Northeast Buildings 101

Matt Rusteika
Director of Market Transformation
Building Decarbonization Coalition

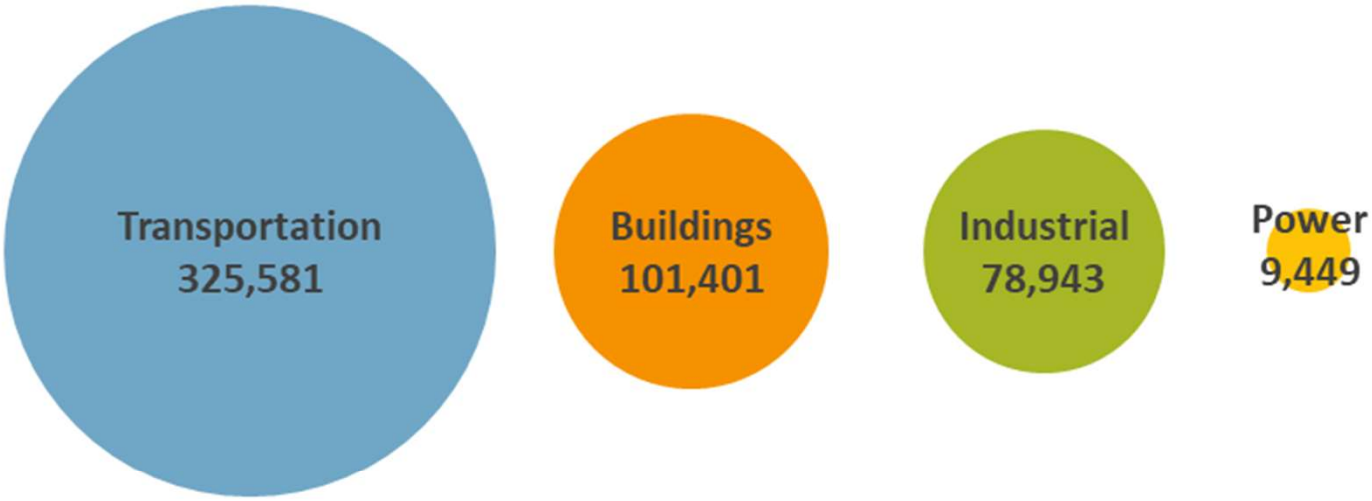
OUR MEMBERS


City of Palo Alto Utilities
East Bay Community Energy
LA DWP
Los Angeles Department of Water & Power
New York State Department of Public Service
NYSERDA
Sonoma Clean Power
Pacific Gas and Electric Company
SMUD
Silicon Valley Clean Energy
Southern California Edison
Association for Energy Affordability
Bay Area Air Quality Management District
BAYREN
City of Menlo Park
Ecology Action
the Energy Coalition
Johnson Controls
MCE
My community. My choice.
Mitsubishi Electric
Monterey Bay Community Power
NRDC
Natural Resources Defense Council
Peninsula Clean Energy
Resource Refocus
Rheem
Sierra Club
Silicon Valley Power
StopWaste
2050 Partners
350 Sacramento
Active SGV
AIM Associates
Alameda Municipal Power
Alter
AO Smith
Innovation has a name.
Ardenna Energy
BC Hydro
Power smart
Beyond Efficiency
Bradford White
Bright Green Strategies
Bright Power
Brummitt Energy Associates Inc
British Columbia
Build It Green
The Building Electrification Initiative
Burohappold Engineering
California Air Resources Board
California Geothermal Heat Pump Association
CUSP
Palo Alto Carbon Free Challenge
Celeritas Engineering
Center for Sustainable Energy
Urban Institute
CIDC
CityGreen
City of Boulder
City of Emeryville
City of Fremont
City of Morgan Hill
City of Oakland
Petaluma
City of San Jose
Capital of Silicon Valley
City of San Luis Obispo
City of Santa Cruz
City of Santa Monica
Clean Coalition
Clean Energy Works
CPA
Clean Power Alliance
Locally powered energy innovation.
Cullen
The Climate Reality Project
codecycle
Community Energy Labs
CommonSpark Consulting
AVE
Ann V Edminster
Design AVEnues LLC
Earthjustice
ECO2
Ecotope
ecotrust canada
EfficiencyFirst California
ehdd architecture
Electrify My Home
electrify now
Elevate Energy
Endeavour
Emerald Cities Collaborative
emerald eco
enwave
ERASE40.org
Greenbank Associates
GRID Alternatives
Guttmann & Blaevoet
HEA
HEA Home Energy Analytics
Integral Group
Kitchens to Life
Berkeley Lab
LWV League of Women Voters of California
Local Government Commission
Massachusetts Clean Energy Center
Menlo Spark
Sustainability Alliance
NEOCHARGE
nbi new buildings institute
neep
nyle water heating systems
ohmconnect
slipstream
Olympic International
PAE
Peoples' Self-Help Housing
REDCAR REU Analytics
Redwood Energy
Rocky Mountain Institute
Rising Tide
SF Climate Emergency Coalition
SF Environment
San Jose Clean Energy
SFO
Siegel & Strain Architects
SL Climate Coalition
SWEEP
Schiller Consulting
Sustainable San Mateo County
Sustainable Silicon Valley
Taylor Engineering
TerraVerde Energy
ULI
Urban Land Institute
williams + paddon
Architects + Planners
WRNS Studio
zero energy project

EMISSIONS

NOx Emissions by Sector in the NESCAUM Region

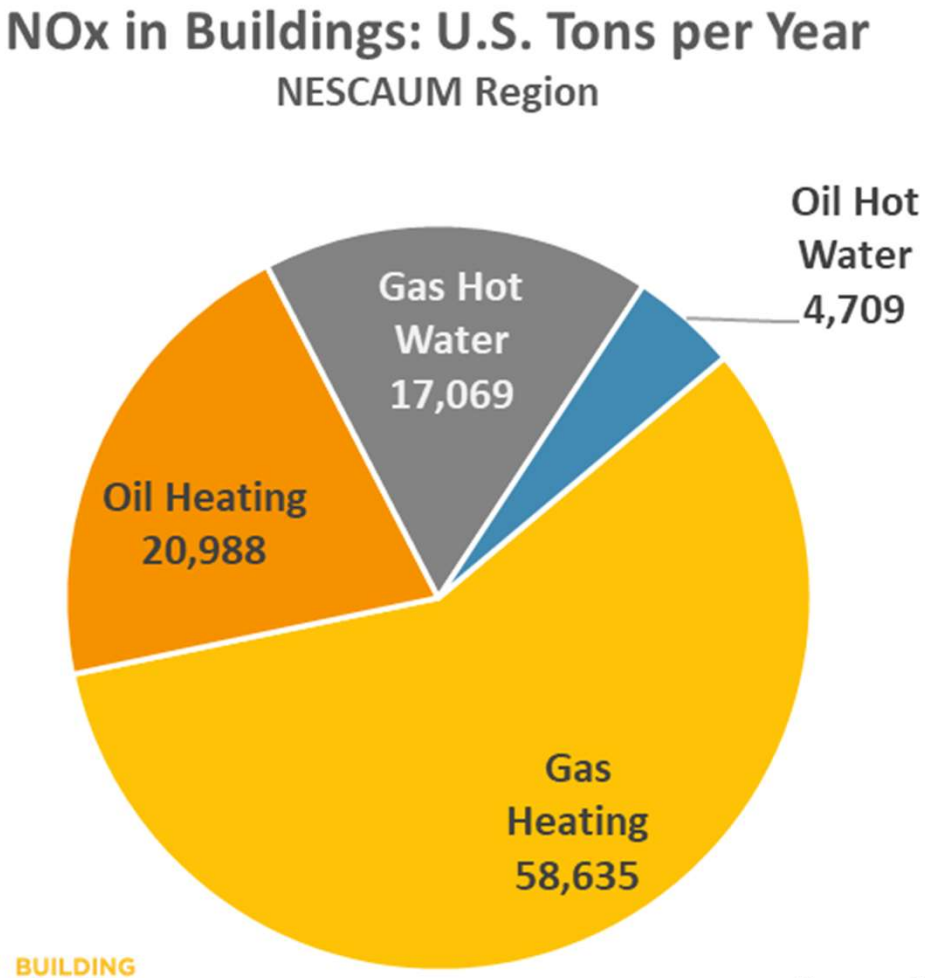
U.S. Tons per Year



BUILDING DECARBONIZATION COALITION

Source: EIA State Energy Data System (SEDS), AP42

- Buildings are the second biggest source of NOx in the NESCAUM region after transportation.
- Homes & businesses in the region produce >100,000 tons of NOx annually.

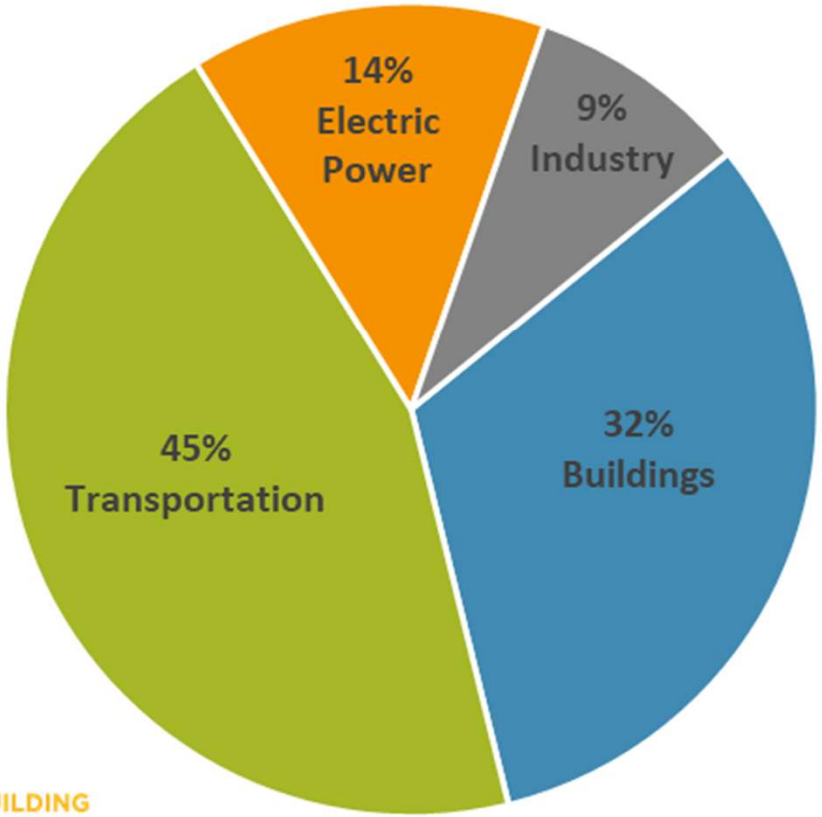


BUILDING DECARBONIZATION COALITION

Source: RECS, CBECS, AP42

- Est. 79% of NOx from buildings comes from space heating equipment.
  - 76% in NJ (least) to 85% in ME (most)
- Of that, 74% is from gas heating equipment.
  - 20% in ME (least) to 91% in NJ (most)

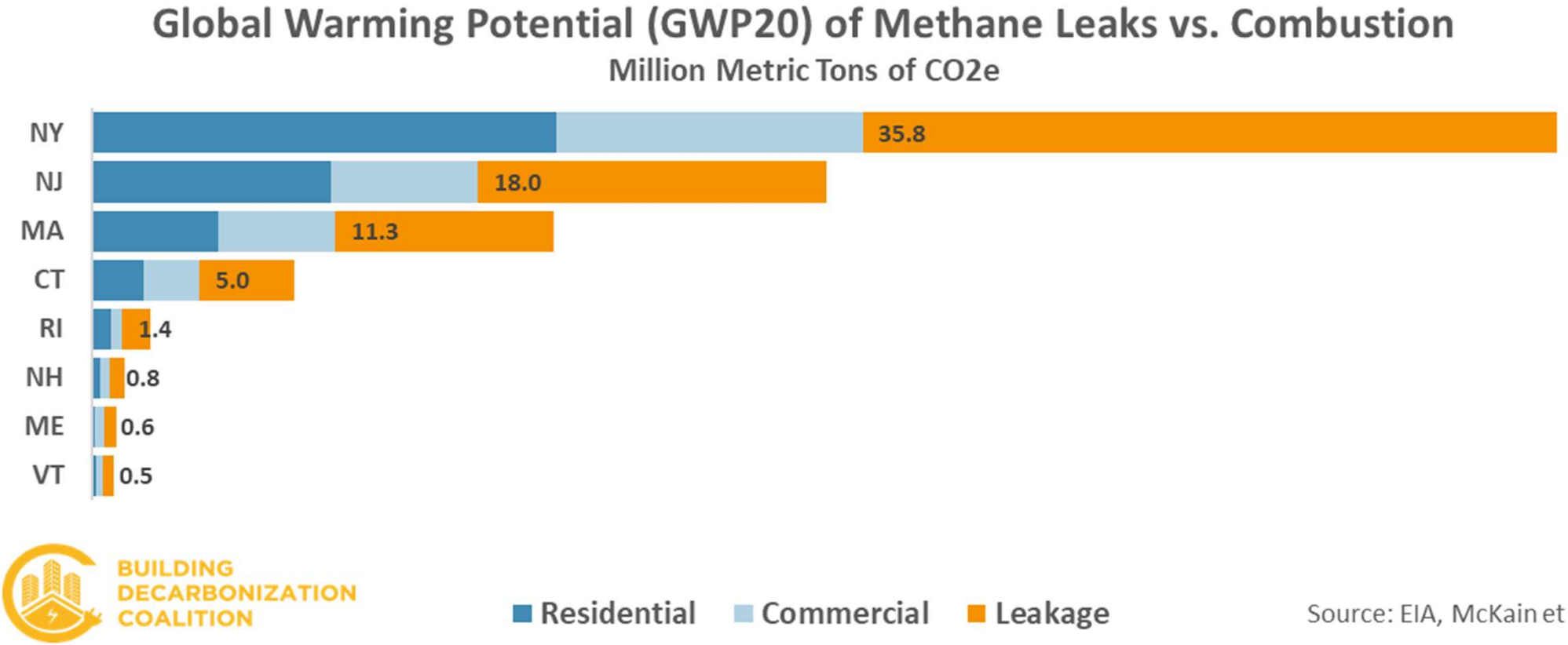
Buildings Contribution to GHG Emissions
NESCAUM States



BUILDING DECARBONIZATION COALITION

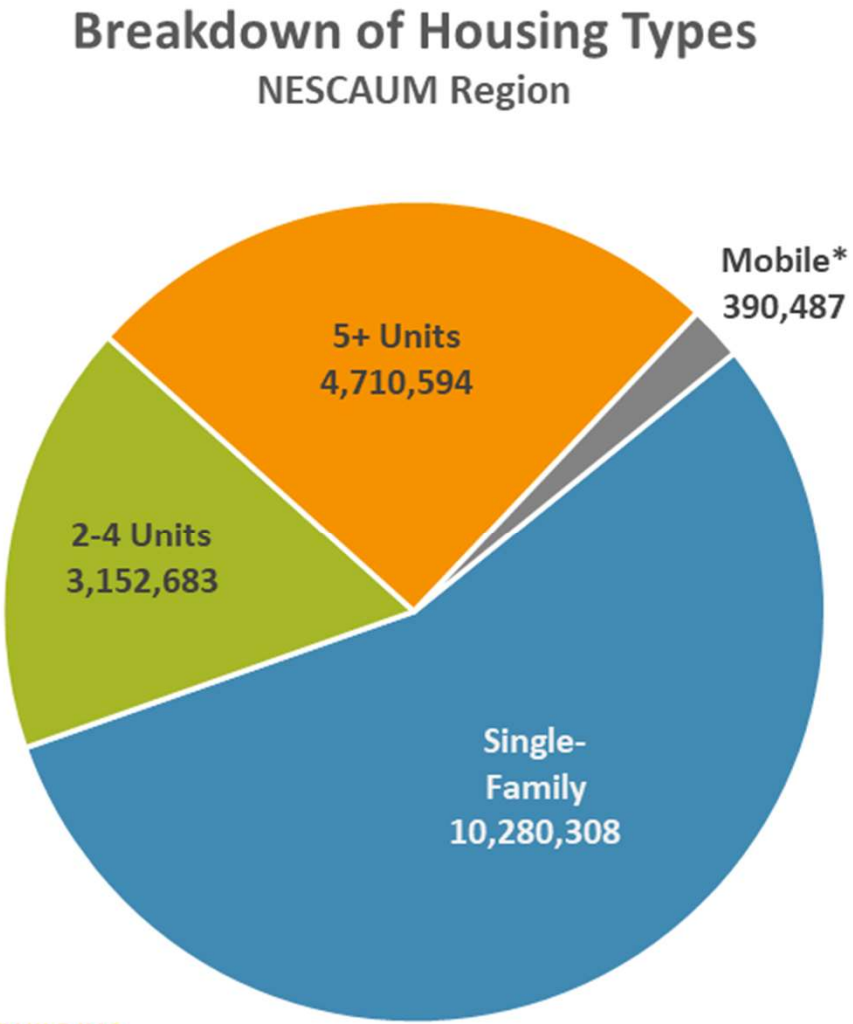
Source: EPA State Inventory Tool

Buildings represent about one third of all greenhouse gas emissions in the NESCAUM states.



Methane leaks from the gas distribution system might nearly double the overall GWP of natural gas.

RESIDENTIAL

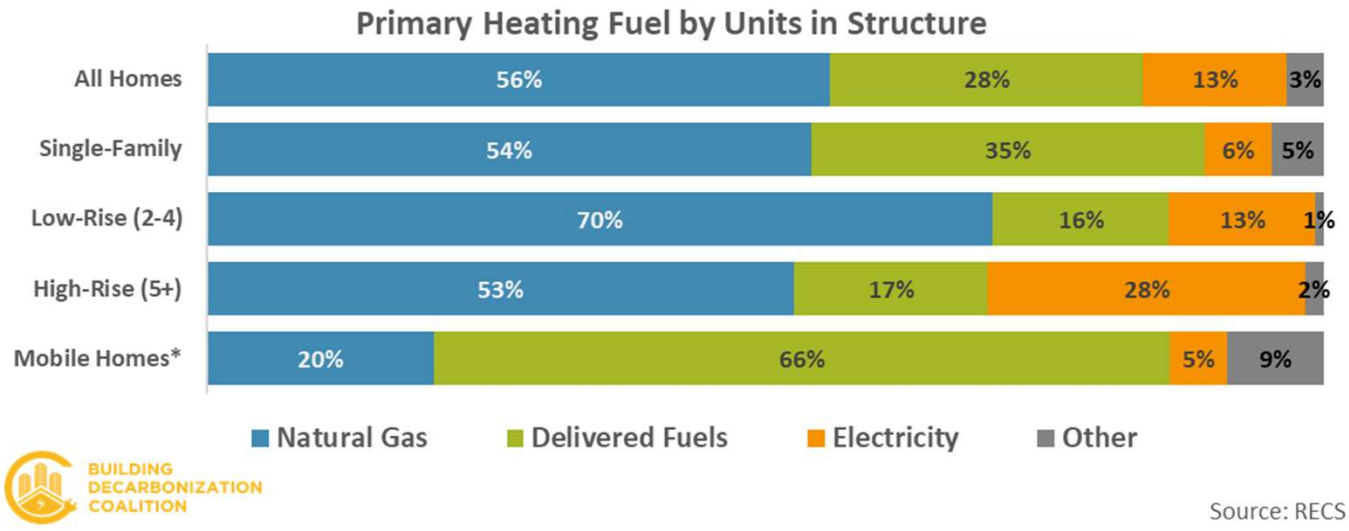


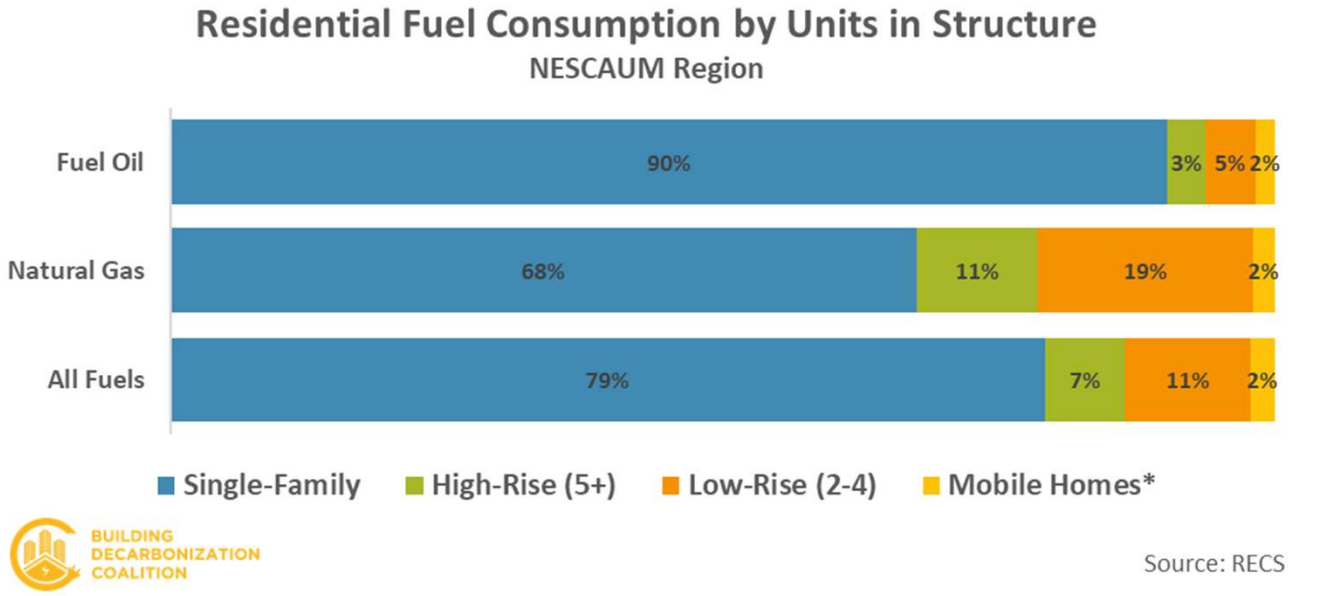
BUILDING DECARBONIZATION COALITION

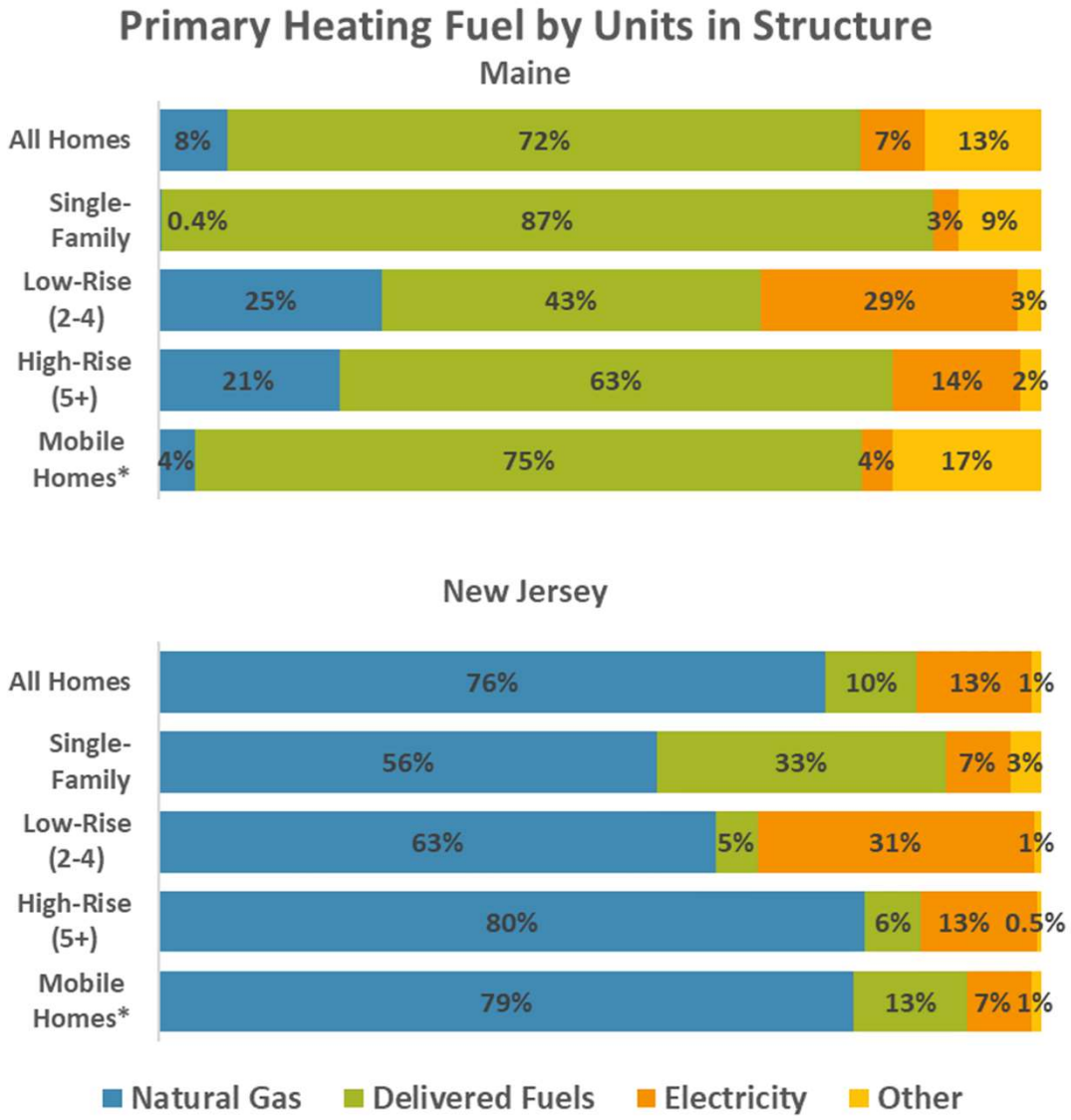
Source: U.S. Census American Community Survey (2019)
* Includes mobile homes, boats, vans, and RVs

- There are 18.5 million homes in the NESCAUM states
- More than half of them (55%) are single-family
- About a quarter are in larger apartment buildings (5+ units)

- Gas heats more than half of homes within every type.
- Electric heat remains common in high-rises.
- The 35% of single-family homes that heat primarily with oil account for 90% of oil use in the region.
- Single-families represent 55% of all homes but 68% of natural gas consumption.



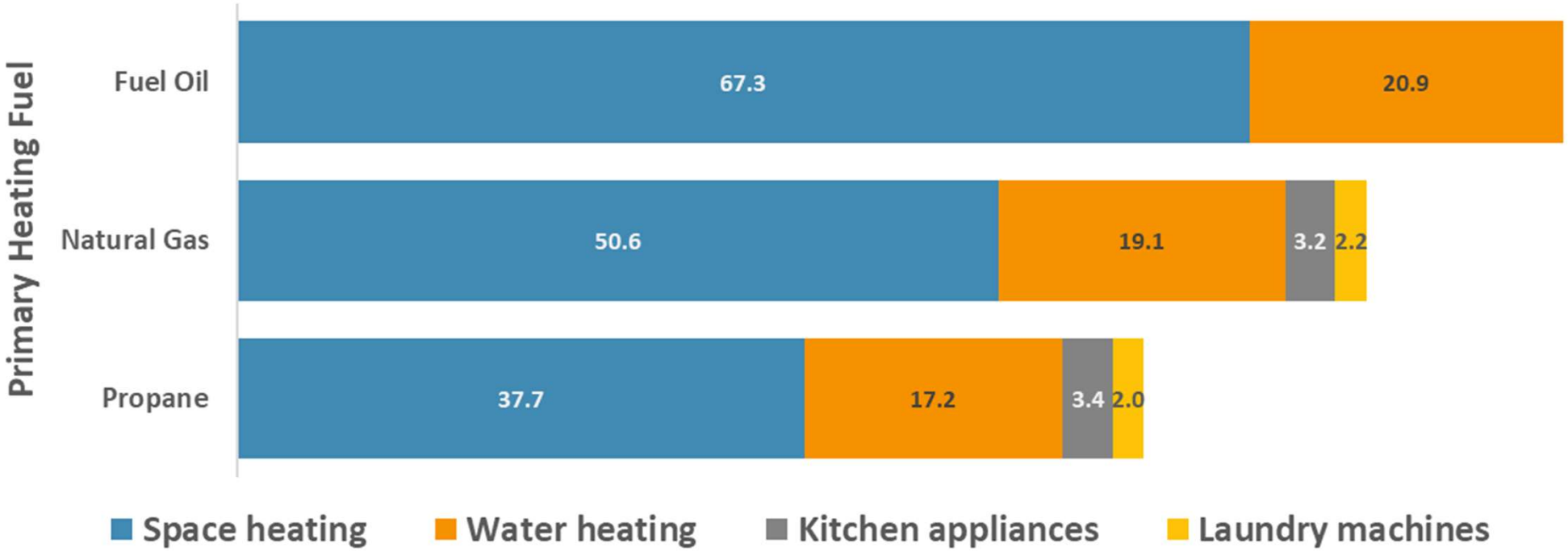




Residential fuel consumption patterns differ substantially between states.

End Use Breakdown for an Average Northeast Home: Fuel Combustion

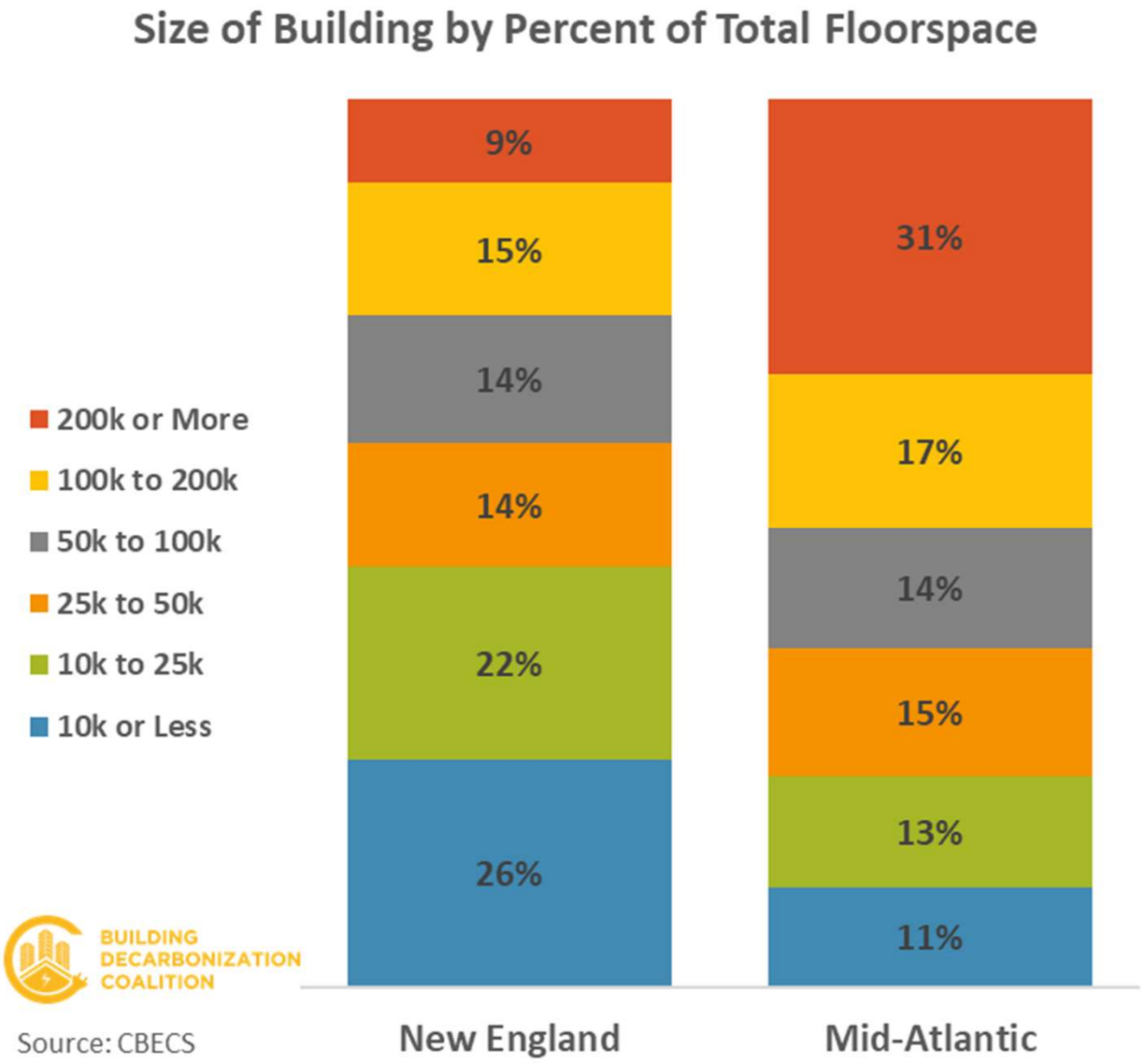
Site MMBTU from Fossil Fuels per Year



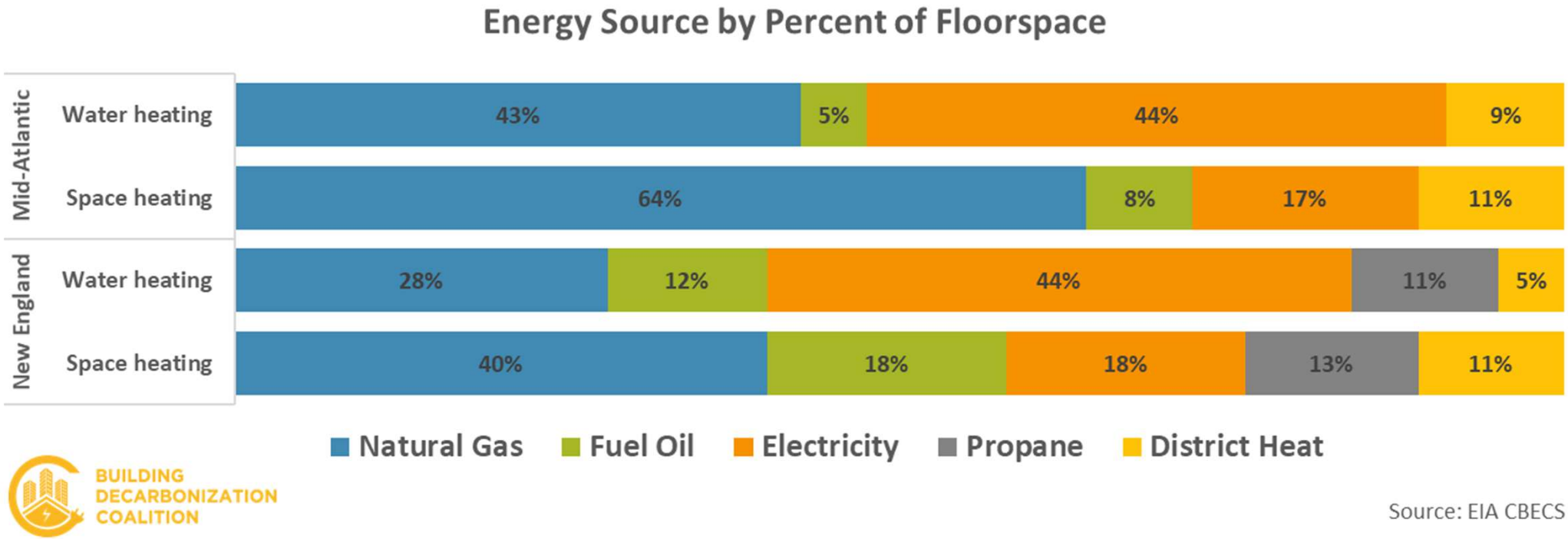
BUILDING DECARBONIZATION COALITION

Source: U.S. EIA Residential Energy Consumption Survey (RECS)

COMMERCIAL



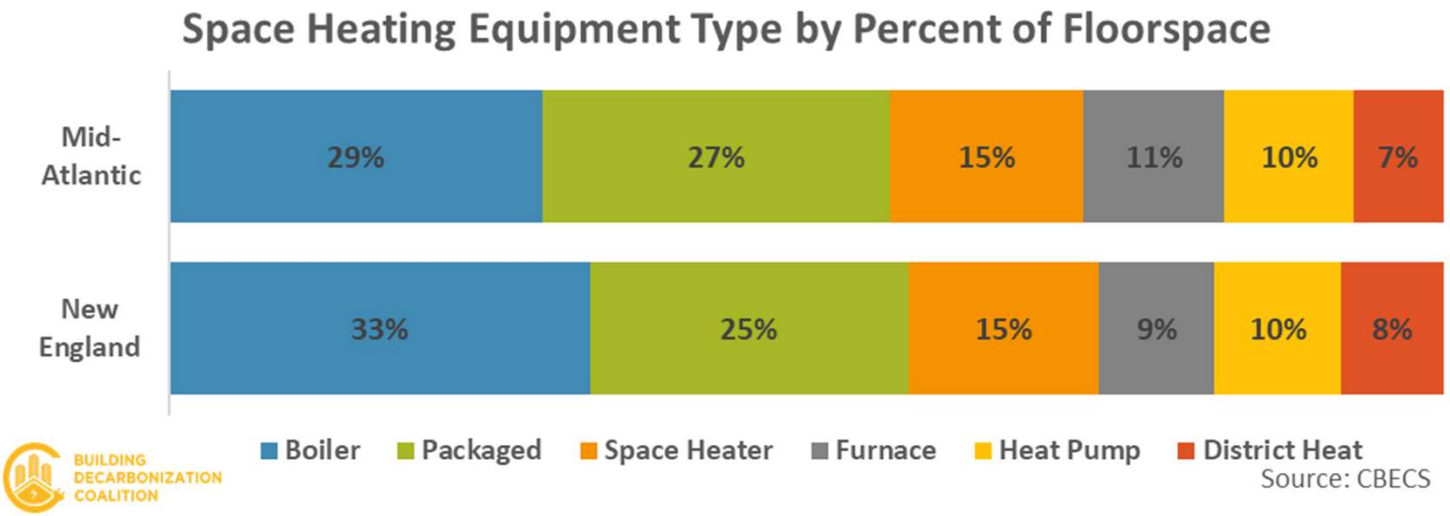
- Individual buildings are larger in the Mid-Atlantic.
- Almost half of commercial floorspace in New England is in buildings with areas <25k s.f.



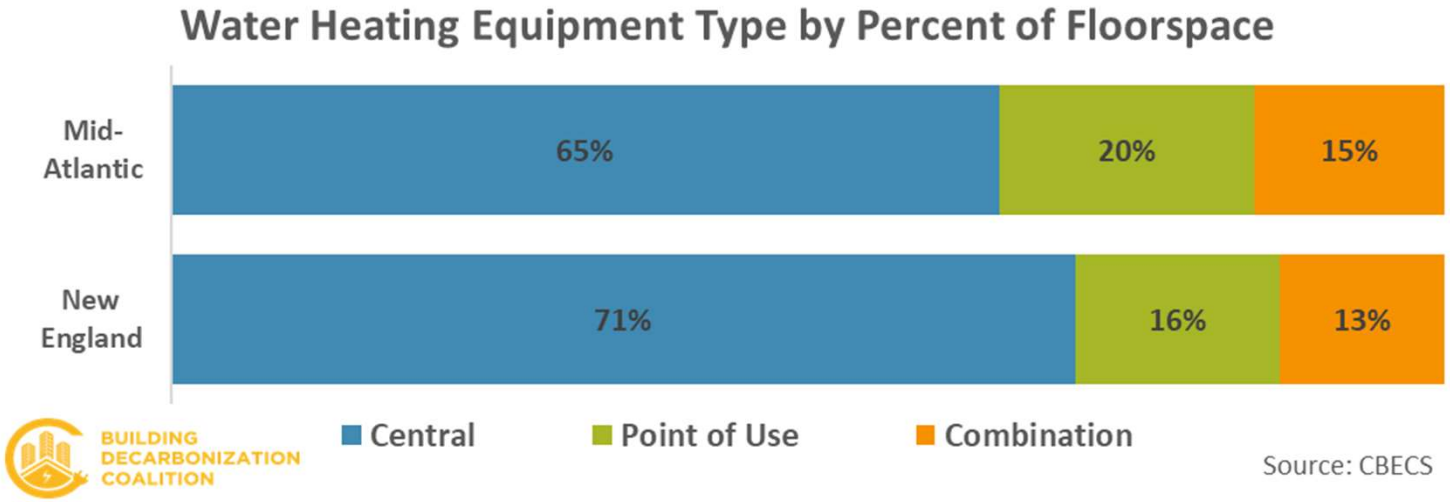
BUILDING DECARBONIZATION COALITION

Source: EIA CBECS

It is common for commercial buildings to have fuel-fired space heating but electric water heating. Electricity is more common than gas as a water heating fuel.

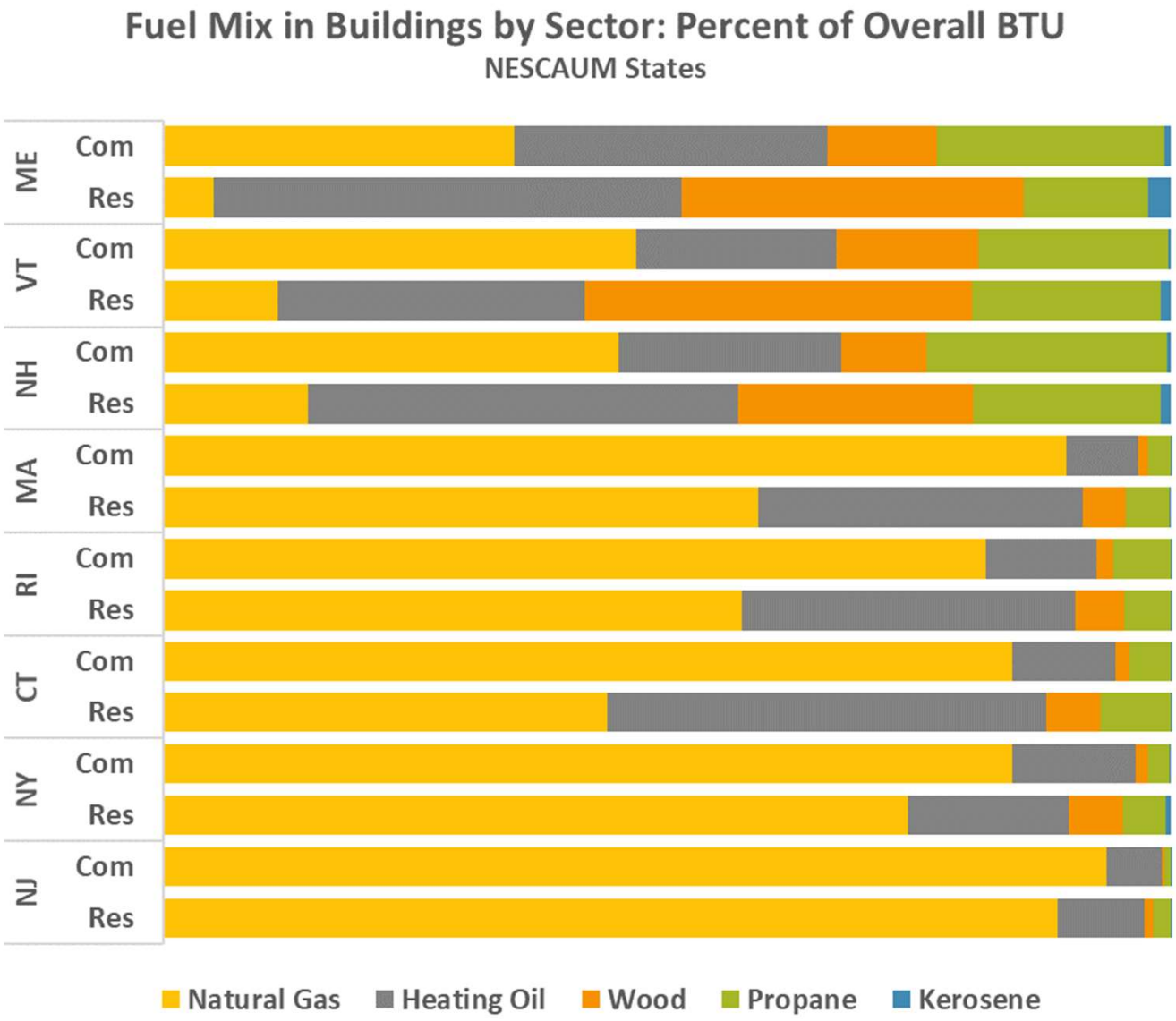


"Central" space heating systems may only account for about half of heating by floorspace.



By contrast, central water heating systems serve 80% or more of commercial floorspace.

FUELS



A Few Takeaways

- Natural gas dominates thermal energy use in the region.
- Fuel oil is more common in residential than commercial.
- Wood & propane remain common in rural areas.

Thank you!

matt@buildingdecarb.org

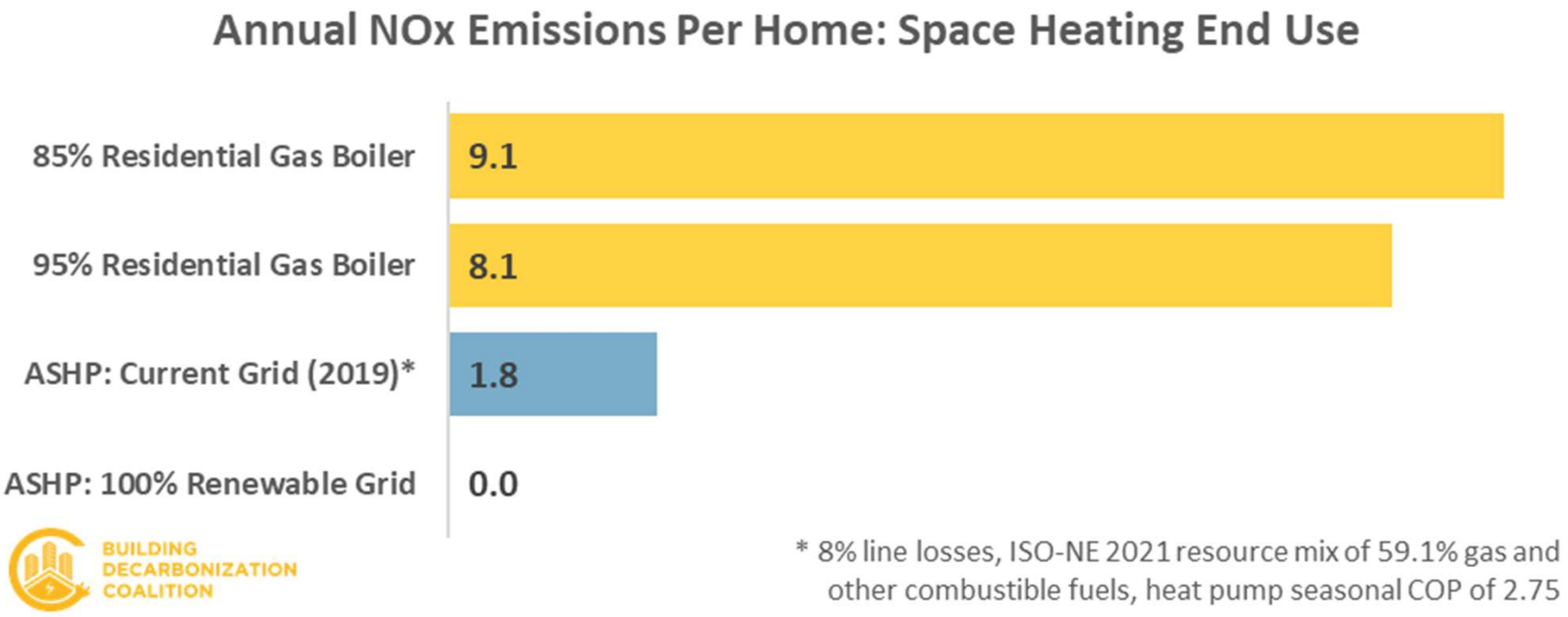
(617) 620-3426

APPENDIX

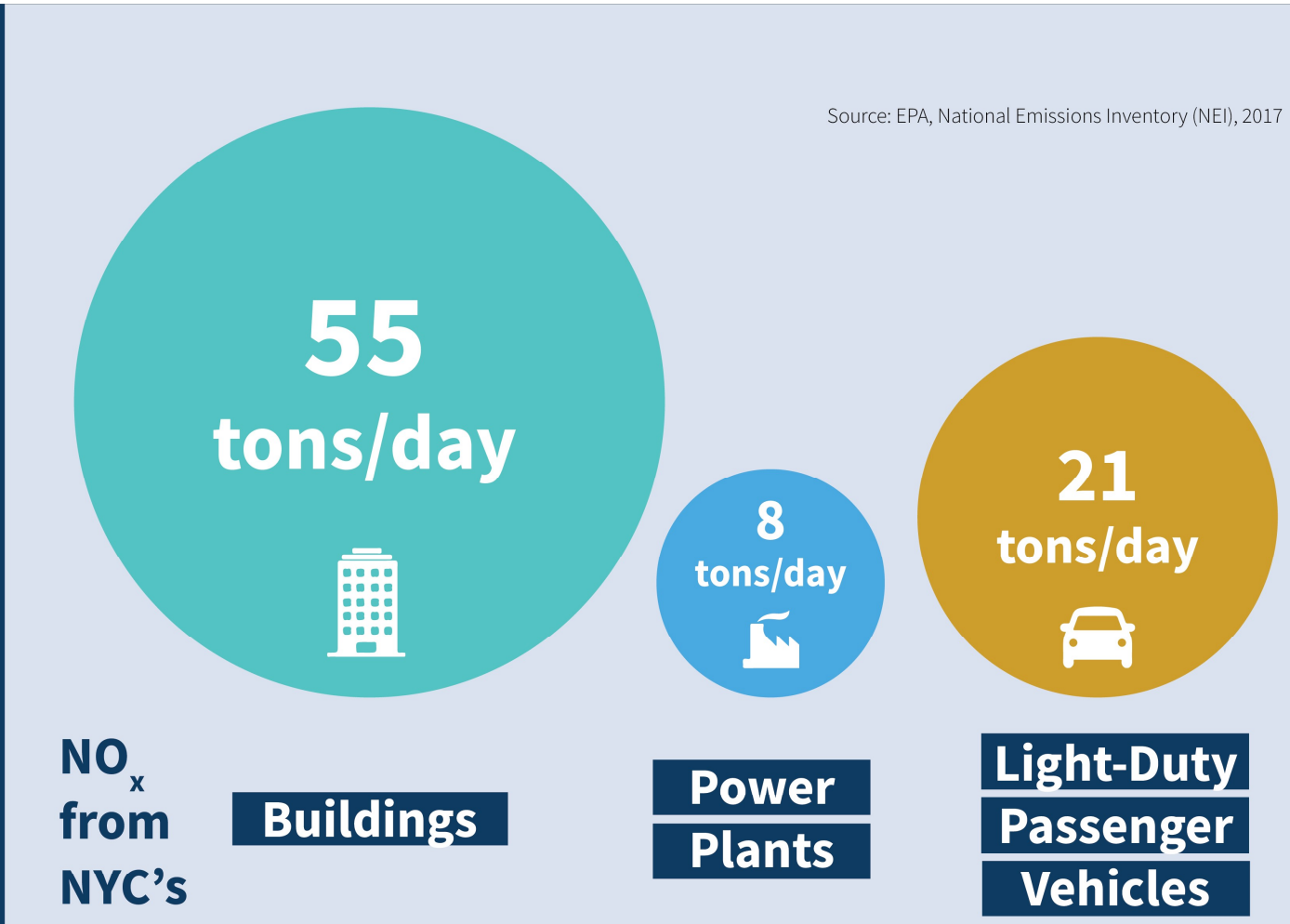
Buildings Matter

- Buildings produce an estimated 20% of the region's NOx and 30% of its greenhouse gases.
- Limits on these pollutants are few.
- Existing policies are mostly incentive-based—"all carrot, no stick" only goes so far.
- Our ability to address pollution from buildings via efficiency regs is limited—but not so for air pollution regs.

Current state policies that target existing buildings are incentive-based, incremental, and **reduce emissions as a side effect** rather than a core purpose.



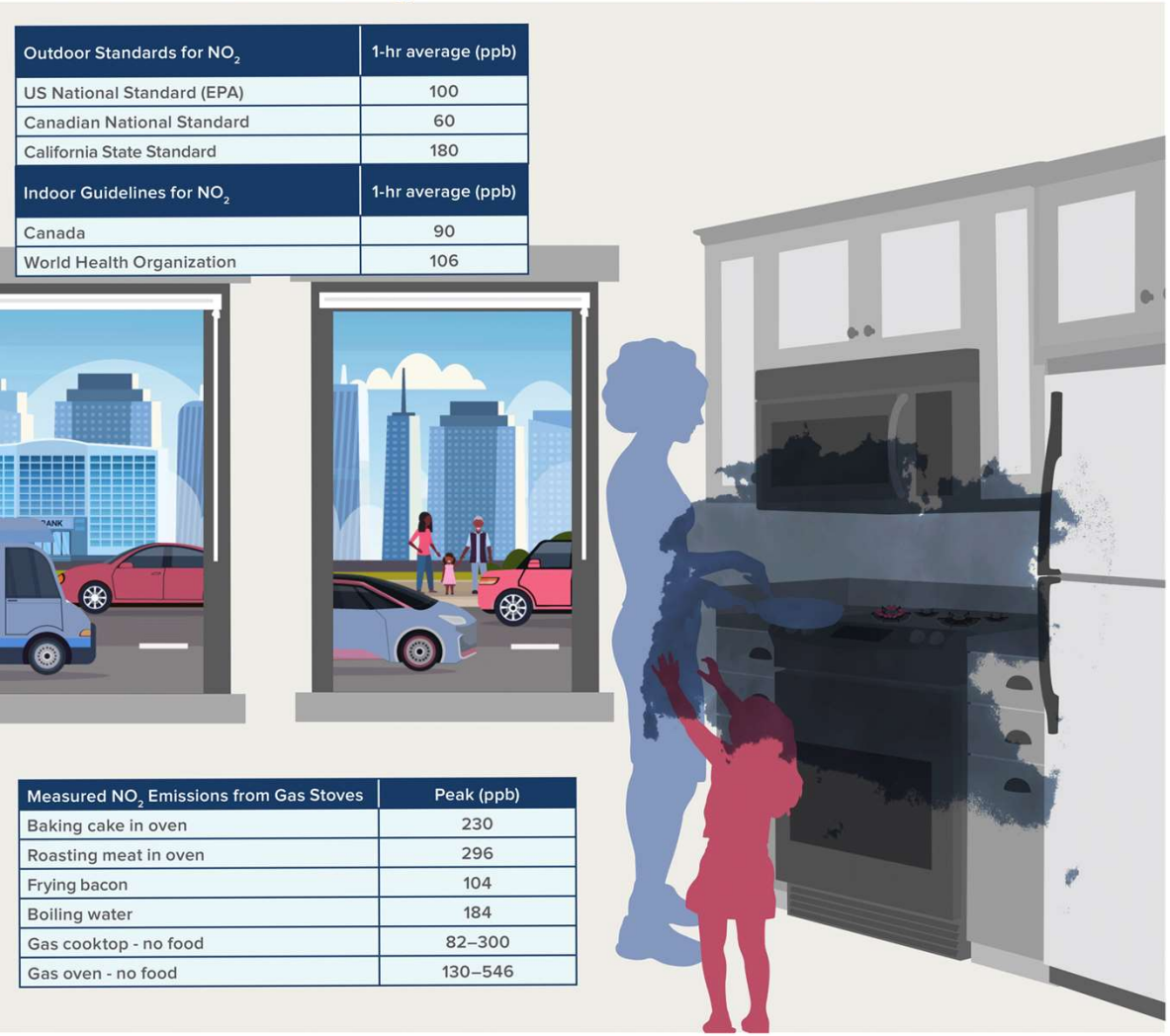
In New York City, burning fossil fuels in buildings generates twice as much NO_x as light-duty passenger vehicles and seven times as much NO_x as power plants.



Credit: RMI (available here)

Gas Stoves Can Emit Elevated Indoor Nitrogen Dioxide (NO_2) Levels Often Exceeding Indoor Guidelines and Outdoor Standards

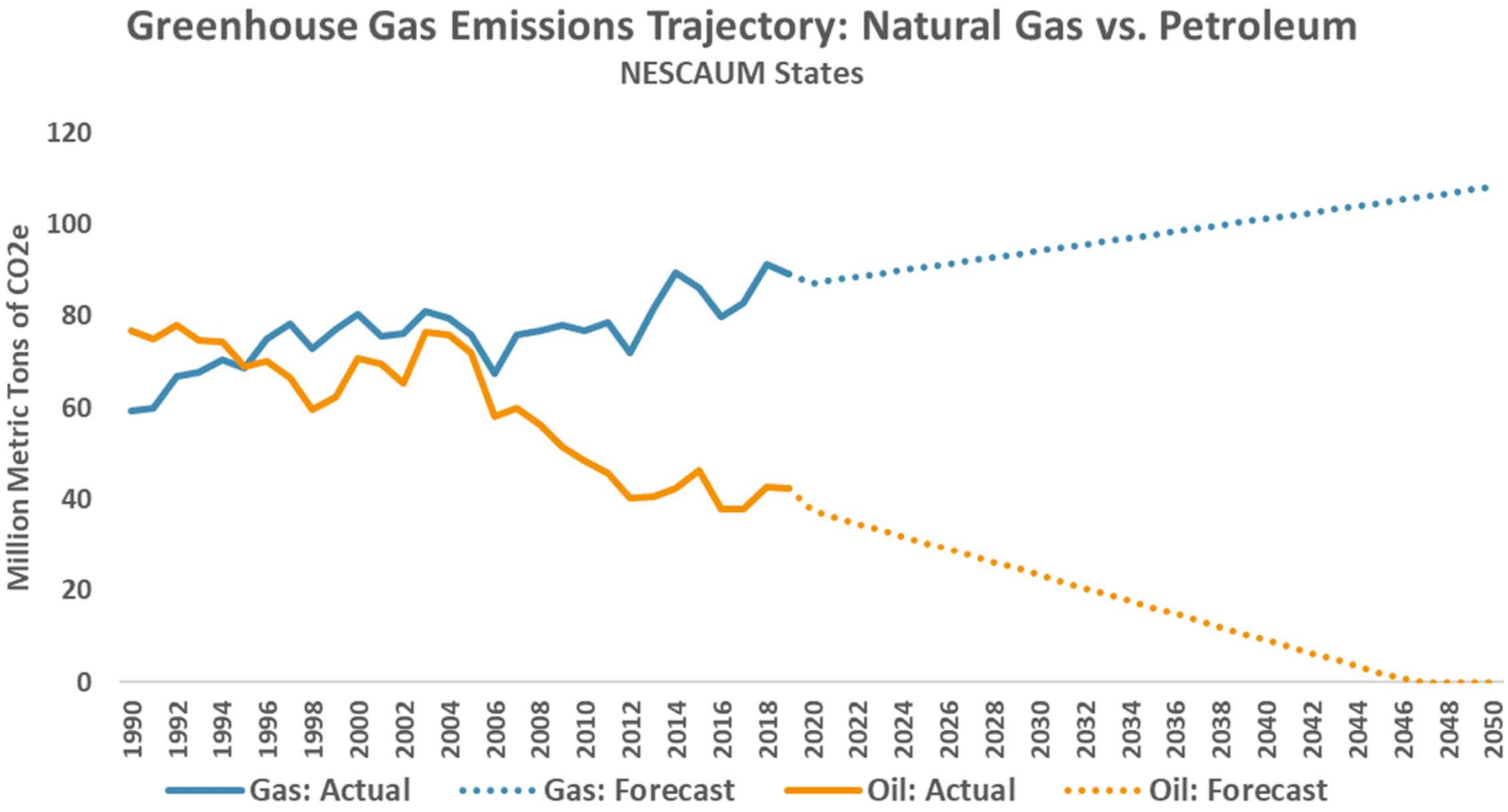
Outdoor Standards for NO_2	1-hr average (ppb)
US National Standard (EPA)	100
Canadian National Standard	60
California State Standard	180
Indoor Guidelines for NO_2	**1-hr average (ppb)**
Canada	90
World Health Organization	106



Measured NO_2 Emissions from Gas Stoves	Peak (ppb)
Baking cake in oven	230
Roasting meat in oven	296
Frying bacon	104
Boiling water	184
Gas cooktop - no food	82–300
Gas oven - no food	130–546

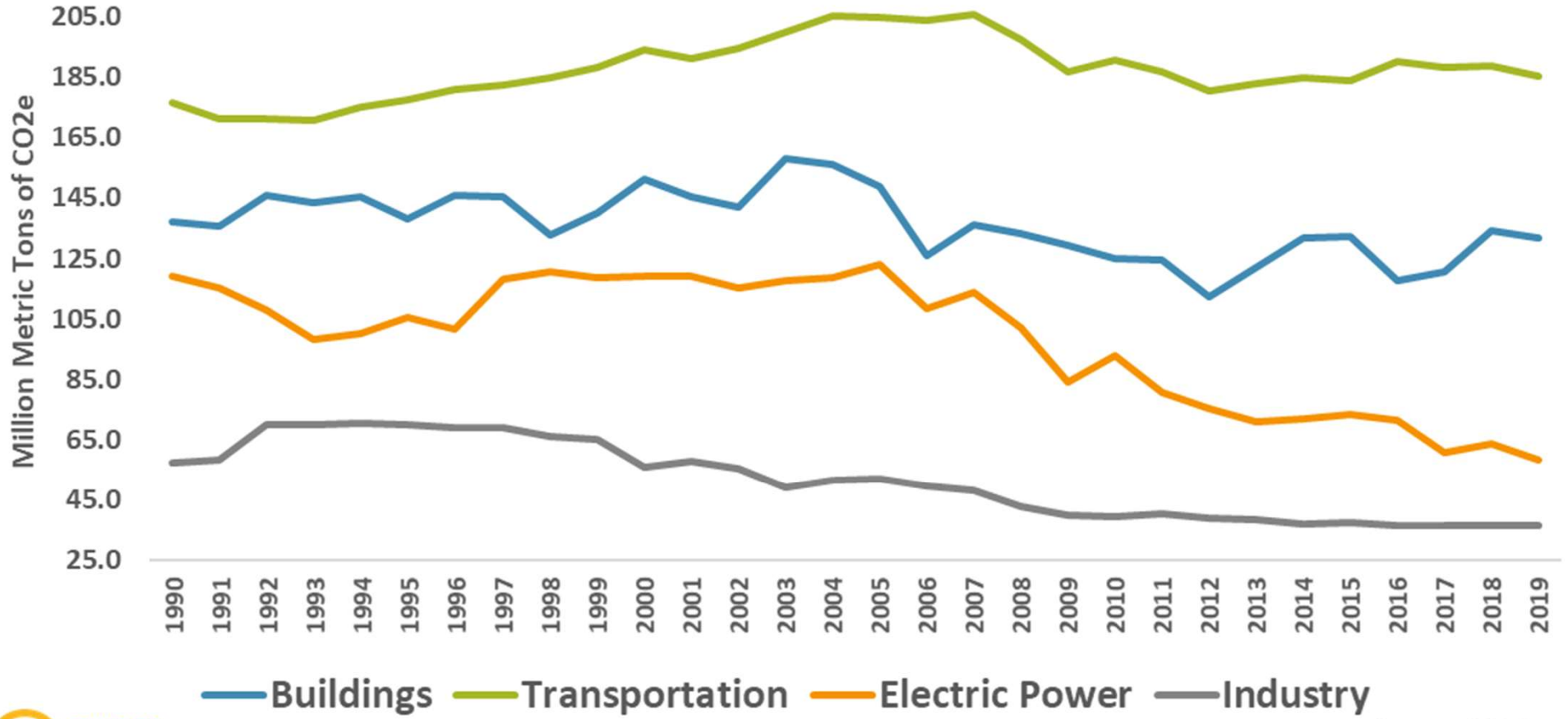
Source: https://rmi.org/insight/gas-stoves-pollution-health

- Research has begun to demonstrate the health impacts of burning fuels in the home.
- Indoor NOx can exceed EPA outdoor limits in homes with gas stoves.
- Stanford study found that stoves leak methane even when they're off.


Greenhouse Gas Emissions Trajectory: Natural Gas vs. Petroleum
NESCAUM States
Million Metric Tons of CO2e
120
100
80
60
40
20
0
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022
2024
2026
2028
2030
2032
2034
2036
2038
2040
2042
2044
2046
2048
2050
Gas: Actual
Gas: Forecast
Oil: Actual
Oil: Forecast

GHG Emissions by Sector in the NESCAUM States

1990-2019

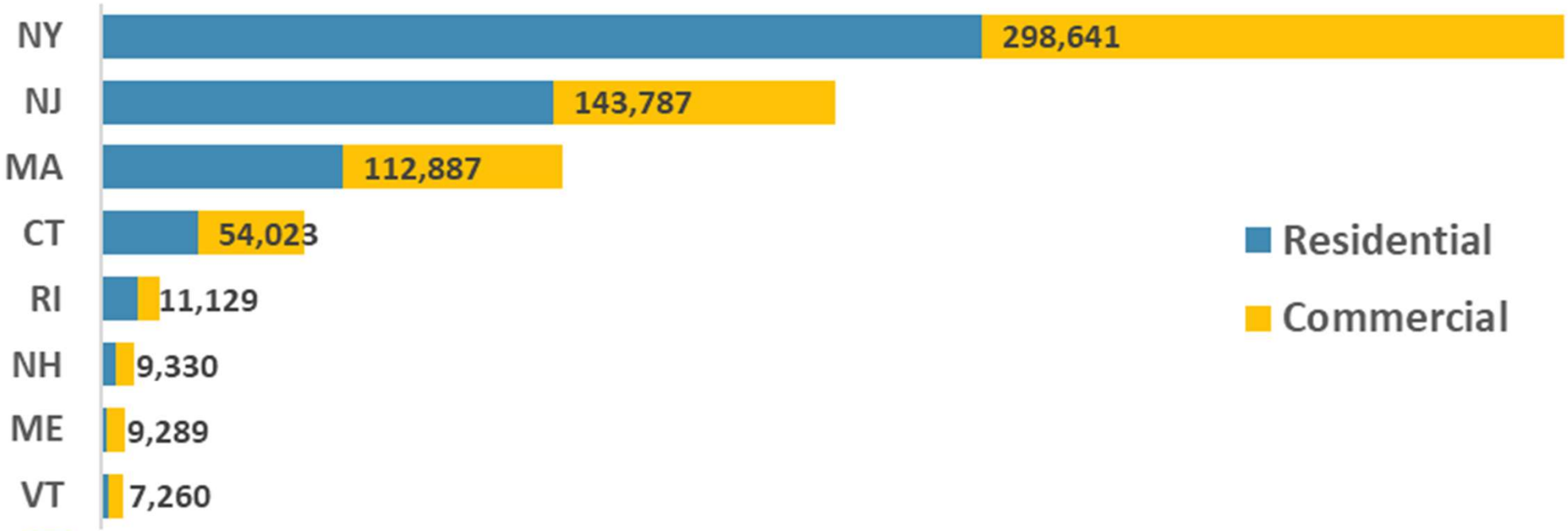


BUILDING DECARBONIZATION COALITION

Source: EPA State Inventory Tool

2020 Natural Gas Consumption in NESCAUM States

Billion BTU

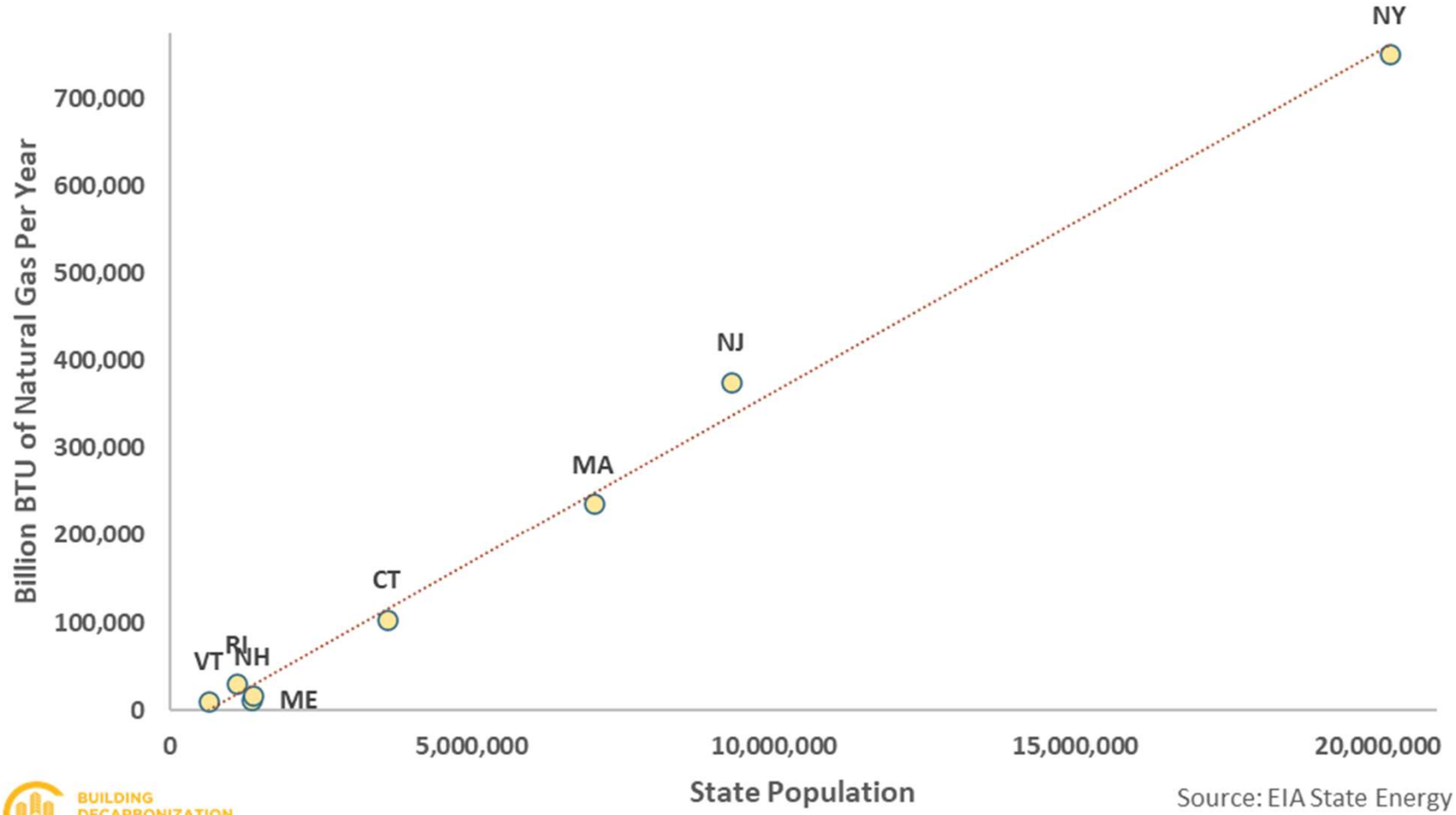


BUILDING DECARBONIZATION COALITION

Source: EIA State Energy Data System (SEDS)

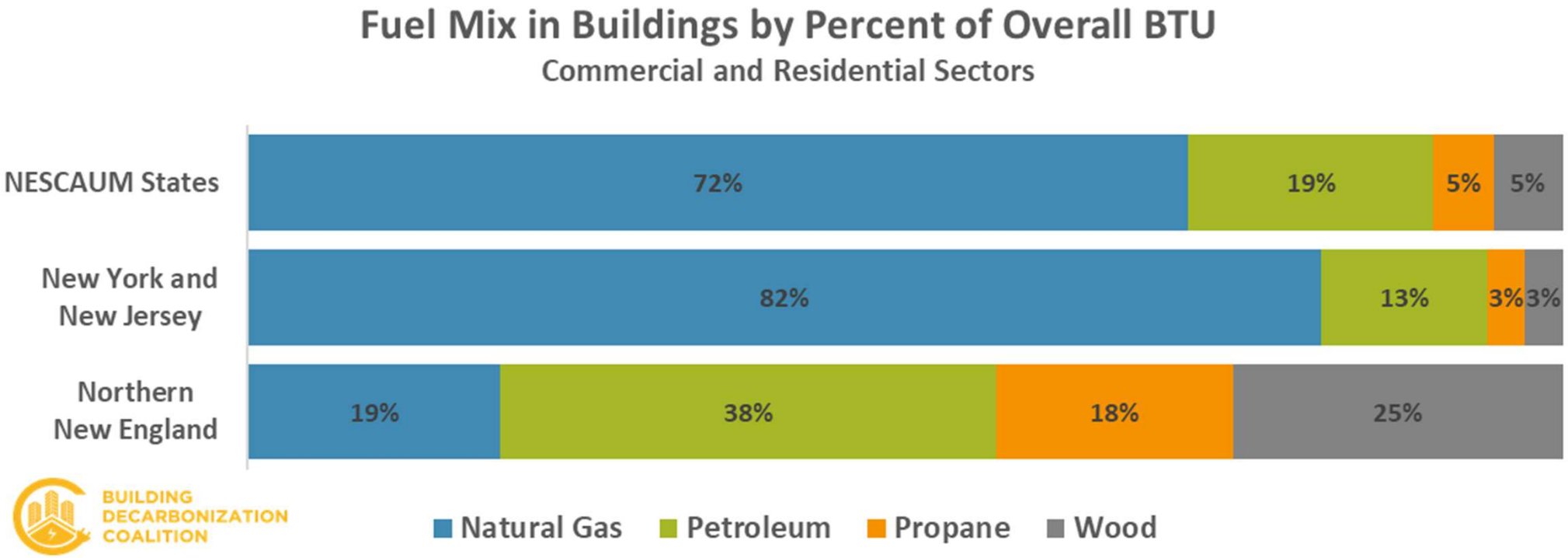
Natural Gas Consumption vs. State Population

NESCAUM Region



BUILDING DECARBONIZATION COALITION

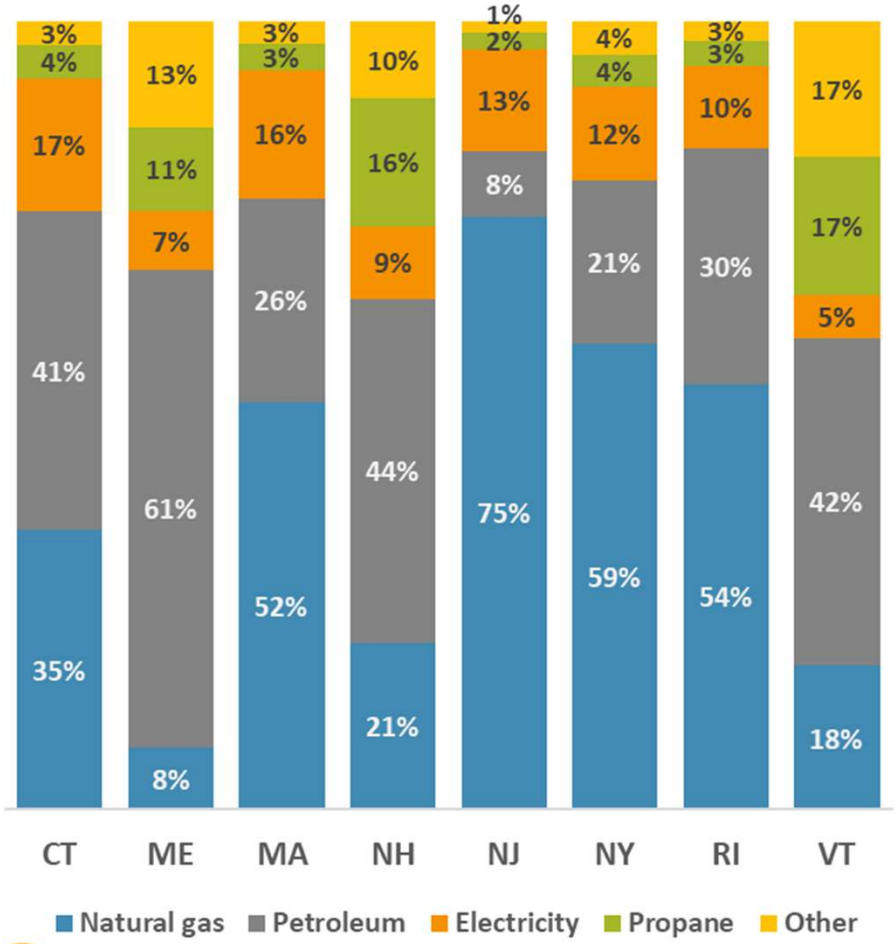
Source: EIA State Energy Data System (SEDS), U.S. Census



Natural gas accounts for nearly three quarters of buildings' total fuel consumption in the NESCAUM states.

Residential Primary Heating Fuel

NESCAUM Region

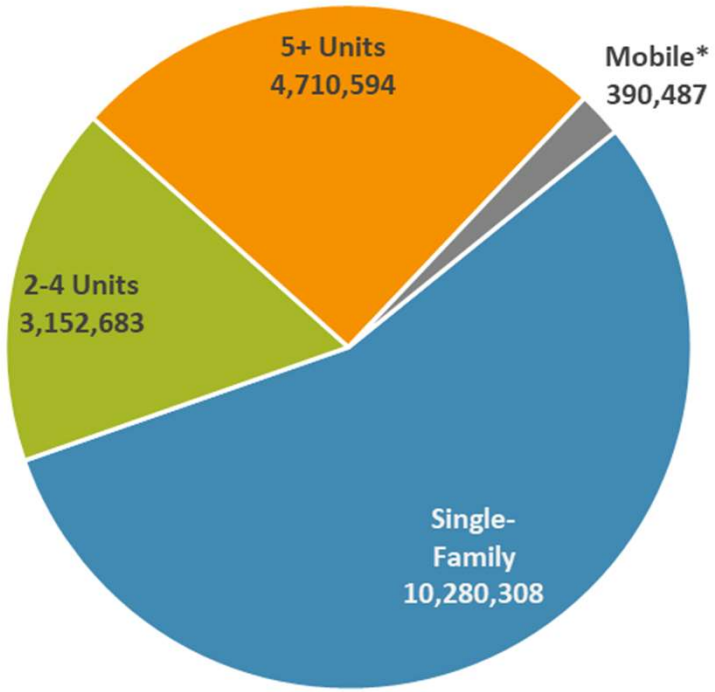


BUILDING DECARBONIZATION COALITION

Source: U.S. Census American Community Survey (2019)

Breakdown of Housing Types

NESCAUM Region



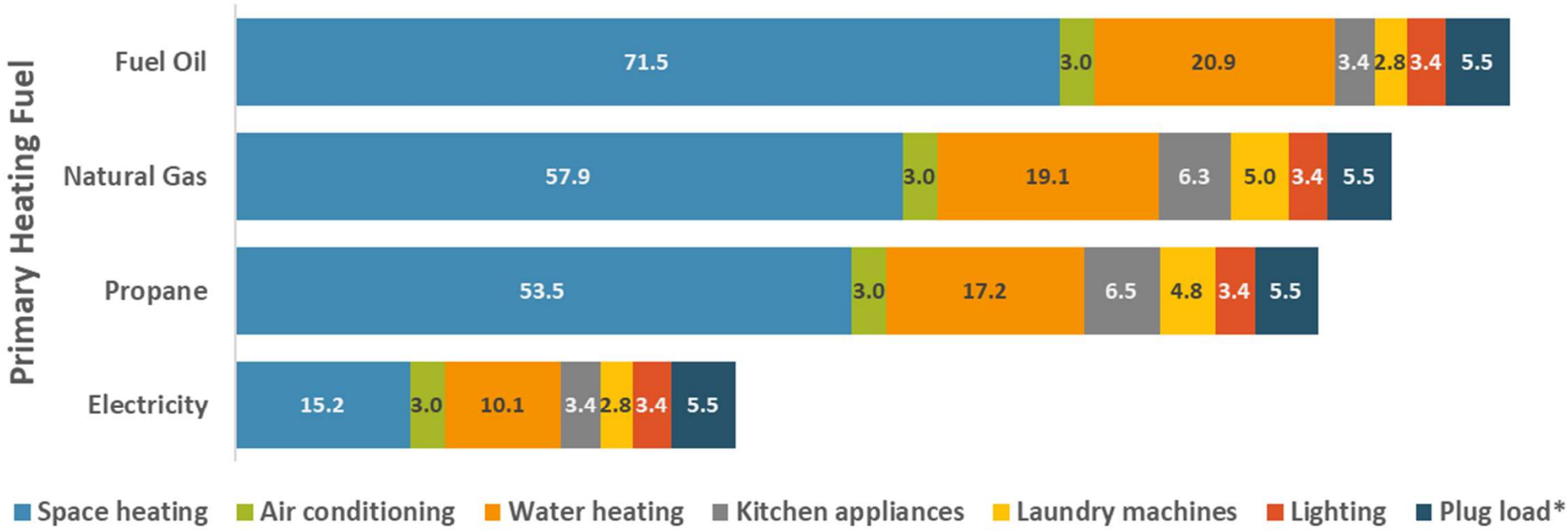
BUILDING DECARBONIZATION COALITION

Source: U.S. Census American Community Survey (2019)

* Includes mobile homes, boats, vans, and RVs

End Use Breakdown for an Average Northeast Home

Site MMBTU per Year



BUILDING DECARBONIZATION COALITION

Source: U.S. EIA Residential Energy Consumption Survey (RECS)

* Includes TV, set top box, and dehumidifier. Lamps are included in lighting.