



Furnace Standard Analysis Discussion Document

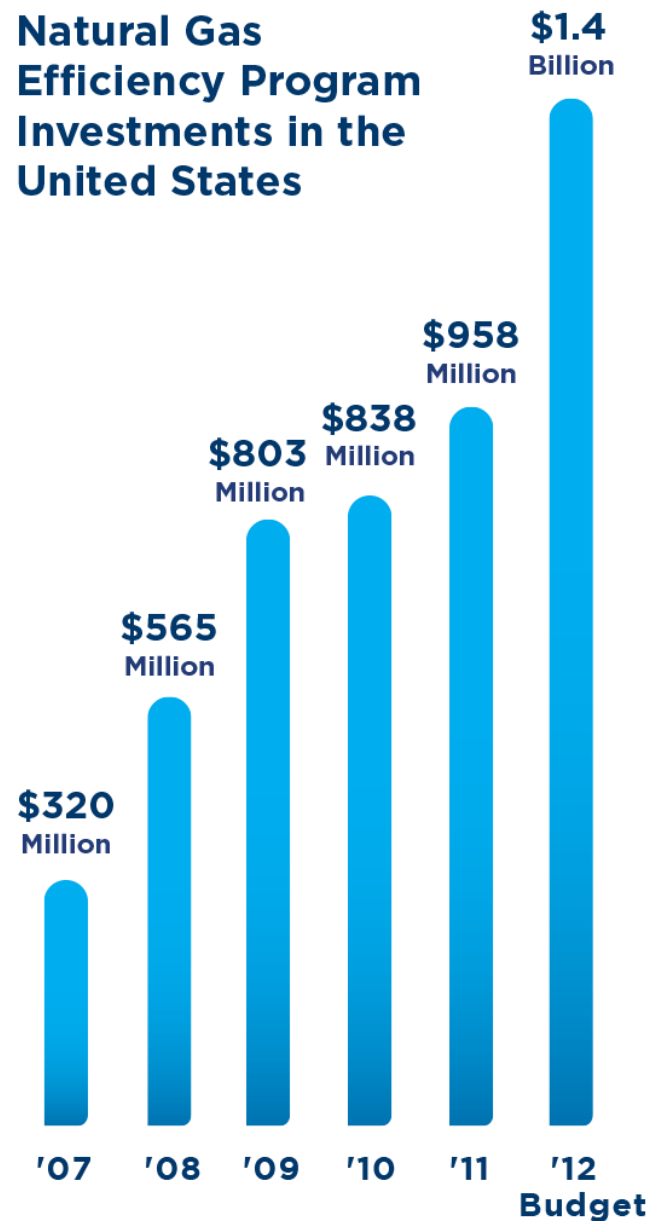
Assessing and Quantifying Effects of a New Furnace Standard

- *Using field intelligence and thoughtful analysis – assess and quantify the effects a regional or national condensing standard for natural gas furnaces could have on energy efficiency and environmental objectives.*
 - Provide insight on the potential impact limiting customer choices for heating systems could have on overall energy usage, cost, and carbon emissions outcomes.
 - Provide all data, models and sources of information to DOE and other stakeholders, to gain their confidence in the analysis and demonstrate full transparency.

Desired Outcome

Demonstrate the need for DOE to incorporate similar analyses in new minimum efficiency standard proceeding for natural gas furnaces.

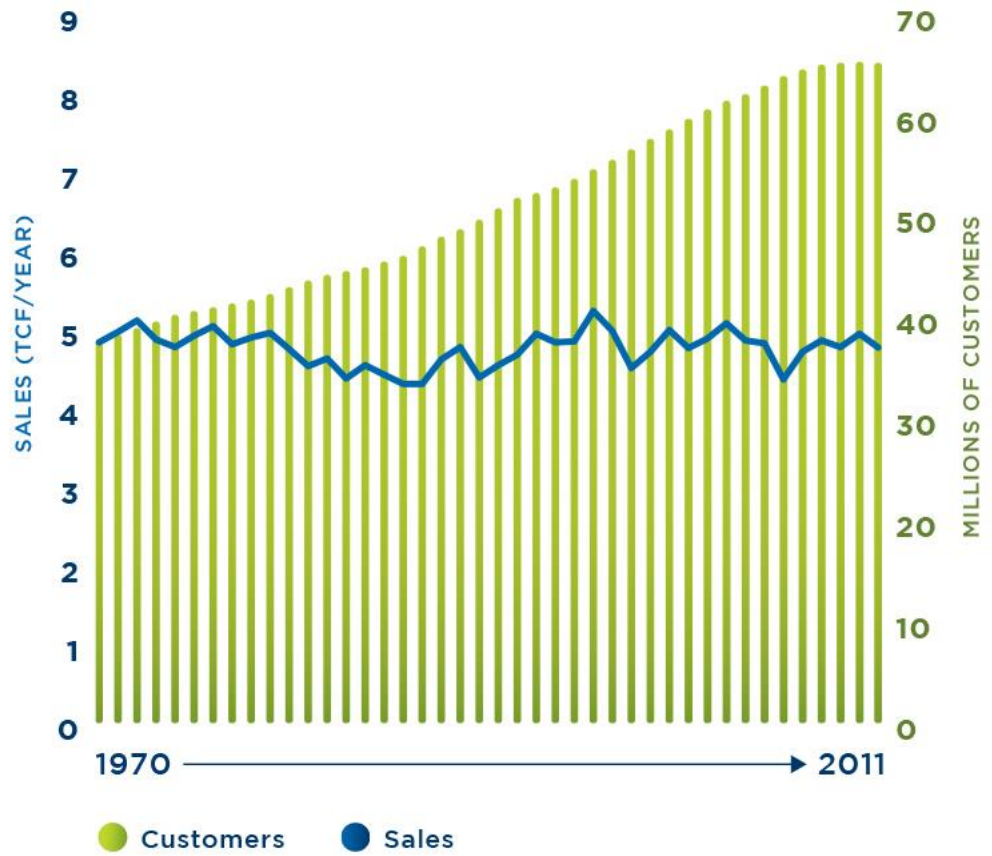
Industry Commitment to Efficiency





Natural gas usage per household has decreased even as overall demand for energy has risen. This trend is due in part to installation of tighter-fitting windows and doors, better insulation, utility sponsored energy efficiency programs, and the development of increasingly more efficient natural gas appliances.

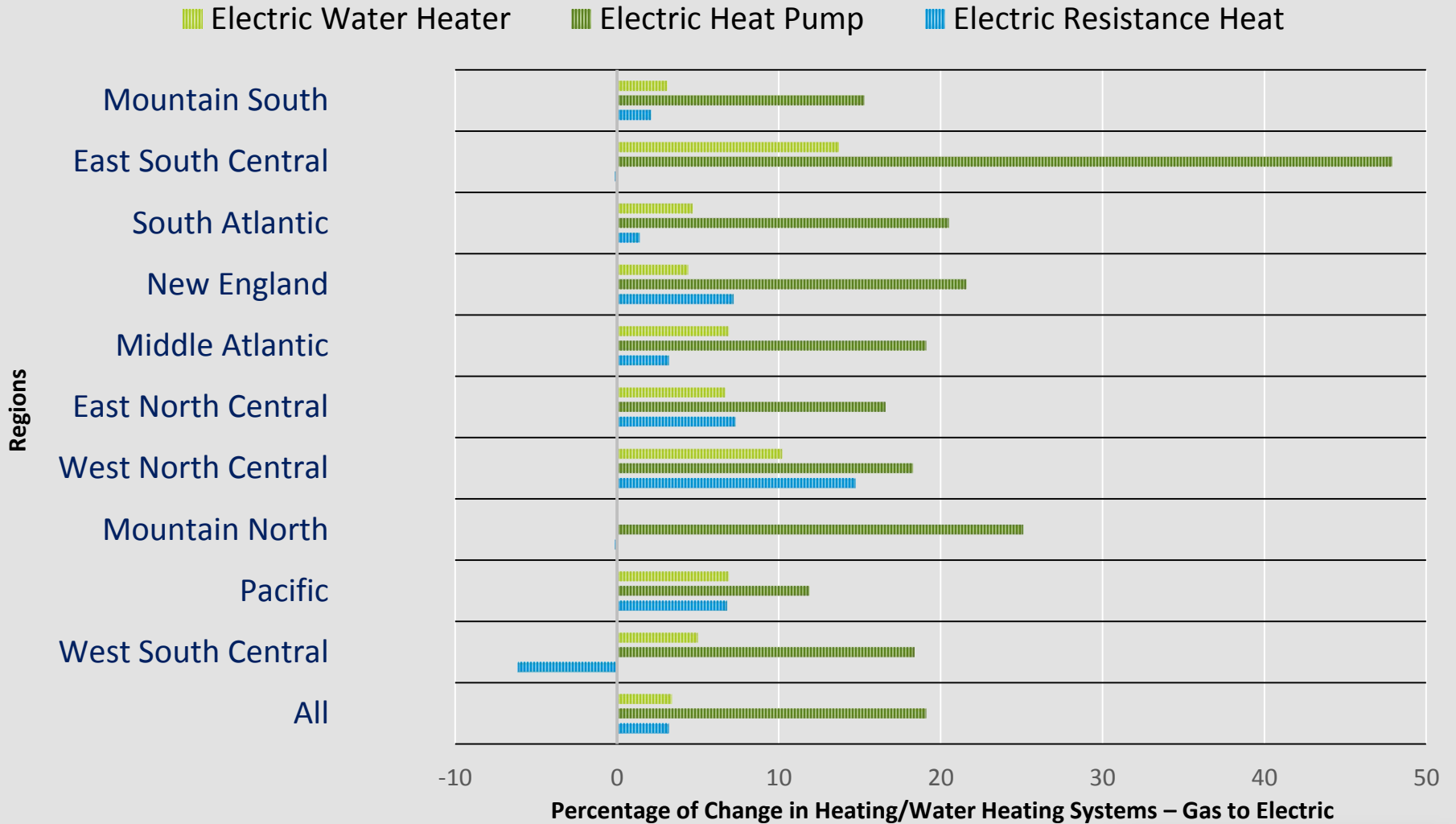
Residential Natural Gas Use: An Efficiency Success Story



Step 1: Enhance Field Intelligence by Engaging Builders and Contractors

- **Need:** A study to evaluate the potential impact a new minimum efficiency standard for natural gas furnaces could have on the distribution of heating systems and fuel types in the new construction and replacement markets.
- **Objective:** To gather intelligence from home builders and HVAC contractors on how they would change their approach to providing heating and water heating system proposals if a condensing standard was established for furnaces.
- **Approach:** Develop, administer, collect and analyze a nationwide survey designed to capture current fuel and technology choices for heating and water heating systems as well as the anticipated fuel and technology choices under two scenarios.
 1. A non-condensing furnace minimum standard
 2. A condensing furnace minimum standard

Survey results indicate a condensing furnace standard would cause a sizeable change in the type and energy source of heating and water heating systems installed



Comparison of Residential Space Heating Appliances



Electric Heat Pump



Electric
Resistance
Furnace



Natural Gas Furnace

| | | | | | |
|--------------------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| DOE/NAECA Efficiency | 7.7 HSPF | 9.0 HSPF | 99 AFUE | 80 AFUE | 94 AFUE |
| Full-Fuel-Cycle Energy Use per Year* | 96 MMBtu | 89 MMBtu | 156 MMBtu | 68 MMBtu | 52 MMBtu |
| CO ₂ e** Emissions/Yr* | 5.9 Metric Tons | 5.5 Metric Tons | 9.5 Metric Tons | 4.5 Metric Tons | 3.5 Metric Tons |
| Annual Cost | \$1,119 | \$1,029 | \$1,806 | \$714 | \$544 |

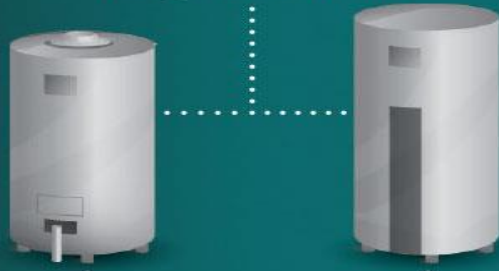
• Excludes A/C operations

** Includes greenhouse gas impact from unburned methane

July 2014 version

Residential Water Heater Efficiency*

Storage Water Heaters



**NATURAL
GAS**

**ELECTRIC
RESISTANCE**

Energy Cost (annually)

\$252

\$550

Full-Fuel-Cycle Energy Consumption (annually)

26.5 MMBtu

49.7 MMBtu

CO₂ Emissions (annually)

1.5 tons

2.8 tons

* Based on National Averages

Step 2: Analyze and Measure the Impact of Survey Results on Energy Efficiency Metrics

- **Need:** Demonstrate the market impact the contractor survey results would have on key energy efficiency metrics.
- **Objective:** To develop a credible and transparent model that quantifies the potential impact on key metrics energy efficiency standards are intended to address.
- **Approach:** Build a “Case Study” model that incorporates key market data and findings from the builder and contractor survey as inputs. The output from the model will identify the potential impact on the following metrics using furnace shipment data for a single year:
 1. Annual consumer energy costs
 2. Annual source energy usage
 3. Annual CO2 emissions

Key Variables and Inputs Used in Impact Analysis Model

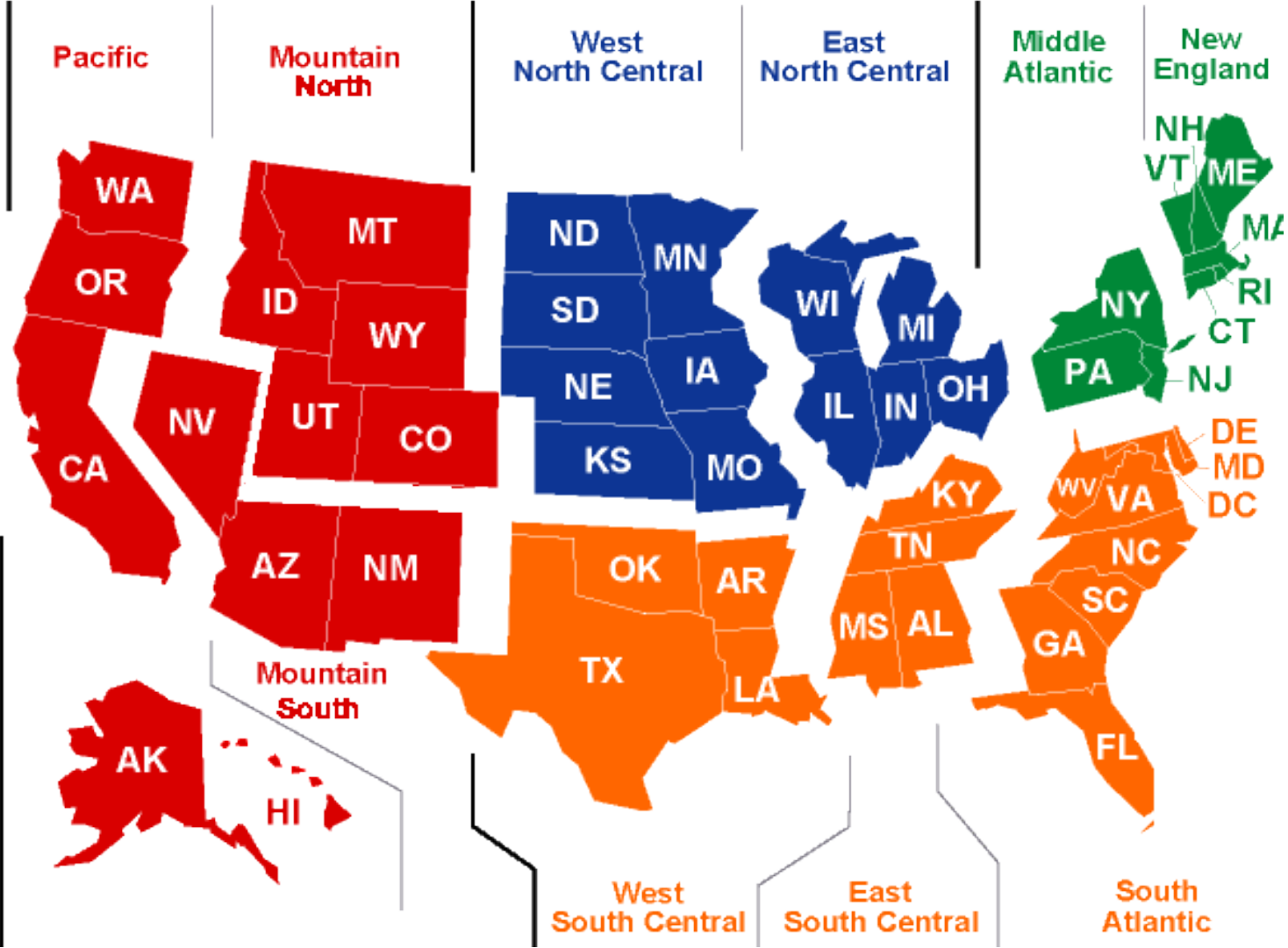
Market Data

- National furnace shipments data
- Regional furnace stock data
- Annual consumption data for gas furnaces by furnace category and region
- Annual consumption data for gas storage water heaters by region
- Annual consumption for electric heat pumps, furnaces and water heaters by region
- Factors for converting site energy consumption to primary energy consumption by region
- CO2 emissions factors for energy source and region

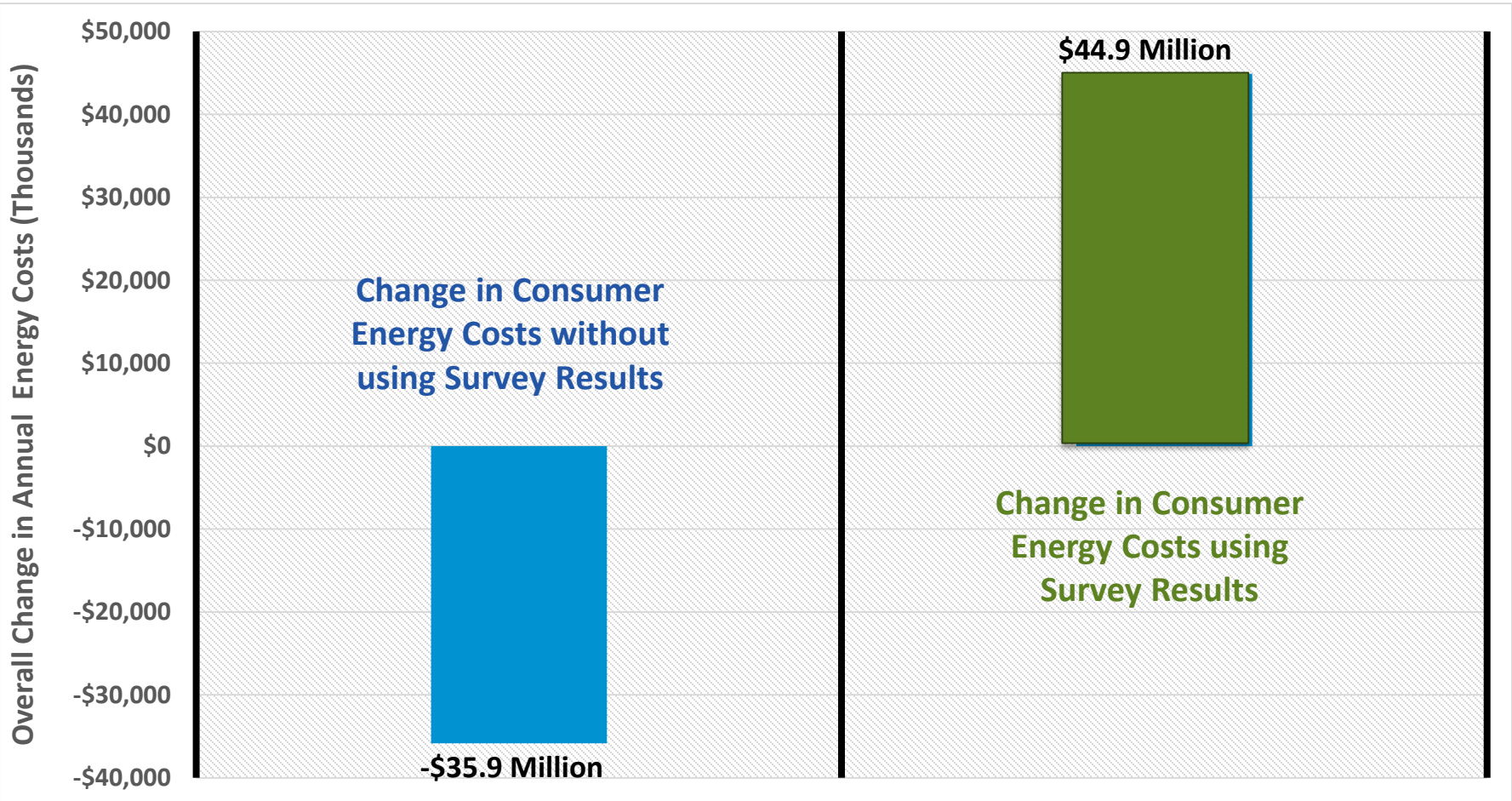
AGA/APGA Studies Data

- Survey results on current distribution of furnace installations by category of furnace and region
- Survey results on potential changes in heating system installations and fuel source by region
- Survey results on potential changes in water heating system installations and fuel source by region
- Marginal rates for electric and gas consumption by region

Regions Considered in the Analysis – Based on U.S. Census Regions

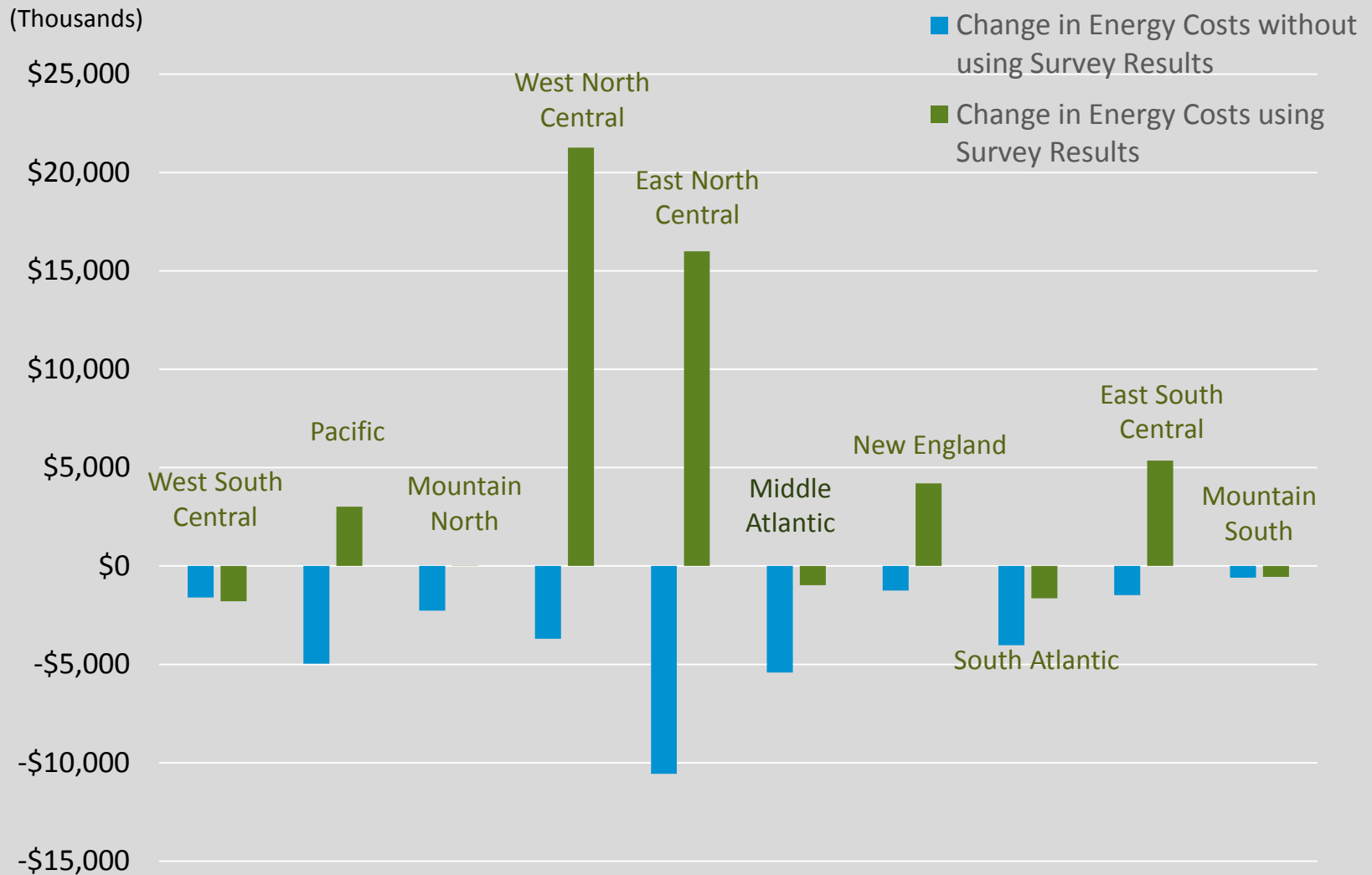


Model indicates a condensing furnace standard would *increase overall energy costs** when contractor survey results are considered in the analysis



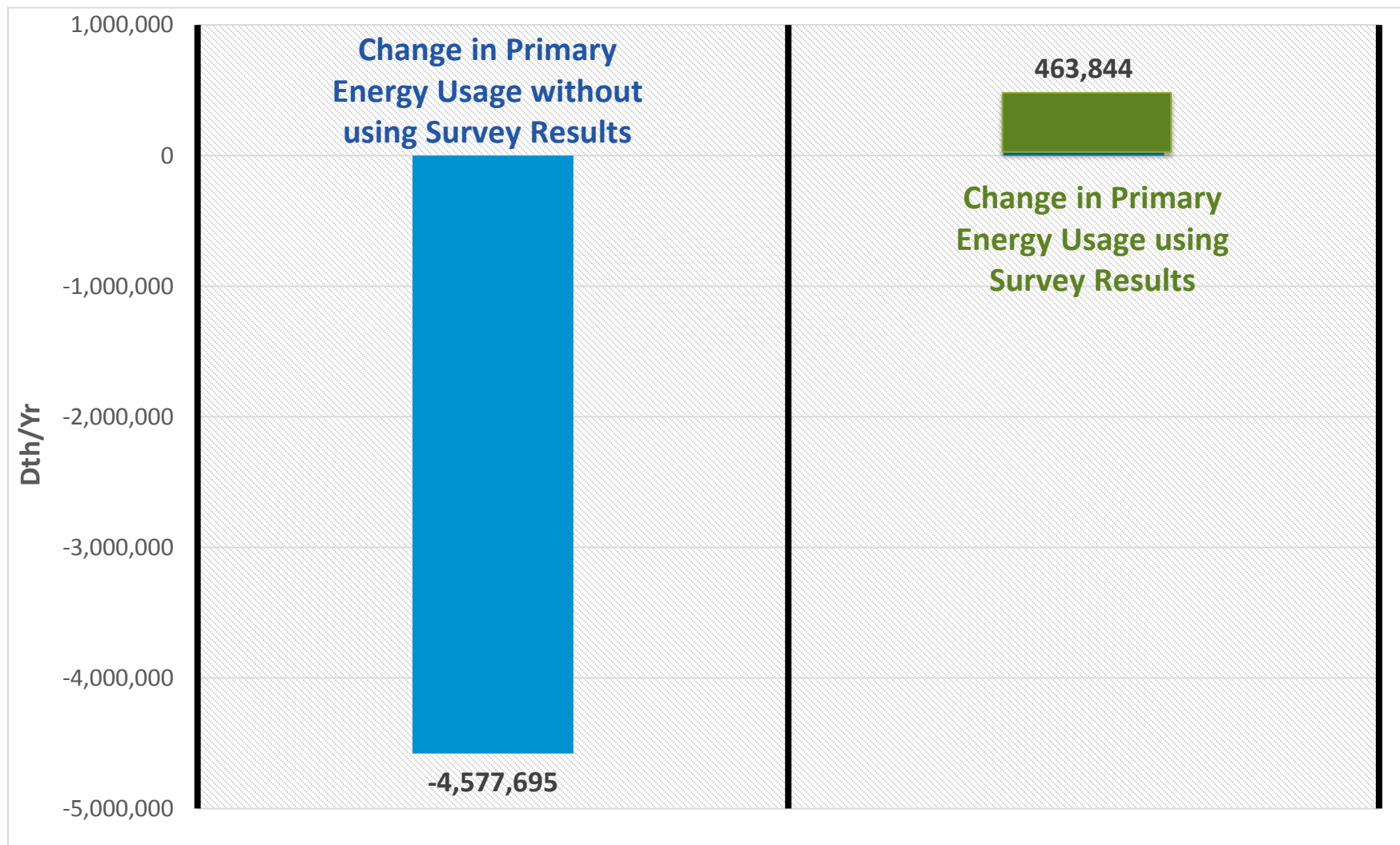
* Energy costs calculated using marginal natural gas and electricity rates.

Potential Impact of a Condensing Furnace Standard on Consumer Energy Costs* By Region (\$/Year)

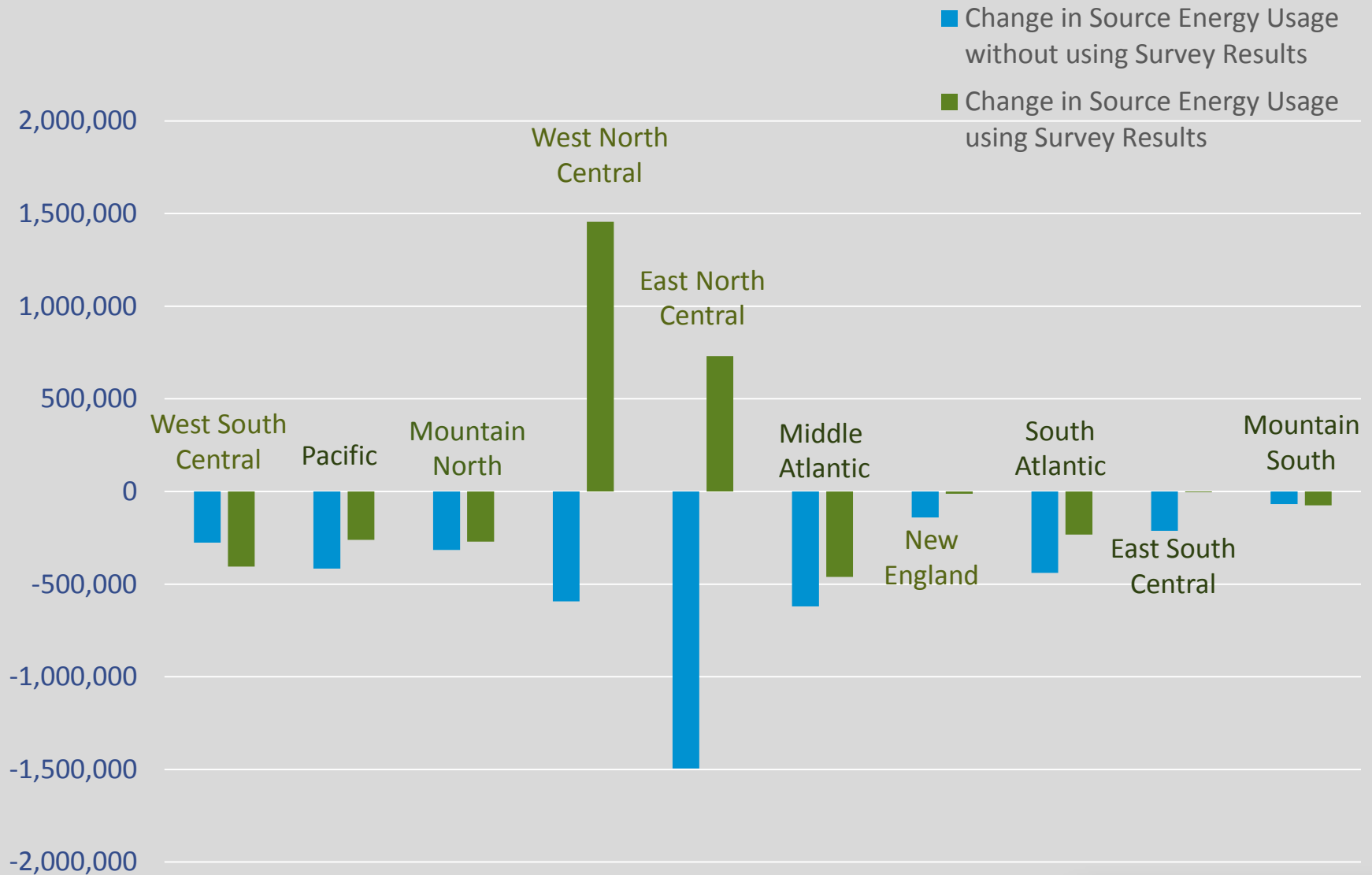


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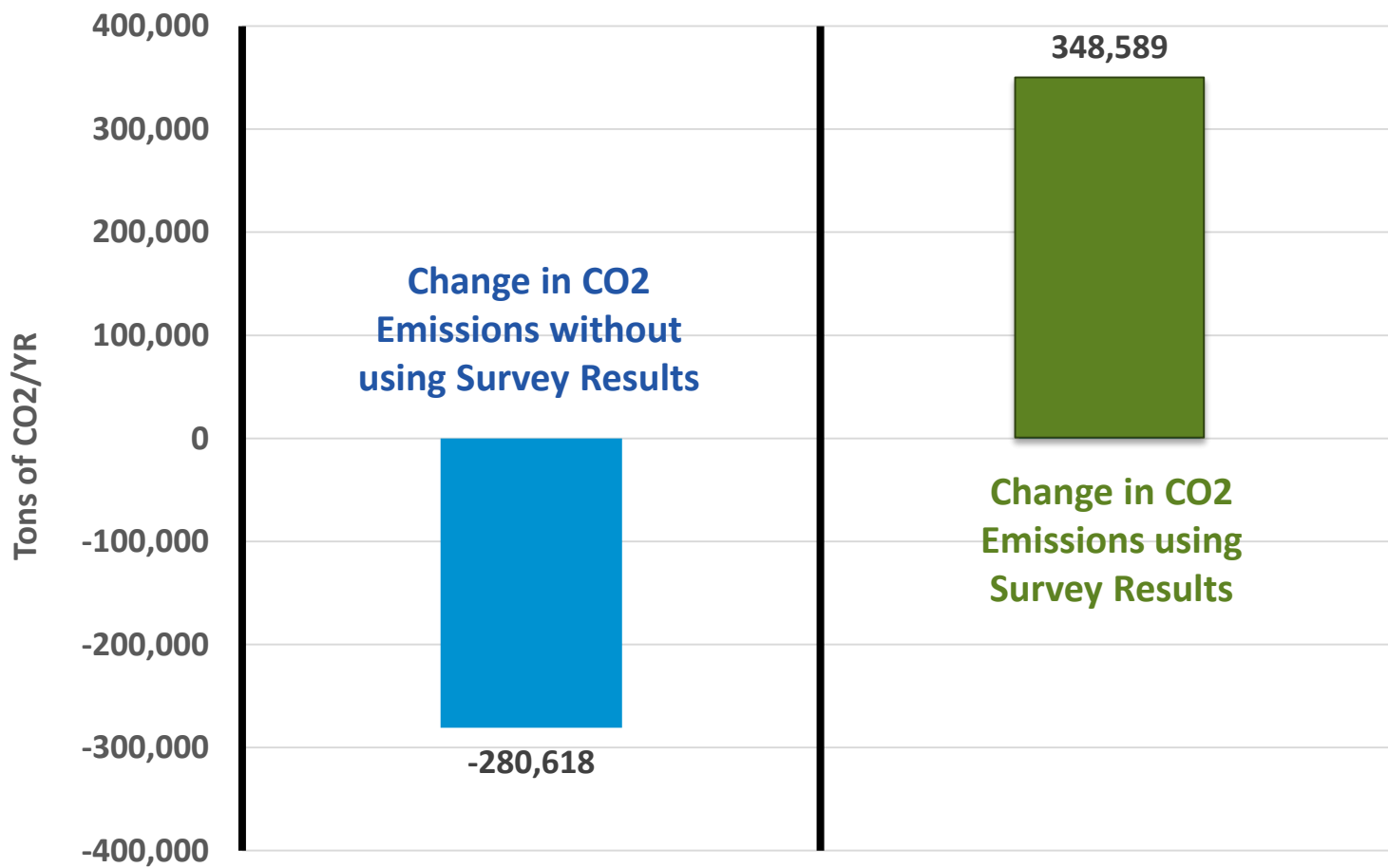
Model indicates a condensing furnace standard would *increase source energy usage* when contractor survey results are considered in the analysis



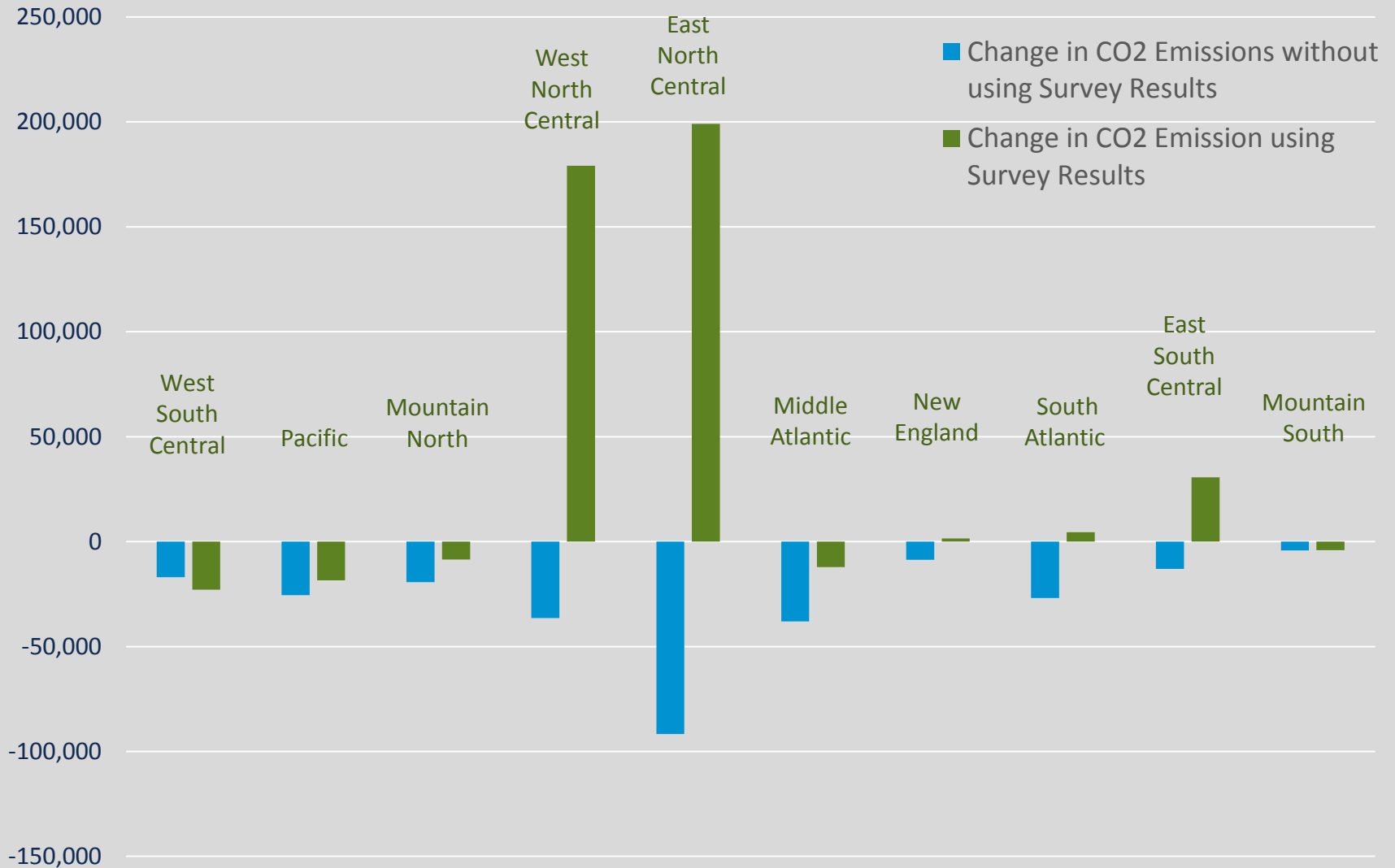
Potential Impact of a Condensing Furnace Standard on Source Energy Usage By Region (Dth/Year)



Model indicates a condensing furnace standard would *increase CO2 emissions* when contractor survey results are considered in the analysis



Potential Impact of a Condensing Furnace Standard on CO2 Emissions By Region (Tons CO2/Year)



What We Have Learned

- Contractor and builder survey responses indicate changes in heating and water heating system choices would be expected if a national or regional condensing furnace standard was established
 - Two primary factors driving the change include:
 - First cost premiums (equipment and installation) for natural gas condensing furnaces
 - Installation issues (venting and condensate disposal) associated with natural gas condensing furnaces
- Changes in system choice would conflict with our commitment to:
 - Helping customers save money
 - Helping improve the efficiency of how we use energy
 - Helping the nation achieve the objective of lowering emissions
- It is important to understand the regional impacts of changes in system choice
 - Eight out of the ten regions see substantially diminished benefits and increased costs
 - Impacts are especially significant in northern regions of the country.

Discussion

- ❖ Contractor/Builder Survey
Methodology and Results
- ❖ Impact Analysis Model
Assumptions and Inputs
- ❖ Model Outputs
- ❖ Solutions for Overcoming
Installation Challenges
- ❖ Preventing Unintended
Consequences from Standard



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