribution companies ("EDCs") to study the best pathway to achieve incremental heat electrification targets and supporting the EDCs' NE:NY target goals through the lead referral program. The Company will hold annual NPA solicitations to seek innovations to deliver DSM more cost effectively than traditional utility programs[12]
CNG	Increased capacity to 62 MDth/day; new capacity in development to increase total CNG capacity to 80 MDth/day
LNG Vaporization	Fully designed and engineered; extensive environmental reviews performed and public meetings held; awaiting final permits to proceed to construction
ExC Project	Iroquois submitted the project to FERC on January 31, 2020, and National Grid filed a letter in support to emphasize the need. Iroquois is still awaiting FERC approval to proceed

2.11. Despite the progress made to date, the Distributed Infrastructure Solution faces challenges and risks to completion that include permitting and regulatory risk and obstacles to scaling up incremental DSM programs.

Despite the steps taken by National Grid to implement the Distributed Infrastructure Solution, the solution faces risks to successful implementation. The distributed infrastructure projects face permitting delays and the risk of not obtaining needed regulatory approvals. The incremental demand-side programs face implementation risks in terms of uncertainty of regulatory approval and funding and uncertainty of meeting targets given the ambitious levels of these programs' demand reduction targets, and the unpredictable nature of customer participation.

In particular, while only a few permits remain for the LNG Vaporization Project, the Company has experienced substantial delays in obtaining those permits and the LNG Vaporization Project is key to being able to solve for the Demand-Supply Gap in the near future. Similarly, the ExC project, which Iroquois submitted to FERC in January 2020, is still awaiting approval after a year and a half, and Iroquois is now not expected to ascertain whether it will receive all necessary permits and approvals until 2022. With the implementation lags and other risks inherent in achieving the savings under the DSM programs and the still evolving external work around Net Zero, it is critically important that these distributed infrastructure projects move forward as quickly as possible to meet the growing demands of Downstate NY.

Table 2-4 summarizes the key implementation risks for each of-the individual components of the Distributed Infrastructure Solution.

[12] While the NPA market solicitations do not yet add capacity to close the Demand-Supply Gap, the Company still views them as part of its Distributed Infrastructure Solution

Table 2-4: Key Implementation Risks of Distributed Infrastructure Solution Components

Project	Risk	Risk Likelihood	Impact	Description
Incremental Energy Efficiency	Market Resourcing Market Potential Legal and Regulatory Delays	MEDIUM	HIGH	◆ Lack of market resources to execute projects ◆ Overestimation of market potential and ability to reach accelerated levels of adoption ◆ Failure to get legal and regulatory approval of programs and their costs
Demand Response Programs	Market Potential Program Reliability Legal and Regulatory Delays	MEDIUM	HIGH	◆ Overestimation of market potential and ability to reach accelerated levels of adoption ◆ If reductions are unreliable, may not have other DR program workarounds ◆ Failure to get legal and regulatory approval of programs and their costs
Incremental Electrification	Market Resourcing Market Potential Legal and Regulatory Delays High costs	HIGH	HIGH	◆ Lack of market resources to execute projects ◆ Overestimation of market potential and ability to reach accelerated levels of adoption ◆ Heat Electrification is currently uneconomical for many customers, esp. low-income customers, and, as costs for heat electrification programs are higher than for all other demand-side programs, needed incentive programs would require multiple legal and regulatory approvals.
LNG Vaporization Project	Failure to obtain FDNY and DEC permits	MEDIUM	HIGH	◆ Without these permits, National Grid cannot construct the LNG Vaporization Project ◆ The LNG Vaporization Project is deemed by the Company to be the only distributed infrastructure project that can be brought on line in time to meet projected demand
ExC Project	Failure to obtain FERC approval and subsequent state/ local permits	MEDIUM	HIGH	◆ Without FERC approval, and then the state and local permits, Iroquois cannot move forward with the ExC Project.
Additional CNG Facility	Inability to procure land; permitting and construction delays	HIGH	HIGH	◆ Scarcity of available land in service territory could impact the size and scale of the additional site; permitting and construction delays could impact timing of implementation.

2.12. In the event certain circumstances prevent or delay the Distributed Infrastructure Solution from being fully implemented, National Grid has evaluated alternative approaches to solve the projected Demand-Supply Gap, including both alternative infrastructure projects and additional non-gas infrastructure options.

We have analyzed a set of contingency scenarios that capture the impacts of certain potential setbacks to the Distributed Infrastructure Solution; while not an exhaustive list, these include: permitting delays or rejection of the ExC Project, permitting delays or rejection of the LNG Vaporization Project, a combination of both, or failure of our incremental DSM programs to fully meet their targets. For each of these contingency scenarios, we quantified what projected supply-demand gaps would emerge without complete and timely implementation of the Distributed Infrastructure Solution.

Figure 2-8 depicts the gaps that might occur in such scenarios (positive numbers indicate gaps). In each scenario, we are assuming that all other components of the Distributed Infrastructure Solution are fully implemented and meet their targets.

Figure 2-8: Contingency Scenario Gaps by Year (MDth/day)

Contingency Scenario	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36
DI Sol'n in Full	-72	-105	-53	-88	-57	-27	-1	-18	-22	-24	-10	-20	-17	-18	-4
ExC Delayed (LNG Vap on-time)	-72	-105	-53	-26	-57	-27	-1	-18	-22	-24	-10	-20	-17	-18	-4
ExC Rejected (LNG Vap on-time)	-72	-105	-53	-26	**6**	**35**	**61**	**45**	**40**	**38**	**52**	**42**	**45**	**45**	**58**
LNG Vap Delayed (ExC on-time)	-72	-47	**6**	-88	-57	-27	-1	-18	-22	-24	-10	-20	-17	-18	-4
LNG Vap Rejected (ExC on-time)	-72	-47	**6**	-29	**2**	**32**	**57**	**41**	**36**	**35**	**49**	**39**	**41**	**41**	**54**
ExC & LNG Delayed	-72	-47	**6**	-26	-57	-27	-1	-18	-22	-24	-10	-20	-17	-18	-4
ExC & LNG Rejected	-72	-47	**6**	**33**	**65**	**94**	**120**	**104**	**99**	**97**	**111**	**101**	**104**	**104**	**117**
80% of DI Sol'n DSM	-70	-98	-43	-75	-40	-7	**24**	**14**	**16**	**21**	**41**	**38**	**47**	**53**	**72**

As indicated by Figure 2-8 above, the largest gaps ("contingency scenario gaps") result from the denial of one or more of the distributed infrastructure projects. The first year a contingency scenario gap emerges is the winter of 2023/2024, even assuming completion of the incremental CNG capacity and successful implementation of the DSM programs planned as part of the Distributed Infrastructure Solution.

The contingency scenario gap analysis above and in this report compares available gas capacity and Design Day demand at an aggregate level for the Company's entire service territory.[13] In fact, each year National Grid and Consolidated Edison engage in an extensive, detailed joint effort to conduct hydraulic modeling of their systems to reflect actual expected gas flows under Design Hour conditions. This more detailed analysis

[13] This report was prepared using National Grid's latest Adjusted Baseline Demand Forecast, which is prepared annually in June. The detailed hydraulic modeling process with Consolidated Edison relies on the latest forecasts from both companies, takes iterations over several months to complete, and cannot start until after National Grid and Consolidated Edison update their annual long-term gas demand forecasts. As such, the annual hydraulic modeling analysis was still underway at the time this report was completed.

captures specific locational gas capacity constraints that the aggregate-level analysis in this report cannot identify. As such, while useful to understand risks and evaluate options, the aggregate supply-demand gap analysis above may not tell the whole story in terms of how a setback to the Distributed Infrastructure Solution would create challenges. This goes beyond just the potential for locational gas capacity constraints. For example, in the contingency scenario where the LNG Vaporization Project is delayed, a contingency scenario gap appears in winter 2022/2023. Overlaying additional setbacks (e.g., inability to expand CNG capacity or delays in meeting incremental DSM demand reduction targets) would exacerbate this gap. Under the Distributed Infrastructure Solution the incremental DSM components have time to scale up and further prove themselves (such as building out the track record for relatively new DR programs) before they are essential to ensure reliability. In contrast, with a delay to the LNG Vaporization Project, the incremental DSM component is thrust into the role of ensuring reliability years ahead of schedule.

Because we have already experienced delays in permitting our Distributed Infrastructure Solution, the likelihood of one or more of these contingency scenarios coming to pass is substantial. Faced with these contingency scenarios, National Grid has examined all available options to meet these potential contingency scenario gaps.

As a starting point, National Grid reviewed and updated the list of additional options from the Supplemental Report. We have also considered other options, including one new distributed infrastructure option.

While all the additional options described in the Original Report and the Supplemental Report continue to have potential, the Company chose to focus on distributed infrastructure and non-gas infrastructure options to close the contingency scenario gaps rather than any large infrastructure options due to the low likelihood of a new large infrastructure project being permitted, as exemplified by the rejection of the Company's large infrastructure solution from the Supplemental Report.

To develop the most viable approach for closing a contingency scenario gap, National Grid filtered out those options that could not provide meaningful capacity contribution in the near term. The approach then analyzed the remaining options' likelihood for successful implementation in light of legal and permitting hurdles. The Company then excluded from consideration the options where overcoming those hurdles seemed extremely unlikely. Following the filtering process, the Company's list of options ("contingency options") is presented in Table 2-5.[14]

The Company considered several combinations of these contingency options, including a pure non-gas infrastructure approach, to address the various contingency scenario gaps.

Table 2-5: List of Contingency Options to Solve Contingency Scenario Gaps

Contingency Options	Size(MDth/day)
Distributed Infrastructure Options	
Clove Lakes Transmission Loop Project	80
LNG Barges	50 (per barge, scalable)
Micro-LNG Tank	18
Non-Gas Infrastructure Options	
Incremental DR over and above the Distributed Infrastructure Solution	Up to 44 MDth/day
Heat Electrification over and above the Distributed Infrastructure Solution	Up to 90 MDth/day

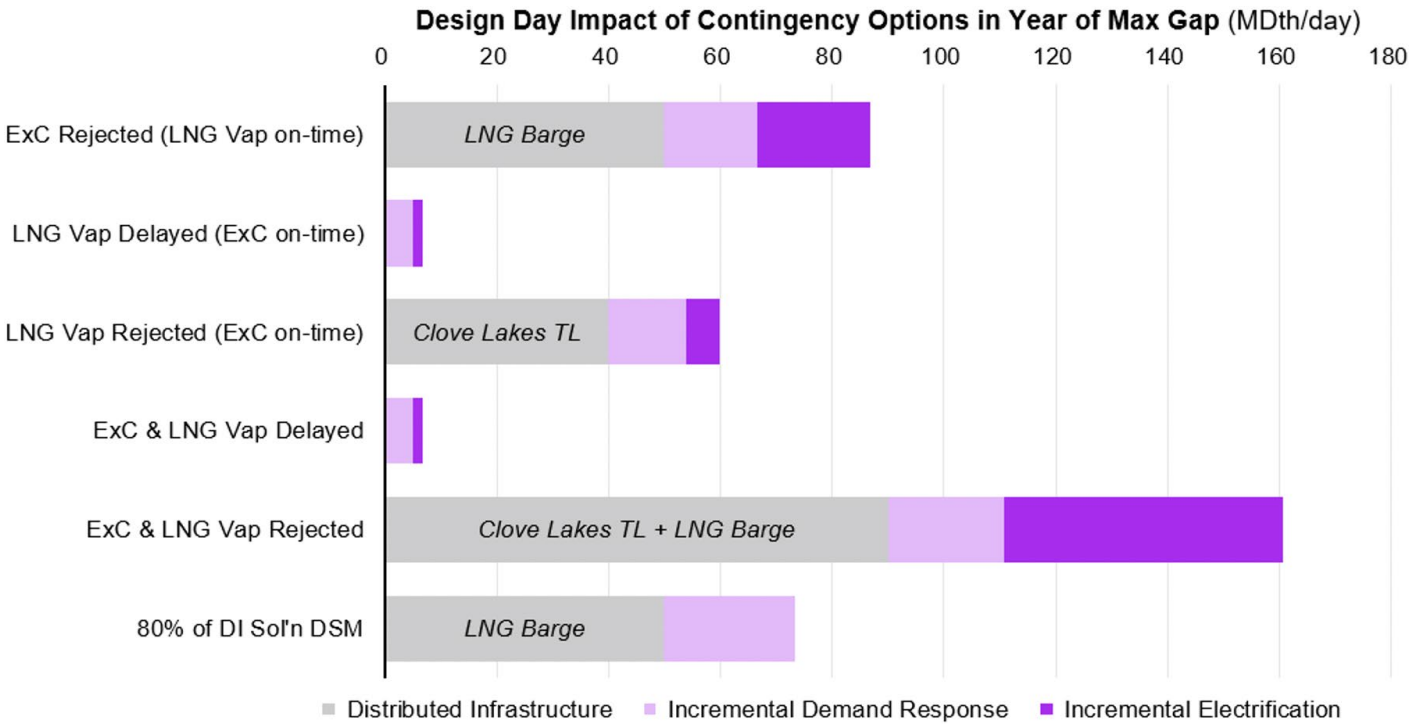
[14] The Company considered but filtered out due to scale and/or feasibility additional seasonal peaking capacity, local RNG production, and incremental gas energy efficiency. Options filtered out due to smaller scale might be pursued as opportunities arise, such as newly identified gas energy efficiency programs or local RNG.

2.13. In a scenario where one or both of the Distributed Infrastructure Solution enhancements to existing infrastructure are denied, the lead time and feasibility for any alternative approach would entail significant risk that projected customer demand could not be met. The alternative approaches that best balance cost and feasibility would include incremental gas demand response and heat electrification along with substitute infrastructure projects — specifically, the Clove Lakes Transmission Loop project and/or an LNG Barge project — but all alternative approaches have much higher costs and greater risks to successful and timely implementation than the Distributed Infrastructure Solution.

The Company's primary factors in the evaluation of the contingency options to address contingency scenario gaps were cost, deliverability and potential for success. Looking at the costs of the alternatives and how quickly the Company could implement the solution, taking into account engineering time and permitting hurdles, the Company assessed that, for the contingency scenario gaps resulting from delays in the implementation of either the LNG Vaporization Project or the ExC Project, the least expensive approach was a combination of incremental demand response and heat electrification. For the gaps caused by denials of either the LNG Vaporization Project or the ExC Project, the least expensive approaches included either a combination of the Clove Lakes Transmission Loop option ("Clove Lakes Transmission Loop") and/or the LNG Barge option with incremental demand response and heat electrification. In all cases, the costs of these approaches are far in excess of the costs of the Distributed Infrastructure Solution as currently planned.

Figure 2-9 depicts the approaches the Company found to be the most feasible to solve each contingency scenario gap.[15]

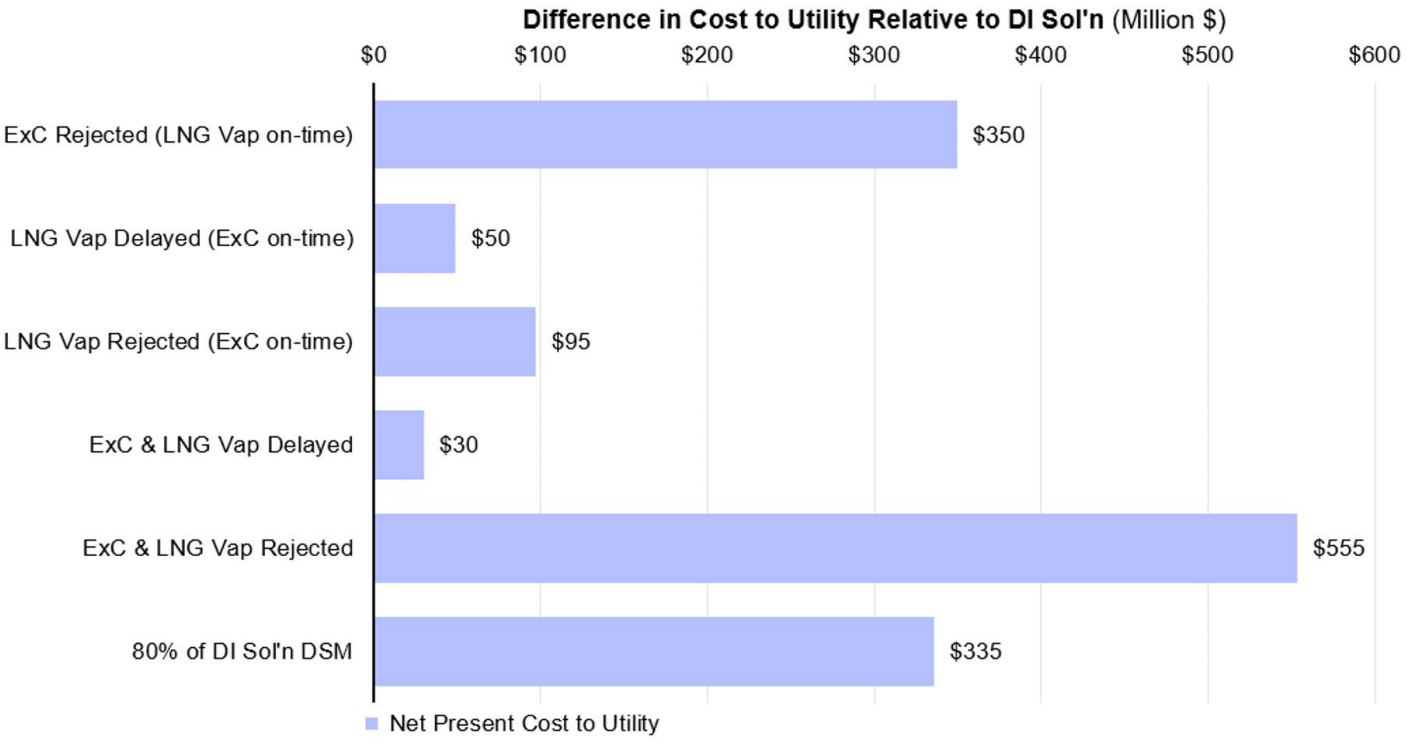
Figure 2-9: Contingency Scenarios Approaches



[15] The Clove Lakes Transmission Loop is the least costly option to replace the LNG Vaporization Project if the LNG Vaporization Project is denied, as both primarily support KEDNY territory. Because ExC primarily supports the Company's KEDLI territory, if it is denied, the Company would need to look to an LNG Barge due to operational constraints related to the Clove Lakes Transmission Loop option. If both projects are rejected, National Grid would look to develop both options.

The costs for each of these approaches, which are the lowest for each contingency scenario, are shown in Figure 2-10 below. For example, the least-cost contingency solution to a rejection of the LNG Vaporization Project and the ExC Project would include the Clove Lakes Transmission Loop, a LNG Barge and incremental DSM and would be $555 million more expensive than the Distributed Infrastructure Solution. Over the next five years, even this least-cost alternative approach would increase total customer bills by approximately 6.6% as compared to the Distributed Infrastructure Solution.

Figure 2-10: Contingency Scenario Solution Net Utility Costs



Note: Net present value of the contingency approach is lower in the case when both ExC & LNG Vap are delayed than when only LNG Vap is delayed due to the fact that ExC is constructed and paid for one year later. Though delay in ExC construction does not lead to an apparent incremental supply-demand gap in the aggregated model, it would prevent National Grid from potentially scaling down reliance on and cost of running CNG trucking, which could lead to savings not reflected in the above calculation.

In each of the contingency scenarios, an increase in investment in demand response and heat electrification programs in a very short amount of time will be necessary. Relying on a combined solution of non-gas infrastructure with distributed infrastructure in those scenarios where either the LNG Vaporization Project or the ExC Project is denied, however, was less expensive than if the Company were to attempt a pure non-gas infrastructure solution, which would be heavily dependent on a rapid scale up of incremental heat electrification efforts. For example, in the scenario where the LNG Vaporization Project and the ExC Project are rejected, relying only on an exclusively non-gas infrastructure solution instead of the least cost solution presented in Figure 2-9 would require full heat electrification customer conversions at nearly 6 times the level currently planned under NE:NY through 2025 at a current estimated total cost of $1.23 Billion.[16] This same exclusively non-gas infrastructure alternative approach would lead to average total customer bills nearly 10% higher than under the Distributed Infrastructure Solution through 2025. The contingency scenarios approaches are also relying heavily on demand response; in particular it would

[16] Section 7.3 contains a complete discussion of the potential contingency solutions and their costs.

require significantly reducing (by as much as 50%) the historic migration of existing demand response non-firm customers (dual fuel customers) to firm rates and converting as many as 10-15% of existing firm customers to demand response non-firm customers. This is not an easy task considering this historic migration to firm rates is driven by broad market trends and regulatory policy changes (e.g., bans on certain types of heating oils) which have a broad range of financial, regulatory and logistical implications.

As indicated by Figure 2-10, all of the alternative approaches to the Distributed Infrastructure Solution come at a higher cost – between an incremental $30M and $555M in net present value depending on the contingency scenario. These alternative approaches also carry more feasibility risk than the Distributed Infrastructure Solution. Both the Clove Lakes Transmission Loop option and LNG Barge option would likely face difficult permitting hurdles, as evidenced by the difficulties the Company has faced with the current projects. The incremental demand response and heat electrification options also carry uncertainty due to being reliant on extensive customer participation. Timing is another concern, as any alternative approach would need to meet highly aggressive and challenging timelines for approvals and implementation to successfully address a contingency scenario gap.

2.14. Customer curtailment is the option of last resort for maintaining system reliability if the Company cannot meet customer demand growth in the face of the timing and feasibility challenges of an alternative approach to the Distributed Infrastructure Solution and if even restrictions on new customer connections cannot sufficiently reduce customer demand.

If the Distributed Infrastructure Solution cannot be fully implemented in a timely manner, there may be a need for a targeted or more widespread pause in new customer connections. There is a risk that even restrictions on new customer connections could prove insufficient to avoid all projected Design Day demand growth. In the event that available gas supply capacity cannot meet customer demand during peak conditions, the Company would need to rely as a last resort on the Company's customer curtailment plan, starting by interrupting service to large commercial and industrial customers and potentially shutting off sections of its gas network affecting large numbers of homes and businesses.

2.15. The Company continues to seek new supply/demand options, including through market solicitations for Non-Pipeline Alternatives (NPAs) and Innovative Supply-Side Proposals to meet our customers' needs and New York's Net Zero goal.

National Grid continues to exhaustively consider all options for meeting projected customer needs. In addition to the options evaluated in the Original Report, Supplemental Report, and now this report, the Company is looking externally to market innovators to uncover any additional options that can be deployed. To this end, National Grid is soliciting ideas on both the non-traditional gas supply side and on the demand-side from a wide array of competitive and innovative technology and energy companies.

National Grid has issued a request for information (RFI) for innovative supply-side options, expected to yield proposals related to RNG, CNG and LNG options for consideration, and will be issuing its first NPA request for proposals (RFP) later this year. The Company is also advancing new models for gas utility delivery of clean heating solutions and studying the potential for innovative new technologies on the demand side.

The Company welcomes new ideas and innovative solutions in response to its RFIs, RFPs and this report. The Company can fold new options identified via these market solicitations into the overall Distributed Infrastructure Solution as appropriate.

2.16. In conclusion, National Grid confirms that the Distributed Infrastructure Solution remains the best available solution to resolve the projected Demand-Supply Gap, and National Grid welcomes stakeholder feedback on this finding and its evaluation of the alternative approaches.

As demonstrated by the evidence and analysis in this Second Supplement Report, National Grid faces a projected Demand-Supply Gap starting in winter 2022/2023 based on existing gas supply capacity and the latest demand forecast, and the Distributed Infrastructure Solution is the best available solution for addressing that challenge. National Grid plans to continue to pursue the successful implementation of all parts of that solution.

To date, National Grid has made progress on implementation of the Distributed Infrastructure Solution, but the Distributed Infrastructure Solution faces real risks in the form of permitting delays or denials. There is a material risk for pauses in the Company's ability to connect new customers in the future due to lack of adequate natural gas capacity given the greater implementation challenges associated with all alternative approaches to the Distributed Infrastructure Solution. In particular, delays to timely permitting of the LNG Vaporization Project or the outright rejection of that project even if all other components of the Distributed Infrastructure Solution proceeded according to plan would create a projected gap between gas supply capacity and Design Day demand in winter 2023/2024.

The Distributed Infrastructure Solution builds on New York's current, ambitious gas energy efficiency and heat electrification programs and targets with its incremental DSM. Moreover, the Distributed Infrastructure Solution addresses near-term reliability needs while providing the flexibility to right-size National Grid's gas capacity portfolio over time as additional Net Zero policies and programs change the gas demand outlook.

Reinforcing this assessment of how the Distributed Infrastructure Solution aligns with Net Zero, National Grid has committed, in keeping with a joint proposal (the "Joint Proposal") filed with the Commission on May 14, 2021 in the currently pending KEDNY/KEDLI rate case (Cases 19-G-0309 and 19-G-0310), to a number of additional reports evaluating how the Company's business may further evolve to support the goals of the CLCPA, NYC's Local Law 97 and the Company's Net Zero Plan.

In Case 20-G-0131, the Commission will establish a new process and requirements for long-term planning by New York's gas utilities. The anticipated requirements for National Grid to prepare regular long-term plans and conduct related stakeholder engagement will build on this Second Supplemental Report and provide ongoing transparency and opportunities for stakeholder feedback. This enhanced approach will help ensure that the Company's long-term plan continues to align with New York's Net Zero goal and emerging policies and programs.

As with the Original Report, we invite readers to provide feedback on this Second Supplemental Report and the analysis and conclusions contained herein. The Company also welcomes creative ideas and innovative solutions to its market solicitations for both the supply-side and demand-side proposals described above. In addition to filing the Second Supplemental Report with the Commission, we will be publishing this report on our website and will deploy other options for sharing the report with stakeholders, including a virtual meeting.[17]

[17] The Second Supplemental Report and related content, including the details for providing stakeholder feedback, are available at: https://ngridsolutions.com/.

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