



# Life Cycle Analysis of the Northeast Supply Enhancement Project

IPPNY Annual Fall Conference

Tuesday, September 17, 2019

The Future of Natural Gas Infrastructure in New York State

MJB & A

# Overview

- This study was prepared by M.J. Bradley & Associates for National Grid, to provide an independent evaluation of life cycle greenhouse gas emissions associated with operation of the Northeast Supply Enhancement Project, as well as the local air emission co-benefits.
- Environmental Defense Fund (EDF) requested that National Grid undertake such an evaluation to inform regulatory review of the project.
- The findings of the life cycle GHG analysis presented in this report were prepared by MJB&A based on market demand and technology adoption assumptions in the geographic study area.
- EDF engaged with the MJB&A team to provide technical assistance on certain issues, including the social cost of carbon and methane leakage rates.

The report is available on MJB&A's website at:

<https://www.mjbradley.com/reports/life-cycle-analysis-northeast-supply-enhancement-project>

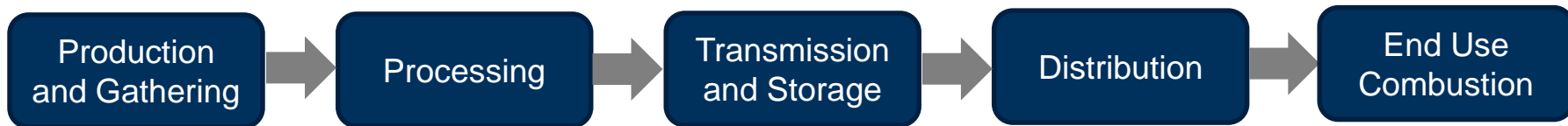
# Life Cycle Assessment

**Goal:** Calculate the life cycle emissions associated with natural gas compared to the life cycle emissions associated with energy sources that would be used if sufficient gas is unavailable to meet projected demand.

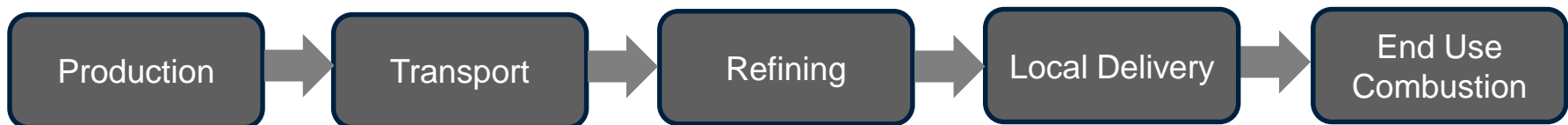
Greenhouse Gas Emissions  
[Methane (CH<sub>4</sub>), Carbon Dioxide (CO<sub>2</sub>), and Others]



## Natural Gas System



## Petroleum System



# Overview of the Approach

**MJB&A developed a “NESE Case” and a “ No NESE Case” and compared the results of the two cases.**

## **NESE Case**

- Incremental natural gas demand of 2.1 million dekatherms (MMDth) beginning in the 2020/2021 heating season increasing to 11.8 MMDth in 2025 and 19.2 MMDth in 2030
- Natural gas supplied for space heating, water heating, and other uses (cooking and clothes drying) in the single family, multi-family, and commercial sectors
- Oil-to-gas conversions and new construction in the single family, multi-family, and commercial sectors
- Life cycle greenhouse gas emissions—CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O
- Local air pollution emissions—NO<sub>x</sub>, SO<sub>2</sub> and PM

## **No NESE Case**

- Combination of heating oil and electricity to meet the same energy demands as the NESE Case
- Continued oil use for space heating, water heating in single family, multi-family, and commercial buildings
- Oil-to-electric heat pump conversions in the single family, multi-family, and commercial sectors
- Oil and electric heat pumps in new construction in the single family, multi-family, and commercial sectors
- Life cycle greenhouse gas emissions—CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O
- Local air pollution emissions—NO<sub>x</sub>, SO<sub>2</sub> and PM

# Assumptions: No NESE Case Incremental Energy Demand

In the No NESE Case, the energy demand that would have been served by the natural gas delivered by NESE is met by a combination of heating oil and air- and ground-source heat pumps.

## Conversions

- Residential single-family and multi-family: 2% adopt heat pumps in 2020, 2% annual increase, reaching 22% in 2030
- Commercial: 2% adopt heat pumps in 2020, 3% annual increase, reaching 32% in 2030

## New Construction

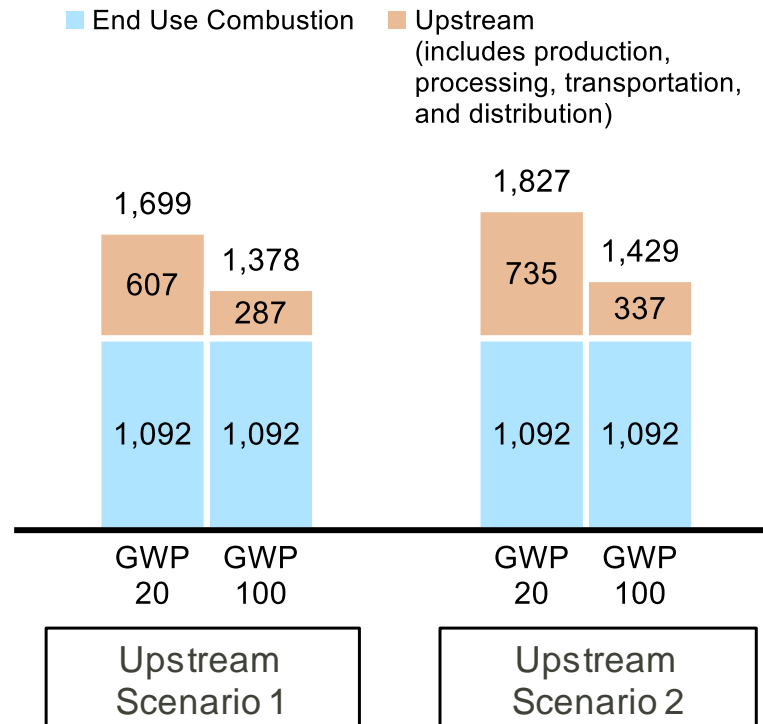
- Residential single-family, multi-family, commercial: 10% adopt heat pumps in 2020, 3% annual increase, reaching 40% in 2030

NO - NESE CASE													
SPACE HEAT	RESIDENTIAL SINGLE FAMILY				RESIDENTIAL MULTIFAMILY				COMMERCIAL				
	ELIGIBLE CONVERSIONS		NEW CONSTRUCTION		ELIGIBLE CONVERSIONS		NEW CONSTRUCTION		ELIGIBLE CONVERSIONS			NEW CONSTRUCTION	
	% #2	% Elec	% #2	% Elec	% #2	% Elec	% #2	% Elec	% #4	% #2	% Elec	% #2	% Elec
2020	98.0%	2.0%	90.0%	10.0%	98.0%	2.0%	90.0%	10.0%	10.0%	88.0%	2.0%	90.0%	10.0%
2021	96.0%	4.0%	87.0%	13.0%	96.0%	4.0%	87.0%	13.0%	9.0%	86.0%	5.0%	87.0%	13.0%
2022	94.0%	6.0%	84.0%	16.0%	94.0%	6.0%	84.0%	16.0%	8.0%	84.0%	8.0%	84.0%	16.0%
2023	92.0%	8.0%	81.0%	19.0%	92.0%	8.0%	81.0%	19.0%	7.0%	82.0%	11.0%	81.0%	19.0%
2024	90.0%	10.0%	78.0%	22.0%	90.0%	10.0%	78.0%	22.0%	6.0%	80.0%	14.0%	78.0%	22.0%
2025	88.0%	12.0%	75.0%	25.0%	88.0%	12.0%	75.0%	25.0%	5.0%	78.0%	17.0%	75.0%	25.0%
2026	86.0%	14.0%	72.0%	28.0%	86.0%	14.0%	72.0%	28.0%	4.0%	76.0%	20.0%	72.0%	28.0%
2027	84.0%	16.0%	69.0%	31.0%	84.0%	16.0%	69.0%	31.0%	3.0%	74.0%	23.0%	69.0%	31.0%
2028	82.0%	18.0%	66.0%	34.0%	82.0%	18.0%	66.0%	34.0%	2.0%	72.0%	26.0%	66.0%	34.0%
2029	80.0%	20.0%	63.0%	37.0%	80.0%	20.0%	63.0%	37.0%	1.0%	70.0%	29.0%	63.0%	37.0%
2030	78.0%	22.0%	60.0%	40.0%	78.0%	22.0%	60.0%	40.0%	0.0%	68.0%	32.0%	60.0%	40.0%
WATER HEAT	RESIDENTIAL SINGLE FAMILY				RESIDENTIAL MULTIPLE UNIT				COMMERCIAL				
	CONVERSIONS		NEW CONSTRUCTION		CONVERSIONS		NEW CONSTRUCTION		CONVERSIONS			NEW CONSTRUCTION	
	% #2	% Elec <sup>1</sup>	% #2	% Elec <sup>1</sup>	% #2	% Elec <sup>1</sup>	% #2	% Elec <sup>1</sup>	% #4	% #2	% Elec <sup>1</sup>	% #2	% Elec <sup>1</sup>
2020	50.0%	50.0%	50.0%	50.0%	75.0%	25.0%	75.0%	25.0%	10.0%	60.0%	30.0%	75.0%	25.0%
2021	50.0%	50.0%	50.0%	50.0%	75.0%	25.0%	75.0%	25.0%	9.0%	60.0%	31.0%	72.5%	27.5%
2022	50.0%	50.0%	50.0%	50.0%	75.0%	25.0%	75.0%	25.0%	8.0%	60.0%	32.0%	70.0%	30.0%
2023	50.0%	50.0%	50.0%	50.0%	75.0%	25.0%	75.0%	25.0%	7.0%	60.0%	33.0%	67.5%	32.5%
2024	50.0%	50.0%	50.0%	50.0%	75.0%	25.0%	75.0%	25.0%	6.0%	60.0%	34.0%	65.0%	35.0%
2025	50.0%	50.0%	50.0%	50.0%	75.0%	25.0%	75.0%	25.0%	5.0%	60.0%	35.0%	62.5%	37.5%
2026	50.0%	50.0%	50.0%	50.0%	75.0%	25.0%	72.0%	28.0%	4.0%	60.0%	36.0%	60.0%	40.0%
2027	50.0%	50.0%	50.0%	50.0%	75.0%	25.0%	69.0%	31.0%	3.0%	60.0%	37.0%	57.5%	42.5%
2028	50.0%	50.0%	50.0%	50.0%	75.0%	25.0%	66.0%	34.0%	2.0%	59.0%	39.0%	55.0%	45.0%
2029	50.0%	50.0%	50.0%	50.0%	75.0%	25.0%	63.0%	37.0%	1.0%	56.0%	43.0%	52.5%	47.5%
2030	50.0%	50.0%	50.0%	50.0%	75.0%	25.0%	60.0%	40.0%	0.0%	53.0%	47.0%	50.0%	50.0%
OTHER	RESIDENTIAL SINGLE FAMILY				RESIDENTIAL MULTIPLE UNIT				COMMERCIAL				
	CONVERSIONS		NEW CONSTRUCTION		CONVERSIONS		NEW CONSTRUCTION		CONVERSIONS			NEW CONSTRUCTION	
	% #2	% Elec	% #2	% Elec	% #2	% Elec	% #2	% Elec	% #4	% #2	% Elec	% #2	% Elec
2020	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	0.0%	50.0%	50.0%	50.0%	50.0%
2021	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	0.0%	50.0%	50.0%	50.0%	50.0%
2022	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	0.0%	50.0%	50.0%	50.0%	50.0%
2023	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	0.0%	50.0%	50.0%	50.0%	50.0%
2024	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	0.0%	50.0%	50.0%	50.0%	50.0%
2025	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	0.0%	50.0%	50.0%	50.0%	50.0%
2026	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	0.0%	50.0%	50.0%	50.0%	50.0%
2027	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	0.0%	50.0%	50.0%	50.0%	50.0%
2028	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	0.0%	50.0%	50.0%	50.0%	50.0%
2029	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	0.0%	50.0%	50.0%	50.0%	50.0%
2030	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	0.0%	50.0%	50.0%	50.0%	50.0%

# Assumptions: Electricity Grid Emission Rates

MJB&A developed electricity sector GHG emission rates for electric generation facilities in the geographic scope of the life cycle analysis—New York Independent System Operator (NYISO) Zone J and Zone K.

The emission rates include end-use combustion during heating months and upstream GHG emissions derived from the two upstream scenarios.

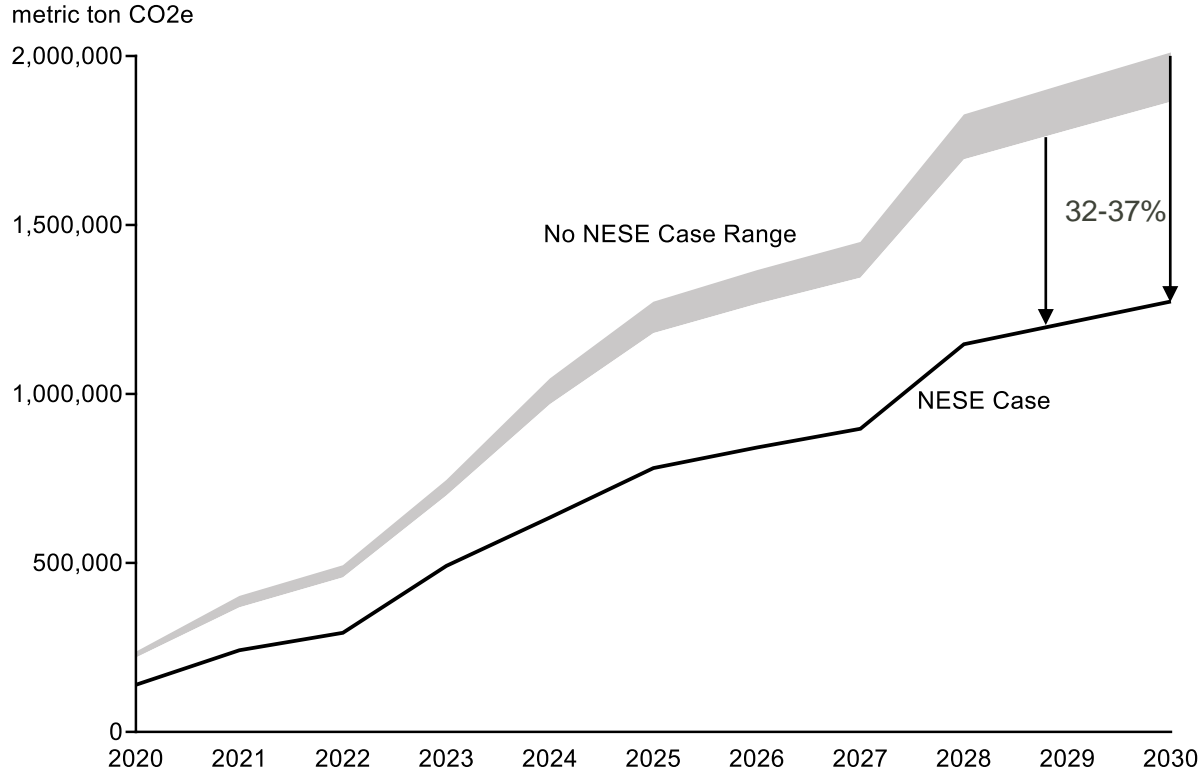


# Results: Projected CO<sub>2</sub>-e Emissions

Annual GHG emissions are reduced by 400,000 to 492,000 metric tons in 2025 and by 591,000 to 737,000 metric tons in 2030.

Cumulatively through 2030, life cycle GHG emissions are approximately 3.9 to 4.8 million metric tons lower in the NESE Case compared to the No NESE Case.

Estimated cumulative monetized societal benefits of these reductions range from \$212 million to \$262 million (2019\$) through 2030.



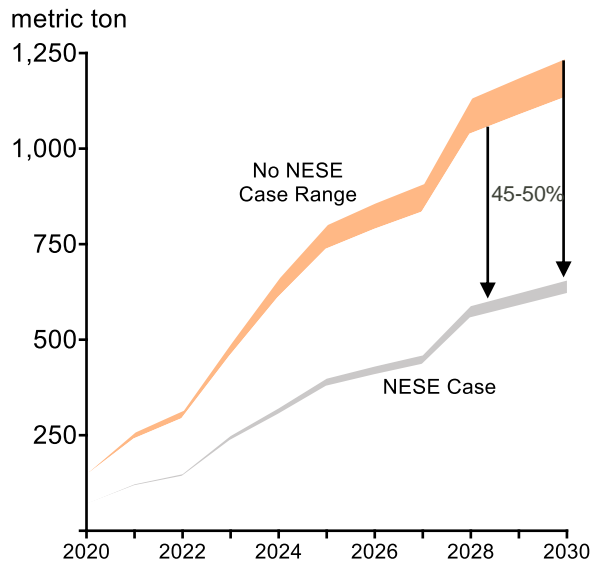
Source: MJB&A Analysis, Upstream Scenario 1, 100-year GWP, and range of low and high new construction.

# Results: Air Pollution Emission Reductions

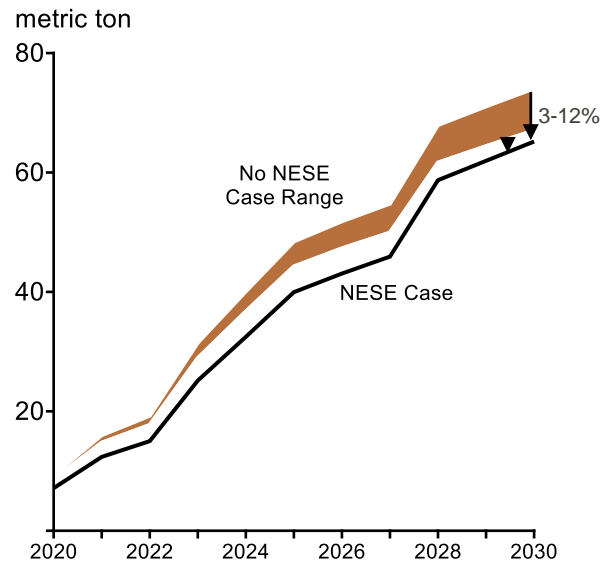
Natural gas supplied by NESE reduces nitrogen oxide (NO<sub>x</sub>), sulfur dioxide (SO<sub>2</sub>), and particulate matter (PM) emissions in New York City and on Long Island compared to the No NESE Case.

Local air pollution emissions reductions range from approximately 3,500 to 4,000 metric tons of NO<sub>x</sub>, 35 to 80 metric tons of PM, and 425 to 500 metric tons of SO<sub>2</sub> by 2030 in the NESE Case compared to the No NESE Case.

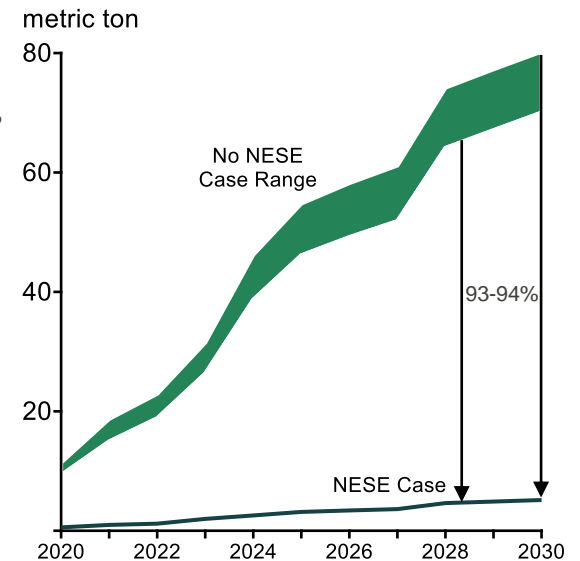
NO<sub>x</sub>



PM



SO<sub>2</sub>



Source: MJB&A Analysis, Upstream Scenario 1, 100-year GWP, and range of low and high new construction.





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