Pathways to Deep Decarbonization in New Mexico

Net-Zero Modeling Results

Jacqueline Ennis
Policy Analysis Schneider Fellow

In collaboration with Noah Long
Director of Western Region Climate & Clean Energy

In consultation with:
Evolved Energy Research
GridLab
Sierra Club
Physicians, Scientists, and Engineers for Healthy Energy
Inclusive Economics
Climate and Clean Energy Equity Fund

March 2022

Pathways to Deep Decarbonization in New Mexico

Net-Zero Modeling Results

Jacqueline Ennis
Policy Analysis Schneider Fellow

In collaboration with Noah Long
Director of Western Region Climate & Clean Energy

In consultation with:
Evolved Energy Research
GridLab
Sierra Club
Physicians, Scientists, and Engineers for Healthy Energy
Inclusive Economics
Climate and Clean Energy Equity Fund

March 2022

Table of Contents

1. Overview
2. Power Sector Results
3. Transportation Results
4. Buildings Results
5. Policy Recommendations

1.5-Degree Trajectory Modeling at NRDC

What pathways can the U.S. follow to achieve its 2030 NDC and a net-zero economy by 2050?

What are the

> economic and societal costs

> technologies needed

> impacts of investing too little or too late

> most challenging sectors to decarbonize

under these pathways?

Modeling Overview:

NRDC analysis leverages Evolved's modeling of the US energy system.

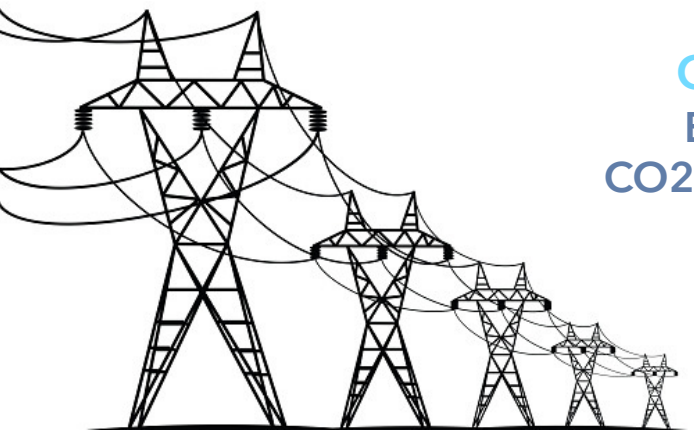
Input
User-defined scenarios
(e.g. policy conditions, technology adoption rates)

Demand-Side Decisions
EnergyPATHWAYS Model
*Calculates **energy system demands** under scenarios*

EVOLVED ENERGY RESEARCH

Supply-Side Decisions
Regional Investment and Operations (RIO) Platform
*Generates **least-cost optimization of energy system supply***
(e.g. balancing fuel supply to meet demand at lowest cost)

Output
Energy, CO2 Emissions, Costs



Scenario Descriptions and Key Assumptions

	Scenario	Description
1	**Reference**	Business-as-usual based on existing policy and market conditions. **Does not achieve net-zero targets.**
2	**Core (53x30)**	Must achieve 50% GHG reductions from *2005* levels by 2030 and net-zero by 2050. Relies on rapid decarbonization of power generation, electrification of end uses in transportation and buildings, and energy efficiency.
3	**Low Demand ("High Energy Efficiency")**	Core case assumptions, but designed to assess the benefits of reducing demand through increased energy efficiency measures (e.g. home retrofits, public transit infrastructure buildout, and reduced heavy-duty vehicle and aviation use).
4	**No Fossil Fuels**	Core case assumptions, but no fossil fuels production or usage is allowed by 2050.

POWER SECTOR RESULTS

Rapidly transitioning to clean electricity is key to decarbonizing other sectors.

FIGURE 2. *New power plant capacity in New Mexico, 2020s-2040s. Under the Core case, 0.41 GW/year of solar, wind, and storage are built, compared to 0.16 GW/year under the Reference case. Under the Fossil Free scenario, an average of over 6GW/yr must be built.*

Wind power dominates the clean power generation mix.

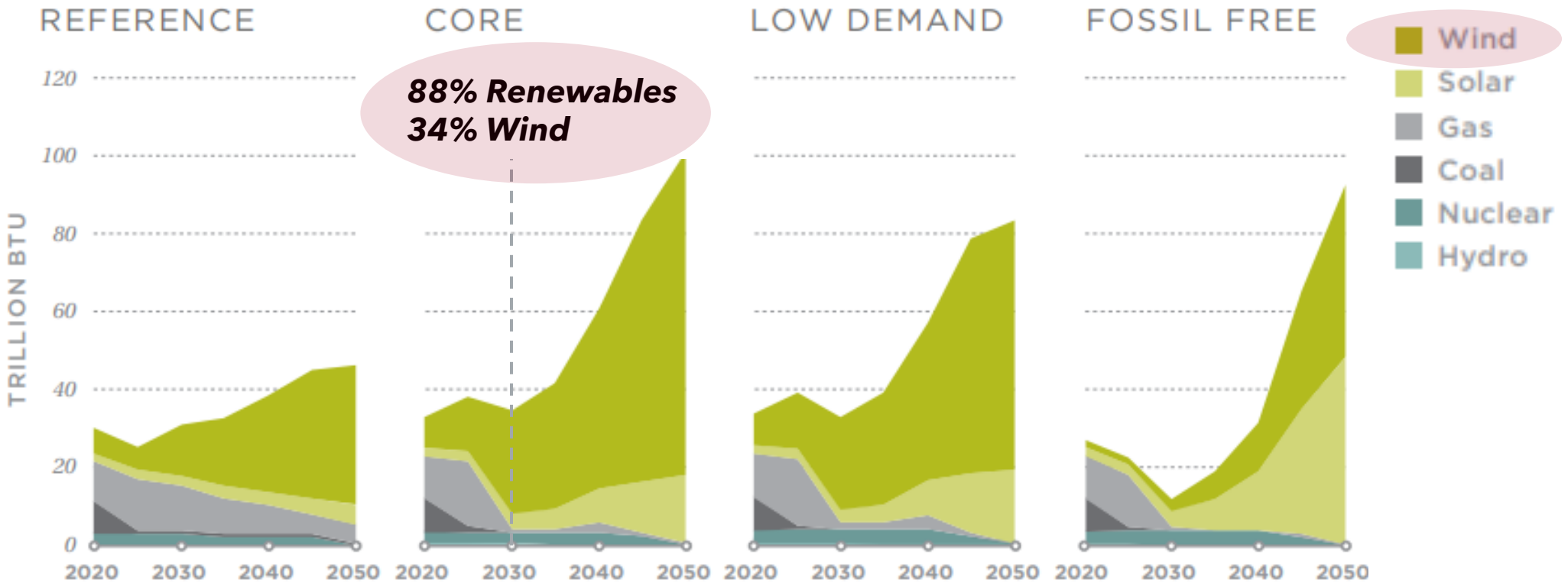


FIGURE 1. *Electricity generation in New Mexico, 2020-2050.*

Load flexibility and reliability are increasingly important to a highly electrified energy system.

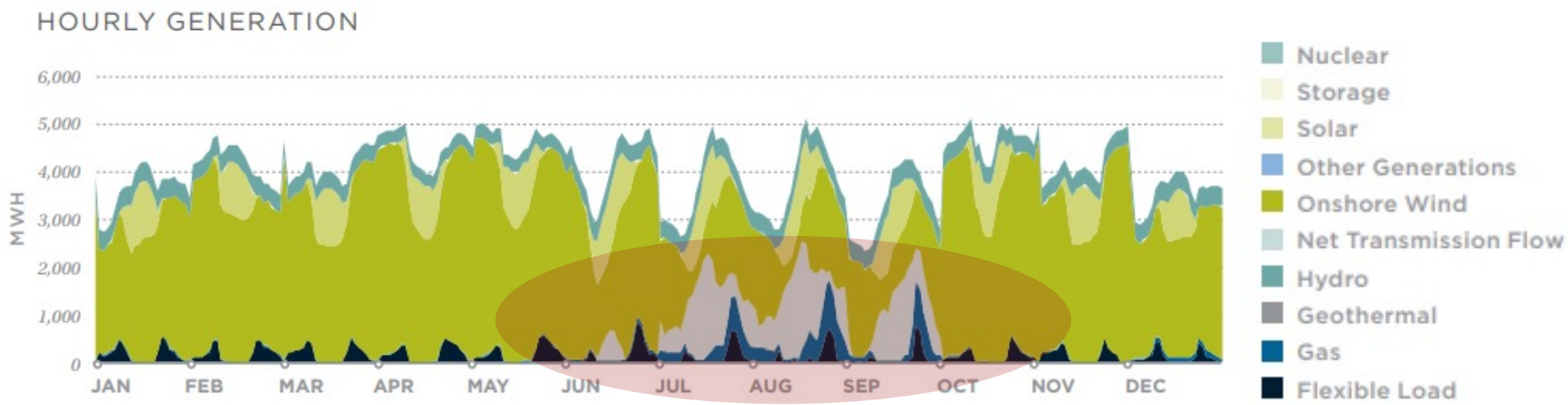


FIGURE 3. *a. Projected hourly electricity generation dispatched in New Mexico in 2030. In addition to flexible load (in navy), infrequent fossil gas (in orange) operates in the near term during summer months (June through September) where lower wind energy output coincides with peak demand. Critically, any fossil gas left online for reliability must not be left in communities overburdened by pollution.*

Energy efficiency aids in reducing household energy burdens.

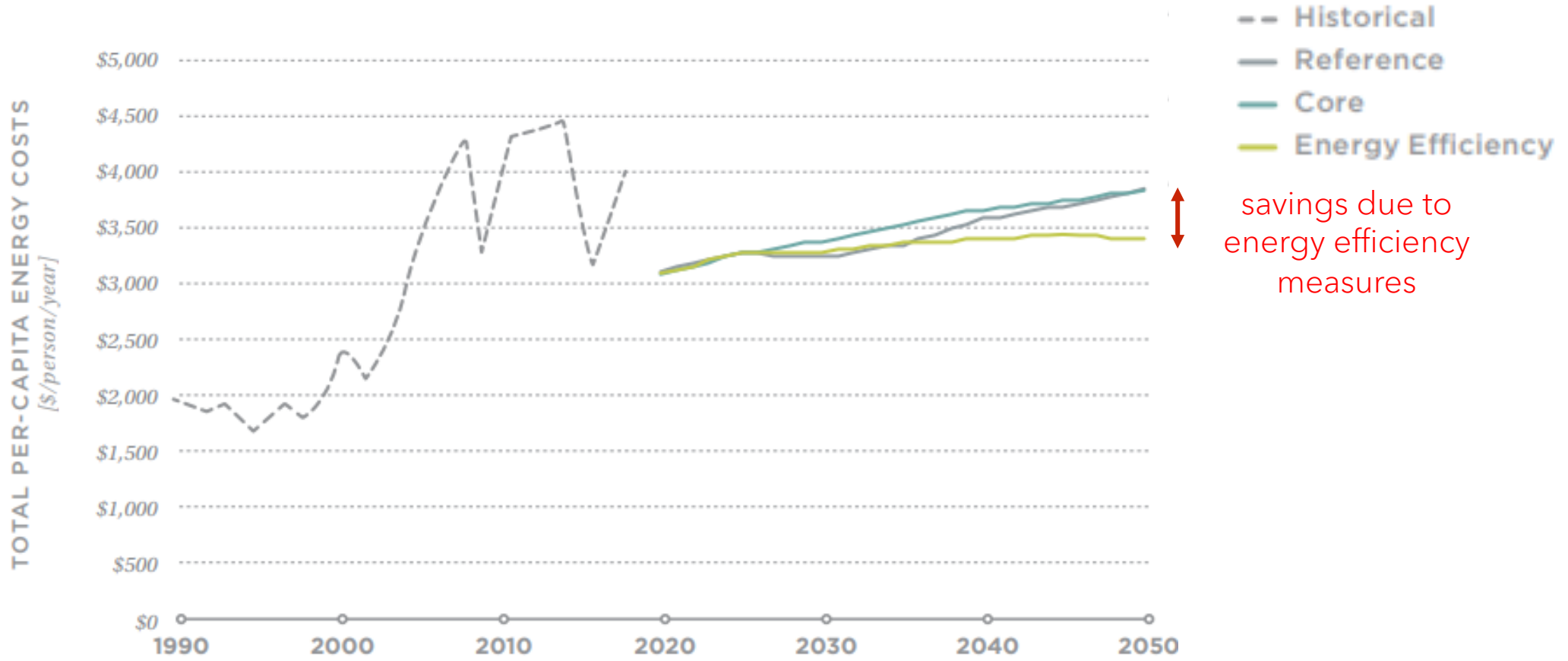


FIGURE 4. *Per capita energy costs in New Mexico, 1990-2050.*

TRANSPORTATION SECTOR RESULTS

Transportation emissions must reach a turning point in the next decade.

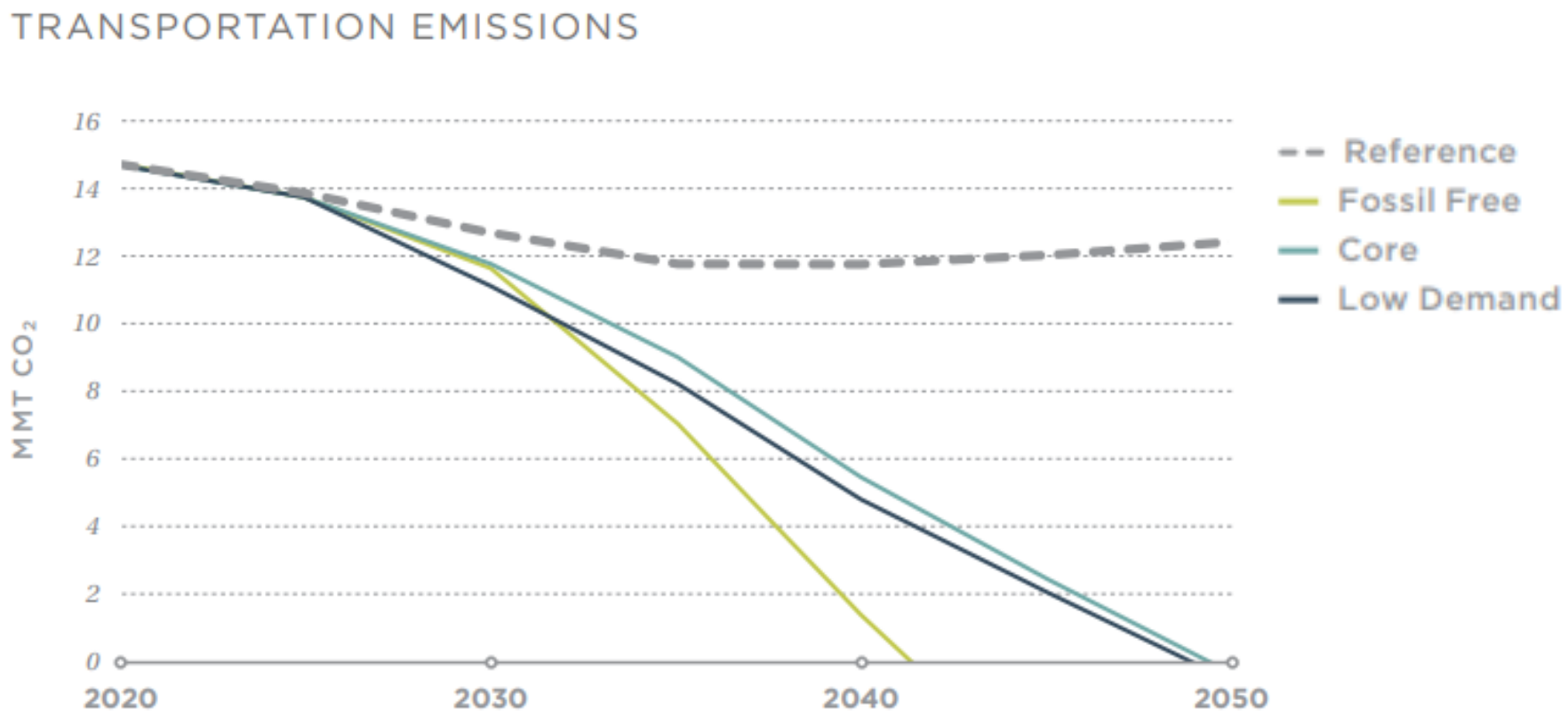


FIGURE 1. *Transportation-related carbon emissions in New Mexico.*

Transportation decarbonization relies on electrification of vehicles and transit.

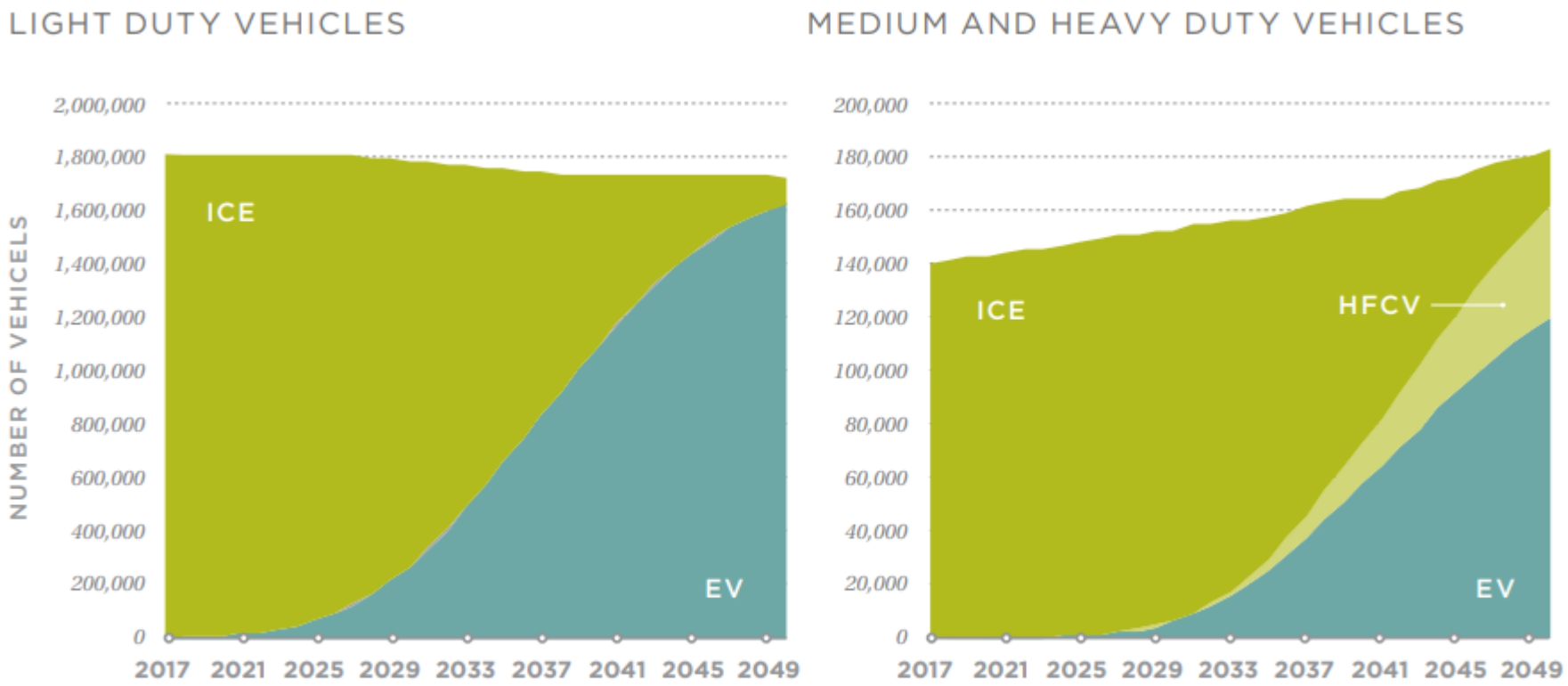


FIGURE 4. *Total vehicle stock under the Core scenario. Note that the scale of the light-duty vehicles axis (left) is 10 times that of the medium- and heavy-duty vehicles axis (right).*

Transportation electrification will increase electricity demand.

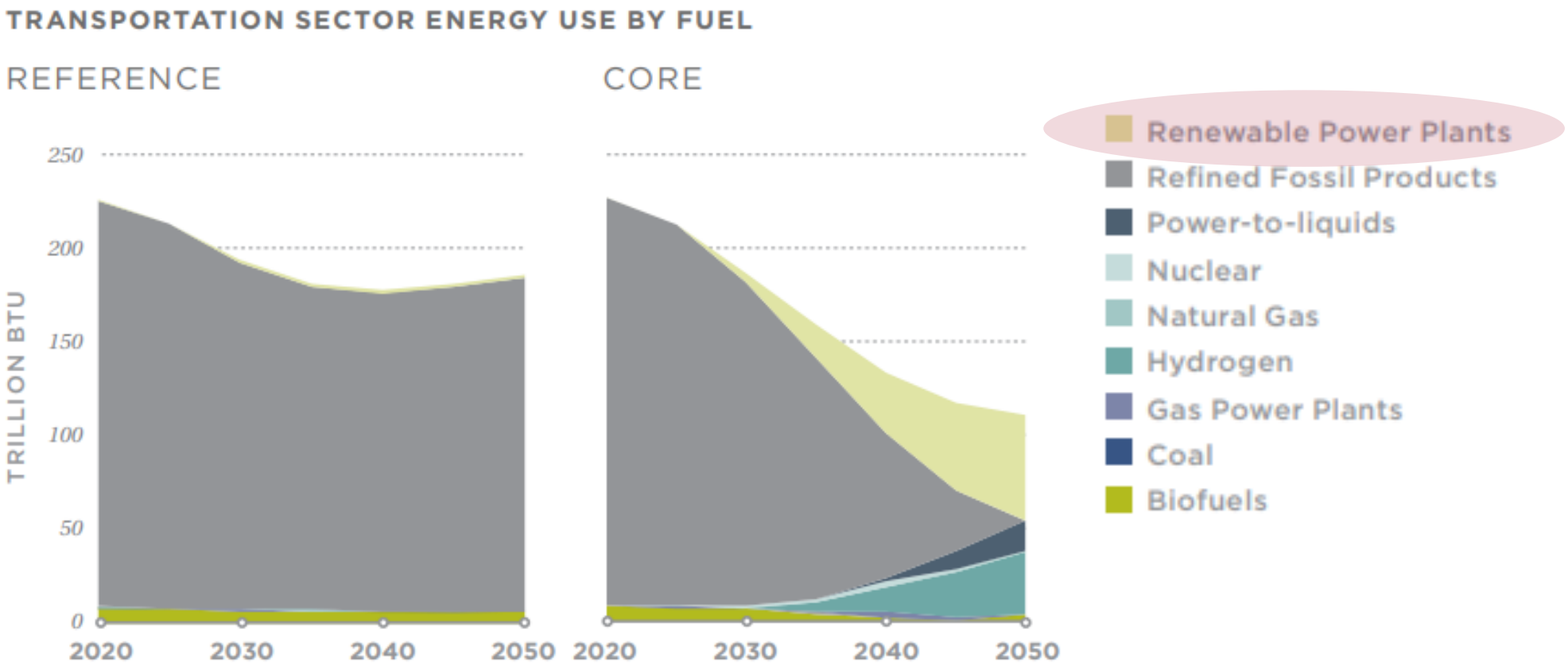


FIGURE 5. *Transportation-related fuel use under Reference and Core scenarios.*

Access to zero-carbon transportation must be distributed equitably.

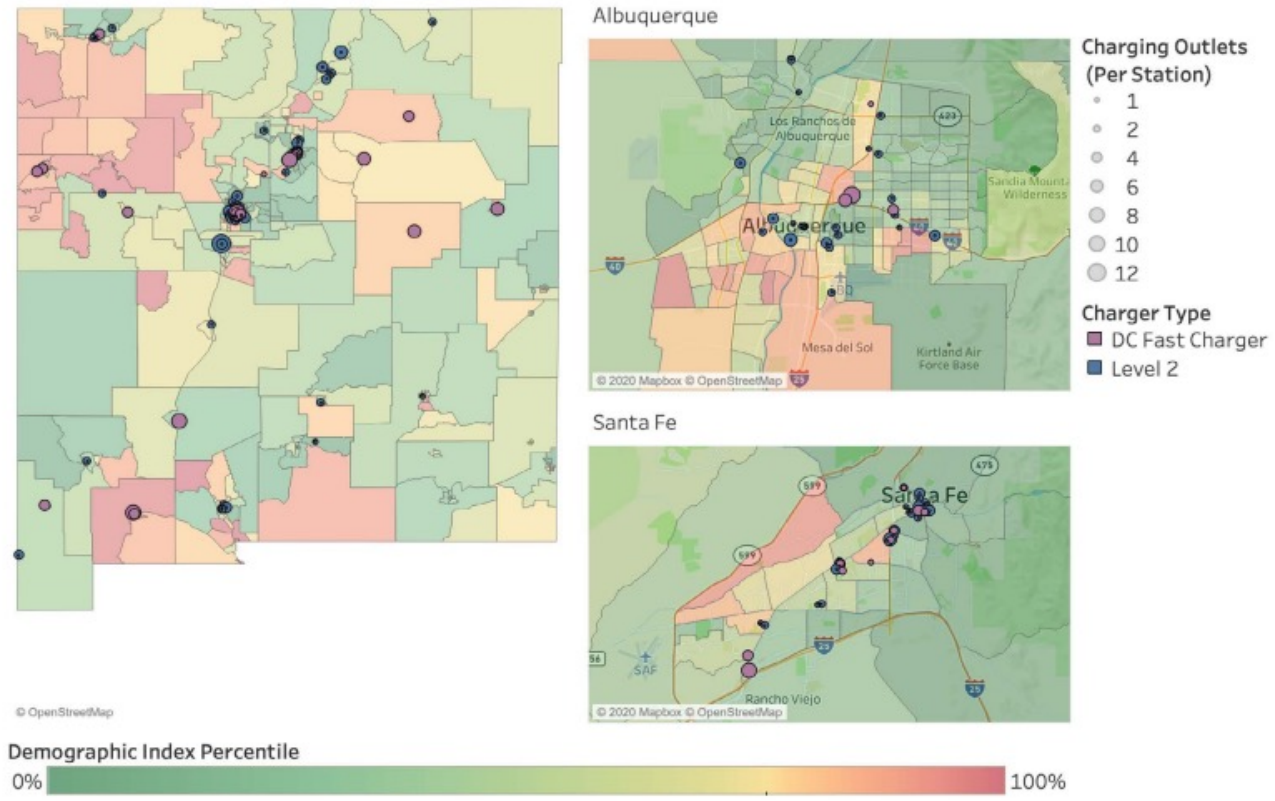


FIGURE 3. *Public electric vehicle charging stations and demographic index in New Mexico, Albuquerque, and Sante Fe. Each dot represents an electric vehicle charging station, while the bubble size reflects the number of charging outlets per station. Charging stations are largely located in urban areas and along interstate highways, but are limited in many rural areas and on public lands.*[10]

BUILDINGS SECTOR RESULTS

Updated building codes are needed to achieve near term emissions reductions.

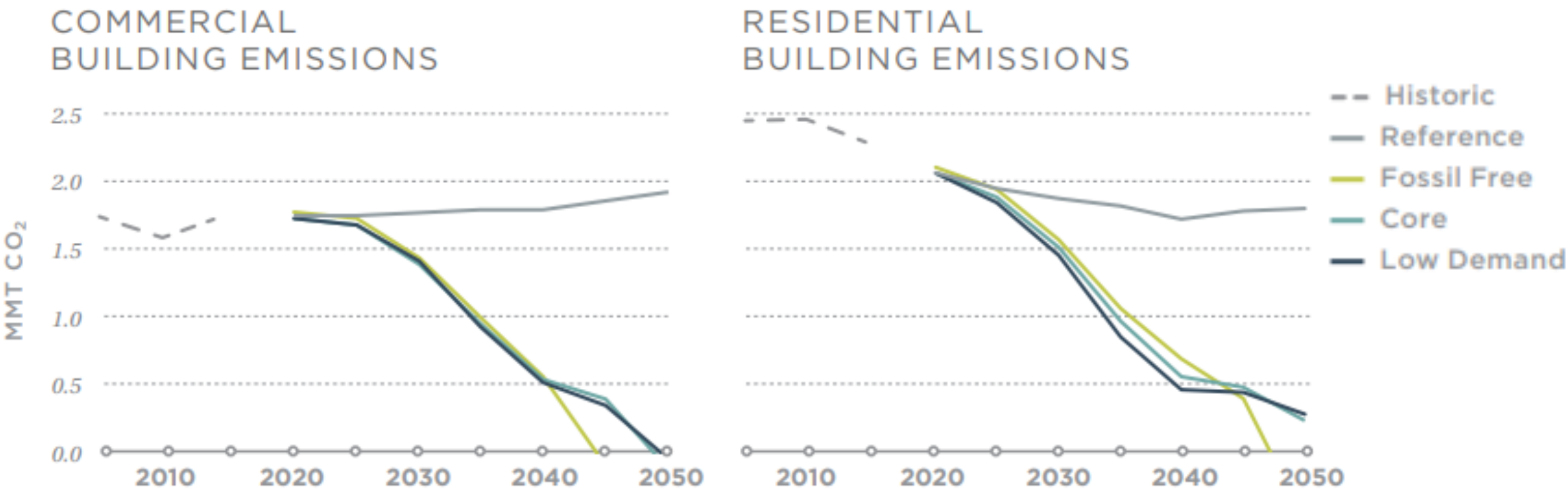


FIGURE 1. *Historic and projected carbon emissions from New Mexico's building stock.*

Electrification is key to building decarbonization.

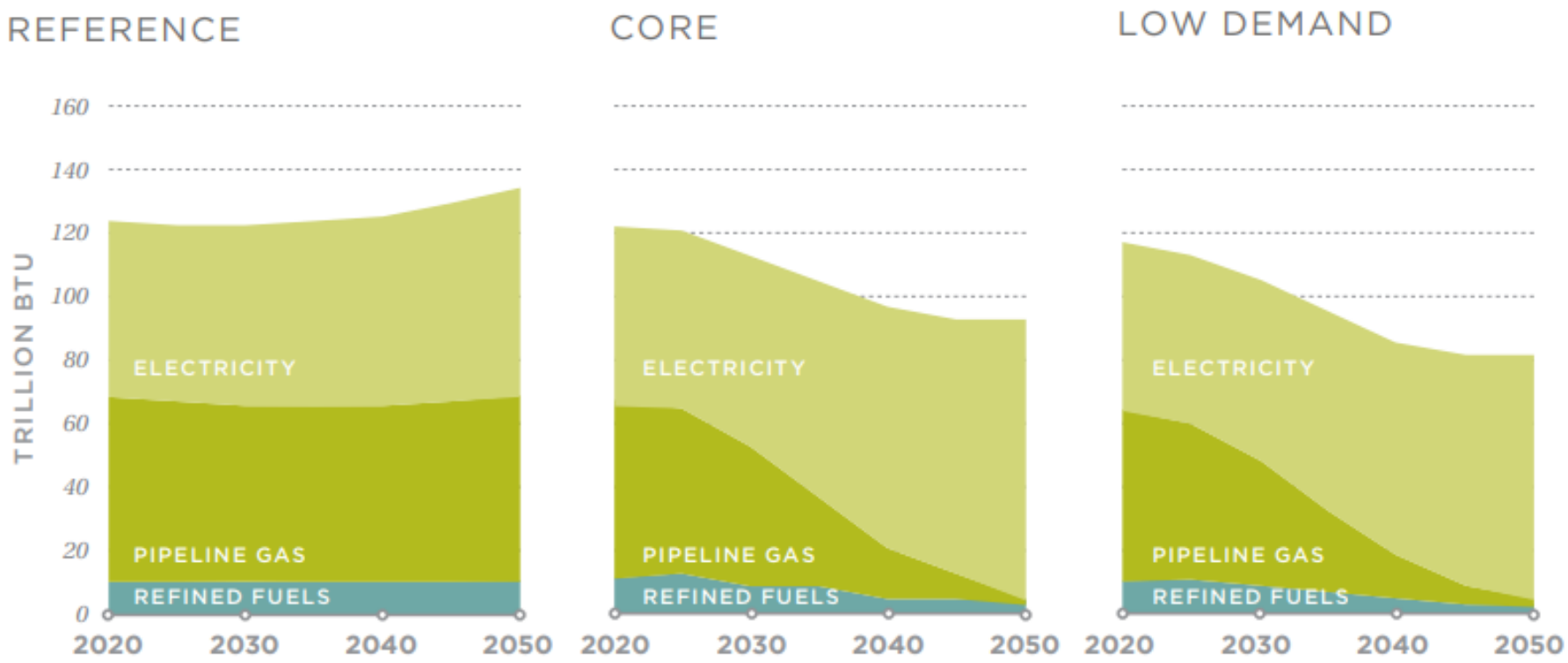


FIGURE 2. *Fuel use mix in buildings. Refined fuels include propane and fuel oil.*

The market grows for electric, high-efficiency, and smart appliances.

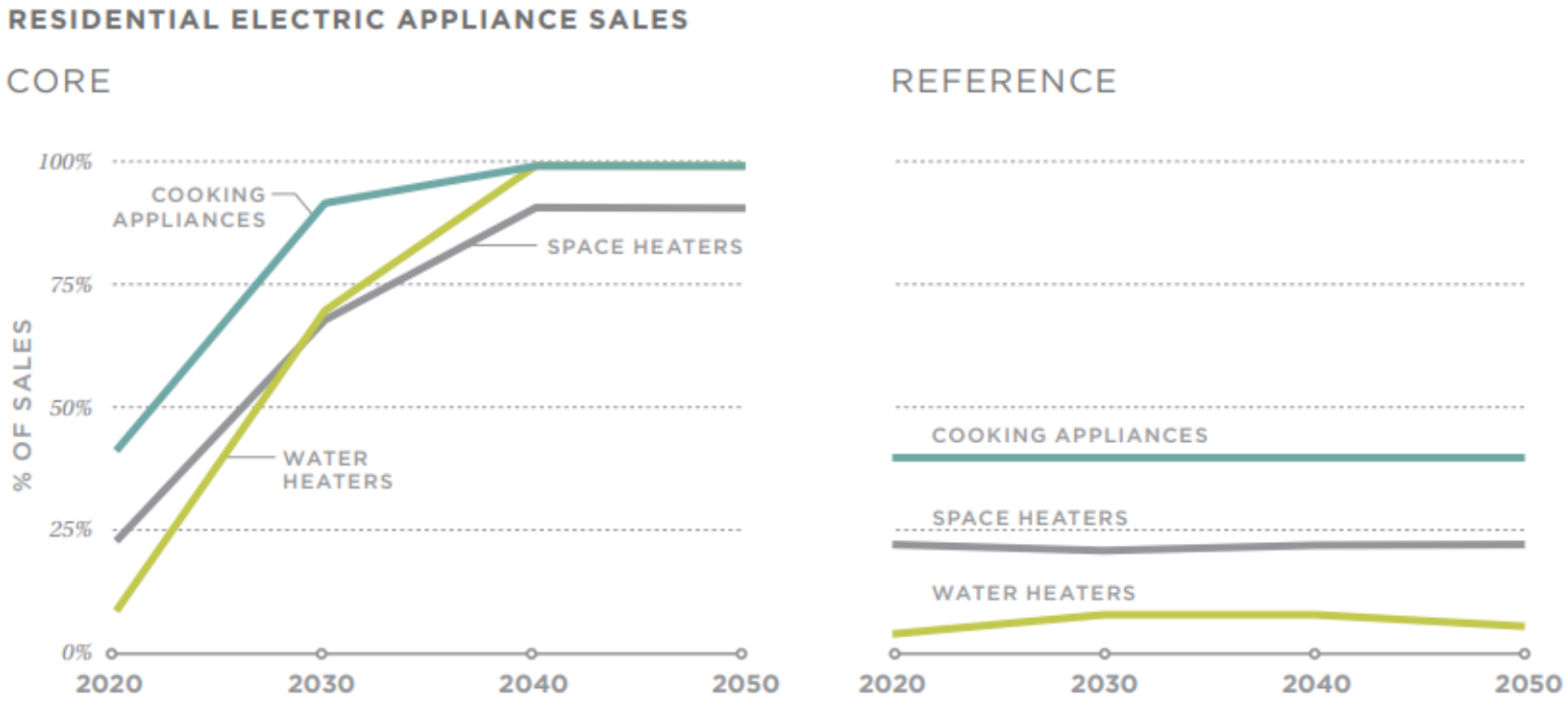


FIGURE 3. *Electric model sales as a percent of all residential appliance sales under the Reference and Core cases. Electric cooking appliances include electric models of stovetops and ovens.*

Underserved communities are a priority for electrification investments.

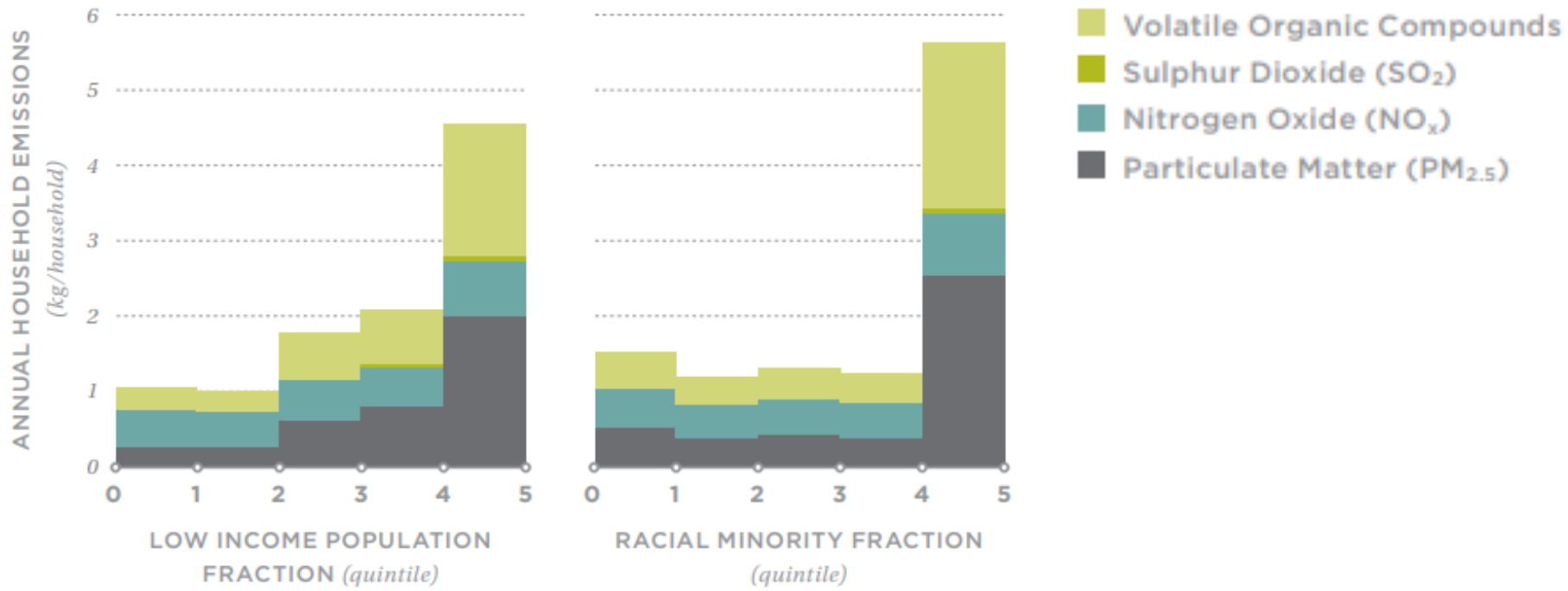


FIGURE 4. *Residential air pollution emissions by demographic, 2015. Average annual household air pollutant emissions are significantly higher in census tracts where higher fractions of the population are low-income and people of color. Census tracts are grouped into quintiles based on the fraction of racial minority and low-income populations in each census tract*[11].

Energy efficiency retrofits enable emissions reductions from existing buildings.

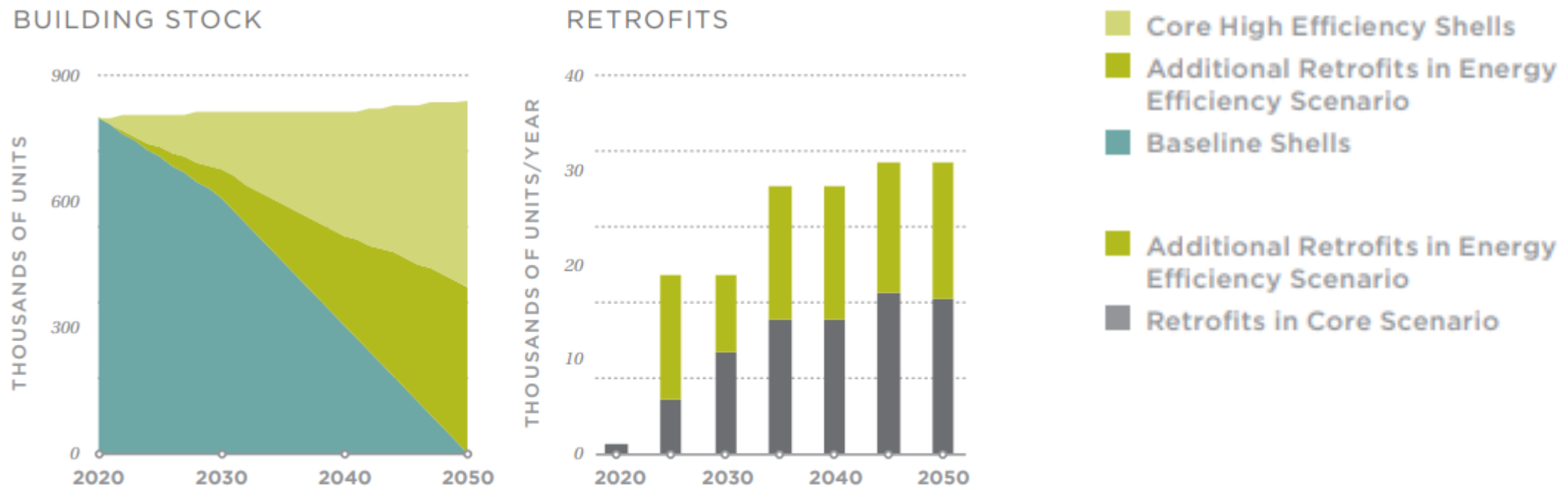


FIGURE 6. *Residential building retrofits under Core and Low Demand (high energy efficiency) scenarios.*

POLICY DISCUSSION

Power Sector Policy Recommendations

1. Accelerate the state's **clean energy target** to 90 percent by 2030 and 100 percent by 2035.
2. **Retire** all remaining coal units in the state by 2025, **end** coal imports from out-of-state and **remediate** legacy coal infrastructure sites across the state.
3. Expand **state and utility energy efficiency programs** and incentives.
4. Design utility programs to ensure **universal access to affordable electricity**, including shutoff protections and graduated electricity rates.

Transportation Sector Policy Recommendations

1. Complement Advanced Clean Car standards with **EV charging infrastructure investments**.
2. Design **public charging infrastructure and EV purchase support programs** for low-income households.
3. Invest federal and state funds in strategies to **reduce vehicle miles traveled (VMT),** including expanding electrified transit, low-fare public transit, freight shipping by rail, and pedestrian and biking infrastructure.

Buildings Sector Policy Recommendations

1. Invest in a Climate Earthshot to **support building improvements**, including through rebates, direct payments, and an expanded sustainable building tax credit.
2. Regularly **update building and stretch codes** to match the International Energy Conservation Code (IECC) model codes on a three year schedule, driving towards a zero-carbon building stock.
3. Develop **commercial building performance and benchmarking standards**.
4. Advance utility investments in **building electrification, weatherization, and flexible load programs**.
5. Co-invest in affordable and transit-friendly **zero-carbon housing**.
6. Launch a planning process at the New Mexico Public Regulation Commission (PRC) that implements **an equitable and responsible reduction of the gas distribution system** over time.

Appendix A. Scenario Descriptions and Key Assumptions

	Scenario	Description
1	**Reference**	Business-as-usual based on existing policy and market conditions (AEO 2021, ATB 2020, federal / state policy as of Summer 2021). **Does not achieve net-zero targets.**
2	**Core (53x30)**	Must achieve 50% GHG reductions from *2005* levels by 2030 and net-zero by 2050. *Key assumptions include:* • **Buildings**: 100% electric sales for all end uses in all building types by 2030. All new buildings ultra efficient by 2030; 30% of existing buildings retrofitted by 2030, 50% by 2040, 80% by 2050. • **Transportation:** 100% zero emission vehicle (ZEV) sales for LDVs by 2035, 100% ZEV sales for M/HDVs by 2040. Vehicle-miles-travelled increase by 38% and aviation miles increase by 89% relative to 2021. • **Industry**: Energy productivity gains of 2% per year, with high levels of electrification and use of hydrogen for high heat industrial applications (e.g. steel making). • **Power:** Least-cost optimization of a decarbonized electricity generation mix. Coal retires on time or earlier.
3	**Low Demand**	Core case assumptions, but designed to assess the benefits of reducing demand through increased energy efficiency measures (e.g. home retrofits, public transit infrastructure buildout, and reduced heavy-duty vehicle and aviation use). • **Buildings**: All existing residential buildings are retrofitted by 2050. • **Transportation:** Light- and heavy-duty vehicle-miles-travelled decrease by 20% and aviation miles increase by 50% by 2050 relative to 2021.
4	**No Fossil Fuels**	Core case assumptions, but no fossil fuels production or usage is allowed (in any part of the economy, including industrial feedstocks) by 2050.