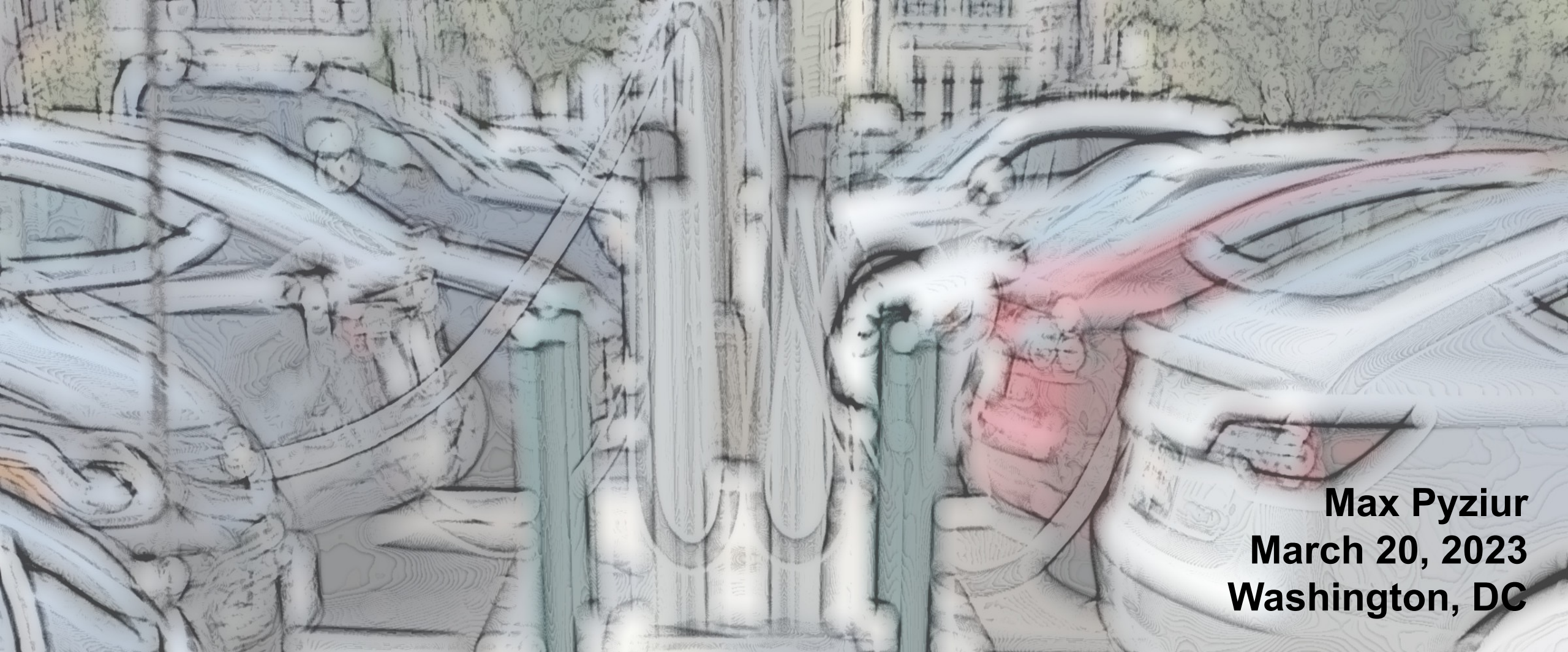


Massachusetts: Electrification Challenges in Response to Recent Legislation and Rules



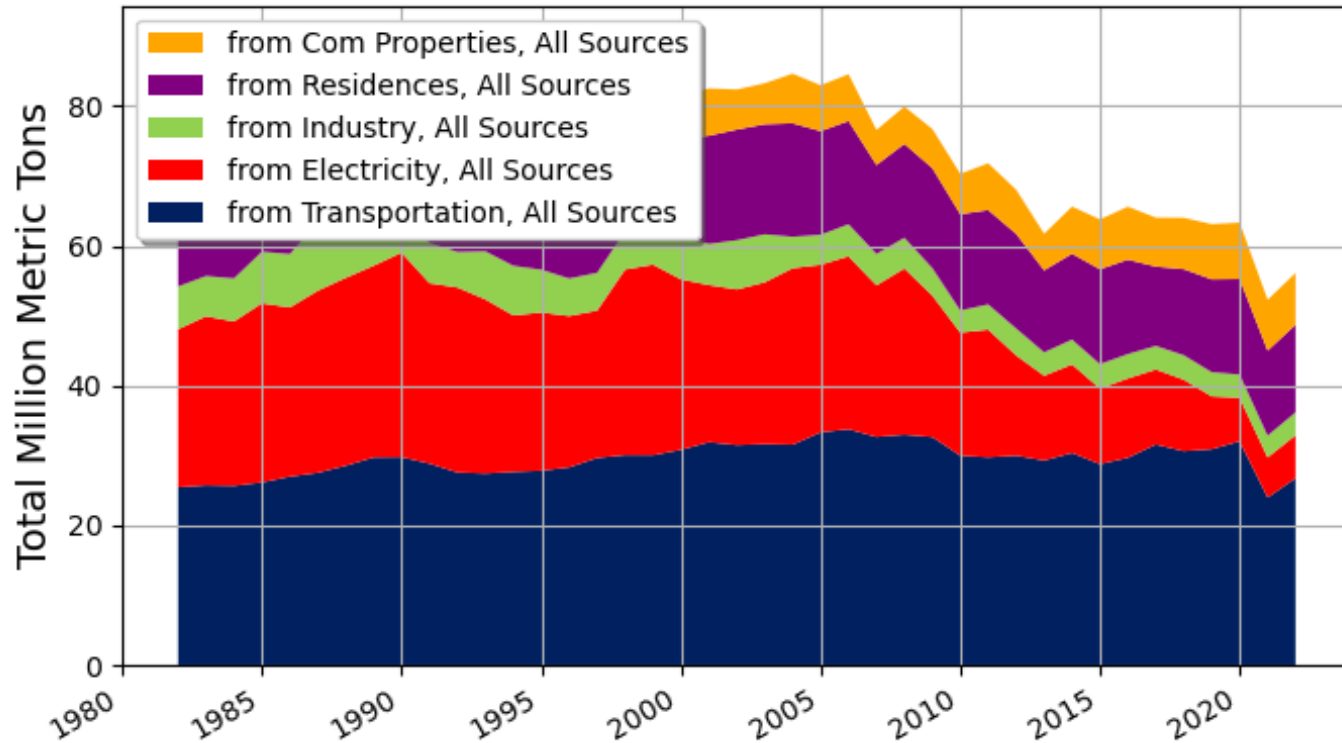
Max Pyziur
March 20, 2023
Washington, DC

Massachusetts: Electrification Challenges



- **On December 6, 2023, Massachusetts Department of Public Utilities issued Order 20-80. The Order changes the Commonwealth's existing natural gas regulatory program to one that limits the amount that local natural gas utilities can recover. Effectively, this mandates the decommissioning of the existing natural gas system and a shift to electric heating in residences.**
- **This ruling builds on Massachusetts' 2021 climate law. The 2021 law seeks to displace hydrocarbon fuels with the use of electricity in order to lower the amount of CO₂ emissions produced in the Commonwealth. The 2021 law requires a 28% reduction in emissions by 2025 compared to 1990 levels and 47% reduction by 2030.**
- **Currently, residential and commercial emissions are 18% below those of 1990.**

Massachusetts CO2 Emissions: 12/31/1981 to 12/31/2021



Analysis based on Annual EIA Data

EPRINC

In 2021, Massachusetts generated 56.1 million metric tons of CO₂ emissions from the combustion of hydrocarbon fuels. This is down 34.6% from the peak of 85 million in 1997.

Critical to this decline has been the displacement of coal-powered electricity generation by natural gas. In 2005, coal accounted for 30% of in-state generation. The last Massachusetts coal-fired plant was shut down in 2018. By 2022, natural gas dominated Massachusetts electricity generation accounting for 70.8% of the total.

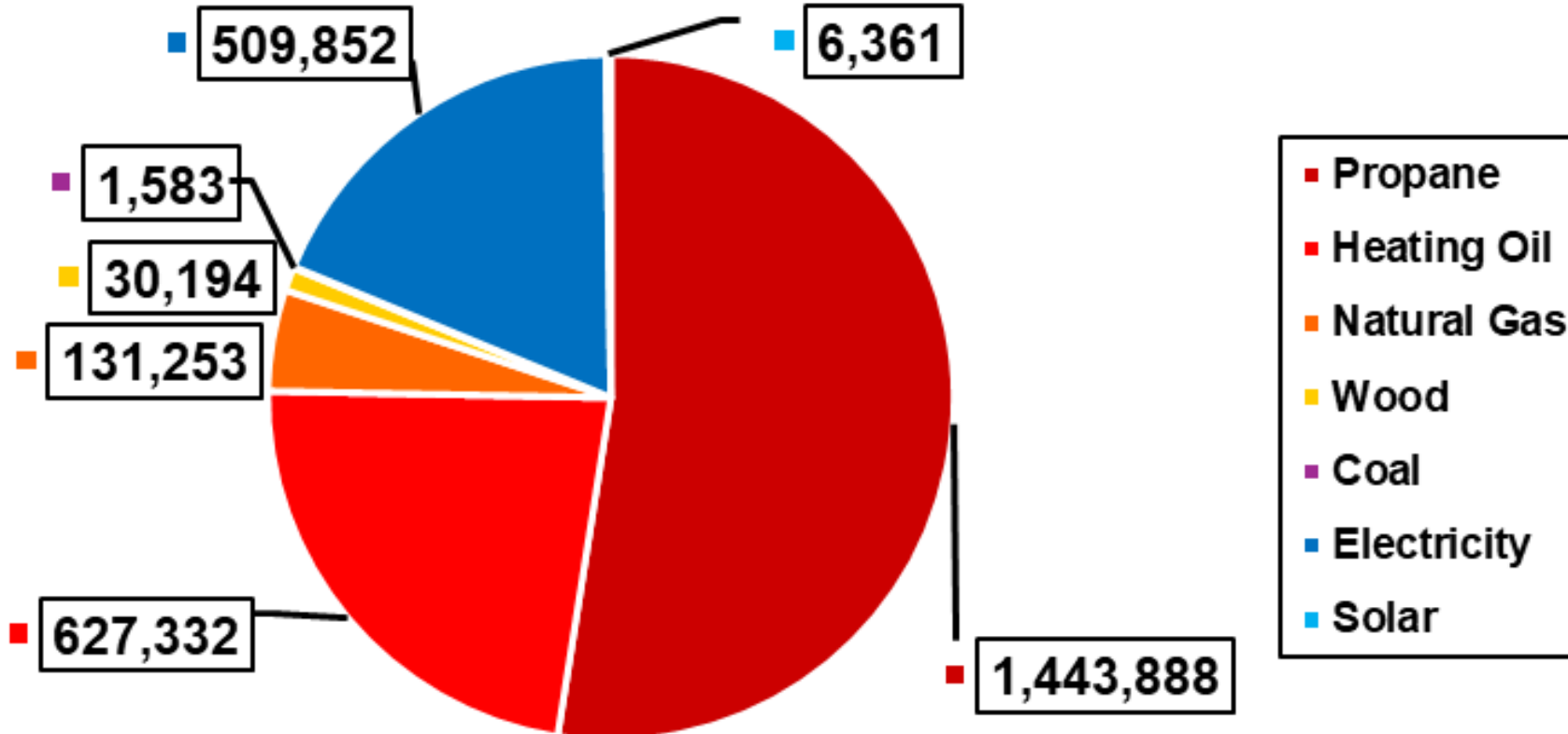
Can the Massachusetts Power Grid Manage An Immediate Switch to Electric Vehicles?				
			Factor	Formula/Source
A	Massachusetts Total Miles On-Highway Driven (VMT)	61.7	Billion	U.S. DoT - 2023 Data
B	Number of Light Duty Vehicles (LDVs) (90% of VMT)	5.0	Million	U.S. DoE - 2022 Data
C	Heavy Duty Vehicles (HDVs) (10% of VMT)	0.3	Million	
D	LDVs VMT	55.5	Billion	90% * A
E	HDVs VMT	6.2	Billion	10% * A
F	MPG-Equivalent LD Electric Vehicle	100.0	One	U.S. DoT & EPA Data
G	MPG-Equivalent HD Electric Vehicle	30.0	One	
H	LDV Fuel – Gasoline KWH/Gallon	35.3		U.S. EPA Data
I	HDV Fuel – Diesel KWH/Gallon	40.3		
J	LDV EV Annual Electricity Requirement	19.568	Billion KiloWatt Hours	$(D \div F) * H$
K	HDV EV Annual Electricity Requirement	8.3	Billion KiloWatt Hours	$(E \div G) * I$
L	Total EV Annual Electricity Requirement	27.8	Billion KiloWatt Hours	J + K
M	Massachusetts Total In-State Electricity Generation	21.0	Billion KiloWatt Hours	U.S. EIA Data
N	Additional Amount of Generation Required	132.4%		
Analysis based on EIA & DOE Data				EPRINC

In order to accommodate a full fleet of electric vehicles in Massachusetts, it would require an additional 132%, or 27.8 billion KWHs, more of electricity.

Formula:
 1) U.S. vehicle miles traveled divided by average MPG Implies energy requirements;
 2) Convert to equivalent electricity needs;
 3) Evaluate relative to existing generation

MA - Number of Dwellings by Heating Fuel

2.2 Million Heated with Combustible Fuels vs 0.5 Million with Electricity



Analysis Based on U.S. Census Data

EPRINC

There are 2.2 million dwellings heated with combustible fuels in Massachusetts.

Conversions to electric heat range between \$5 and \$20 thousand.

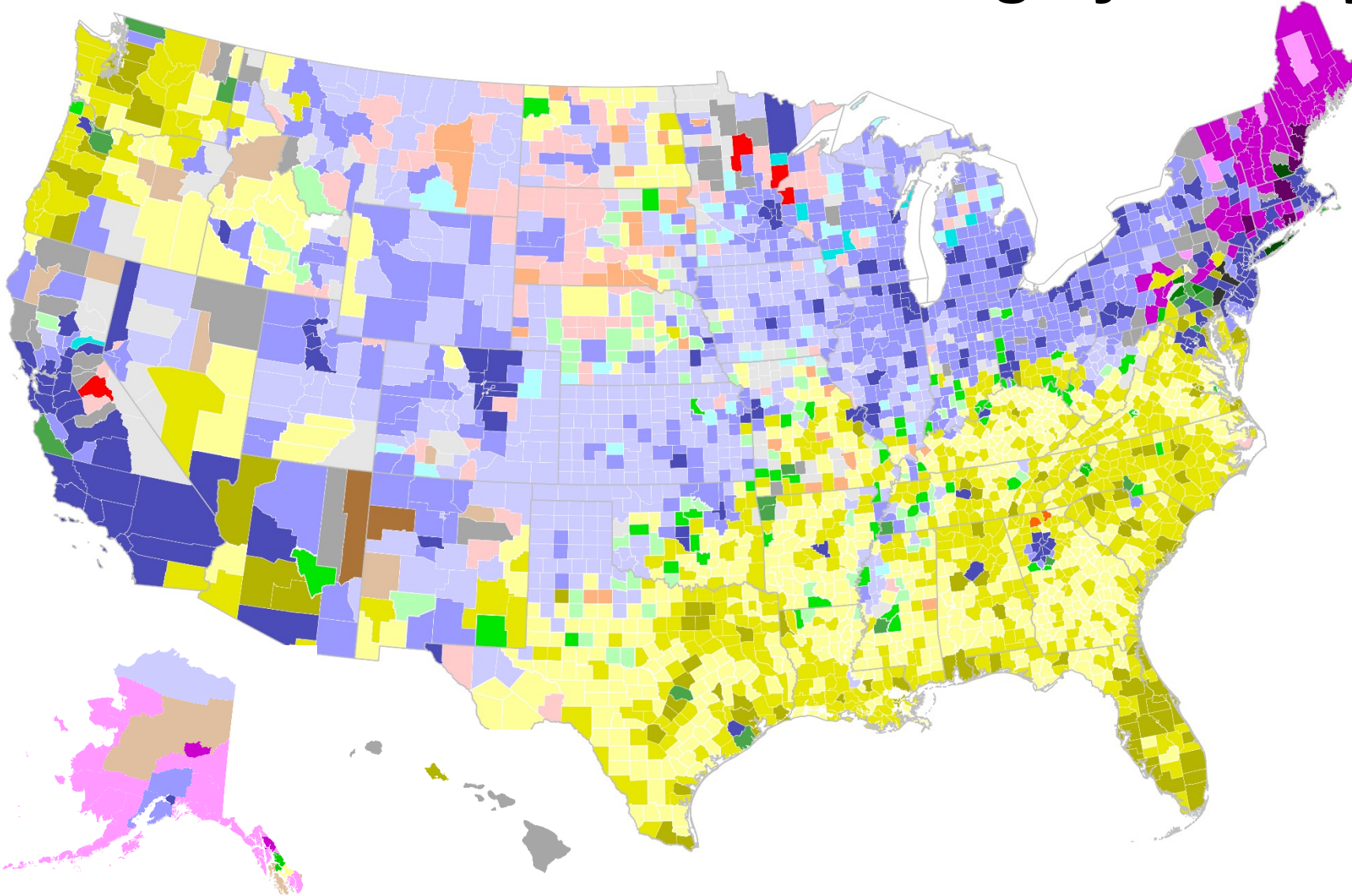
At these rates, the total implied conversion cost would be \$11 to \$44 billion.

Vineyard 1 (V1) Offshore Wind Project	
Location:	15 Miles Offshore, South of Massachusetts
Acreage:	160,000
Number of Turbines:	62
Turbine Capacity:	13.6 MW
Nameplate Capacity:	800 MWs
Projected Cost:	\$2.8 Billion
Number of Serviceable Homes from V1 Generation:	400,000
Massachusetts - Total Number of Dwellings	2,797,000
Acreage Comparison	
City of Boston	13.4 times
New York City	0.8 times
City of Chicago	1.1 times
EPRINC	



Additional Slides

U.S. Residential Heating by County



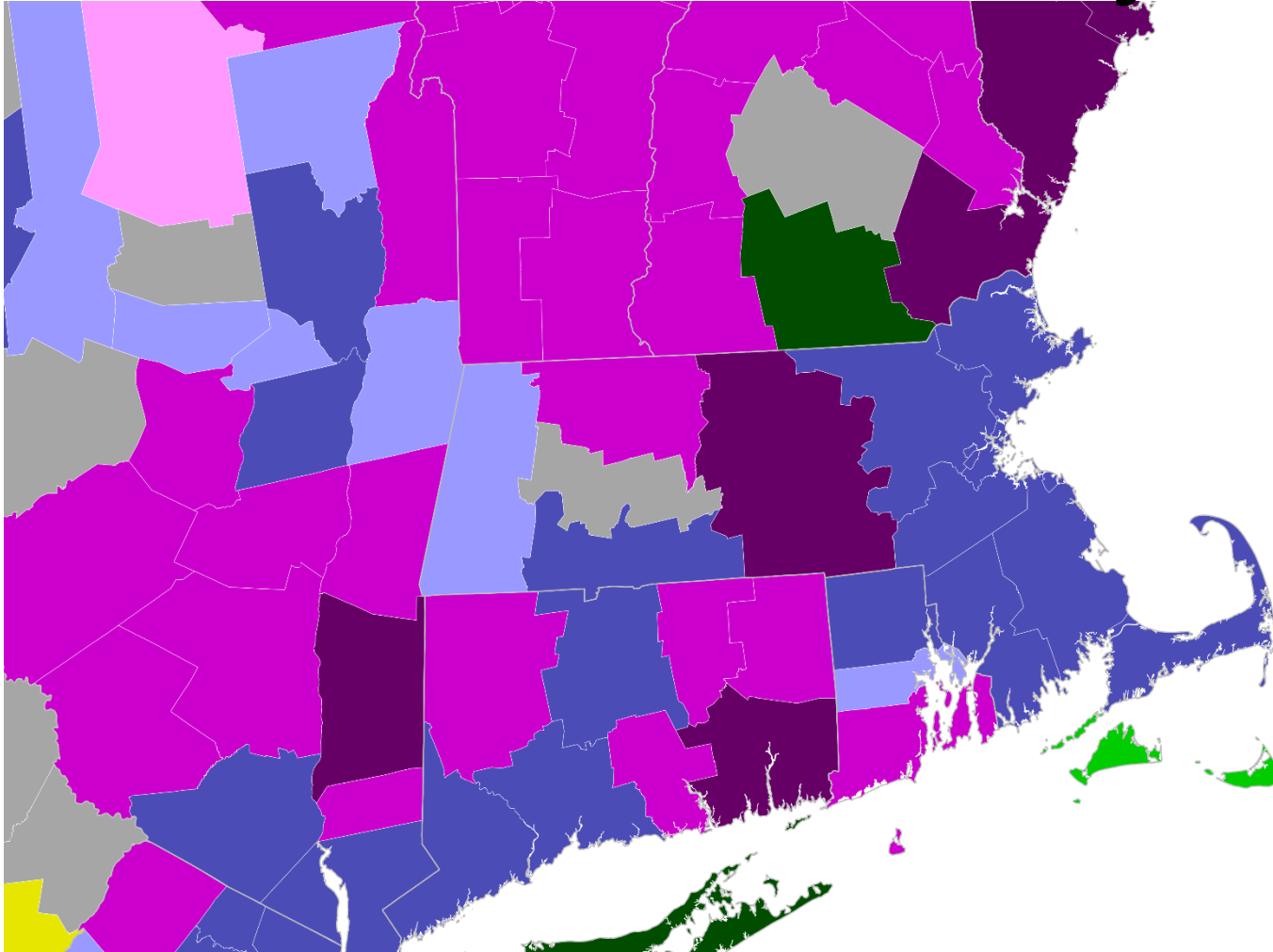
Number of County Dwellings	> 80k	10k to 80k	< 10k
	Single Fuel Dominance		
Natural Gas			
Electricity			
Propane			
Heating Oil			
Wood			
Dual Fuel Dominance			
Gas + Electricity			
Gas + Propane			
Propane + Elec.			
Heating Oil + Natural Gas or + Propane or + Electricity			
No Dominant Heating Fuel			

Analysis based on 2022 U.S. Census Data

Energy Policy Research



Massachusetts Residential Heating by County

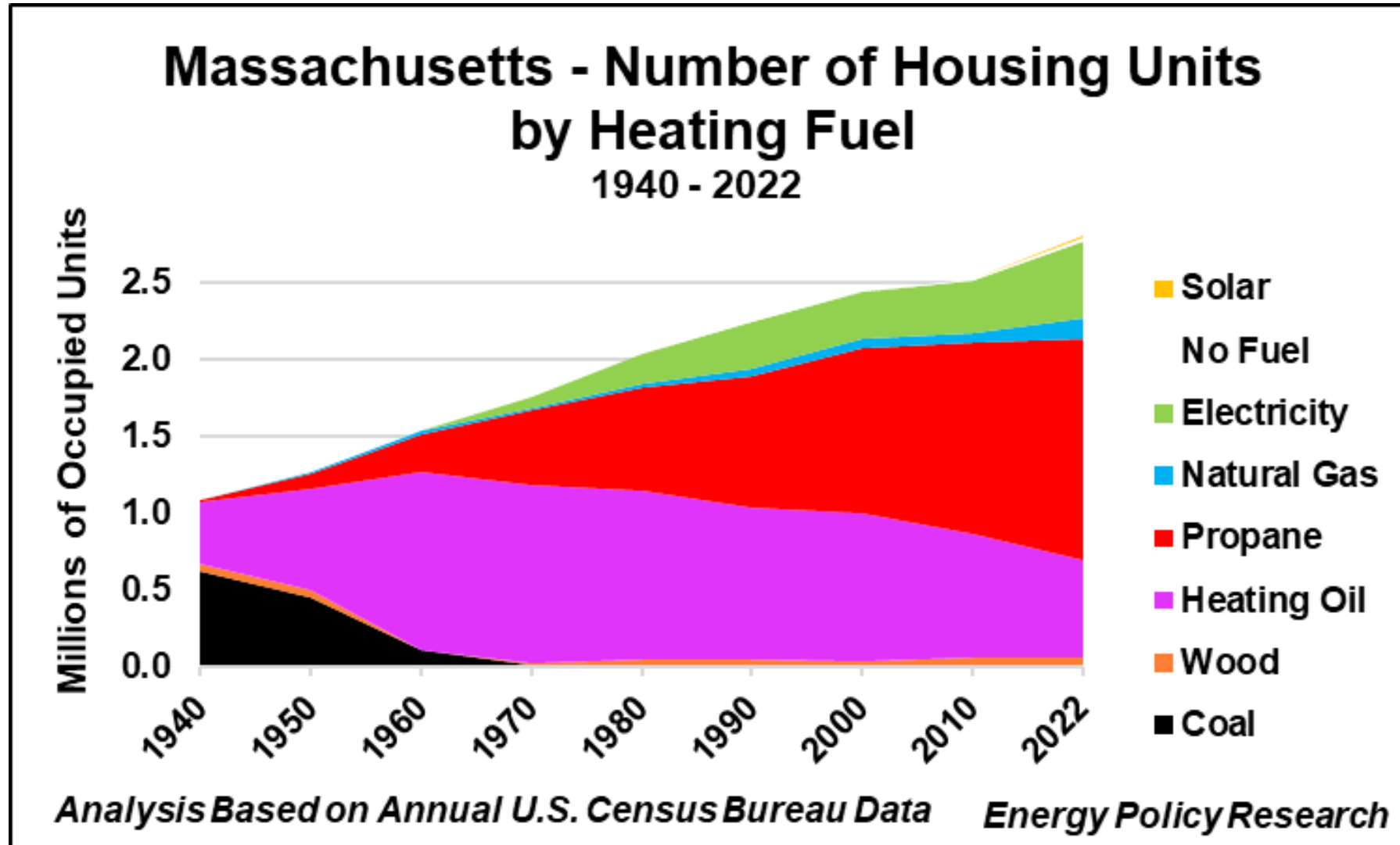


Number of County Dwellings	> 80k	10k to 80k	< 10k
	Single Fuel Dominance		
Natural Gas			
Electricity			
Propane			
Heating Oil			
Wood			
Dual Fuel Dominance			
Gas + Electricity			
Gas + Propane			
Propane + Elec.			
Heating Oil + Natural Gas or + Propane or + Electricity			
No Dominant Heating Fuel			

Analysis based on 2022 U.S. Census Data

Energy Policy Research





Massachusetts: Electrification Challenges



- This slide deck is available at: <https://eprinc.org/chart-of-the-week/>
- For more information on these charts, please contact Max Pyziur (maxp@eprinc.org).