briefing

Advancing Passive House Policy

NAPHN 2016 policy session 1 presentations

"The building sector offers the largest low-cost potential in world regions to lower emissions."

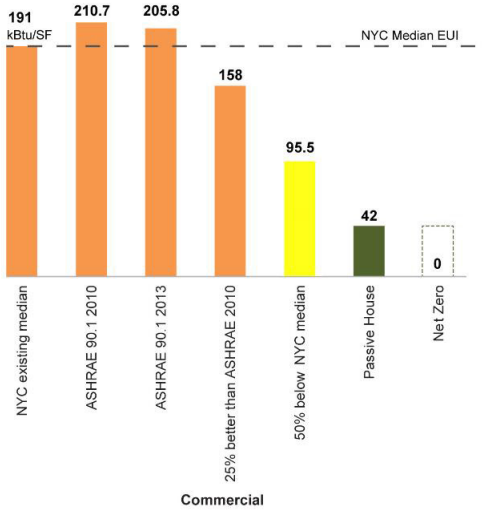
- Dr. Diana Urge-Vorsatz, Vice Chair, Intergovernmental Panel on Climate Change (IPCC)

be ex

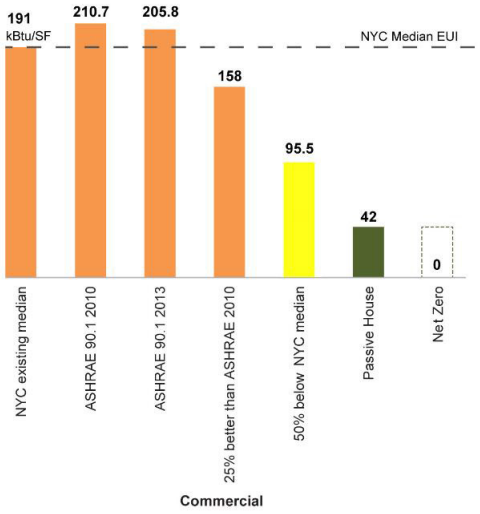
building energy exchange

appendix c: session 1 presentations

John Lee
NYC Mayor's Office of Sustainability



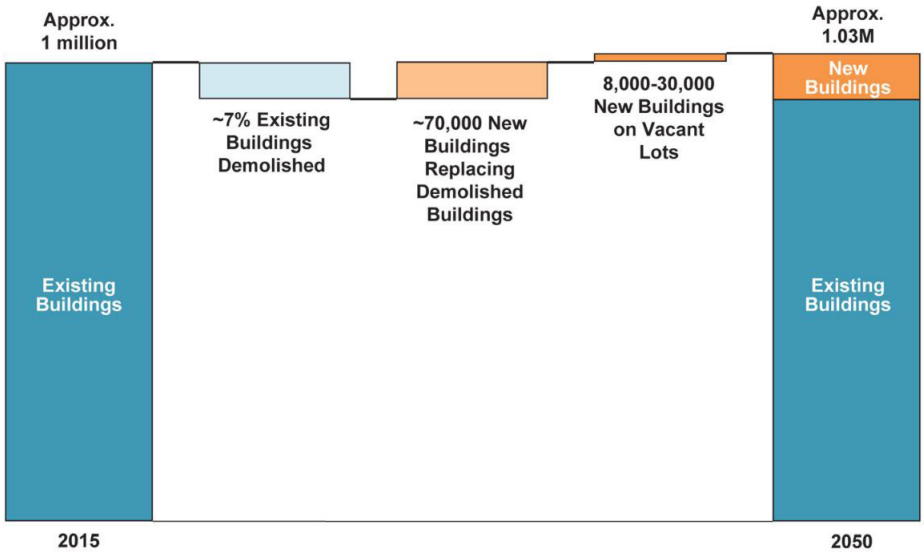
Starting in 2017, all City-owned new buildings and major renovations must meet a very-low-energy design target, at least 50% below comparable buildings

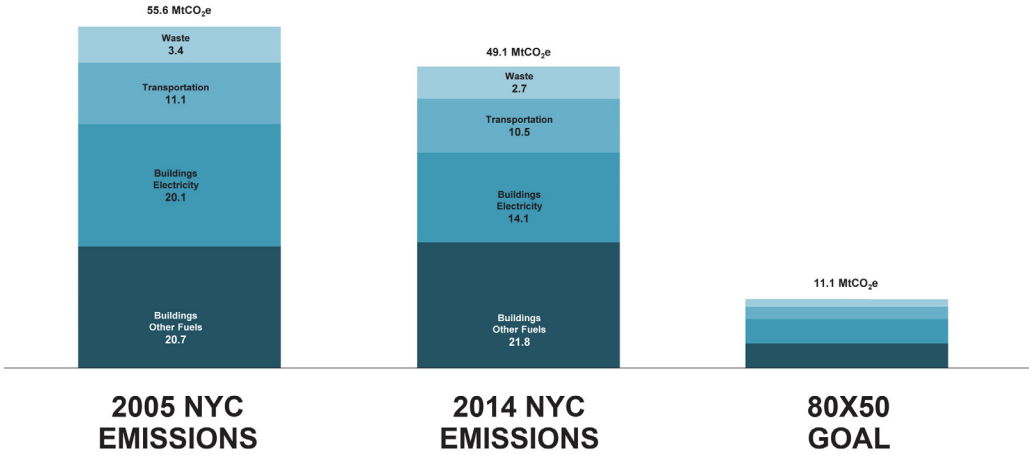


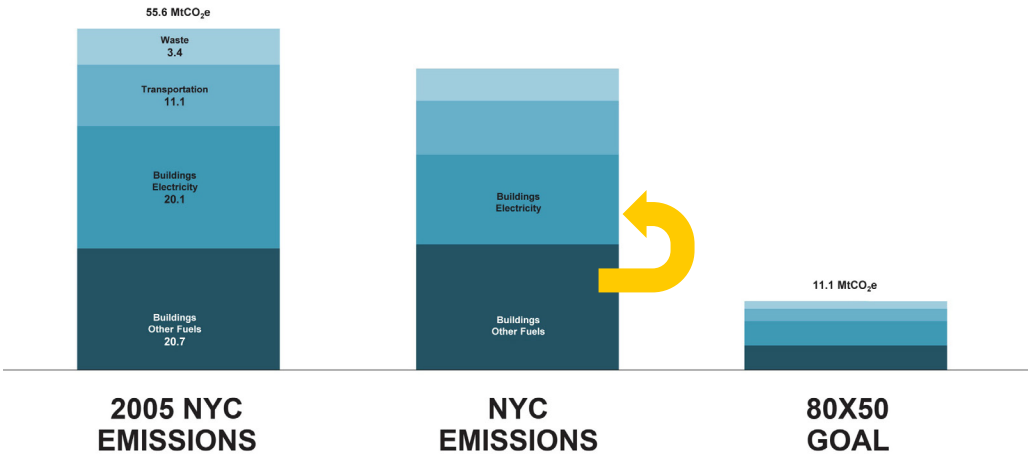
For private sector new buildings:

2019: Report on an energy performance metric

2022: Meet a whole building energy performance design target




55.6 MtCO2e
Waste 3.4
Transportation 11.1
Buildings Electricity 20.1
Buildings Other Fuels 20.7
49.1 MtCO2e
Waste 2.7
Transportation 10.5
Buildings Electricity 14.1
Buildings Other Fuels 21.8
11.1 MtCO2e
2005 NYC EMISSIONS
2014 NYC EMISSIONS
80X50 GOAL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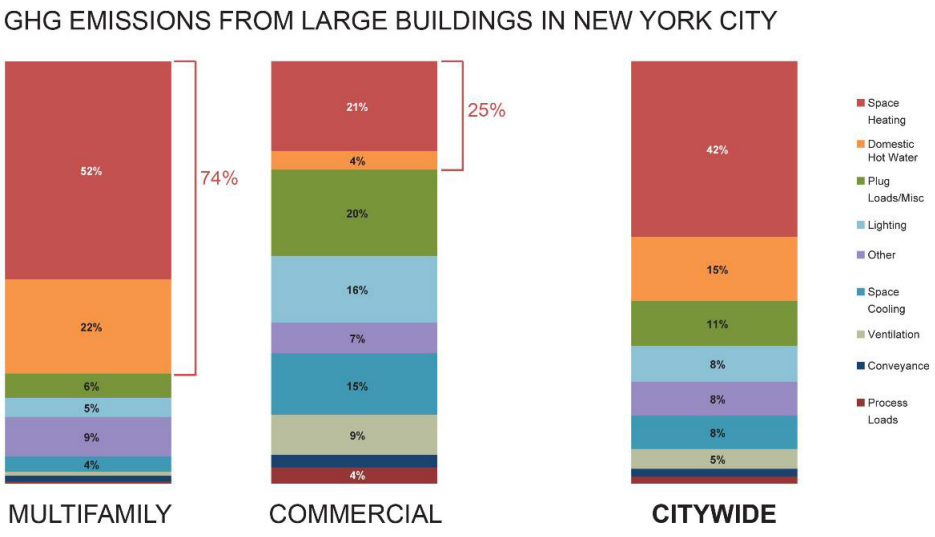
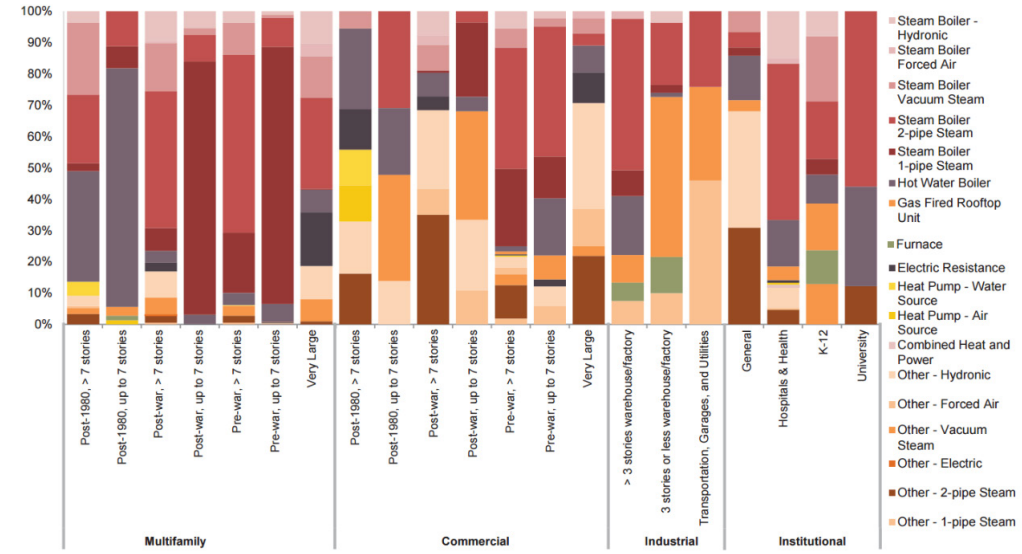
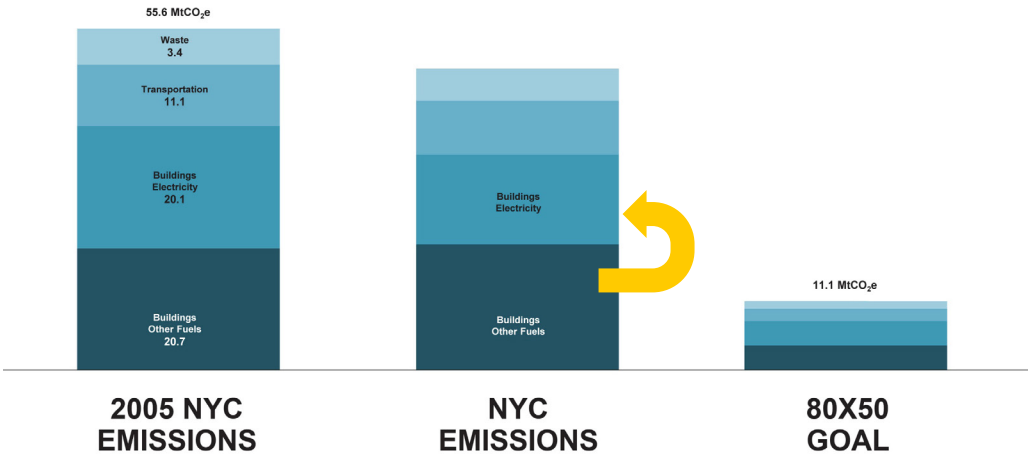

GHG EMISSIONS FROM LARGE BUILDINGS IN NEW YORK CITY
52%
22%
6%
5%
9%
4%
74%
21%
4%
20%
16%
7%
15%
9%
4%
25%
42%
15%
11%
8%
8%
8%
5%
Space Heating
Domestic Hot Water
Plug Loads/Misc
Lighting
Other
Space Cooling
Ventilation
Conveyance
Process Loads
MULTIFAMILY
COMMERCIAL
CITYWIDE


100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Post-1980, > 7 stories
Post-1980, up to 7 stories
Post-war, > 7 stories
Post-war, up to 7 stories
Pre-war, > 7 stories
Pre-war, up to 7 stories
Very Large
Post-1980, > 7 stories
Post-1980, up to 7 stories
Post-war, > 7 stories
Post-war, up to 7 stories
Pre-war, > 7 stories
Pre-war, up to 7 stories
Very Large
> 3 stories warehouse/factory
3 stories or less warehouse/factory
Transportation, Garages, and Utilities
General
Hospitals & Health
K-12
University
Multifamily
Commercial
Industrial
Institutional
Steam Boiler - Hydronic
Steam Boiler Forced Air
Steam Boiler Vacuum Steam
Steam Boiler 2-pipe Steam
Steam Boiler 1-pipe Steam
Hot Water Boiler
Gas Fired Rooftop Unit
Furnace
Electric Resistance
Heat Pump - Water Source
Heat Pump - Air Source
Combined Heat and Power
Other - Hydronic
Other - Forced Air
Other - Vacuum Steam
Other - Electric
Other - 2-pipe Steam
Other - 1-pipe Steam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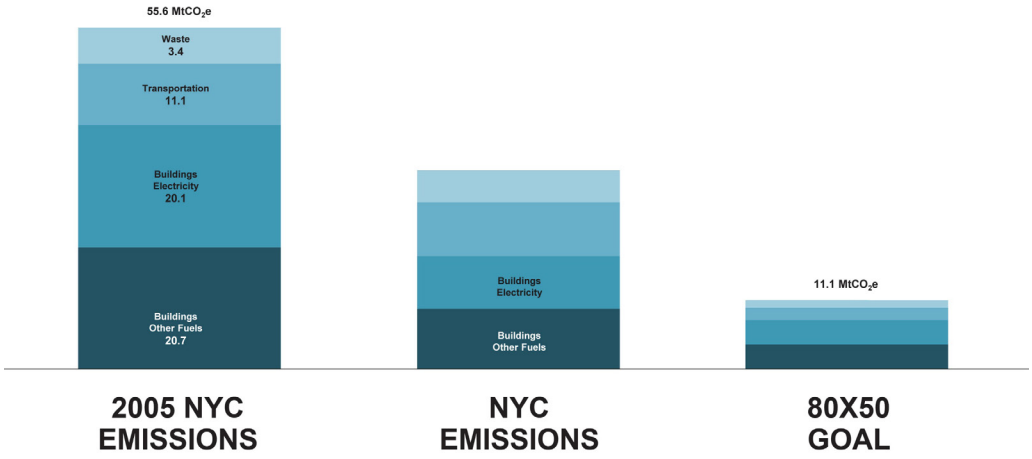
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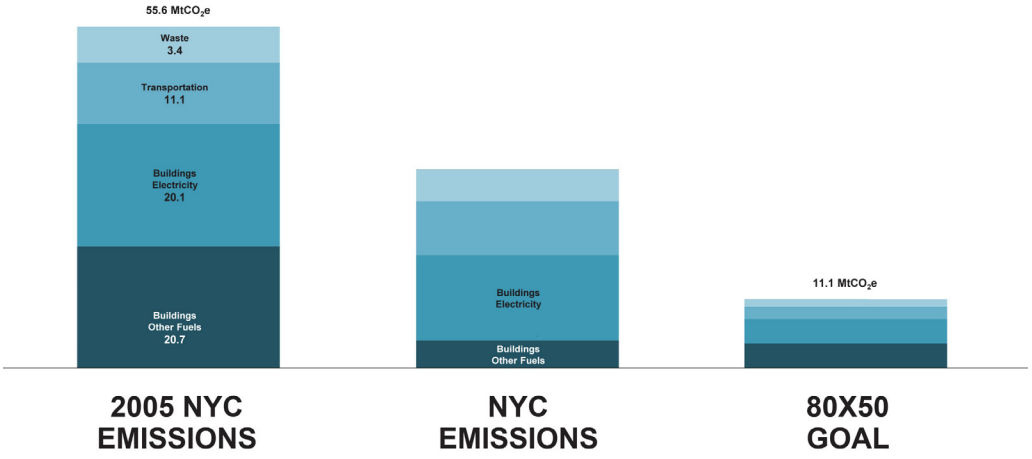
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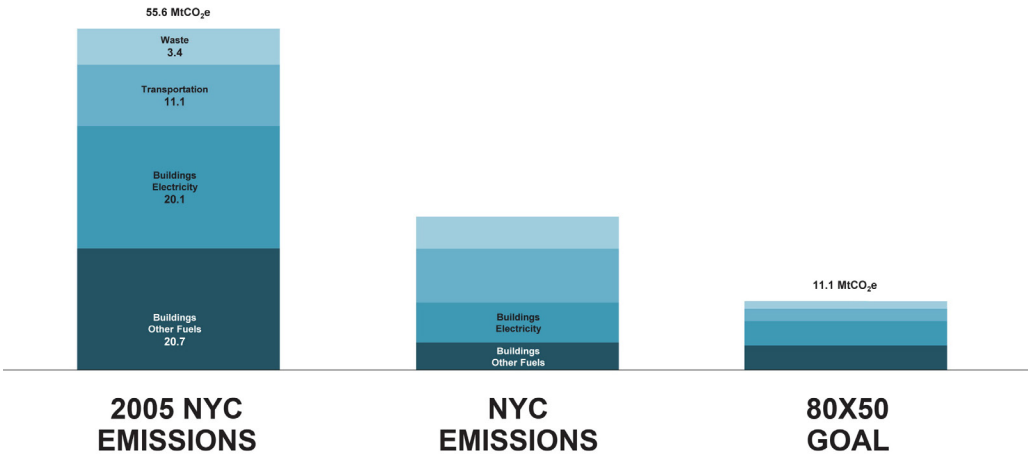
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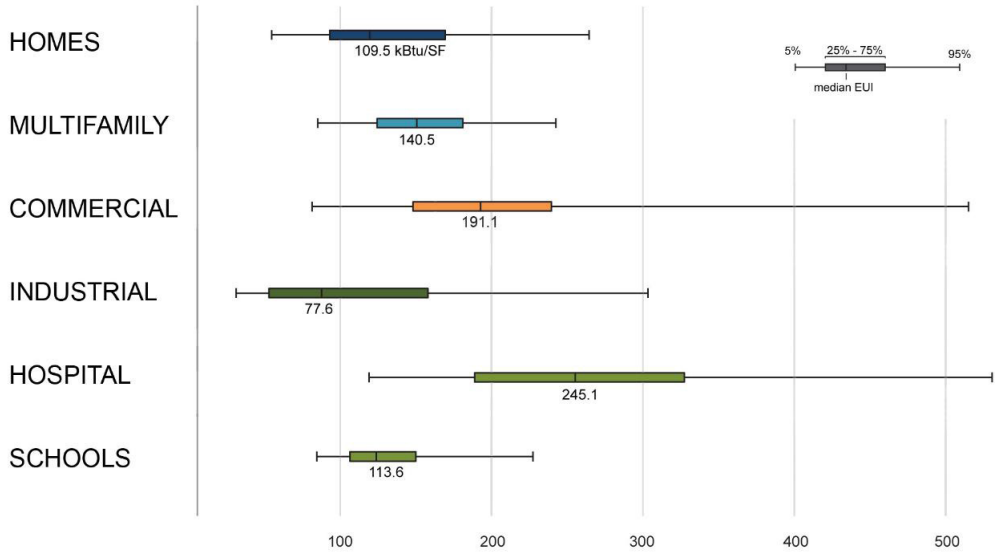
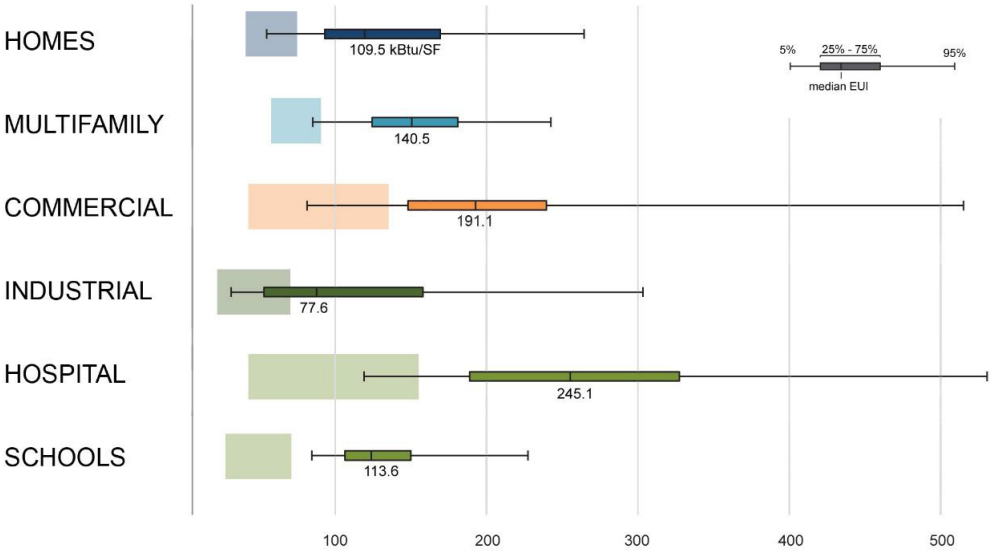

HOMES
MULTIFAMILY
COMMERCIAL
INDUSTRIAL
HOSPITAL
SCHOOLS
109.5 kBtu/SF
140.5
191.1
77.6
245.1
113.6
5%
25% - 75%
95%
median EUI
100
200
300
400
500



ONE- TO FOUR-FAMILY HOMES

This typology includes both one- to four-family freestanding homes and row homes, which covers both the greatest absolute number of buildings and the most square footage of the City's 21 building typologies. The baseline building includes a steam boiler with one-pipe steam distribution for heating, window air conditioning units for cooling that cause air leakage, and exhibits a high air infiltration rate that is typical of these buildings.

Size 3,000 SF

Height 3 Stories + 1 Below-grade

Baseline Conditions
Wall Construction: Mass wall with infiltration (R-5)
Roof: Modified bitumen roof on wood rafters, crawl space (R-15)
Windows and Glazing: Double-pane windows, vinyl frame
Lighting: 0.90 Watts/SF
Plug Loads: 0.67 Watts/SF
Heating System: Gas boiler, 1-pipe steam, radiators
Cooling System: Window A/Cs
DHW System: Direct fired storage tank, natural gas

Efficiency Measures Applied to All Paths
- **Lighting:** Reduce LPD
- **Plug loads:** Replace appliances; Master switching; Smart plugs
- **Ventilation:** Reduce over-ventilation; Upgrade fans
- **Envelope;** Maximize roof insulation; Air sealing
- **DHW:** Install low flow fixtures; On-demand gas hot water heater
- **Renewables:** Solar PV on 20% of the roof

Path 1
Hydronic Conversion
- Hydronic conversion
- Upgrade boiler
- ENERGY STAR A/C
- Replace windows

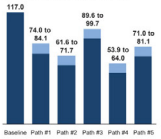
Path 2
Envelope + Hydronic Conversion
- *Row Home:* Reclad/insulate rear exterior wall
- *Freestanding Home:* Insulate wall cavities
- Insulate basement walls
- Install ERVs
- Hydronic conversion
- Upgrade boiler
- ENERGY STAR A/C
- Install triple pane windows

Path 3
Electrification + Path 2 Envelope
- Air source heat pump with mini-split for heating/cooling
- Electric DHW heat pump
- *Row Home:* Reclad/insulate rear exterior wall
- *Freestanding Home:* Insulate wall cavities
- Insulate basement walls
- Install ERVs
- Install triple pane windows

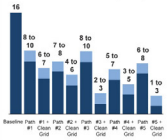
Path 4
High Performance Envelope
- *Row Home:* Spray foam on inside of all exterior walls
- *Freestanding Home:* Apply rigid exterior insulation
- Extensive air sealing
- Insulate basement walls
- Install triple pane windows
- Install ERVs
- Hydronic conversion
- Upgrade boiler
- Multisplit A/C

Path 5
Electrification + Path 4 Envelope
- Air source heat pump with mini-split for heating/cooling
- DHW heat pump
- *Row Home:* Spray foam on inside of all exterior walls
- *Freestanding Home:* Apply rigid exterior insulation
- Extensive air sealing
- Insulate basement walls
- Install ERVs

Path Source EUI Reduction (kBtu/SF)



Path GHG Emissions Reduction ($MtCO_2e$)



MULTIFAMILY, PRE-WAR
UP TO 7 STORIES

This typology includes the most square footage in New York City after one- to four-family homes. These buildings typically include one-pipe steam distribution systems with limited or no controls to provide space heating. Window air conditioners provide summertime cooling and create window or wall penetrations and lead to air leakage year-round and a high air infiltration rate.

Size 12,600 SF

Height 4 Stories + 1 Below-grade

Baseline Conditions
Wall Construction: Mass wall (R-5)
Roof: Insulation above deck (R-12)
Lighting: 0.40 Watts/SF
Plug Loads: 0.55 Watts/SF
Heating System: Dual fuel boiler, 1-Pipe Steam
Cooling System: Window A/C
DHW System: Indirect coil in steam boiler

Efficiency Measures Applied to All Paths
Lighting: Reduce LPD
Plug loads: Master switching; Smart plugs; Replace appliances
DHW: Install low flow fixtures; Condensing gas boiler
BMS/EMS: Controls to provide indoor feedback and implement set-backs
Ventilation: Unitized through-wall exhaust ventilation
Envelope: Replace windows with double-pane, low-e windows, maximize roof insulation and air-sealing

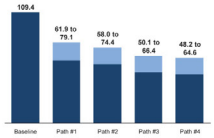
Path 1
Efficient Systems
- Optimized best in class natural gas steam boiler and steam distribution
- ENERGY STAR A/C
- Solar PV on 25% of the roof

Path 2
Hydronic Conversion
- Remove Window A/C
- Water source heat pump with gas boiler and air cooled condenser for heating and cooling
- Solar PV on 25% of the roof

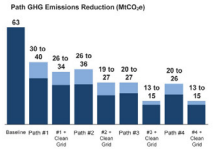
Path 3
Electrification
- Remove window A/C
- Air source heat pump with minisplits for heating and cooling
- Solar thermal for 50% of the DHW load

Path 4
Electrification + Re-cladding
- Re-clad 100% of facade
- Remove window A/C
- Air source heat pump with minisplits for heating and cooling
- Solar thermal for 50% of the DHW load

Path Source EUI Reduction (kBtu/SF)

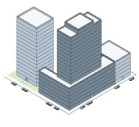


Path GHG Emissions Reduction ($MtCO_2e$)



MULTIFAMILY, POST-WAR
GREATER THAN 7 STORIES

This building typology includes taller buildings that were constructed in the post-war period but before the first Energy Code was enacted in New York City. The baseline building includes a two-pipe steam heating system with a steam boiler and limited heating system controls. In addition, this building uses through-wall sleeve air conditioners for cooling, which result in the potential for air leakage at wall penetrations.



Size 185,600 SF

Height 16 Stories + 1 Below-grade

Baseline Conditions
Wall Construction: Mass wall (R-5)
Roof: Insulation above deck (R-12)
Lighting: 0.50 Watts/SF
Plug Loads: 0.65 Watts/SF
Heating System: Natural gas boiler, 2-Pipe Steam
Cooling System: Through-wall A/C
DHW System: Indirect coil in steam boiler

Efficiency Measures Applied to All Paths
Lighting: Reduce LPD
Plug loads: Master switching; Smart plugs; Replace appliances; Replace old elevators
DHW: Install low flow fixtures; Condensing gas boiler
BMS/EMS: Controls to provide indoor feedback and implement set-backs
Ventilation: Seal and balance kitchen and toilet risers; Upgrade fans
Envelope: Replace windows; Maximize roof insulation; Air Sealing

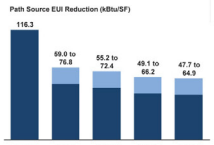
Path 1
Efficient Systems
- Optimized best in class natural gas steam boiler and steam distribution
- Solar PV on 23% of the roof

Path 2
Hydronic Conversion
- Remove Through-wall A/C
- Water source heat pump with gas boiler and cooling tower for heating and cooling
- Solar PV on 23% of the roof

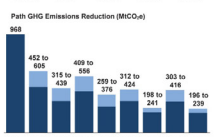
Path 3
Electrification
- Remove Through-wall A/C
- Variable Refrigerate Flow for heating and cooling
- Solar thermal for 50% of the DHW load

Path 4
Electrification + Re-cladding
- Re-clad 100% of facade
- Remove Through-wall A/C
- Variable Refrigerate Flow for heating and cooling
- Solar thermal for 50% of the DHW load

Path Source EUI Reduction (kBtu/SF)



Path GHG Emissions Reduction ($MtCO_2e$)



MULTIFAMILY, POST-1980
GREATER THAN 7 STORIES

This building typology includes taller buildings that were constructed after the first Energy Code was enacted in New York City. The baseline building for this typology includes a hydronic heating system, PTACs for cooling, and steel framed window-wall construction.

Size 78,000 SF

Height 11 Stories + 1 Below-grade

Baseline Conditions
Wall Construction: Steel framed window wall with some insulation (R-6)
Roof: Insulation above deck (R-19)
Lighting: 0.50 Watts/SF
Plug Loads: 0.67 Watts/SF
Heating System: Natural gas boiler, Hydronic with PTACs
Cooling System: PTACs
DHW System: Indirect storage tank, natural gas boiler

Efficiency Measures Applied to All Paths
Lighting: Reduce LPD
Plug loads: Master switching; Smart plugs; Replace appliances; Replace old elevators
DHW: Install low flow fixtures; Condensing gas boiler
BMS/EMS: Controls to provide indoor feedback and implement set-backs
Ventilation: Seal and balance kitchen and toilet risers; Upgrade fans
Envelope: Replace windows; Maximize roof insulation; Air Sealing

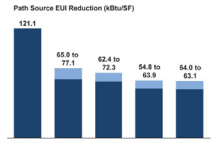
Path 1
Efficient Systems
- Optimized best in class natural gas hot water boiler and hydronic distribution
- Upgrade PTACs
- Solar PV on 19%of the roof

Path 2
Water Source Heat Pump Upgrade
- Remove PTACs
- Water source heat pump with gas boiler and cooling tower for heating and cooling
- Solar PV on 19%of the roof

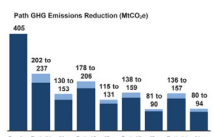
Path 3
Electrification
- Remove PTACs
- Variable Refrigerate Flow for heating and cooling
- Solar thermal for 50% of DHW load

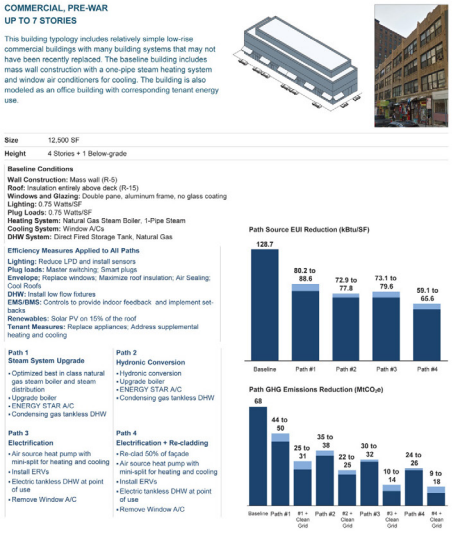
Path 4
Electrification + Re-cladding
- Re-clad 100% of facade
- Remove PTACs
- Variable Refrigerate Flow for heating and cooling
- Solar thermal for 50% of DHW load

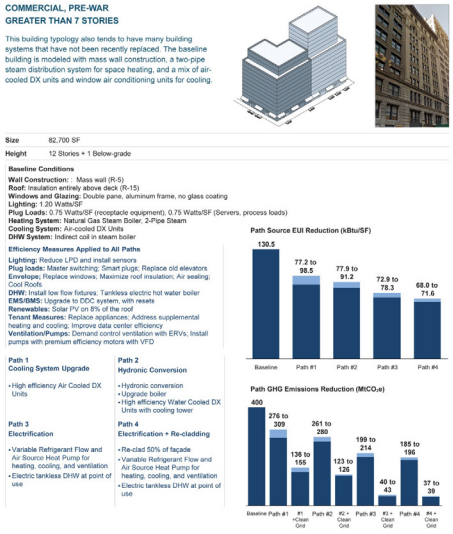
Path Source EUI Reduction (kBtu/SF)

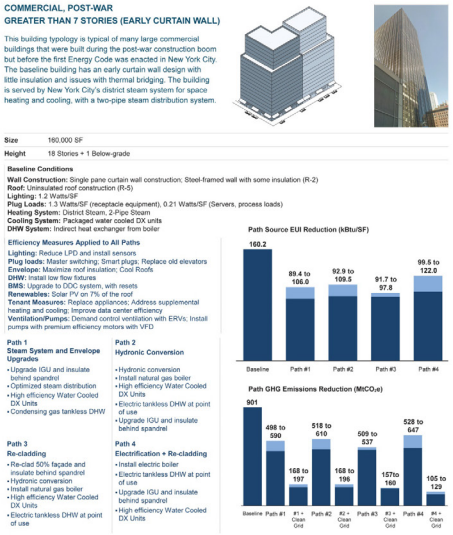


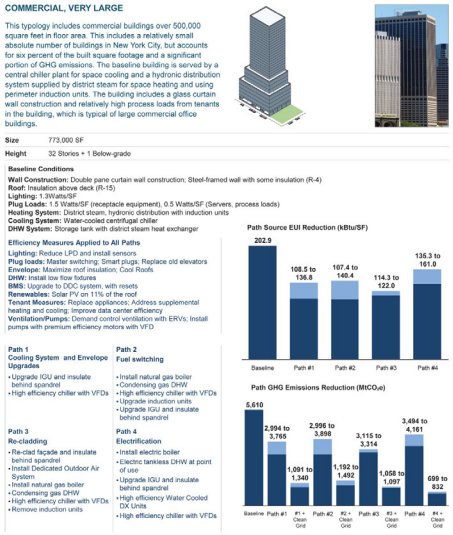
Path GHG Emissions Reduction ($MtCO_2e$)









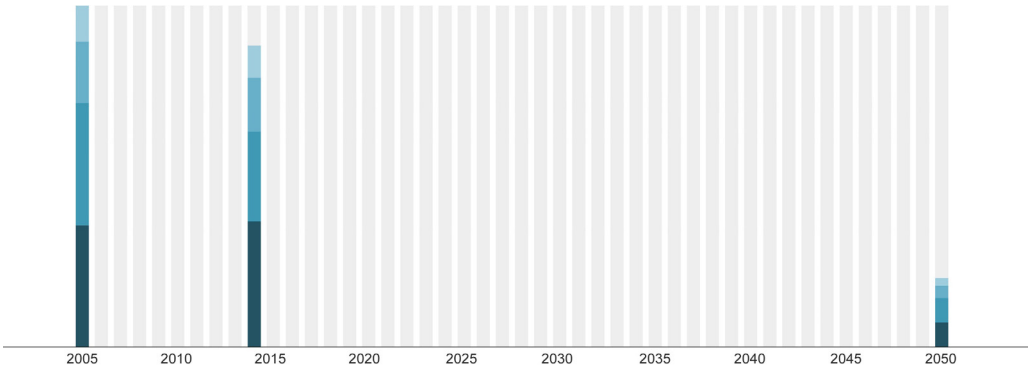


New York City's 80X50 strategies for buildings

1. Upgrade existing buildings to increase energy efficiency
2. Help owners, tenants, and residents understand and invest in energy efficiency
3. Ensure exceptional energy performance in new buildings
4. Prepare the workforce to deliver high performance buildings
5. Become a global hub for clean energy and energy efficiency technology


2% of properties
=
45% of citywide
energy consumption
benchmarking.cityofnewyork.us
WEATHER NORMALIZED ENERGY USE INTENSITY (KBTU/FT²)
< 110
595+


NYC Retrofit ACCELERATOR
Buildings That Make a Difference
HOME
ABOUT
RESOURCES
FAQs
CONTACT
Buildings that Make a Difference
We work with you every step of the way to make energy efficiency upgrades that can help your building. Click here to get started.
The NYC Retrofit Accelerator is a one-stop resource provided by the City of New York to help owners and operators of privately owned buildings reduce operating costs and increase the sustainability of their properties through energy and water upgrades.


2005
2010
2015
2020
2025
2030
2035
2040
2045
2050

The Building Energy Exchange connects the Manhattan real estate communities to energy and lighting efficiency solutions through exhibitions, education, technology demonstrations, and research. We identify opportunities, navigate barriers to adoption, broker relationships, and showcase best practices at our resource center in the Surrogate's Courthouse in Manhattan.

be-exchange.org