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VIA ELECTRONIC FILING

Draft Scoping Plan Comments
NYSERDA
17 Columbia Circle
Albany, NY 12203-6399

Re: Climate Action Council Draft Scoping Plan

To the Climate Action Council and NYSERDA:

Please accept these comments on behalf of the National Fuel Cell Research Center in response to the January 2022 request from the New York Climate Action Council for comments on the Draft Scoping Plan.

Respectfully Submitted,

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New York Climate Action Council Draft Scoping Plan

Comments of the National Fuel Cell Research Center

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I. Introduction

The National Fuel Cell Research Center ("NFCRC") appreciates the opportunity to provide comments to the New York State Energy Research and Development Authority ("NYSERDA") on the Climate Action Council Draft Scoping Plan ("Scoping Plan") issued December 30, 2021.

The NFCRC (1) facilitates and accelerates the development and deployment of fuel cell technology and systems; (2) promotes strategic alliances to address the market challenges associated with the installation and integration of fuel cell systems; and (3) educates and develops resources for the power and energy storage sectors. The NFCRC was established in 1998 at the University of California, Irvine, by the U.S. Department of Energy and the California Energy Commission to develop advanced sources of power generation, transportation, and fuels and has overseen and reviewed thousands of commercial fuel cell applications.

II. Summary of Recommendations

The NFCRC applauds the State of New York for taking on the challenge of climate change and a continued focus on growing and preserving clean energy jobs. To further fulfill this mission, the NFCRC recommends to following additions and edits to the Scoping Plan:

1. **Chapter 3. New York's Climate Leadership**

   The overview of past and current policies should include:

   a. Governor's Hochul's hydrogen initiatives in the State-of-the-State book;
   b. The U.S. Department of Energy Hydrogen Energy Earthshot; and
   c. The recent federal Infrastructure Investment and Jobs Act, including programs for hydrogen, electrolysis and multi-sector decarbonization.

2. **Chapter 6. Achieving Climate Justice**

   Fuel cells should be considered a priority measure to reduce greenhouse gas emissions and co-pollutants that affect air quality and health in disadvantaged communities.

3. **Chapter 8. Public Health**

   Non-combustion fuel cell systems should be considered a zero-emission end-use of hydrogen and to replace diesel generators.

4. **Chapter 9. Analysis of the Plan**

   Scenario 2, Scenario 3, and Scenario 4 analyses should use low- and zero-carbon hydrogen in non-combustion fuel cells for power generation and difficult-to-electrify applications.

5. **Chapter 11. Transportation**
    a. The adoption of zero-emission trucks, buses, and non-road equipment are sectors well-suited to the use of hydrogen to achieve zero emissions.
    b. The decarbonization strategies for ports should include the entire power system, such as shore power, backup power, as well as material handling equipment and vehicles, and should acknowledge the emissions reduction potential for fuel cells and hydrogen at ports.
    c. The Scoping Plan should acknowledge that electric vehicle charging also increases emissions by charging on a grid that is not 100% renewable and that charging dynamics often also create challenging electricity peaks (e.g., charging vehicles at home in the evening) that cause the increased utilization of dirty combustion peaker plants to meet peak demand.
    d. The NFCRC agrees that a focus on the carbon intensity (federal statute reference) of renewable fuels is the right metric to ensure desired emission reductions and is consistent with federal policy. Adding criteria pollutant emissions intensity metrics for renewable fuels is desired.

6. **Chapter 12. Buildings**
    a. Fuel cell systems should be a preferred solution to power difficult-to-electrify buildings. Public incentives proposed in 12.2 should be technology neutral, allowing emissions reduction and electrification via local fuel cell generation as well as other means of electrification.
    b. The NFCRC supports directing funding to LMI ratepayers. Some of this funding should be allocated to the replacement of diesel generators for resilient and/or long-duration backup power. Air quality in disadvantaged communities cannot be sufficiently improved without eliminating the emissions from diesel generators.

7. **Chapter 13. Electricity**
    a. Assessment and determination of emissions reduction targets, as well as promulgation of emissions regulations for electricity should include sources of backup power, especially in disadvantaged communities.

b. The Scoping Plan should not limit large-scale resources to solar, battery storage and wind. Hydrogen, electrolyzers, and fuel cell systems should be part of this strategy.
c. A multi-pronged approach to distributed generation and resilience should include hydrogen and dispatchable fuel cell systems. Climate resilience hubs based on solar and battery storage alone will not create a resilient system for multi-week outages or long-duration shortages of solar and wind power.
d. Hydrogen should be used for long-duration storage of renewable electricity to address the need for seasonal storage, peaking, and long-term planning.

8. Chapter 14. Gas System Transition

The Climate Action Council should restore the inclusion and evaluation of hydrogen and hydrogen blends in the gas system in the Scoping Plan.

III. Comments

BACKGROUND

Chapter 3. New York's Climate Leadership

Chapter 3.1 High-Level Overview of Past and Current Policies

The Executive Leadership section of the Scoping Plan should incorporate the large-scale hydrogen initiatives included in Governor Hochul's 2022 State-of-the-State book, with a stated objective of making New York a hydrogen hub.[1] The Governor calls for an integrated, decarbonized energy system to animate the market for green hydrogen and to ensure green job creation. On March 24, 2022, Governor Hochul announced the signing of a multi-state agreement to propose regional clean energy hydrogen hub with Connecticut, Massachusetts and New Jersey, as well as numerous public and private partners.[2] It is a significant oversight that these initiatives are not included in Chapter 3 of the Scoping Plan.

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[1] *2022 State of the State*, Governor Kathy Hochul. Available at: 2022StateoftheStateBook.pdf (ny.gov)
[2] https://www.governor.ny.gov/news/governor-hochul-announces-multi-state-agreement-signed-major-hydrogen-ecosystem-partners

In addition to stating an objective of making New York a green hydrogen hub, the State-of-the-State book describes additional proposals for:

- Development of a Regulatory Framework to measure emission reduction and codes and standards
- A program for locally-owned green hydrogen microgrids
- NYSERDA Hydrogen Innovation Funding of $27M – product development, pilots, and demonstrations Q222 w/federal FOAs.
- District Heating and Cooling – NYSERDA green hydrogen demonstration
- Industry Collaboration – NYSERDA invests in convening utilities, renewable energy companies, automobile OEMs and hydrogen end-users
- Green Hydrogen Prize program for firms seeking NY expansion
- New York Truck Voucher Incentive Program that includes green H2 school bus electrification

The intent and objectives of New York for development of a hydrogen ecosystem are consistent with federal policy. On June 7, 2021 the United States Department of Energy (DOE) announced a Hydrogen Energy Earthshot[3] to reduce the cost of clean hydrogen by 80% to $1 per 1 kilogram in 1 decade. This target should inform assumptions in any cost modeling of hydrogen decarbonization pathways resulting from the Scoping Plan.

The 2021 Federal Infrastructure and Investment Act includes $9.5 billion for hydrogen and related fuel cell programs and policy development. The Governor has expressed intention to leverage this funding to bolster achievement of New York's climate objectives. The Scoping Plan should be updated to acknowledge and include the very significant Federal Infrastructure Investment and Jobs Act,[4] signed by President Biden on November 5, 2021, with the intention to update and upgrade America's aging infrastructure**.** The groundbreaking 2021 Infrastructure Investment and Jobs Act (Bipartisan Infrastructure Bill) includes a total of $9.5 billion for clean hydrogen programs (Section 813-816, 822):

a. Clean Hydrogen Production Qualifications – Definition of "clean hydrogen" – Hydrogen produced with a carbon intensity equal to or less than 2 kilograms of carbon dioxide-

[3] Department of Energy Hydrogen Energy Earthshot Initiative, June 21, 2021. Available at: https://www.energy.gov/eere/fuelcells/hydrogen-shot

[4] Available at congress.gov: H.R.3684 - 117th Congress (2021-2022): Infrastructure Investment and Jobs Act | Congress.gov | Library of Congress

equivalent produced at the site of production per kilogram of hydrogen produced. Sec. 822(b)(1)(B).

b. Regional Hydrogen Hubs - $8 billion to develop at least 4 large-scale hydrogen production and utilization projects in diverse geographies with diverse feedstocks and multi-sector end uses of hydrogen.

c. Clean Hydrogen Electrolysis Program - $1 billion for research, development, demonstration, commercialization, and deployment program for commercialization to improve efficiency, durability, and reduce cost of producing clean hydrogen using electrolyzers. Includes hybrid storage.

d. Clean Hydrogen Manufacturing and Recycling - $500 million to support a clean hydrogen domestic supply chain.

e. Clean School Bus Program - $1 billion for adoption of clean school buses and zero-emission school buses.

f. Grants for Charging and Fueling Infrastructure - $7.5 billion for grant program to award grants to install publicly accessible electric vehicle charging infrastructure, hydrogen fueling infrastructure, propane fueling, or natural gas fueling infrastructure directly related to the charging or fueling of a vehicle.

g. Electric of Low-emitting Ferry Pilot Program - $50 million to provide grants for the purchase of electric or low-emitting ferries and the electrification of or other reduction of emissions from existing ferries.

h. Port Infrastructure Development Program - $2.25 billion for projects that improve the resiliency of ports to address sea-level rise, flooding, extreme weather events, earthquakes, tsunamis, and projects that reduce or eliminate port-related criteria pollutant or greenhouse gas emissions. This includes workforce training and development.

i. Clean Hydrogen Research and Development Program – to advance research and development to demonstrate and commercialize the use and storage of clean hydrogen in the transportation, utility, industrial, commercial, and residential sectors. Incorporates fossil fuels with carbon capture, utilization, and sequestration, renewable fuels, biofuels, and nuclear energy.

j. National Clean Hydrogen Strategy and Roadmap – directs the development of the first US national strategy to facilitate a clean hydrogen economy by May 15, 2022.

As further evidence of the importance of the Hydrogen hubs that are forming around the country to compete for this funding to meet their state and regional decarbonization goals:

- California has announced a $100 million budget item to contribute to the development of a statewide hydrogen hub.[5]

[5] https://www.ebudget.ca.gov/2022-23/pdf/GovernorsBudget/3000/3360.pdf

- Oregon and Washington are planning a renewable green hydrogen hub and have already passed supporting legislation and tariffs.[6]
- Arkansas, Louisiana, Oklahoma have announced a hub focused on industrial decarbonization.[7]
- Colorado, New Mexico, Utah, Wyoming are creating a hydrogen hub to meet greenhouse gas emission reduction goals.[8]

Chapter 6. Achieving Climate Justice

6.1 Climate Justice and the Climate Act

Fuel cells are a firm, zero-emission resources that generate power and are required to utilize hydrogen and renewable fuels without combustion. Fuel cell systems displace traditional emergency backup generators (almost exclusively fossil diesel combustion generators) that emit criteria air pollutants and greenhouse gas (GHG) emissions. This feature is especially critical given that poor air quality can be a major issue in economically disadvantaged communities that are often disproportionately burdened by air pollution and risks of COVID-19. By providing always-on dispatchable zero criteria pollutant emissions power, fuel cells can increase adoption of intermittent renewable wind and solar resources throughout New York while significantly increasing the generation of decarbonized and pollutant-free electricity. By increasingly using renewable fuels (including renewable hydrogen) in fuel cells over time, these dispatchable systems will become a key technology for enabling completely zero emissions in all sectors of the economy.

6.3 Prioritizing Measures to Reduce Greenhouse Gas Emissions and Co-Pollutants in Disadvantaged Communities

The NFCRC understands and agrees that building electrification is an essential part of a comprehensive strategy to combat climate change and air pollution. Electrification of new

[6] https://www.chronline.com/stories/state-passes-hydrogen-clean-energy-support-legislation-lewis-county-poised-to-be-a-regional,287080
[7] https://www.ttnews.com/articles/oklahoma-louisiana-arkansas-create-hydrogen-hub
[8] https://www.denverpost.com/2022/02/24/colorado-rocky-mountain-hydrogen-hub/

construction is especially important and including the higher efficiency of heating and cooling through heat pumps and coupling energy storage and demand response to more directly use the increasingly available renewable resources on the grid is important to accomplish in as many end-uses as possible. On the other hand, we have learned that the technical details of building electrification, especially in retro-fit applications and in dense urban environments are critically important and that absent critical analysis and science-based decision-making, unintended adverse consequences can result.

The NFCRC recommends that the Scoping Plan place a deliberate focus on eliminating the combustion of fossil fuels, an approach that is consistent with New York City's recently passed building decarbonization law. Combustion-based air pollution is harmful to all communities and has disproportionately affected low-income and minority communities. Eliminating air pollution should be just as important as reducing greenhouse gases in advancing environmental justice concerns. There are currently 10,000 backup generators in New York City alone, and ninety percent of backup generators are diesel fueled. Backup diesel generators release greenhouse gases and particulate matter (PM), volatile organic compounds (VOCs), nitrous oxides (NOx) and sulfur dioxide (SO_2), all of which are harmful criteria air pollutants that create smog and exacerbate respiratory harm.

Building electrification is an important component of New York's efforts to reduce carbon emissions and mitigate the public health burdens of energy-related local air pollution. Effective building electrification strategies focus on eliminating fossil fuel use within buildings by promoting the use of heat pumps, induction stoves, and other technologies. The NFCRC cautions the Council, however, that when building electrification rules are applied to DER like non-combustion fuel cells, and related infrastructure outside of buildings, these rules run the risk of inadvertently promoting the increased operation of peaking power plants and the use of diesel generators. This is because on-site DER like fuel cells interact with the electric grid to displace less efficient and higher emitting peaker units and diesel backup generators. Hydrogen-based fuel cell systems are a direct, zero-emission replacement for diesel generators. The NFCRC recommends that proposed building electrification measures support infrastructure for on-site smaller and cleaner DER and microgrids, and prohibit fuel supplies from higher polluting peaker plants and diesel generators that back up those larger and dirtier central station plants. This would avoid the unintended consequence of extending the life and expanding the use of dirty peaking power plants and diesel generators which will, in turn, exacerbate air quality and health impacts in the local communities near those plants and diesel generators.

LAND USE

As an example of the decreased land use that can be achieved using fuel cell systems for electric generation, Doosan has installed 30.8 MW of fuel cells for district heating and electricity for 71,500 homes in the City of Busan, Korea. This system can also operate when the grid goes down and is configured in a tiered structure and sited on only one acre of land; an equivalent 30 MW peak solar farm could require more than 75 acres and would produce as little as $1/6^{th}$ the amount of electric energy and zero heat.

Another example is a 59 MW FuelCell Energy power plant located at Gyeonggi Green Energy south of Seoul, Korea. This system produces 440 million kilowatt-hours of electricity per year and supplies district heating, all on just 5.2 acres of land.

Chapter 8. Public Health

8.3 Sector-Specific Health Co-Benefits of Climate Policies

Fuel cells are required for non-combustion, non-emitting end uses of hydrogen. For reliability purposes, New York also requires local generation (DER) to address peak load issues currently addressed by diesel. Diesel generators have a disproportionate impact in non-attainment zones and disadvantaged communities. Fuel cell systems are replacing diesel generators for both primary and backup power around the U.S., including in New York.

With respect to hydrogen generation, the non-combustion use of hydrogen in fuel cell systems should be identified in the plan. It is misleading to focus this section on combustion of hydrogen with large turbines without noting the option of using hydrogen in non-combustion fuel cell systems. Both gas turbine combined cycle plants and fuel cells can be used over time, and increasingly zero emissions fuel cells will be adopted as their costs are currently on a much steeper decline compared to the more mature gas turbine technologies.

Chapter 9. Analysis of the Plan

Chapter 9.2 Scenario Design

Scenario 2, Scenario 3, and Scenario 4 analyses and decarbonization results can be enhanced by using low- and zero-carbon hydrogen in non-combustion fuel cells for power generation and difficult-to-electrify applications.

Chapter 11. Transportation

Chapter 11.2 Key Sector Strategies

T2. Adoption of Zero-Emission Trucks, Buses, and Non-road Equipment

The Scoping Plan should acknowledge that zero-emission trucks, buses and non-road equipment are sectors better suited to the use of hydrogen fuel cell electric vehicles. Stationary fuel cell systems can also power transit facilities and co-generate hydrogen for fuel cell electric vehicles.

Decarbonization strategies for ports should include the entire power system, such as shore power, backup power, material handling equipment, and vehicles. According to the U.S. Environmental Protection Agency ("EPA"): "The emissions from goods movement through trucks, marine vessels, trains, cargo handling equipment as well as from stationary sources such as refineries, oil and gas storage facilities, power generation and storage of open coal piles found near port facilities can introduce many air pollutants with the potential to severely impact the health of near-port communities."[9]

Through the study of existing inventories, the U.S. Department of Energy ("DOE") has estimated the timeframe for conversion of equipment from combustion to fuel cells and the hydrogen demand at U.S. ports, including the Port Authority New York and New Jersey. [10] Their study has concluded that:

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[9] *Environmental Justice Primer for Ports* United States Environmental Protection Agency Office of Transportation and Air Quality, EPA-420-B-20-007, March 2020. Available at: https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P100YMNT.pdf

[10] https://www.energy.gov/sites/prod/files/2019/10/f68/fcto-h2-at-ports-workshop-2019-viii3-steele.pdf

- Individual port hydrogen demand at lowest adoption rates justifies pipeline over truck delivery;
- Drayage trucks represent the largest hydrogen use associated with port container operations;
- The 2nd highest hydrogen demand is yard tractors and container handling equipment; and
- Adoption rates can be matched to hydrogen generation capacity growth for optimal utilization and lower and fuel cost.

The tugboat and ferry potential hydrogen demand for New York/New Jersey ports is estimated to be 2,923,535 kg of hydrogen per year.

Fuel cell systems and microgrids can also contribute to the decarbonization of ports, while providing the necessary backup power that avoids further procurement and use of diesel generators.[11] The use of hydrogen and fuel cells in ports for both power and transport represent a near-term opportunity to create environmental justice.

Fuel Cells to Support Grid Electric Vehicle Charging

The Scoping Plan should acknowledge that electric vehicle charging also increases emissions by charging on a grid that is not 100% renewable (and will not be for many years) and that vehicle charging dynamics often also create challenging electricity peaks (e.g., charging vehicles at home in the evening) that cause the increased utilization of dirty combustion peaker plants to meet peak demand.Distributed Energy Resources (DERs) should be considered and evaluated as a solution for charging electric vehicles ("EVs") in planning the transition to Zero-Emission Vehicles and Equipment. Most DER deployments, including fuel cell system installations, result in cost savings for the customer in comparison to retail electric rates. In addition, the ability to co-locate clean power generation at the site of a significant new load, like that associated with charging stations for EVs, could lead to additional benefits for ratepayers. These benefits include cost savings associated with infrastructure investment deferrals, peak demand management, reduced emissions, avoided line and conversion/inversion losses, and increased resiliency that should not be overlooked.

[11] M. MacKinnon, G. Razeghi, S. Samuelsen, *The role of fuel cells in port microgrids to support sustainable goods movement.* Renewable and Sustainable Energy Reviews, Volume 147, September 2021, 111226.

"Non-wires" solutions initiatives in New York and Rhode Island have demonstrated that DER deployments can defer or avoid grid upgrades or reinforcements like those required for EV charging infrastructure.[12] These initiatives place DERs specifically in load constrained circuits to take advantage of the locational benefits of clean distributed technologies. In doing so, these DER-based non-wires solutions leverage existing programs to support clean energy, reduce greenhouse gas and criteria pollutant emissions, and decrease the cost of delivering safe and reliable energy to ratepayers.

Co-locating DERs and EV charging creates a new asset class for utilities to use throughout their service territories. These types of assets can be used for peak demand management and load growth management. Instead of managing concerns associated with demand charges, increasing peak demand, or limitations on vehicle charging or vehicle-to-grid discharge, the combination of flexible load and onsite generation can be used to alleviate grid congestion when needed by simply disconnecting the charging load during peak events and exporting generation to the local grid as needed.

As EV adoption increases, demand for grid electricity will increase at certain times and in certain locations where such loads were not originally planned. Without DER assets, such demands will be met by increased production from marginal generators that send power through existing grid infrastructure (e.g., wires, transformers). Marginal generators are primarily natural gas combustion facilities that are environmentally preferable when compared to gasoline or diesel combustion. These generators, however, still produce considerable GHG and pollutant emissions. Existing grid infrastructure may also become constrained and have higher losses as load grows. Using clean DER, such as fuel cell systems, further improves emissions by adding clean generation, instead of serving load growth with older, existing generation capacity and diesel backup generators, clean DERs also alleviate grid constraints, because generation can be placed where load growth occurs.

Another important benefit of a co-located deployment is the avoidance of line losses and transformer or other conversion/inversion losses. Between 5% and 10% of energy sold throughout the U.S. is lost in the transmission and distribution system, [13,14] but generating power onsite eliminates these losses. In addition, most DERs, including fuel cells, generate direct current power, the same type of power that a battery uses to charge and discharge. Systems can be engineered to allow direct current (DC) charging

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[12] Add Reference

[13] Gustafson, M.W. and J.S. Baylor, Approximating the System Losses Equation, IEEE Transactions on Power Systems, Vol. 4, No. 3, August, 1989.

[14] Energy Information Agency, U.S. Department of Energy, data available on-line at: https://www.eia.gov/electricity/state/

of vehicles to avoid additional conversion/inversion losses. In comparison, grid power is delivered as an alternating current that would need to be converted to direct current, with associated losses that can add up to an additional 10% loss.[15]

Finally, use of high-capacity, resilient DER fuel cells would allow electric vehicles to charge even in the event of a grid outage. Fuel cells are among the most reliable forms of power generation available and serve as the anchor generation for numerous microgrids around the world.

T12. Lower Carbon Renewable Fuels

The NFCRC agrees that a focus on the carbon intensity (federal statute reference) of renewable fuels is the correct metric to ensure desired emission reductions. Consistent with federal policy, the NFCRC would like to highlight the use of a carbon intensity standard[16] for clean hydrogen production such as that being developed by the DOE as mandated by the Infrastructure Investment and Jobs Act, to ensure accurate and consistent measurement of carbon emissions reduction. The Council should avoid the use of the subjective "colors" of hydrogen (e.g., grey, blue, green) and focus instead on the technical and objective carbon intensity standard, especially when analyzing pathways to meet CLCPA objectives, and the Report should reflect this recommendation.

Using a consistent carbon intensity standard will also facilitate implementation of the proposed multi-state hydrogen hubs and a U.S.-wide hydrogen strategy. In addition, including an assessment of the criteria pollutant emissions impacts of various hydrogen production, transmission, distribution, storage and conversion pathways should be added to the assessment of hydrogen pathways and should also be added to the assessment of all emissions mitigation measures.

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[15] Apostolaki-Iosifidou, E., Codani, P., Kempton, W., Measurement of power loss during electric vehicle charging and discharging, Energy, Volume 127, Pages 730-742, 15 May 2017.

[16] H.R. 2684 SEC. 40315. CLEAN HYDROGEN PRODUCTION QUALIFICATIONS. Available at congress.gov: H.R.3684 - 117th Congress (2021-2022): Infrastructure Investment and Jobs Act | Congress.gov | Library of Congress

Chapter 12. Buildings

12.2 Key Sector Strategies

The NFCRC supports the electrification of end-uses coupled to an increasingly renewable electric grid with sufficient storage, demand response, dispatchable renewable generation, and other complementary resources. Complete and resilient decarbonization and elimination of pollutant emissions associated with electric generation cannot be achieved, however, by electrification alone, especially when well-intended decarbonization proposals have the inadvertent effects of diminishing the reliability and resilience of the grid and represent unstudied and significant unknown costs to ratepayers.

A 2021 study commissioned by the New York City Mayor's Office of Sustainability[17] identifies policies and strategies to reach deep decarbonization by mid-century. One of the conclusions of the NYC study is that the remaining gas system can transition to deliver low carbon gas (i.e., hydrogen or renewable methane) for end uses that are too costly and complex to electrify, helping mitigate increases in winter peak electricity demand. Fuel cell systems should be a preferred solution to power difficult-to-electrify buildings and therefore public incentives proposed in 12.2 should not be limited to sources of electrification.

Combustion-based air pollution is harmful to all communities and has disproportionately affected low-income and minority communities. Eliminating air pollution should be just as important as reducing greenhouse gases in advancing environmental justice concerns. Backup diesel generators release greenhouse gases and particulate matter (PM), volatile organic compounds (VOCs), nitrogen oxides (NOx) and sulfur dioxide (SO_2), all of which are harmful criteria air pollutants that create smog and exacerbate respiratory harm, cancer risk, hospitalizations and missed work days.

The Advanced Power and Energy Program at UC Irvine recently conducted a study on the public health impacts resulting from air quality degradation during outages of the

[17] New York City Mayor's Office of Sustainability, *Pathways to Carbon-Neutral NYC: Modernize, Reimagine, Reach* (Apr. 2020), available on-line at: https://www1.nyc.gov/assets/sustainability/downloads/pdf/publications/Carbon-Neutral-NYC.pdf

electric grid.[18] The study concluded that the impacts of diesel backup generators are far more significant than commonly understood and that those impacts are not uniformly distributed across populations but are concentrated in disadvantaged communities. According to research from Cornell University, those human health impacts would be magnified in New York City due to restricted air flow in the "urban canyons" created by tall buildings.[19] Jurisdictions elsewhere have inadvertently expanded the deployment of diesel generators due to building electrification policies that do not provide customers with any feasible option other than a diesel combustion backup generator. Recent analyses based upon data from California Air Quality Management Districts reveal that there has been an increase in diesel backup generator deployments of over twenty percent in southern California and over thirty percent in northern California, *all within one year* of the increased power outages that have occurred for public safety.[20] Meanwhile, the risk of large-scale and long-term outages of the electric grid continues to grow while the rationale that diesel back-up generators will not run very often grows demonstrably false. By contrast, non-combustion technologies like fuel cell powered microgrids can provide a cleaner and more reliable alternative to emergency generators, offering a resilience option to critical facilities from hospitals to data centers, without creating a long-term commitment to fossil fuels and the combustion emissions that affect air quality and human health.

The NFCRC supports directing funding to LMI ratepayers.[21] Some of this funding should be allocated to the replacement of diesel generators for resilient and/or long-duration backup power. Air quality in disadvantaged communities cannot be sufficiently improved without reducing the use of diesel generators.

[18] https://www.apep.uci.edu/PDF/Potential_Public_Health_Costs_from_Air_Quality_Degradation_During_Grid_Disruption_Events_070921.pdf
[19] https://www.sciencedirect.com/science/article/abs/pii/S1352231015002381?via%3Dihub
[20] https://calmatters.org/commentary/2021/10/clear-the-air-of-diesel-generators-that-power-californias-shadow-grid
[21] Scoping Plan, at 132.

Chapter 13. Electricity

13.2 Key Sector Strategies

E1. Retirement of Fossil Fuel Fired Facilities

Both Components of the Strategy for electricity "Assessment and Determination of Emissions Reduction Targets" and "Promulgation of Emissions Regulations" should include sources of backup power, especially in disadvantaged communities.

E2. Accelerate Growth of Large-Scale Renewable Energy Generation

Large-scale resources and Components of the Strategy should not be limited to wind and solar. Hydrogen, electrolyzers and fuel cell systems should be part of this strategy. The Plan should acknowledge that 1) commercial load-following fuel cell systems are capable of demand response and addressing capacity shortfalls, and 2) hydrogen can enable deep decarbonization as a renewable fuel with large-magnitude and long-duration storage.

There is great potential for renewable hydrogen to be a major component of New York's climate strategy. The State's own Climate Action Council Scoping Plan found that as much as 27GW of new, zero-carbon firm capacity may be needed to meet CLCPA targets by 2050, even with a massive buildout of wind and solar. Firm power fuel cells and hydrogen for long-term storage can support renewables and play an important role in meeting the CLCPA objectives while dramatically reducing air quality impacts immediately.

On May 13, 2022, California Governor Newsom announced a $5 billion general fund investment for statewide reliability, with $4.2 billion allocated to a strategic capacity reserve, in the face of a 7,000 MW shortfall in 2022 caused, in-part, by fluctuations in renewable capacity.[22] This capacity reserve is intended to procure new clean and reliable generation and storage resources, including backup power generation. Governor Newsom and the California Energy Commission have stated that fuel cell systems will be included in this procurement.

[22] May Revision – 2022-23, Climate Change at 61. Available at: https://www.ebudget.ca.gov/2022-23/pdf/Revised/BudgetSummary/ClimateChange.pdf

Larger hydrogen fuel cell systems are operating around the world today and leading the transition to zero-emission fuel cell systems. Both front-of-the-meter (FTM) and behind-the-meter (BTM) fuel cell resources are well-suited to resolve transmission and distribution needs. Fuel cell power plants reduce greenhouse gases (GHG) and criteria air pollutants, are efficient, compact, quiet and easy-to-site, and are ideal DER solutions where power is needed near a load. Fuel Cell DER facilities serve loads and can provide benefits to the utility system at the distribution level, whether literally on the customer premises (i.e., BTM), or in any number of FTM utility applications including:

a) at substation interface points acting as load reducers and providing capacity to the regional transmission and distribution system;
b) on utility circuits leading to key customers;
c) as a primary generation resource enabling operation of multi-load, multi-customer utility microgrids;
d) under a combination where a normal FTM resource can serve a dedicated circuit providing a BTM service to a critical customer (e.g., a wastewater treatment plant);
e) under a combination where a normal BTM facility can also provide local load reduction as if an FTM resource under a Net Energy Metering, Demand Side Management (DSM) or export situations.

Fuel cell systems generate 24/7, clean, load-following power at close to 100% capacity factors. Compared to other front-of-the-meter generation resources, the combination of fuel cell high efficiency and extremely high capacity factor results in the displacement of more GHG emissions than equivalent-sized intermittent resources. This high capacity factor corresponds to the production of clean, renewable electric energy (MWh) per unit of power capacity (MW) that is on the order of six (6) times that of solar power systems (assuming a 15% capacity factor for solar) and on the order of three (3) times that of wind power systems (assuming a capacity factor of 30% for wind). Thus, investments in fuel cell solutions produce vastly more energy than wind or solar power systems per unit of capacity installed. When this electric energy is produced at times of low renewable energy availability, the fuel cell systems produce much lower GHG emissions per MWh. This translates into substantially more GHG reductions per MW installed.

Installations of fuel cell systems can be used by the utility to (1) support local capacity and spinning reserve requirements that are used for grid reliability, (2) serve as an alternative to costly utility system transmission and distribution upgrades to this system, and (3) with appropriate rate structures allow dynamic dispatch of the fuel cell systems to enable the grid to integrate more intermittent renewable generation.

Fuel cell systems support the utility grid network and can also provide ancillary services such as:

1. Peak demand reduction;
2. Power quality improvements;
3. Grid frequency and voltage support; and
6. Fast ramping and load-following.

E.3. Facilitate Distributed Generation / Distributed Energy Resources

A multi-pronged approach to distributed generation should include hydrogen and fuel cell systems. Climate resilience hubs based upon solar and storage alone will not create a resilient system for multi-week periods of insufficient solar and wind power and other outages. For large-magnitude and long-duration storage, lithium-ion batteries are limited due to self-discharge and connected power and energy density, in addition to other challenges[23] and are prohibitively expensive for storage durations that extend over days. Strategies for maintaining and improving reliability and resilience, including cleaner and greener long-duration and large magnitude energy resources will be needed for the foreseeable future.

A modern grid and utility infrastructure incorporates resiliency and the features that microgrids can provide into energy resource planning. When paired with storage, wind, solar, demand response, and other technologies, fuel cell systems can serve as the backbone for microgrids that integrate numerous distributed energy resources and controls. Microgrids that use fuel cell systems as baseload power can immediately disconnect from the grid and island (operate autonomously) from the larger grid when circumstances demand (e.g., grid outage). The fuel cell installation innately operates as an energy management system, with critical loads for backup power already identified and immediately followed in the event of an outage. A fuel cell system can smoothly

[23] Saeedmanesh, A., Mac Kinnon, M. and Brouwer, J. *Hydrogen is Essential for Sustainability,* *Current Opinion in Electrochemistry* 2018, 12:166–181.

transition from the grid to fully power the load during a grid outage, without interruption to the end user, and to seamlessly re-connect to the grid when its power is restored. Fuel cells can be, but do not need to be, connected to a storage device to provide these and other resiliency benefits.

Dispatchable fuel cell systems are available on the market and have been used by telecommunications companies for critical backup and primary power at cell phone towers, cable nodes, and telecommunications hubs for nearly two decades. Commercial products are available on the market and have been deployed in government communication networks, telecommunication and utility backup power applications that scale from below 1kW to multi-MW capacities. There are more than 5,000 telecommunication and cable locations using fuel cell systems for backup power in North America, hundreds of which are in California serving power requirements ranging from under 200 Watts to over 10kW in urban, rural, and remote settings. Fuel cell systems have provided backup power to telecommunications during natural disasters like hurricanes in the Southeastern U.S. and the Caribbean, and in California after earthquakes and wildfires. During Hurricane Sandy in 2012, fuel cell systems were instrumental in providing backup power for cell towers and keeping cell phone communications open for many in New York, New Jersey and Connecticut.[24]

Fuel cell systems that can run on stored hydrogen - scalable to the required runtime - have been commercially deployed since the early 2000s. Other fuel cell systems that are used for cell tower backup power can run on a mixture of methanol/water fuel, which can reduce total system footprint for extended runtime (beyond 72 hours). Higher power fuel cell systems (200 kW and up) that use biogas or natural gas are also being used today by telecommunications providers such as AT&T[25], Cox[26] and Verizon.[27] These systems are grid-connected and seamlessly take over the load

[24] U.S. Department of Energy, Calling All Fuel Cells, December 7, 2012. Available at: https://www.energy.gov/articles/calling-all-fuel-cells

[25] AT&T Progress Toward our 2020/2025 Goals, at 4. Available at: https://about.att.com/content/dam/csr/sustainability-reporting/PDF/2017/ATT-Goals.pdf

[26] Doosan Fuel Cell America Project Profile: Cox Communications. Available at: http://www.doosanfuelcellamerica.com/en/news-resources/project-profiles/

[27] GreenTech Media, Verizon's $100M Fuel Cell and Solar Power Play, April 30, 2013. Available at: https://www.greentechmedia.com/articles/read/verizons-100m-fuel-cell-and-solar-power-play

during a grid outage. They also operate as long as fuel is available, and have run for weeks at a time during extended outages in the Northeast.

E6. Deploy Existing Storage Technologies

Hydrogen should be considered as part of the portfolio of energy storage technologies that can be used for long-duration storage. Renewable or "green" hydrogen generated through electrolysis is a unique resource that offers important features and technical capabilities for optimal use of renewable electricity. Because hydrogen can be generated during peak production of renewables and stored indefinitely, it can be used to store massive amounts of renewable electricity for later conversion via a fuel cells to generate electricity during times of peak demand and when intermittent renewables are temporarily or seasonally insufficient. And because hydrogen is a versatile gas, it can be conveyed through pipeline systems to efficiently convey stored renewable electricity – stored and transmitted as a gas – to where it is most needed. As a means of energy storage, hydrogen fills a gap left by a batteries-only approach due to features of separate power and energy scaling that enables less expensive massive energy storage and negligible self-discharge which enables long duration storage, thereby enabling deeper emissions reductions. In short, a Scoping Plan that includes hydrogen is well positioned to power massive electrification and near-complete GHG and criteria pollutant emissions reductions. In addition, hydrogen is uniquely versatile in that it can also be used as renewable gas for customers that cannot afford electrification, or those who cannot easily electrify their end uses (e.g., steel, cement, glass, ammonia, and plastics manufacturing), or those who prefer to continue using some form of gas for end uses.

Anticipated costs and commercial risks of hydrogen will decrease over time and these costs and risks are especially likely to decline in the context of many jurisdictions that have decided to significantly invest in hydrogen and hydrogen infrastructure. These jurisdictions include Australia,[28] France,[29] Germany,[30] Korea,[31] the Netherlands,[32] Portugal,[33] and the United Kingdom.[34, 35, 36] who have each committed around $10 billion to support hydrogen production, storage, transmission and distribution, and conversion infrastructure. The goal of the USA effort is to achieve $1/kg H_2 within one decade, which is more than an 80% reduction in cost. The aforementioned 2021 New York City study also estimates significant declines in the cost of hydrogen and other renewable fuels from 2030 to 2050.[37] Given the fast pace of development in the hydrogen space that is occurring all around the world, we encourage the Independent Consultants to emphasize the importance of ensuring that the LDC plans are updated frequently to account for technological advances and cost reductions that will be especially significant for emerging technologies such as electrolysis, hydrogen storage, and fuel cell systems.

Acknowledgments of the value of hydrogen and the critical role it could play in deep global decarbonization are coming to the forefront. An April 2021 a study conducted by the Center for Global Energy Policy at Columbia University cites several other studies of decarbonization pathways, including those from the University of California Berkeley and Princeton University, all of which conclude that some components and features of the gas system need to remain active and must be repurposed for renewable fuels to attain 100% decarbonization.[38] The 2021 Hydrogen Insights report from McKinsey & Company and the Hydrogen Council went deeper into the economic implications, and offers a comprehensive perspective on market deployment around the world, investment momentum as well as implications on cost competitiveness of hydrogen solutions. The report states that:

[28] https://arena.gov.au/news/hydrogen-to-be-trialled-in-nsw-gas-networks/
[29] https://fuelcellsworks.com/news/french-minister-unveiled-his-100m-hydrogen-plan/
[30] https://www.dena.de/en/topics-projects/projects/energy-systems/power-to-gas-strategy-platform/
[31] https://www.rechargenews.com/energy-transition/our-largest-energy-source-south-korea-plans-40-foreign-hydrogen-bases-to-meet-vast-future-demand/2-1-1110526
[32] https://www.mhps.com/news/20180308.html
[33] https://www.iea.org/policies/12436-hydrogen-strategy
[34] https://networks.online/gphsn/news/1000904/trial-explore-blending-hydrogen-gas-network
[35] *Id.*
[36] https://www.telegraph.co.uk/business/2018/01/06/hydrogen/
[37] *Id.* at xvii.
[38] Blanton, E. M., Lott, Dr. M. C. and Smith, K. N., *Investing in the U.S. Natural Gas Pipeline System to Support Net-Zero Targets*, Center on Global Energy Policy at Columbia University School of International and Public Affairs (Apr. 2021), available at: https://www.energypolicy.columbia.edu/research/report/investing-us-natural-gas-pipeline-system-support-net-zero-targets.

- Hydrogen pipelines are cheaper than electricity transmission lines.
- Hydrogen pipelines can effectively transport renewable hydrogen across long distances.
- They can transport 10 times the energy at one-eighth the cost associated with electricity transmission lines.
- Hydrogen pipelines have a longer lifespan than electricity transmission lines and offer dual functionality, serving as both a transmission and storage medium for green energy.[39]

In *Exhibit 13: Comparing Hydrogen Pipelines*, the Hydrogen Insights report shows cost estimates of hydrogen networks that vary by type, length of network, and the condition of the retrofitted pipeline itself.[40] These are just narrow cross sections of examples demonstrating both rapid technological change and the potential for hydrogen to drive deeper emissions reductions than strategies that are possible compared to those strategies that do not consider renewable gases altogether.

Planning and forecasting for the future gas system must be based on accurate forecasts of the potential volumes of renewable gas hat could be produced, including renewable hydrogen; the potential for distributed fuel cells fueled by hydrogen as a flexible, dispatchable, long duration of operation, and zero emissions resource; and the uses of the gas system, including service as a long duration storage resource and to supply decarbonized gas for various end-uses (e.g., zero carbon electricity generation, building energy, industrial energy), in a future in which New York meets its zero emission goals.

Chapter 14. Gas System Transition

The Scoping Plan should emphasize the impracticable costs to ratepayers for 100% electrification and supplement the final report with studies that demonstrate the ratepayer benefits of electrification whenever possible as complemented by the repurposing the

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[39] Hydrogen Council, McKinsey & Company, *Hydrogen Insights A perspective on hydrogen investment, market development and cost competitiveness*, p. 20 (Feb. 2021), available at: https://hydrogencouncil.com/en/hydrogen-insights-2021/.

[40] *Id.* at 21.

natural gas system. The NFCRC underscores the very risky financial and resilience/reliability proposition associated with 100% decommissioning of the gas system, and, conversely, references the well-studied costs and technical analyses of hydrogen production and distribution. Decommissioning the pipeline distribution network will have massive costs as the issue of stranded assets puts financial pressure on a declining number of ratepayers.[41] The value of transforming the gas system has not been thoroughly or reasonably assessed. It is certain that the full economic impact of decommissioning is unknown and the value of transformation to service of a zero-emissions energy system should be determined.

The evaluation of whether using existing portions of the gas system to transmit, distribute and store hydrogen or hydrogen blends to reduce greenhouse gas emissions and co-pollutants, should be restored to the Scoping Plan, after its last-minute removal at the December 2021 Climate Action Council meeting. The Climate Action Council should be required to look to other states and countries that are decarbonizing their natural gas systems to garner scientific insights into the features, values and best practices for achieving zero emission to promote objectivity and administrative efficiencies.

In fact, a study on tactical decommissioning of portions of the natural gas system is currently underway by the California Energy Commission, SoCalGas, and Rand Corporation.[42] The study is expected to tackle the issues of transition costs and strategic decommissioning. Until such a study is available for this proceeding, any cost analysis of 100% electrification will be incomplete and risks unduly burdening a declining number of gas customers with high energy costs as others are transitioned off the system.

In terms of assessing the true costs of efficient gas scenarios, the comprehensive vision laid out in *Extending the European Hydrogen Backbone* represents a pan-European view of hydrogen production, transmission, distribution and storage infrastructure to 2040, including estimated investment and operating costs,[43] further

[41] Draft Report, Part I: Decarbonization Pathways, pp 11, 14.

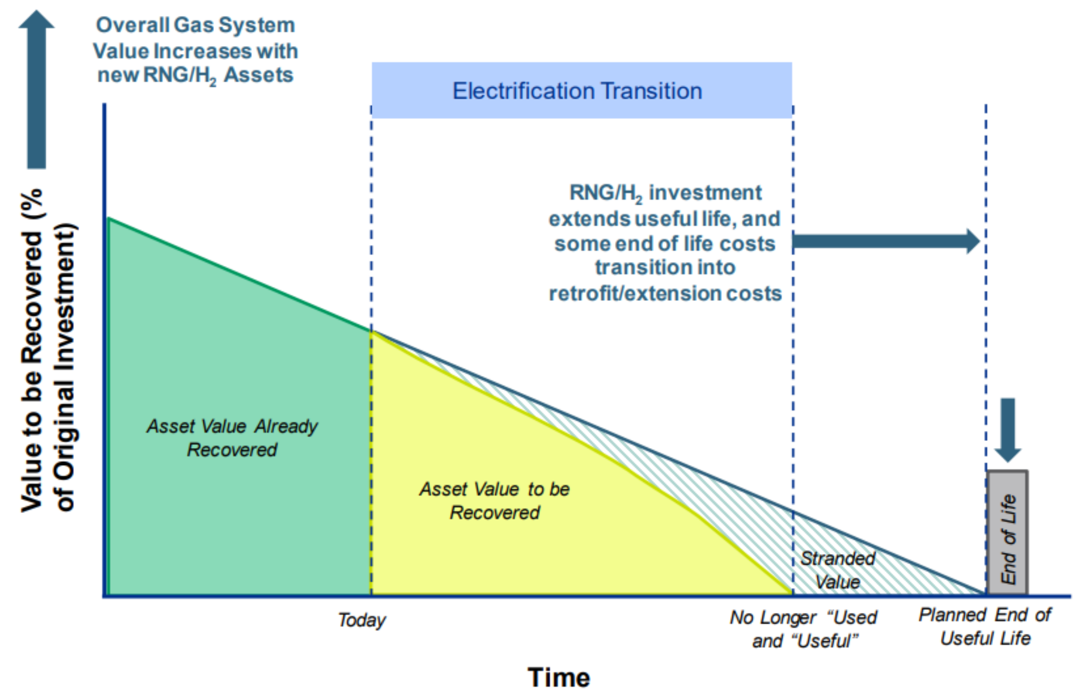
[42] *See* California Energy Commission, *Staff Workshop on Strategic Pathways and Analytics for Tactical Decommissioning of Portions of Natural Gas Infrastructure*, Docket 19-ERDD-01, available at: https://www.energy.ca.gov/event/workshop/2021-11/staff-workshop-strategic-pathways-and-analytics-tactical-decommissioning .

[43] Jens, J., Wang, A., van der Leun, K., Peters, D., Buseman, M. *Extending the European Hydrogen Backbone: a European Hydrogen Infrastructure Vision Covering 21 Countries*, Guidehouse (Apr. 2021), available at:

illustrating the availability of cost information for efficient gas scenarios in contrast to the unknown burden of decommissioning.

In addition, the cost savings of utilizing the gas system for decarbonization are not a new revelation. In a 2019 report by the Environmental Defense Fund (EDF) on stranded gas assets in California EDF included an analysis of alternative uses of existing assets. The following chart from the report highlights the substantial cost savings of repurposing gas infrastructure to meet emissions reduction targets compared to abandoning the system before end-of-life.[44]

Finding Alternative Uses for Gas Assets



[78] de Santoli, L., Paiolo, R., & Lo Basso, G. (2017). An overview on safety issues related to hydrogen and methane blend applications in domestic and industrial use. Energy Procedia.
[79] International Energy Agency. (2015). Technology Roadmap: Hydrogen and Fuel Cells.
[80] NREL. (2013). Blending Hydrogen into Natural Gas Pipeline Networks: A Review of Key Issues.

This chart shows how repurposing natural gas infrastructure can significantly reduce the stranded cost and ratepayer equity issues. Additionally, by maintaining gas infrastructure and upgrading it for use by renewable and zero carbon gases, New York

https://gasforclimate2050.eu/wp-content/uploads/2021/06/European-Hydrogen-Backbone_April-2021_V3.pdf
[44] Environmental Defense Fund, Managing the Transition: Proactive Solutions for Stranded Gas Asset Risk in California (2019), available at: https://www.edf.org/sites/default/files/documents/Managing%20the%20Transition_1.pdf

will be able to keep the existing gas infrastructure workforce, while also adding value to it and creating new industries with new jobs that have long-term viability.

The Scoping Plan should encourage adoption of protections for gas customers left on the system. The NFCRC has observed significant discussion about the customers that will remain on the gas system as its use is phased out, and how they will be left to bear significant and disproportionate costs.[45] The NFCRC recommends some approaches to address this significant concern. First, the final report should clearly state that customers that remain on the system are still protected by the "just and reasonable" rate standard and therefore will be protected from unreasonable costs. Second, to continue achieving emissions reductions while protecting those customers, the final report should highlight the additional benefits of repurposing the natural gas infrastructure to utilize renewable gases; this permits those customers to stay on the system with reasonable prices while ensuring continued emissions reductions.

The Center for Global Energy Policy (at Columbia University) study concludes with clear recommendations that support these approaches to protect consumers who remain on the gas system, such as recommending that we should:

- Accelerate the pace to replace remaining cast-iron pipelines—which constitute a small percentage of the existing infrastructure but are responsible for an outsized percentage of methane leaks and are also incompatible with transporting hydrogen—and mandate replacement of aging pipelines.
- Adopt state-level methane reduction targets for gas utilities.[46]
- Update federal pipeline standards to require annual inspections, change the criteria for which leaks need to be repaired, and require all leaks be reported.
- Conduct state-level inventories of the metallurgy in their pipeline infrastructure to identify parts most compatible with increased hydrogen usage, while questions surrounding how best to blend hydrogen and other zero-carbon fuels into the system

[45] Draft Report, Part I: Decarbonization Pathways, pp. 92 & 95.
[46] Such a program already exists in Massachusetts. Under 310 CMR 7.73: Reducing Methane Emissions from Natural Gas Distribution Mains and Services, distribution system owners are required by the Massachusetts Department of Environmental Protection to meet annually-declining emissions caps. This is implemented in concert with the DPU's Gas System Enhancement Plan (GSEP) which requires pipeline replacements based on material type, targeting total replacement of leak-prone pipes.

undergo further study. Require that mains replacement programs use hydrogen-compatible plastic pipes.

- Consider specific rate add-ons that allow states to modify the system to accommodate hydrogen if those modifications can be made without an undue burden on ratepayers, especially lower income groups.[47]

The Climate Action Council should consider such recommendations and conduct further analysis on the cost of decommissioning versus conversion, including the detailed impacts on ratepayers. Other concepts that should be explored include departing load charges for customers leaving the gas system and transitioning gas rates to a fixed plus variable structure that better aligns with cost causation than current predominantly volumetric rates.

IV. Conclusion

The NFCRC greatly appreciates the tremendous effort of the Climate Action Council to put together this comprehensive draft Scoping Plan, and we appreciate the opportunity to comment. The NFCRC emphasizes that a diversity of fuel sources and distributed energy resources must be available to enable the 100% renewable grid in the future is critical to meeting New York policy goals. Essential to this required diversity is clean, firm, 24/7, dispatchable power generation that can address the realistic integration of renewable and distributed resources.

[47] Blanton, E. M., Lott, Dr. M. C. and Smith, K. N. *Investing in the U.S. Natural Gas Pipeline System to Support Net-Zero Targets*, Center on Global Energy Policy at Columbia University School of International and Public Affairs, p. 7 (Apr. 2021), available at: https://www.energypolicy.columbia.edu/research/report/investing-us-natural-gas-pipeline-system-support-net-zero-targets .