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Memorandum

To:	Caitlyn Nichols, Division of Environmental Permits New York State Department of Environmental Conservation
From:	Henry Kearney, Kevin Edwards
Date:	October 20, 2021
Re:	National Grid Greenpoint Energy Center – CLCPA GHG Assessment
cc:	Linda Sullivan, Cathy Waxman/National Grid; Sheveta Sharma/AKRF

INTRODUCTION

In July of 2019, New York State enacted the Climate Leadership and Community Protection Act (CLCPA) establishing statewide greenhouse gas (GHG) emission limits that represent a 40 percent reduction from 1990 levels by 2030, and an 85 percent reduction from 1990 levels by 2050. Among other requirements to meet the state's emission reduction goals, the CLCPA directs state agencies to determine if their decisions are consistent with the statewide GHG emission limits established by the CLCPA in Environmental Conservation Law (ECL) Article 75. In the case of the New York State Department of Environmental Conservation (NYSDEC), a CLCPA consistency determination is required for applications for new state facility permits, new Title V permits, and significant modifications to state facility permits and Title V permits.

The Brooklyn Union Gas Company dba National Grid NY (National Grid) is seeking to re-permit the Greenpoint Energy Center from a Major Title V permit to an Air State Facility (ASF) permit, as well as install two new liquified natural gas (LNG) vaporizers. The ASF permit will include new permit conditions to cap or limit emissions of nitrogen oxides (NO_x) to less than 25 tons per year, which is roughly half the existing Title V permit limit. The new vaporizers (Vaporizers 13 and 14) will be located within the existing footprint of the 118-acre site.

As requested by NYSDEC, a CLCPA consistency assessment was performed for the combustion equipment proposed for the Greenpoint LNG Plant, as discussed in more detail below. The assessment demonstrates that the proposed project would result in a decrease of the energy consumption and GHG emissions from the facility's vaporizers, making it consistent with the CLCPA goals.

METHODOLOGY FOR ESTIMATING GHG EMISSIONS

POLLUTANTS OF CONCERN

GHGs are those gaseous constituents of the atmosphere, both natural and anthropogenic, that absorb and emit radiation at specific wavelengths within the spectrum of infrared radiation emitted by the Earth's surface, the atmosphere, and clouds. The general warming of the Earth's atmosphere caused by this phenomenon is known as the "greenhouse effect." The United States Environmental Protection Agency (EPA) identifies seven types of GHGs that are relevant for GHG inventory purposes: carbon dioxide (CO_2), nitrous oxide (N_2O), methane (CH_4), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), nitrogen trifluoride (NF_3), and sulfur hexafluoride (SF_6). There are no significant direct or indirect sources of HFCs, PFCs, NF_3, or SF_6 associated with the facility; therefore, the GHG assessment of the facility focuses on CO_2, N_2O, and methane.

To present a complete inventory of all GHGs, component emissions are added together and presented as carbon dioxide equivalent (CO_2e) emissions—a unit representing the quantity of each GHG weighted by its effectiveness using CO_2 as a reference. This is achieved by multiplying the quantity of each GHG emitted by a factor called global warming potential (GWP). GWPs account for the lifetime and the radiative forcing[1] of each chemical over a period of 20 years (e.g., CO_2 has a much shorter atmospheric lifetime than N_2O and therefore has a much lower GWP). The GWPs for the main GHGs discussed here are presented in **Table 1**.

Table 1
Global Warming Potential (GWP) for Major GHGs

Greenhouse Gas	20-Year Horizon GWP
Carbon Dioxide (CO_2)	1
Methane (CH_4)	84
Nitrous Oxide (N_2O)	264
Source: 6 NYCRR 496.5	

STATEWIDE GHG INVENTORY AND EMISSION LIMITS

As part of the regulations adopted at 6 NYCRR Part 496 in 2020, the New York State Energy Research and Development Authority (NYSERDA) developed the 1990 baseline GHG emissions for New York State consistent with the calculation requirements specified under the CLCPA. The statewide inventory is separated into four sectors and includes:

1. Energy Sector—This sector includes direct fuel combustion within the state (associated with building fuel usage, vehicle travel, and electricity generation), fugitive emissions within the state (associated with emissions released during production and transportation of fuels), electricity transmission (associated with the leakage of GHGs during the manufacture, use, and disposal of equipment used in the transmission and distribution of electricity), fuels imported into the state (associated with emissions from out of state industrial production and transportation), and electricity imported into the state (associated with emissions from out of state generation and transmission).
2. Industrial Processes and Product Use—This sector includes emissions from the manufacturing process or from a manufactured product and are separate from the combustion of fossil fuels by industries, which is accounted for in the Energy sector.
3. Agriculture Forestry and Other Land Use—This sector includes emission sources associated with land management relating to livestock, land use, and other agriculture sources.

[1] *Radiative forcing* is a measure of the influence a gas has in altering the balance of incoming and outgoing energy in the Earth-atmosphere system and is an index of the importance of the gas as a GHG.

4. Waste—This sector includes emissions associated with solid waste disposal, biological treatment of solid waste, waste combustion, and wastewater treatment.

The GHG inventory performed by NYSERDA determined a statewide 1990 annual baseline emission total of 409.78 million metric tons (MMT) of CO_2e. Subsequently, this established the statewide annual CO_2e emission limits for 2030 and 2050 as 245.87 MMT and 61.47 MMT, respectively.

PROCESS DECSCRIPTION

The LNG plant at the Greenpoint Energy Center has been in service since 1968 to supplement the gas supply to customers on the coldest days of the year. The plant liquifies and stores gas from the National Grid system during low demand periods, and the plant vaporizes LNG to return gas to the system when it is needed most. LNG is currently stored at the facility in two existing storage tanks, which are not changing as part of the proposed project. LNG is vaporized on peak demand days (typically during the coldest days of the year) to ensure there is adequate capacity in National Grid's gas system to service its customers.

The proposed project would involve installation of two new 42.76 MMBtu/hr vaporizers to provide natural gas to the National Grid system from stored LNG and would reduce the facility's reliance on the existing 48.0 MMBtu/hr vaporizers. The proposed new vaporizers operate with an improved energy efficiency of 95.8 percent compared to the existing units with an energy efficiency of 92.4 percent.

The new vaporizers do not increase annual output from the facility or frequency of plant operation because vaporization at the facility is limited by the capacity of the existing storage tanks. Liquefaction is a slow process that occurs over an extended period of time during periods of low demand, such that it takes approximately 225 days to fill the existing storage tanks, which as mentioned previously are not changing as part of the proposed project. Furthermore, the liquefaction process cannot occur simultaneously with vaporization, so it does not occur during the peak heating season. Vaporization, on the other hand, is a quick process, such that the storage tanks can be emptied in approximately 6-10 days. The new vaporizers will allow the facility to vaporize its current annual capacity at a faster rate to meet demand during short-term, high demand periods, with redundancy in the event of equipment failure. The vaporizers are operated infrequently but are critical to the overall gas supply portfolio. In addition to energy efficiency and gas conservation measures, this project is one of the alternatives needed to meet peak demand pursuant to National Grid's Natural Gas Long-Term Capacity Supplemental Report.

The assessment of GHG emissions estimated the amount of LNG vaporized per year as 90 percent of the facility's total storage capacity—approximately 17.7 million gallons per year of LNG vaporized which is equivalent to 1.44 billion standard cubic feet of natural gas per year (scf/yr).[2] The heat output from the vaporizers to vaporize this amount of LNG within a single year was conservatively estimated by assuming the existing vaporizers would operate at full load for 14 days (336 hours). This results in approximately 81,265 MMBtu heat output from the vaporizers. This level of operation is well beyond the anticipated operating hours of the facility but is used in the ASF permit application as an overly conservative estimate (note that vaporization operation is also limited by the proposed NO_x emission cap for the ASF permit). The proposed project will not change the facility's LNG storage capacity, the amount of LNG vaporized, or increase transport of natural gas to the site for liquefaction.

GHG EMISSIONS

As discussed above, the proposed new natural gas-fired vaporizers operate with an improved energy efficiency of 95.8 percent compared to the existing units with an energy efficiency of 92.4 percent. While the new vaporizers would not completely replace the existing units, the assessment of the facility's GHG emissions demonstrated that the use of the new, more efficient vaporizers would result in a decrease of the

[2] The LNG tanks cannot be fully emptied under normal operations, so the estimated volume that can be vaporized assumes that the tanks are emptied to a minimum of 10 percent capacity, as per National Grid.

natural gas consumption from the facility's vaporizers—86,439 MMBtu per year using the existing vaporizers compared to 85,404 MMBtu per year when fully utilizing the new units.

GHG emissions from the vaporizers were calculated based on estimated fuel consumption over a single year. The quantity of fuel was then multiplied by emission factors of 54.55 grams CO_2e per standard cubic feet of natural gas taken from EPA Emission Factors for Greenhouse Gas Inventories for stationary combustion.[3] These emissions would correlate to direct fuel combustion under the Energy Sector of the 1990 baseline GHG Inventory.

Upstream emissions were projected for the annual fuel consumed by the vaporizers. Upstream emission factors for natural gas have been specified by NYSDEC for upstream and out-of-state emissions.[4] Fuel may originate from either in-state or out-of-state sources; therefore, portions of the facility's upstream emissions would correlate to the Industrial Processes and Product Use Sector as fuel production emissions. The remaining portion would correlate to the Energy Sector as either direct fuel combustion associated with in-state vehicle travel, fugitive emissions occurring within the state, as well out-of-state emissions associated with the production and transport of imported fuel.

Additionally, the upstream emissions associated with the natural gas delivered to the site for LNG storage and the downstream emissions of CH_4 associated with the distribution of natural gas from the site after vaporization was included. In this situation, the quantity of fuels to be produced, transported to the site, and distributed from the site will be the same before and after the proposed project. This is because the amount of natural gas is limited by the existing capacity of the LNG storage tanks, which are not changing as part of the proposed project. The proposed project does not increase gas supply to the region from interstate pipelines.

The fuel consumption, usage, emission factors, and resulting GHG emissions for the vaporizers for the existing facility and the proposed project are presented in **Tables 2** and **3**.

Table 2
Existing Facility Annual GHG Emissions from Fuel Consumption

Type	Annual Usage	Category	Emission Factors			Emissions (metric tons CO_2e/year)
			CO_2	CH_4	N_2O	
Natural Gas for Vaporizers	84,744,471 scf	Direct(1)	53,060 g/MMBtu	1.00 g/MMBtu	0.10 g/MMBtu	4,596
		Upstream(2)	11,913 g/MMBtu	384 g/MMBtu	0.136 g/MMBtu	3,821
					Natural Gas Total	**8,417**
Natural Gas for LNG	1,440,000,000 scf	Direct (1)	53,060 g/MMBtu	1.00 g/MMBtu	0.10 g/MMBtu	0 (4)
		Upstream(2)	11,913 g/MMBtu	384 g/MMBtu	0.136 g/MMBtu	64,928
		Downstream (3)	N/A	23 g/MMBtu	N/A	2,838
					LNG Total	**67,776**
					Facility Total	**76,183**

Notes:
scf—standard cubic feet
g—grams
MMBtu—million British thermal units

(1) Direct emission factors for natural gas consumption taken from EPA Emission Factors for Greenhouse Gas Inventories for stationary combustion (https://www.epa.gov/sites/production/files/2020-04/documents/ghg-emission-factors-hub.pdf).

[3] EPA. *Emission Factors for Greenhouse Gas Inventories*. 26 March 2020.

[4] NYSDEC. *Preliminary Interim Draft Emission Factors for Use by State Agencies and Project Proponents*. February, 2021

(2) Upstream emission factors for natural gas and diesel fuel specified by NYSDEC, *Preliminary Interim Draft Emission Factors for Use by State Agencies and Project* Proponents, February, 2021.
(3) Downstream emissions of CO_2 or N_2O are not anticipated. Downstream CH_4 emission factors for natural gas specified by NYSDEC, *Preliminary Interim Draft Emission Factors for Use by State Agencies and Project Proponents*, February, 2021.
(4) No direct emissions are associated with the vaporized LNG. However, the assessment includes the upstream emissions associated with the extraction and transport of natural gas to the facility for liquefaction and vaporization.

Table 3
Proposed Facility Annual GHG Emissions from Fuel Consumption

Type	Annual Usage	Category	Emission Factors			Emissions (metric tons CO_2e/year)
			CO_2	CH_4	N_2O	
Natural Gas for Vaporizers	83,729,882 scf	Direct(1)	53,060 g/MMBtu	1.00 g/MMBtu	0.10 g/MMBtu	4,541
		Upstream(2)	11,913 g/MMBtu	384 g/MMBtu	0.136 g/MMBtu	3,775
					Natural Gas Total	**8,316**
Natural Gas for LNG	1,440,000,000 scf	Direct (1)	53,060 g/MMBtu	1.00 g/MMBtu	0.10 g/MMBtu	0 (4)
		Upstream(2)	11,913 g/MMBtu	384 g/MMBtu	0.136 g/MMBtu	64,928
		Downstream (3)	N/A	23 g/MMBtu	N/A	2,838
					LNG Total	**67,776**
					Facility Total	**76,082**

Notes:
scf—standard cubic feet
g—grams
MMBtu—million British thermal units

(1) Direct emission factors for natural gas consumption taken from EPA Emission Factors for Greenhouse Gas Inventories for stationary combustion (https://www.epa.gov/sites/production/files/2020-04/documents/ghg-emission-factors-hub.pdf).
(2) Upstream emission factors for natural gas and diesel fuel specified by NYSDEC, *Preliminary Interim Draft Emission Factors for Use by State Agencies and Project* Proponents, February, 2021.
(3) Downstream emissions of CO_2 or N_2O are not anticipated. Downstream CH_4 emission factors for natural gas specified by NYSDEC, *Preliminary Interim Draft Emission Factors for Use by State Agencies and Project Proponents*, February, 2021.
(4) No direct emissions are associated with the vaporized LNG. However, the assessment includes the upstream emissions associated with the extraction and transport of natural gas to the facility for liquefaction and vaporization.

Due to the reduced on-site natural gas consumption from the proposed project, the facility's direct GHG emissions are estimated to decrease by up to 101 metric ton of CO_2e per year. Total emissions from the vaporizers are estimated to be 76,183 metric tons (with 8,417 metric tons associated with the natural gas combusted on site, and 67,776 metric tons with the natural gas stored as LNG) when using the existing units and 76,082 metric tons (with 8,316 metric tons associated with the natural gas combusted on site, and 67,776 metric tons with the natural gas stored as LNG) when fully utilizing the new vaporizers units. Similarly, co-pollutant emissions would also decrease by a similar amount. The emissions calculations are attached to this memorandum.

ADDITIONAL GHG EMISSION REDUCTION MEASURES

National Grid and its affiliates have developed a comprehensive strategy to meet a goal of achieving net zero GHG emissions by 2050. It is actively working with various stakeholders to consider various pathways to meeting these decarbonization and efficiency goals in its downstate New York service territories. National Grid's net-zero ambitions are built upon several principles for achieving carbon reductions,

including: targeting the highest-emitting fuels and sectors; optimizing the utilization of existing energy networks; and maintaining affordability through the strategic use of electricity and natural gas. To that end, National Grid has made commitments to implement various investments and programs intended to advance decarbonization goals. These include:

- A commitment to manage National Grid's business with the goal of reducing billed gas usage, not engage in gas marketing activities, eliminate financial incentives for adding new customers, terminate any gas conversion and other incentive programs, and work with various parties (i.e., electric utilities and trade organizations) to promote the adoption of geothermal and other alternative energy options;
- Providing more than $118 million of funding for energy efficiency and demand response programs to allow National Grid to meet the targets for these programs in order to obtain cost recovery of new long-term capacity projects;
- Collaborating with the NYC Mayor's Office of Sustainability and Con Edison on Pathways to Carbon-Neutral NYC to identify three emissions reduction options for NYC to deeply decarbonize by 2050;
- Providing funding for the replacement of more than 650 miles of leak-prone pipe over the next three years to reduce methane emissions; and
- Developing less capital intensive means of reducing emissions in future years, including a program to implement an Enhanced High Emitter Methane Detection Program that will target leaks of ten standard cubic feet per hour or greater for repair or replacement.

National Grid's plan to achieve net zero GHG emissions also includes the following key components:

- A plan to transition from well field natural gas to low- and zero-carbon renewable natural gas (RNG) and hydrogen;
- Investing in transmission projects to support large scale renewable sources of electricity, including on-shore and off-shore wind, and solar;
- Improvements to modernize the grid infrastructure for connection to distributed generation sources;
- Investing in battery energy storage systems to better integrate renewable energy sources into the grid;
- Continuing its efforts to reduce emissions of SF6, which has resulted in a greater than 80% reduction since 2000, by installing no new equipment using SF6 by 2028 and reducing total leaks by 50% by 2030 with the goal to eliminate all SF6 in its equipment by 2050;
- Promoting electric vehicle (EV) adoption and EV charging infrastructure through investments in clean fuel fleet vehicles and improvements in grid infrastructure; and
- Plans to use carbon capture and carbon offset programs where necessary to achieve carbon reduction goals.

National Grid has also previously taken steps to reduce GHG emissions at the Greenpoint Energy Center, including the recent replacement of Vaporizers 3 and 4 with new, more efficient Vaporizers 11 and 12.

These plans and commitments will provide immediate benefits in terms of reducing GHG emissions and encouraging the adoption of electrification and other non-pipe alternatives, while laying the groundwork for further progress. Furthermore, increased use of renewable natural gas or hydrogen is expected to also help New York City achieve its GHG reduction goals as specified under Local Law 97, by allowing users with properties too large or complex to convert to full electrification to use low carbon gas.

In the future, with increased electrification, it is anticipated that the proposed vaporizers will run less frequently. In the meantime, National Grid has a duty to maintain its infrastructure and reliably serve its customers in all types of weather and under all conditions. Vaporizers 13 and 14 are needed to ensure adequate supply to meet peak demand on the coldest days of the year.

CONCLUSIONS

The quantified GHG emission reductions, along with the renewable energy, resiliency, and energy efficiency programs being implemented by National Grid, ensure consistency with the emission reduction goals of the CLCPA when compared to the 1990 baseline, demonstrating a continued commitment to energy reduction that has already resulted in significant reductions in GHG emissions. Additionally, the commitments to achieve net zero GHG emissions by 2050 will result in continued reductions in GHG emissions. Therefore, the GHG emissions associated with the proposed project are consistent with the emission reduction goals of the CLCPA and would not interfere with achieving the statewide GHG emission limits of the CLCPA.

EMISSION CALCULATIONS

National Grid
Greenpoint Energy Center
Summary

	Annual Vaporizer Fuel Consumption			
	Existing Facility	**Future Conditions**	**Change**	**Perecnt Change**
Vaporizers	86,439.36	85,404.48	-1,035	-1.2%

	Annual GHG Emission Summary (metric ton CO2e/yr)			
	Existing Facility	**Future Conditions**	**Change**	**Perecnt Change**
Vaporizers	8,417	8,316	-101	-1.2%
LNG Storage	64,928	64,928	0	0.0%
Total	73,345	73,244	-101	-0.1%

	Annual HAPS Emission Summary (ton/yr)			
	Existing Facility	**Future Conditions**	**Change**	**Perecnt Change**
Vaporizers	0.080	0.079	-0.001	-1.2%

	Annual Vaporizer Heat Output for Vaporization (MMBtu/yr)			
	Existing Facility	**Future Conditions**	**Change**	**Perecnt Change**
Vaporizers	81,264.96	81,264.96	0	0.0%

Note: The amount of LNG the vaporizers would process would remain the same with the proposed project. Therefore the quantity of natural gas transported to the site for liquification would not change, there would be no change in the emissions associated with the production and transportation of natural gas to the site. Also, the heat output of the vaporizer would remain the same.

National Grid
Greenpoint Energy Center
Vaporizer Information

High Pressure Vaporizers	7, 8, 12
Low Pressure Vaporizers	9, 10, 11, 13, 14

Information received from Grid via email dated 9/8/2021

The new vaporizers are about 2-3% more efficient. The efficiency is primarily gained by the new vaporizers (GP LNG Vaps 11, 12, 13, 14) being single burner versus the existing units being multi burner (GP LNG Vaps 7, 8, 9, 10). Please note how low pressure versus high pressure impacts efficiency as well.

High Pressure Vaporizers (350 PSIG Send-Out)	
Multi Burner (Existing Vaporizers)	**Single Burner (New Vaporizers)**
Efficiency (HHV) = Heat Transferred/Fuel Firing Rate = (39.7 MM Btu/hr) / (42.3 MM Btu/hr) = 93.8%	Efficiency (HHV) = Heat Transferred/Fuel Firing Rate = (39.7 MM Btu/hr) / (41.3 MM Btu/hr) = 96.1%
Low Pressure Vaporizers (60 PSIG Send-Out)	
Multi Burner (Existing Vaporizers)	**Single Burner (New Vaporizers)**
Efficiency (HHV) = Heat Transferred/Fuel Firing Rate = (40.92 MM Btu/hr) / (44.3 MM Btu/hr) = 92.4%	Efficiency (HHV) = Heat Transferred/Fuel Firing Rate = (40.92 MM Btu/hr) / (42.76 MM Btu/hr) = 95.8%

Facility Summary

Vaporizer Unit	Capacity (MMBtu/hr)	High Pressure (HP)/ Low Pressure (LP)	Multi Burner (M)/ Single Burner (S)	Fuel Firing Rate (MMBtu/hr)	Heat Transferred (MMBtu/hr)	Efficiency (%)
Vap 7	48	HP	M	42.3	39.7	93.8%
Vap 8	48	HP	M	42.3	39.7	93.8%
Vap 9	48	LP	M	44.3	40.92	92.4%
Vap 10	48	LP	M	44.3	40.92	92.4%
Vap 11	42.76	LP	S	42.76	40.92	95.8%
Vap 12	42.76	HP	S	41.3	39.7	96.1%
Vap 13	42.76	LP	S	42.76	40.92	95.8%
Vap 14	42.76	LP	S	42.76	40.92	95.8%

National Grid
Greenpoint Energy Center
LNG - Natural Gas Upstream & Downstream Emissions

Natural Gas HHV, Btu/cf
1,020

Annual LNG Vaporized		
19,700,000	gal/yr	Total Tank Capacity
1,600,000,000	gal/yr	NG liquefied for Tank Capacity
1,440,000,000	scf/yr	10 percent of Tank Capacity to remain within Tank
1,468,800	MMBtu/yr	

Upstream GHG Emissions (MT/yr)	
17,498	CO2
564	CH4
0	N2O
64,928	CO2e

Downstream GHG Emissions (MT/yr)	
0	CO2
34	CH4
0	N2O
2,838	CO2e

National Grid
Greenpoint Energy Center
Emissions

Existing Conditions

	Capacity (MMBtu/hr)	High Pressure (HP)/ Low Pressure (LP)	Fuel Firing Rate (MMBtu/hr)	Heat Transferred (MMBtu/hr)	Efficiency (%)	Operating (Y/N)
Vap 7	48	HP	42.3	39.7	93.8%	Y
Vap 8	48	HP	42.3	39.7	93.8%	Y
Vap 9	48	LP	44.3	40.92	92.4%	Y
Vap 10	48	LP	44.3	40.92	92.4%	Y
Vap 11	42.76	LP	42.76	40.92	95.8%	Y
Vap 12	42.76	HP	41.3	39.7	96.1%	Y

Natural Gas HHV, Btu/cf	1,020	
Operating Time, hrs/day/unit	24	
Operating Time, days/yr/unit	14	[2 Weeks to empty the tank]
Operating Time, hrs/yr/unit	336	[Assuming all 6 vaporizers operate for 2 weeks]

Annual Heat Transferred	81,264.96	MMBtu/yr
Annual Fuel Usage Estimate	86,439.36	MMBtu/yr
	84,744,471	scf/yr

				Total Emissions			Upstream Emissions
Pollutant	Emission Factor	Units/Basis	Emission Factor (lbs/mmBtu)	Emissions (lbs/yr)	Emissions (tons/yr)	Emissions (MT/yr)	Emissions (MT/yr)
NOx	100	lbs/mmcf, AP-42 Table 1.4-1	0.098	8,474	4.24		
CO	84	lbs/mmcf, AP-42 Table 1.4-1	0.082	7,119	3.56		
VOC	5.5	lbs/mmcf, AP-42 Table 1.4-1	0.0054	466	0.23		
PM10	7.6	lbs/mmcf, AP-42 Table 1.4-1	0.0075	644	0.32		
PM2.5	7.6	lbs/mmcf, AP-42 Table 1.4-1	0.0075	644	0.32		
SO2	0.6	lbs/mmcf, AP-42 Table 1.4-1	0.0006	51	0.025		
CO2	53,060.00	g/MMBtu, EPA				4,586	1,030
CH4	1.000	g/MMBtu, EPA				0.086	33.193
N2O	0.1000	g/MMBtu, EPA				0.009	0.012
CO2e	0.1	MT/MMBtu, EPA				4,596	3,821
Benzene	2.10E-03	lbs/mmcf, AP-42 Table 1.4-1	2.06E-06	1.78E-01	8.90E-05		
Toluene	3.40E-03	lbs/mmcf, AP-42 Table 1.4-1	3.33E-06	2.88E-01	1.44E-04		
Xylenes	N/A		0.00E+00	0.00E+00	0.00E+00		
Formaldehyde	7.50E-02	lbs/mmcf, AP-42 Table 1.4-1	7.35E-05	6.36E+00	3.18E-03		
Naphthalene	6.10E-04	lbs/mmcf, AP-42 Table 1.4-1	5.98E-07	5.17E-02	2.58E-05		
Acetaldehyde	N/A		0.00E+00	0.00E+00	0.00E+00		
Acrolein	N/A		0.00E+00	0.00E+00	0.00E+00		
Methyl chloroform (1,1,1-Trichloroethane)	N/A		0.00E+00	0.00E+00	0.00E+00		
Hexane	1.80E+00	lbs/mmcf, AP-42 Table 1.4-1	1.76E-03	1.53E+02	7.63E-02		
Ethylbenzene	N/A		0.00E+00	0.00E+00	0.00E+00		
Total HAPS				159.414	0.08		

National Grid
Greenpoint Energy Center
Emissions

Proposed New Vaporizers [Proposed Emission Units: U-7404G, U-7404H]

Capacity, mmBtu/hr	42.76					
No. of Units	2	Vaporizers 13, and 14				
Vap 7	48	HP	42.3	39.7	93.8%	Y
Vap 8	48	HP	42.3	39.7	93.8%	Y
Vap 9	48	LP	44.3	40.92	92.4%	Y
Vap 10	48	LP	44.3	40.92	92.4%	Y
Vap 11	42.76	LP	42.76	40.92	95.8%	Y
Vap 12	42.76	HP	41.3	39.7	96.1%	Y
Vap 13	42.76	LP	42.76	40.92	95.8%	Y
Vap 14	42.76	LP	42.76	40.92	95.8%	Y

Natural Gas HHV, Btu/cf	1,020	
Operating Time, hrs/day/unit	24	
Operating Time, days/yr/unit	14	[2 Weeks to empty the tank]
Operating Time, hrs/yr/unit	336	

Annual Heat Transferred	27,498.24	MMBtu/yr
Annual Fuel Usage Estimate	28,734.72	MMBtu/yr

					Total Emissions		
Pollutant	**Emission Factor**	**Units/Basis**	**Emission Factor (lbs/mmBtu)**	**Total Peak Hour Emissions (lbs/hr)**	**Emissions (lbs/yr)**	**Emissions (tons/yr)**	**Emissions (MT/yr)**
NOx	100	lbs/mmcf, AP-42 Table 1.4-1	0.098	8.38	2,817	1.41	
CO	84	lbs/mmcf, AP-42 Table 1.4-1	0.082	7.04	2,366	1.18	
VOC	5.5	lbs/mmcf, AP-42 Table 1.4-1	0.0054	0.46	155	0.08	
PM10	7.6	lbs/mmcf, AP-42 Table 1.4-1	0.0075	0.64	214	0.11	
PM2.5	7.6	lbs/mmcf, AP-42 Table 1.4-1	0.0075	0.64	214	0.11	
SO2	0.6	lbs/mmcf, AP-42 Table 1.4-1	0.0006	0.05	17	0.008	
CO2	53,060.00	g/MMBtu, EPA					1,525
CH4	1.000	g/MMBtu, EPA					0.029
N2O	0.1000	g/MMBtu, EPA					0.003
CO2e	0.1	MT/MMBtu, EPA					1,528
Benzene	2.10E-03	lbs/mmcf, AP-42 Table 1.4-1	2.06E-06	1.76E-04	5.92E-02	2.96E-05	
Toluene	3.40E-03	lbs/mmcf, AP-42 Table 1.4-1	3.33E-06	2.85E-04	9.58E-02	4.79E-05	
Xylenes	N/A		0.00E+00	0.00E+00	0.00E+00	0.00E+00	
Formaldehyde	7.50E-02	lbs/mmcf, AP-42 Table 1.4-1	7.35E-05	6.29E-03	2.11E+00	1.06E-03	
Naphthalene	6.10E-04	lbs/mmcf, AP-42 Table 1.4-1	5.98E-07	5.11E-05	1.72E-02	8.59E-06	
Acetaldehyde	N/A		0.00E+00	0.00E+00	0.00E+00	0.00E+00	
Acrolein	N/A		0.00E+00	0.00E+00	0.00E+00	0.00E+00	
Methyl chloroform (1,1,1-Trichloroethane)	N/A		0.00E+00	0.00E+00	0.00E+00	0.00E+00	
Hexane	1.80E+00	lbs/mmcf, AP-42 Table 1.4-1	1.76E-03	1.51E-01	5.07E+01	2.54E-02	
Ethylbenzene	N/A		0.00E+00	0.00E+00	0.00E+00	0.00E+00	
Total HAPS					52.993	0.026	

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Emissions

Future Conditions

	Capacity (MMBtu/hr)	High Pressure (HP)/ Low Pressure (LP)	Fuel Firing Rate (MMBtu/hr)	Heat Transferred (MMBtu/hr)	Efficiency (%)	Operating (Y/N)
Vap 7	48	HP	42.3	39.7	93.8%	Y
Vap 8	48	HP	42.3	39.7	93.8%	Y
Vap 9	48	LP	44.3	40.92	92.4%	N
Vap 10	48	LP	44.3	40.92	92.4%	N
Vap 11	42.76	LP	42.76	40.92	95.8%	Y
Vap 12	42.76	HP	41.3	39.7	96.1%	Y
Vap 13	42.76	LP	42.76	40.92	95.8%	Y
Vap 14	42.76	LP	42.76	40.92	95.8%	Y

Natural Gas HHV, Btu/cf	1,020	
Operating Time, hrs/day/unit	24	
Operating Time, days/yr/unit	14	[2 Weeks to empty the tank]
Operating Time, hrs/yr/unit	336	[Assuming 6 vaporizers operate for 2 weeks; New LP Vaporizers 13 & 14 are used instead of 9 & 10]

	New Units		Existing Units	
Annual Heat Transferred	81,265	MMBtu/yr	81,264.96	
Annual Fuel Usage Estimate	85,404.48	MMBtu/yr	86,439.36	-1%
	83,729,882	scf/yr		

				Total Emissions			Upstream Emissions
Pollutant	**Emission Factor**	**Units/Basis**	**Emission Factor (lbs/mmBtu)**	**Emissions (lbs/yr)**	**Emissions (tons/yr)**	**Emissions (MT/yr)**	**Emissions (MT/yr)**
NOx	100	lbs/mmcf, AP-42 T	0.098	8,373	4.19		
CO	84	lbs/mmcf, AP-42 T	0.082	7,033	3.52		
VOC	5.5	lbs/mmcf, AP-42 T	0.0054	461	0.23		
PM10	7.6	lbs/mmcf, AP-42 T	0.0075	636	0.32		
PM2.5	7.6	lbs/mmcf, AP-42 T	0.0075	636	0.32		
SO2	0.6	lbs/mmcf, AP-42 T	0.0006	50	0.025		
CO2	53,060.00	g/MMBtu, EPA				4,532	1,017
CH4	1.000	g/MMBtu, EPA				0.085	32.795
N2O	0.1000	g/MMBtu, EPA				0.009	0.012
CO2e	0.1	MT/MMBtu, EPA				4,541	3,775
Benzene	2.10E-03	lbs/mmcf, AP-42 T	2.06E-06	1.76E-01	8.79E-05		
Toluene	3.40E-03	lbs/mmcf, AP-42 T	3.33E-06	2.85E-01	1.42E-04		
Xylenes	N/A		0.00E+00	0.00E+00	0.00E+00		
Formaldehyde	7.50E-02	lbs/mmcf, AP-42 T	7.35E-05	6.28E+00	3.14E-03		
Naphthalene	6.10E-04	lbs/mmcf, AP-42 T	5.98E-07	5.11E-02	2.55E-05		
Acetaldehyde	N/A		0.00E+00	0.00E+00	0.00E+00		
Acrolein	N/A		0.00E+00	0.00E+00	0.00E+00		
Methyl chloroform (1,1,1-Trichl	N/A		0.00E+00	0.00E+00	0.00E+00		
Hexane	1.80E+00	lbs/mmcf, AP-42 T	1.76E-03	1.51E+02	7.54E-02		
Ethylbenzene	N/A		0.00E+00	0.00E+00	0.00E+00		
Total HAPS				157.505	0.08		

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Natural Gas Emission Factors

EPA Emission factors--(Federal Register EPA, March 26, 2020)

https://www.epa.gov/sites/production/files/2020-04/documents/ghg-emission-factors-hub.pdf

	Natural Gas	
CH4	1.00	g/MMBtu
N2O	0.10	g/MMBtu
CO2	53,060	g/MMBtu
CH4	0.00103	g/scf
N2O	0.00010	g/scf
CO2	54.44	g/scf

CO2e	5.317E-02	metric ton/MMBtu

CO2e	5.455E-05	metric ton/scf

https://www.epa.gov/sites/production/files/2020-04/documents/ghg-emission-factors-hub.pdf

Natural Gas Heating Value	
1,020	btu/scf

NYSDEC Upstream Emission Factor

Table 1. Current Upstream and Out-of-State Emission Factors for Imported Fossil Fuels

	Natural Gas as Stationary Fuels	
CH4	384.000	g/MMBtu
N2O	0.136	g/MMBtu
CO2	11,913	g/MMBtu

	Natural Gas as Stationary Fuels	
CH4	0.0004	metric ton/MMBtu
N2O	0.0000	metric ton/MMBtu
CO2	0.0119	metric ton/MMBtu
	0.0442	metric ton/MMBtu
CO2e	45.0890	metric ton/MMscf

NYSDEC, *Preliminary Interim Draft Emission Factors for Use by State Agencies and Project* Proponents, February, 2021

NYSDEC Downstream Emission Factor

Table 2. Current Downstream In-State Emission Factors for Natural Gas/RNG Distribution

	Natural Gas as Stationary Fuels	
CH4	23.000	g/MMBtu
N2O	N/A	g/MMBtu
CO2	N/A	g/MMBtu
CO2e	1,932.0000	g/MMBtu

	Natural Gas as Stationary Fuels	
CH4	0.0000	metric ton/MMBtu
N2O		metric ton/MMBtu
CO2		metric ton/MMBtu
	0.0019	metric ton/MMBtu
CO2e	1.9706	metric ton/MMscf

NYSDEC, *Preliminary Interim Draft Emission Factors for Use by State Agencies and Project* Proponents, February, 2021

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	GWP
CH4	84
N2O	264
CO2	1

6 NYCRR 496.5