



The Path To Paris Includes Clean and Affordable All-Electric Buildings Powered by 100% Clean Electricity

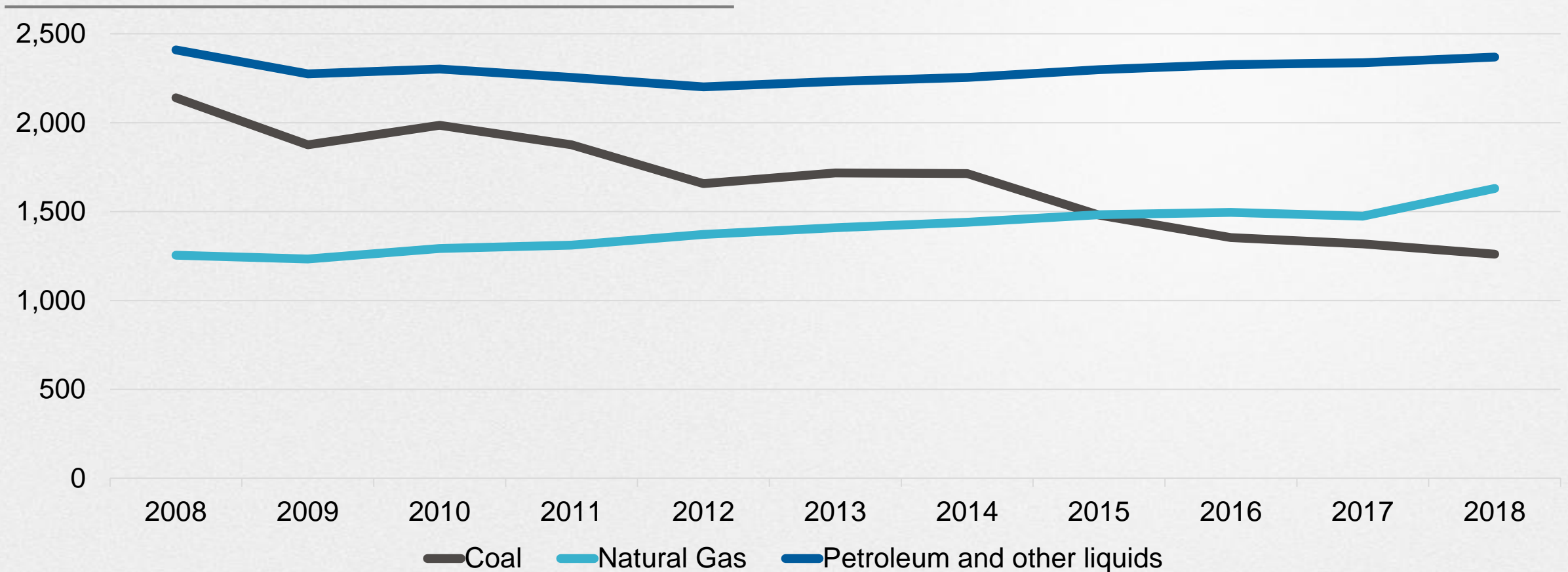
Bruce Nilles, Managing Director



Coal use is declining rapidly in the U.S. and now natural gas is a larger contributor of carbon pollution than coal

U.S. energy-related carbon dioxide emissions by fuel

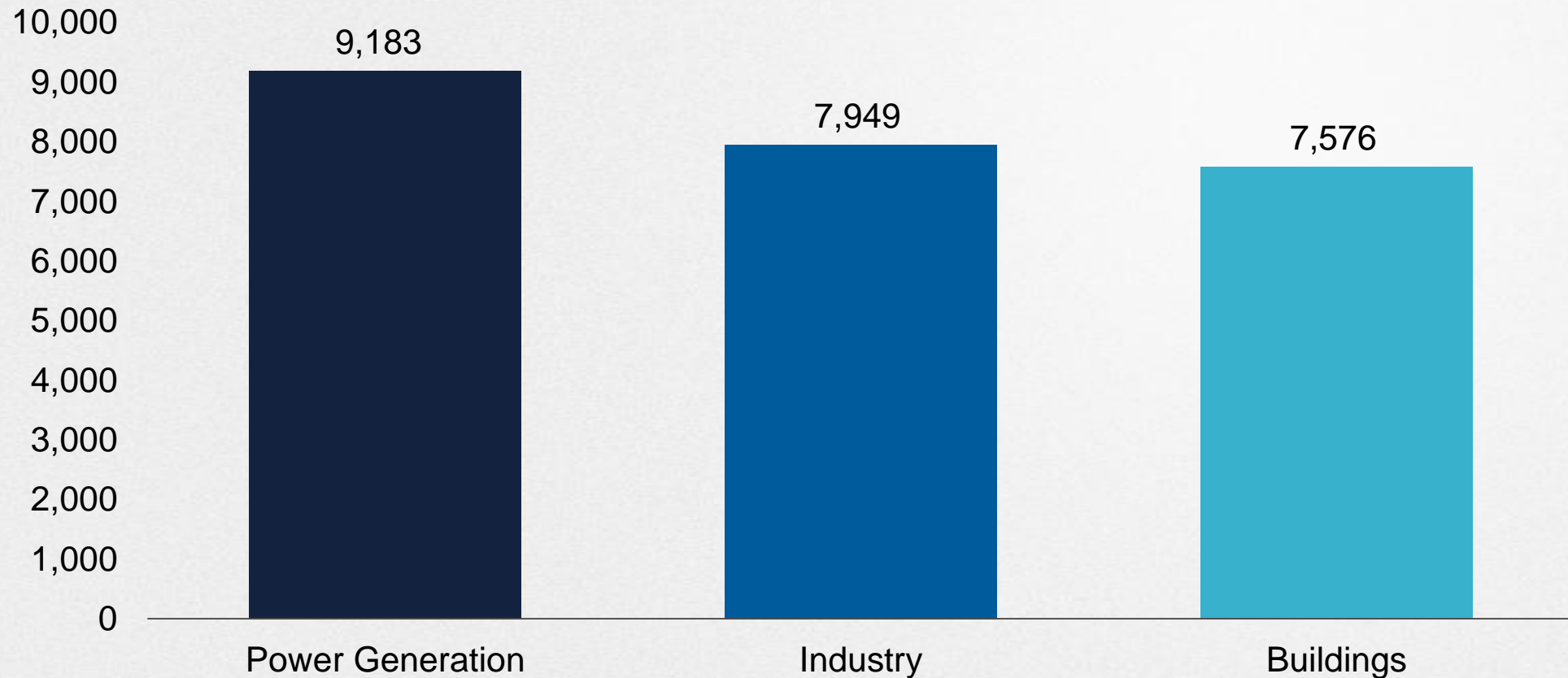
Million metrics tons CO₂



Gas use is spread across roughly three sectors equally: power, industry and building sectors

Natural Gas Consumption by Sector

U.S., Bcf, 2017



Source: EIA

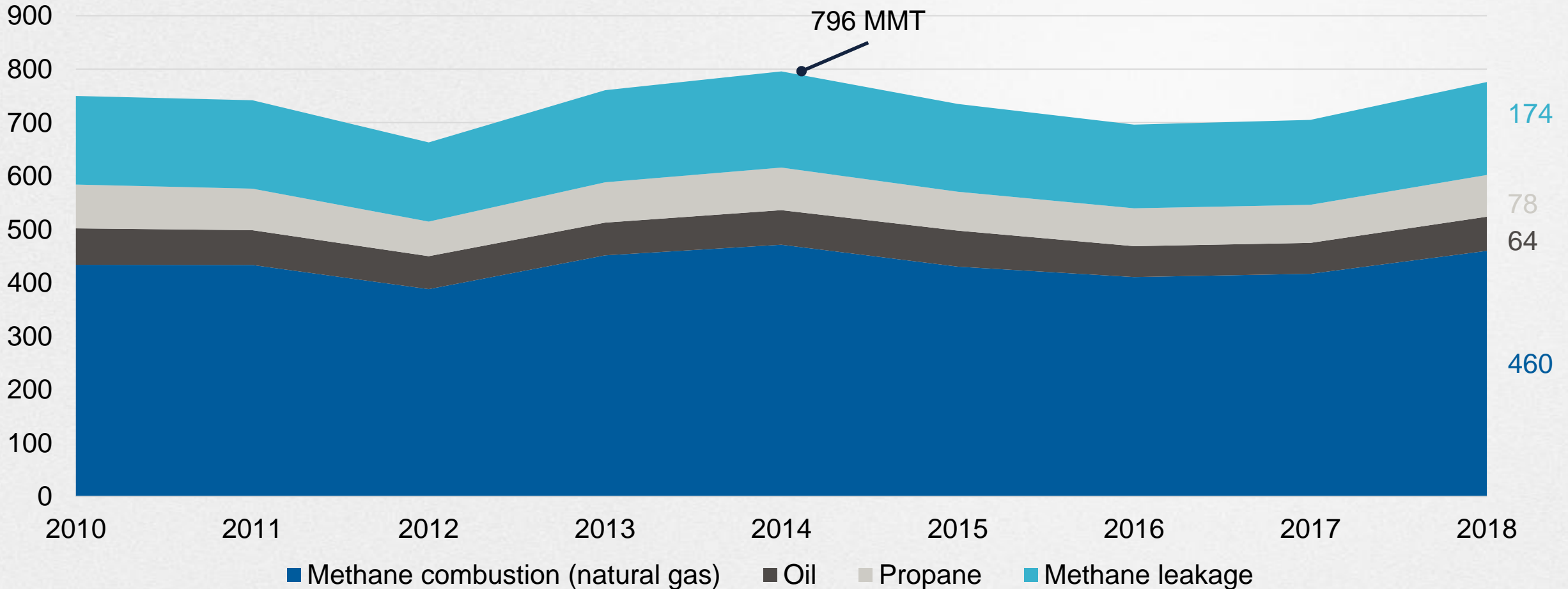
These 3 end uses represent 91% of natural gas consumption



Direct building emissions have remained relatively flat for years

GHG emissions by building fuel

Residential and Commercial Sectors, U.S., MMT CO₂e

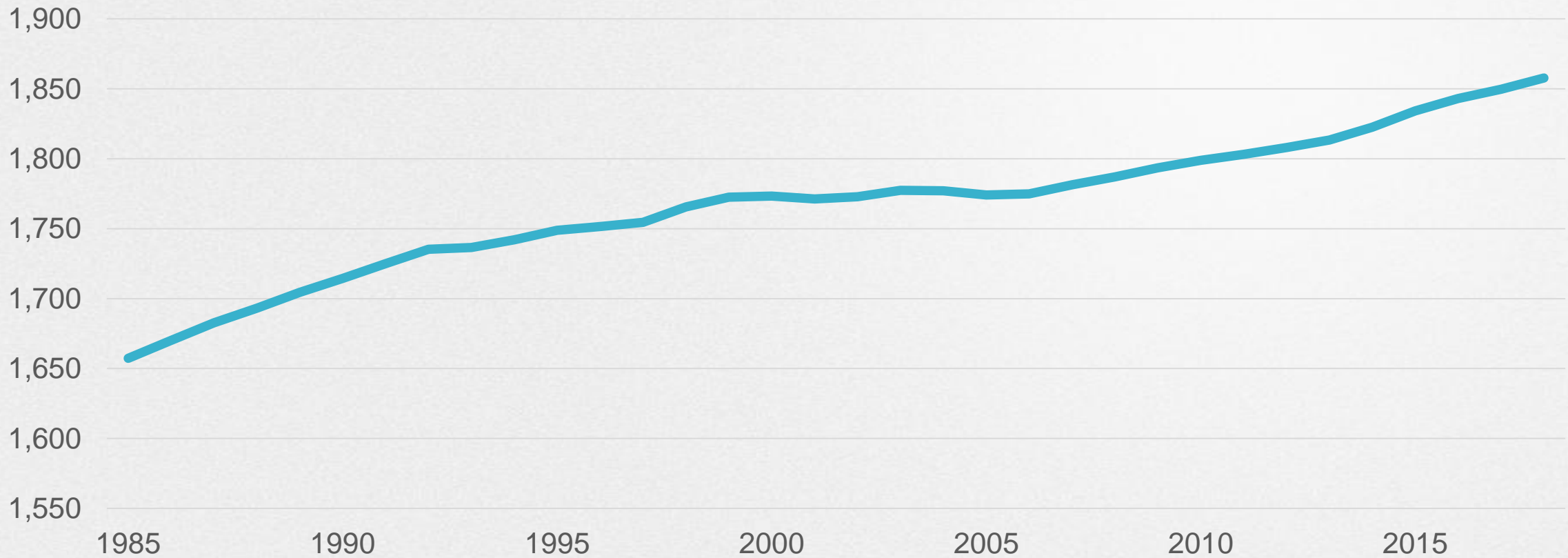


CH₄ leakage = 2.9%, 100-year GWP
Source: EIA, Rhodium Group, RMI analysis



Levels of methane in the atmosphere continue to grow – leaking from the wellhead all the way to the burner tip on our hot water heaters

Global Monthly Mean CH₄
CH₄ mole fraction (ppb)



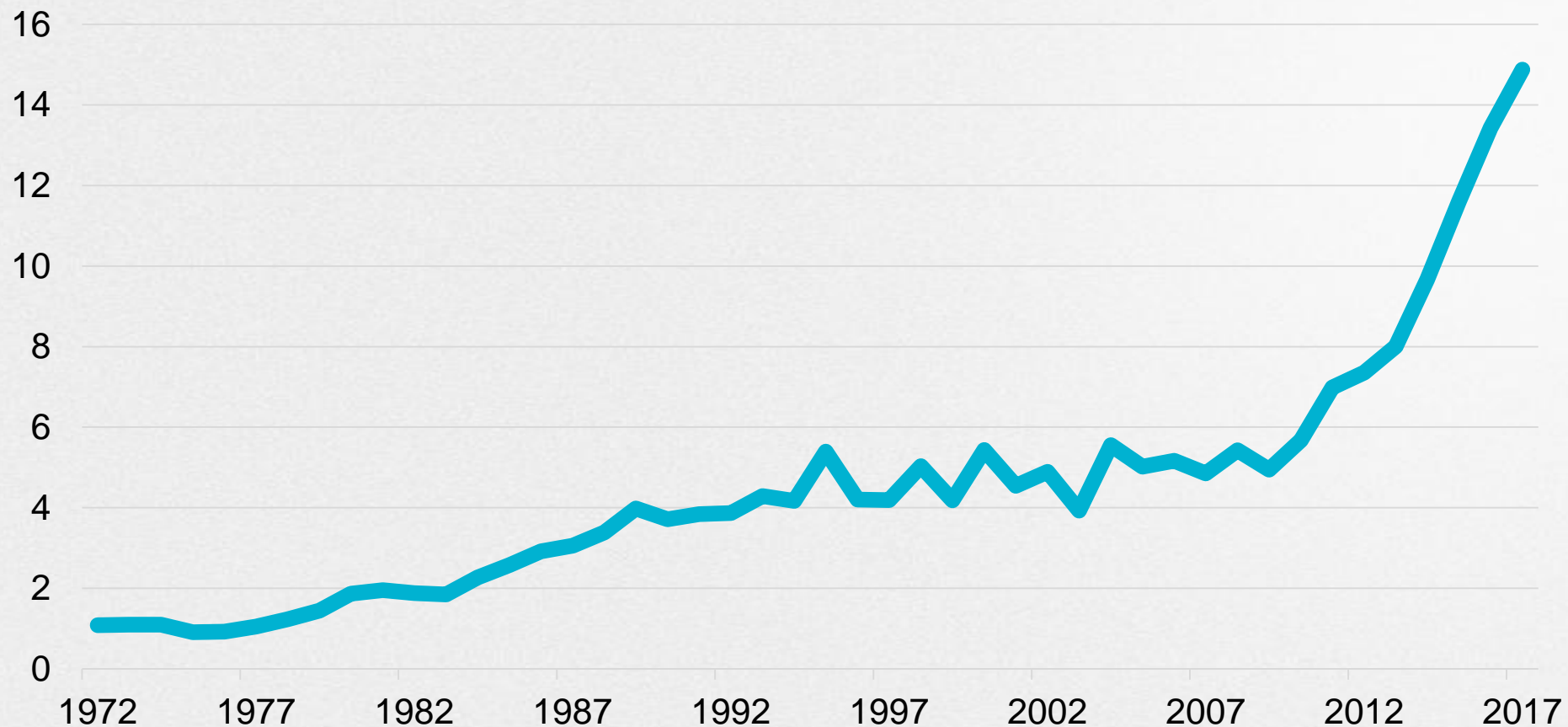
Source: NOAA



We are spending record amounts of money on the gas pipelines in our cities - distribution system - expenditures have tripled between 2009 & 2017, to \$14.9B/year

U.S. natural gas distribution system expenditures

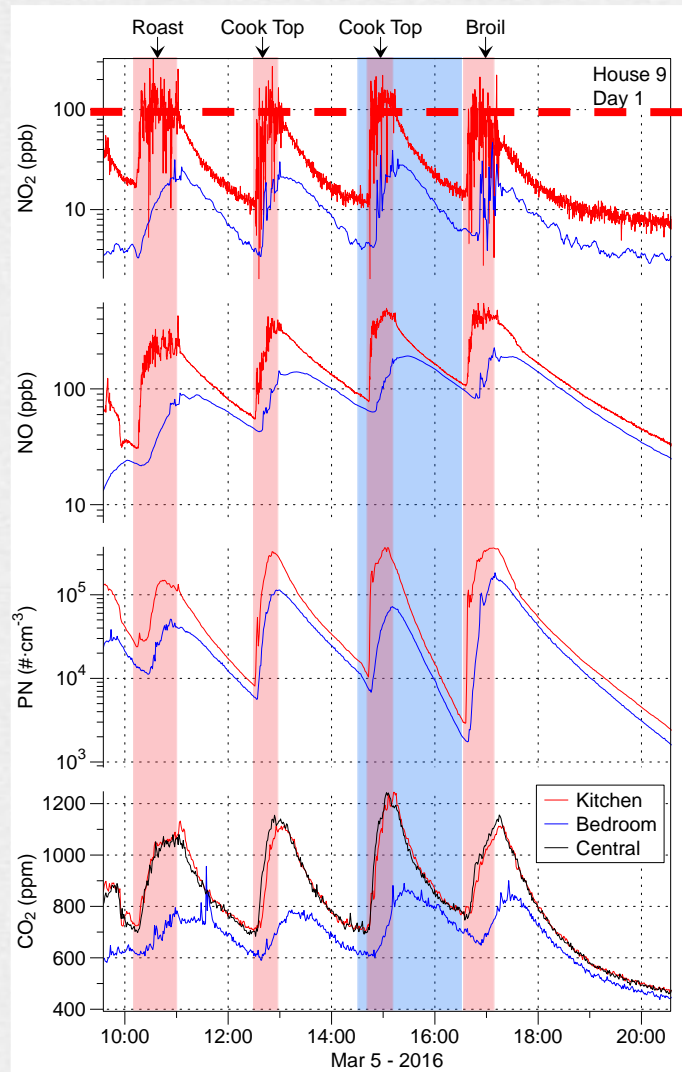
\$ billion, 1972-2017



Appliance sales account for another \$18 billion annual expenditure:

- ~4M gas water heaters, totaling \$4-5B
- ~3.4M gas furnaces, totaling \$14.5B

Indoor air quality is often more harmful than outdoor air in most of the United States, primarily due to the combustion of fossil fuels in homes



$\text{NO}_2 > 100$ ppb
in kitchen

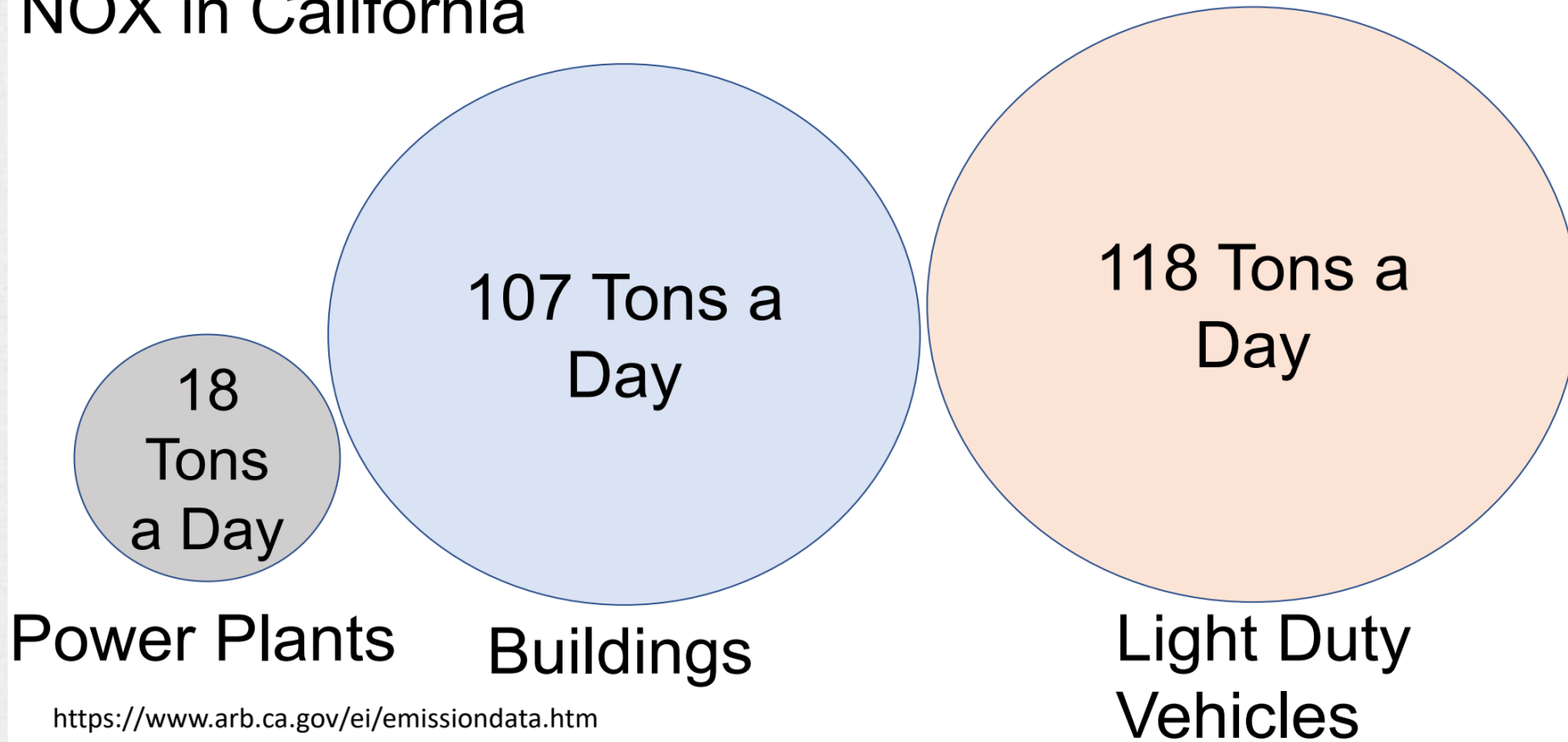
NO_x released by natural gas cooking indoors often exceeds EPA ambient outdoor air requirements

- Airway irritant
- Exacerbates asthma and other respiratory diseases
- May cause asthma and increase infections
- Asthmatics, elderly, young children most susceptible

In addition, there is release of ultrafine particles, $\text{PM}_{2.5}$, and VOCs

Burning of fossil fuels in our buildings is also a big part of our outdoor smog problem (CA example)

NOX in California



New Mexico Situation

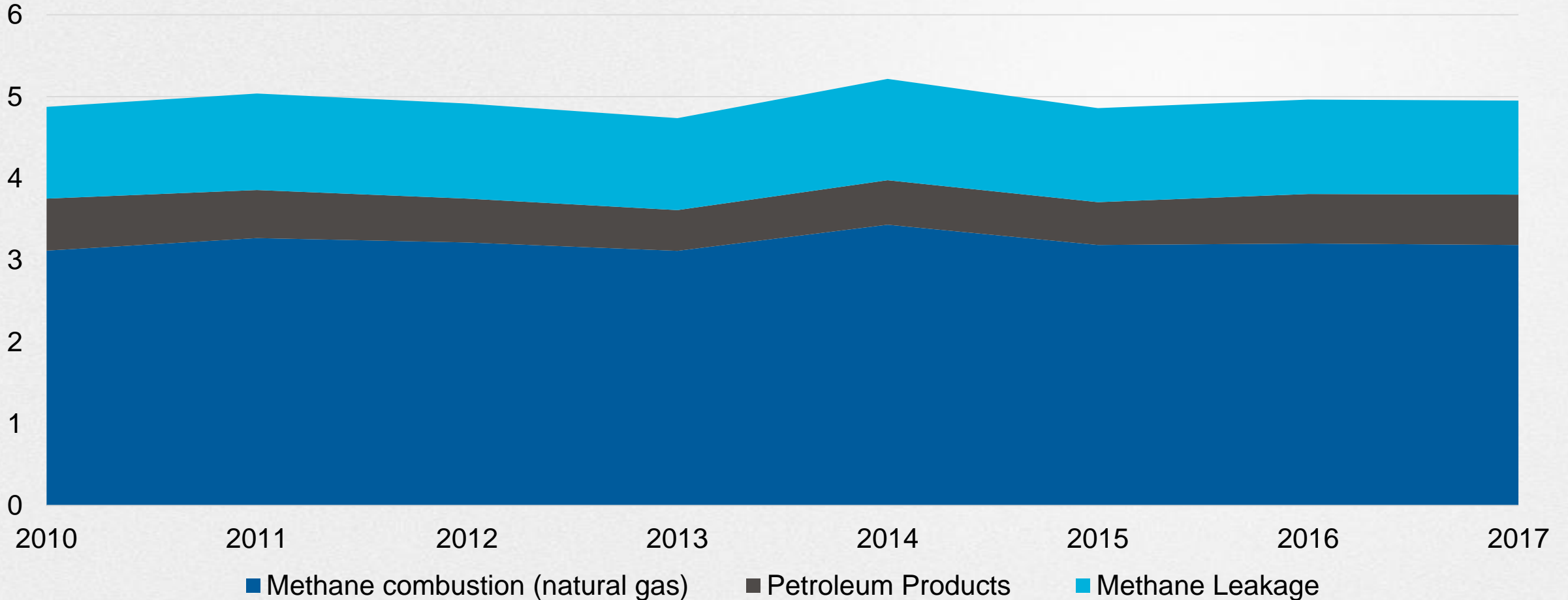


Transforming global energy use to create a clean, prosperous, and secure low-carbon future.

Direct building emissions have remained flat for years

GHG emissions by building fuel

Residential and Commercial Sectors, New Mexico, MMT CO₂e



CH₄ leakage = 2.9%, 100-year GWP

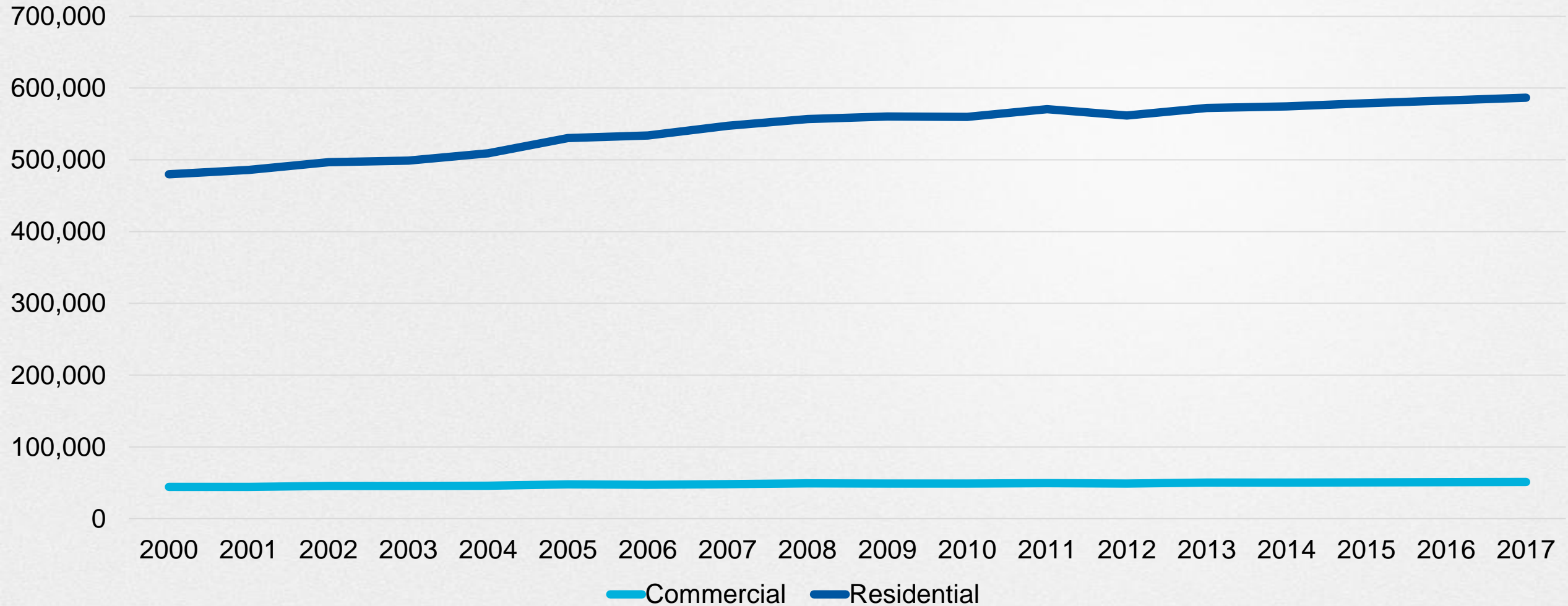
Source: EIA, RMI analysis



While commercial natural gas customers remain flat, since 2000 New Mexico has added more than 100,000 residential natural gas customers

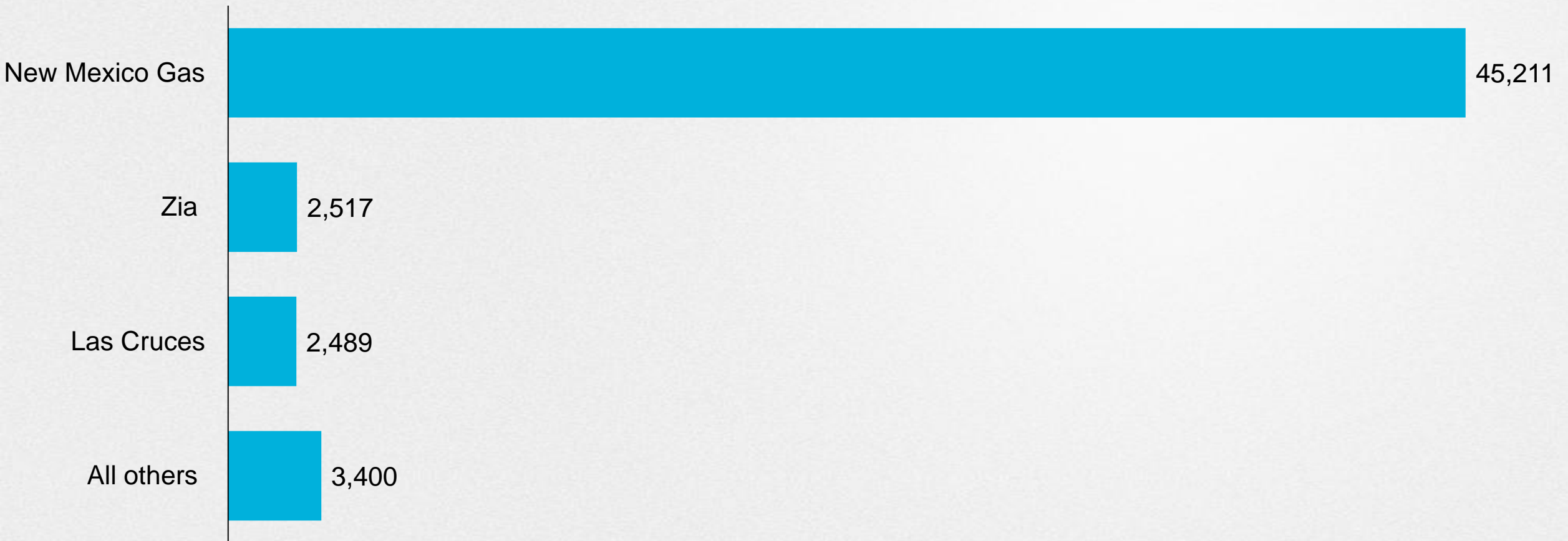
Number of natural gas customers

Residential and Commercial Sectors, New Mexico



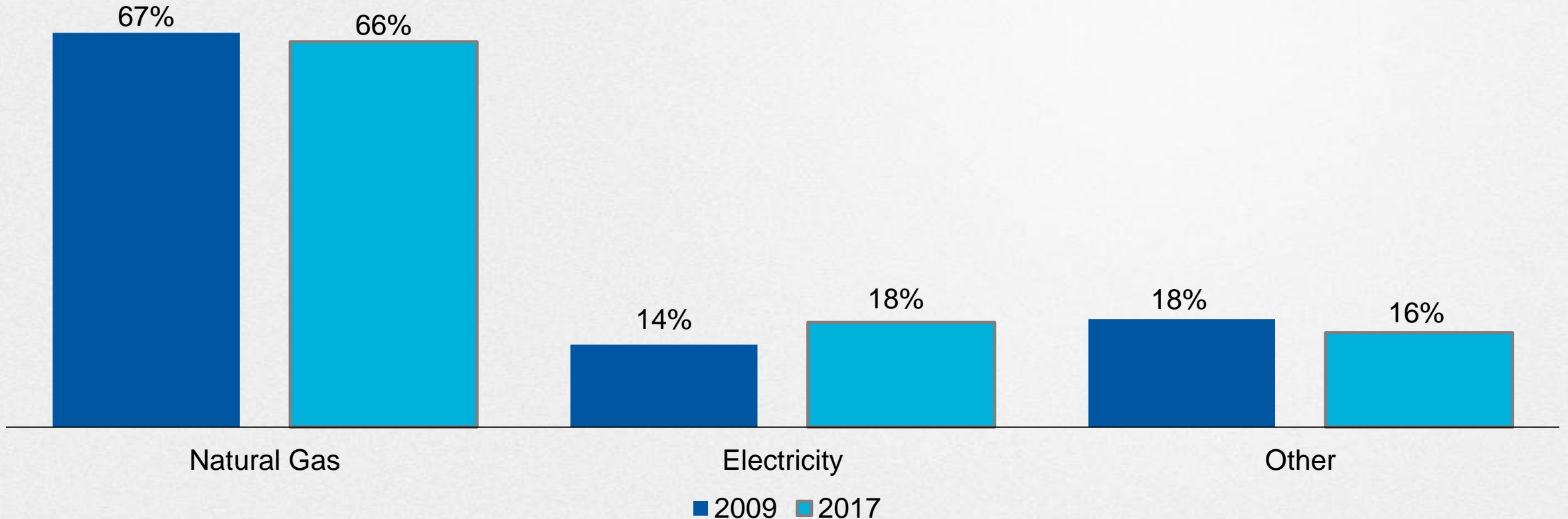
Gas delivery is highly concentrated in New Mexico, with one utility responsible for 84% of residential and commercial sales by volume. Las Cruces operates municipal gas utility.

Natural Gas Sales to Residential and Commercial Sectors by Utility
2017, millions of cubic feet



Although the majority of homes in New Mexico use natural gas as the primary heating fuel, use of electric heating has grown almost 30% since 2009.

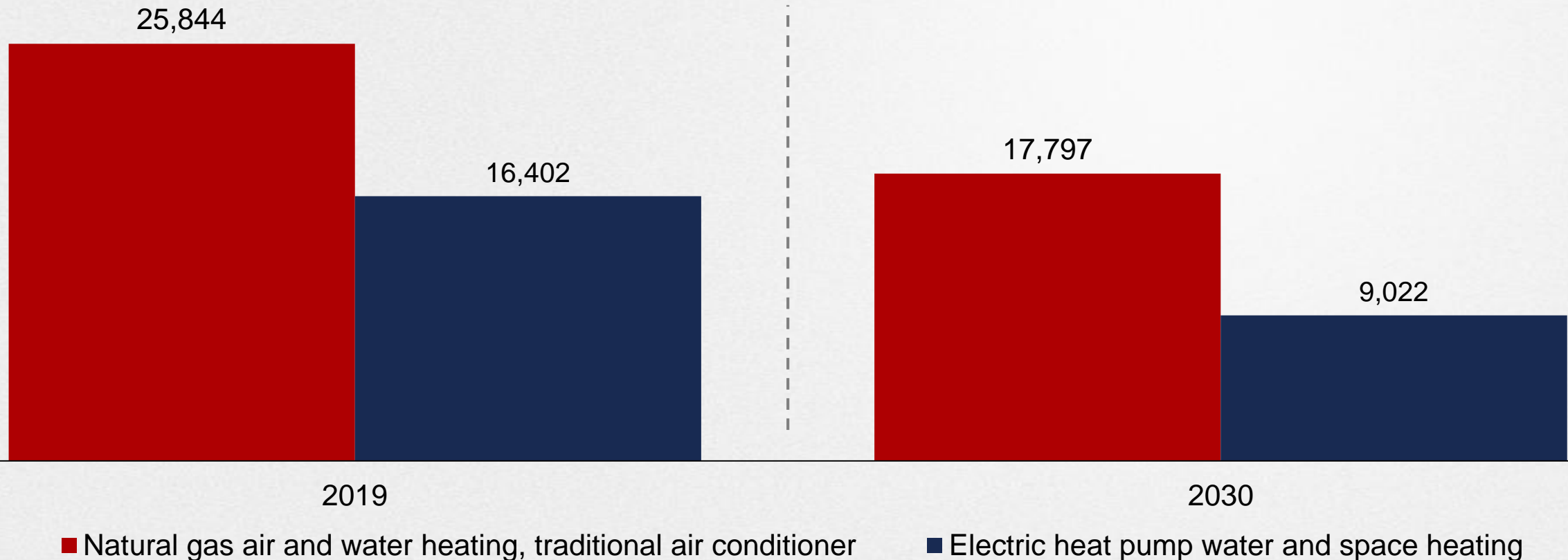
Primary Heating Fuel of Residences in New Mexico
2009 vs. 2017, percent of occupied homes



Using efficient electric appliances produces a lot less carbon pollution than gas today and in 2030

Heating and cooling emissions for an average home, New Mexico 45% reduction scenario, 2019 and 2030

Lbs of CO₂ per year



And it saves money. Our analysis shows new construction and retrofits with all-electric are cheaper than using natural gas in similar markets to New Mexico

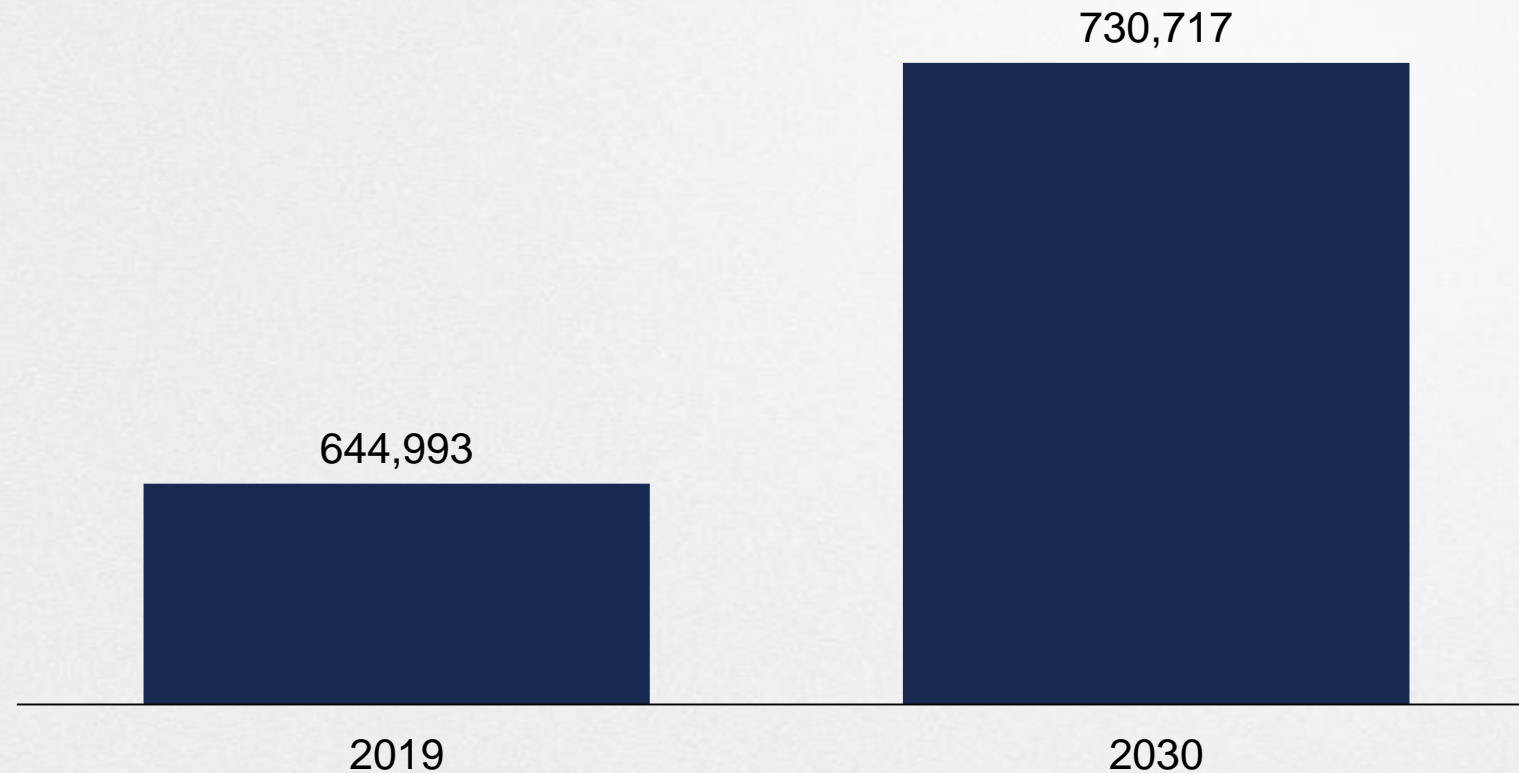
Net present cost of water and space conditioning
thousand \$



Unattended this problem gets worse and NM will add 85,000 new natural gas customers by 2030 and building emissions increase 20%

Total number of natural gas customers

BAU scenario, number of residential and commercial customers, MMT CO₂e,



Policies for Building Electrification

August 2019



Transforming global energy use to create a clean, prosperous, and secure low-carbon future.

To achieve New Mexico's goal of cutting carbon pollution 45% by 2030, the state may need to electrify 50,000 natural gas customers annually from 2020 to 2030 (Draft Analysis)

Cumulative existing natural gas customer electrification to meet 45% building sector reductions in New Mexico by 2030

Annual number of customers electrified per year



Source: RMI analysis *Assuming 45% emission reduction target (2005 baseline) achieved in power generation



Today, there is an opportunity to focus on three immediate actions to lay the groundwork for electrification

1 Invest in market development

Build demand for all-electric solutions, train suppliers and contractors, and consider bulk purchasing, incentives, and other mandates

2 Change programs and policy

Align programs and incentives to support rapid electrification through revised utility programs that ensure low-income families are able to participate and enjoy benefits of electrification

3 Modify codes and mandates

Engage local governments and legislature to change barriers to electrification such as building codes

Investing in market development is the first step...

1 Invest in market development

Build demand for expanding all-electric solutions through customer awareness and incentives, train suppliers and contractors, bulk purchasing, and other nudges

Market Development Examples

1. Remove barriers and launch pilot programs	<ul style="list-style-type: none">•Remove local permitting barriers•Launch pilot projects to demonstrate viability of electrification strategies•Change state regulations prohibiting utility incentives for fuel switching
2. Create and/or align incentives and scale up programs that ensure equitable access	<ul style="list-style-type: none">•Provide permitting or zoning incentives•Launch outreach and training programs for the mass market and frontline communities•Create utility targets for electrification
3. Implement codes and mandates that require electrification	<ul style="list-style-type: none">•Require or encourage electrification in local codes•Enact performance mandates for existing buildings•Ban the build-out of new gas infrastructure

Although challenges exist to market development, solutions exist

Challenges	Potential Solutions	Example program
Heat pump awareness	<ul style="list-style-type: none"> •Increase demand •Support education 	•Building Energy Exchange
Fragmented contractors	<ul style="list-style-type: none"> •Work through manufacturers and distributors 	•Mid-stream incentives
Emergency replacements	<ul style="list-style-type: none"> •Incentivize stocking through mid-stream programs. •Develop familiarity with heat pumps through displacement strategies. •Intervene in the decision-making process early 	•National Grid Heat Pump Water Heater Online Program
Quality of installations	<ul style="list-style-type: none"> •Contractor training •Standardized QA/QC 	•NEEP Guides to Installing ASHPs
Expanding contractors	<ul style="list-style-type: none"> •Standardize contract requirements •Establish high Road Agreements •Research and invest in barriers for diverse contractors 	•Rhode Island- Fostering Fuel Talent
HVAC talent gap	<ul style="list-style-type: none"> •Assess local hiring practices •Job placement programs with incentives for hiring •Public awareness campaign addressing stigma of trade careers 	•Seattle- Home Performance Job Placement Program

Cities across the United States have committed to accelerating building electrification



Example: State of California

BRIEF

California opens \$1B in efficiency funding to electrification

- Last week, CPUC voted unanimously to allow \$1 billion annual utility budget for energy efficiency to be directed toward building electrification efforts
- These existing funds can now be used to convert natural gas customers to electrification if there is a demonstrated energy efficiency gain
- A typical natural gas furnace is 80% efficient; electric resistance heating is 100%, and heat pumps are 200%-300% efficient.

Example: City of Boulder, Colorado

- **Natural gas reduction goal**
 - -85% residential
 - -35% commercial and industrial by 2050
- **Building codes**
 - Net zero for all-new construction and major renovations by 2031
- **Rebates**
 - for heat pumps and city-wide marketing campaign (“Comfort 365”)
 - \$1-1.4k for ASHP, \$900 for HPHW (between city, county, and utility programs)
- **Outcome:** program increased annual adoption by 300%
- **Challenges:** permitting, customer access to rebates, upfront cost, limited technology options



Example: State of Massachusetts

- **Competitive bulk procurement of home heating and cooling solutions, administered by MassCEC and DOER**
- **Outcomes:** finding installers in some communities, cost savings during pilot phase, standardizing pricing
- **Challenges:** energy efficiency comes first, need for workforce development

HEATSMART MASS MODEL

