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# Leveraging Natural Gas to Reduce Greenhouse Gas Emissions

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[C2ES.ORG](http://C2ES.ORG)

## About Center for Climate and Energy Solutions

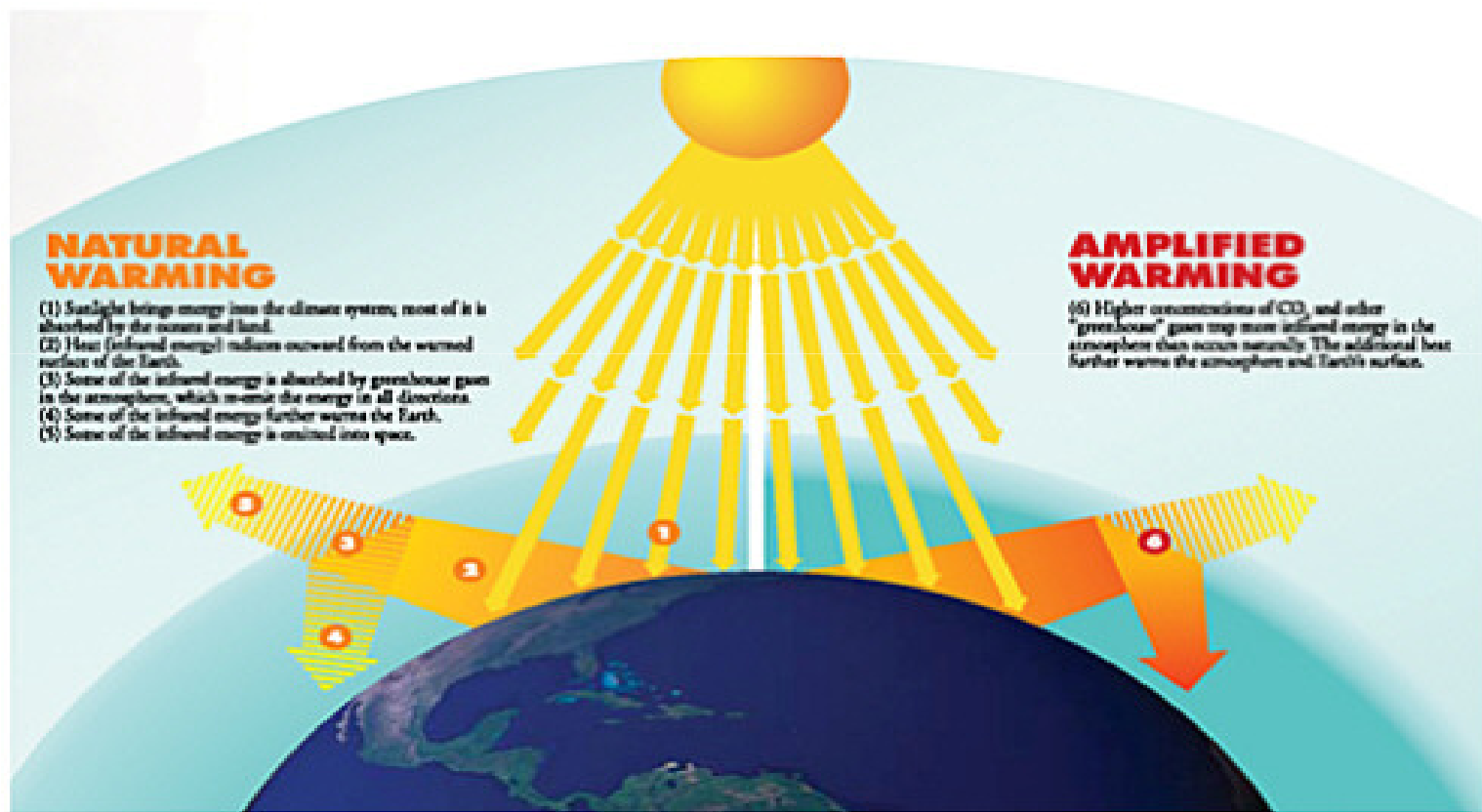


- **Independent, nonpartisan, nonprofit organization**
- **Working to advance strong policy and action to address the twin challenges of energy and climate change**
- **Founded in 1998 as the Pew Center on Global Climate Change**
- **Became C2ES in 2011**
- **Named world's #1 environmental think tank in 2011 (Univ. of Pennsylvania survey)**

# Business Environmental Leadership Council (BELC)



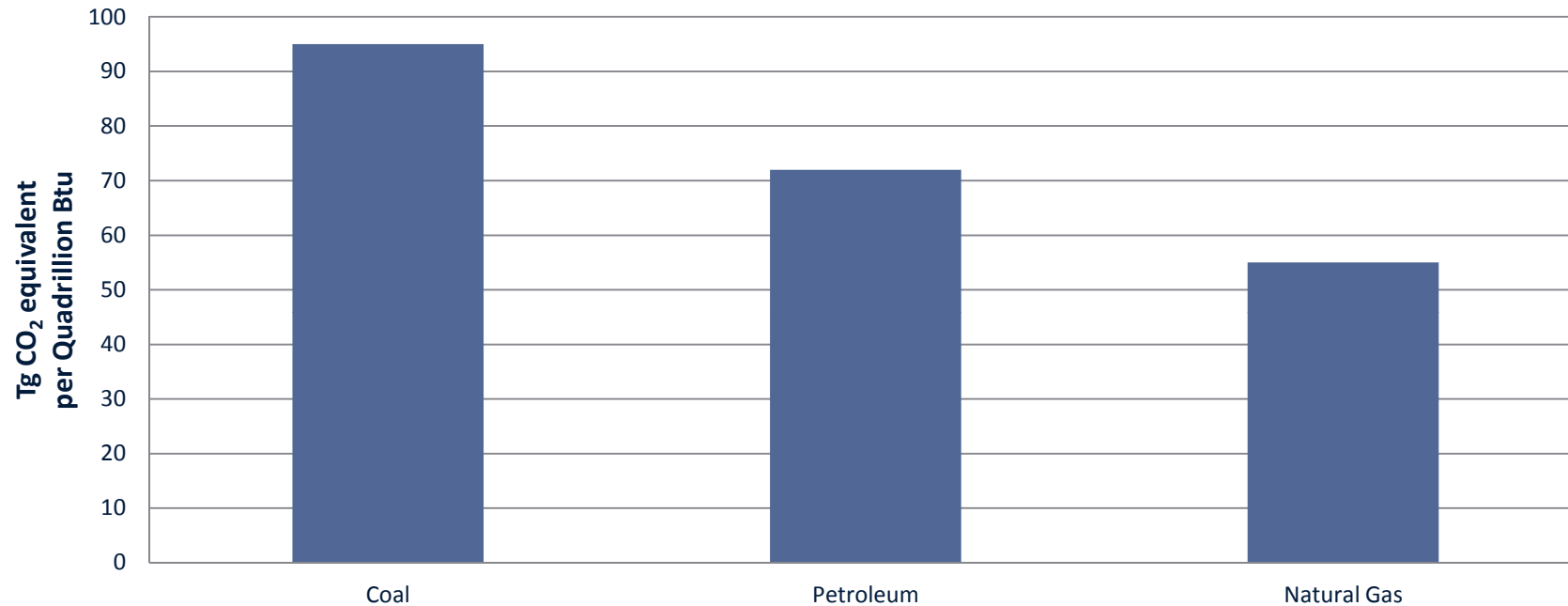
# Climate change is occurring



# Natural gas has relatively lower GHG emissions



## Carbon Content of Fossil Fuels



Source: Environmental Protection Agency, Draft Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2011. 2013. Chapter 3 and Annex 2.

Notes:

\*CO<sub>2</sub> content for petroleum has been calculated as an average of representative fuel types (e.g., jet fuel, motor gasoline, distillate fuel) using 2011 data.

\*\* This graphic does not account for the relative efficiencies of end-use technologies.

## Overarching conclusions

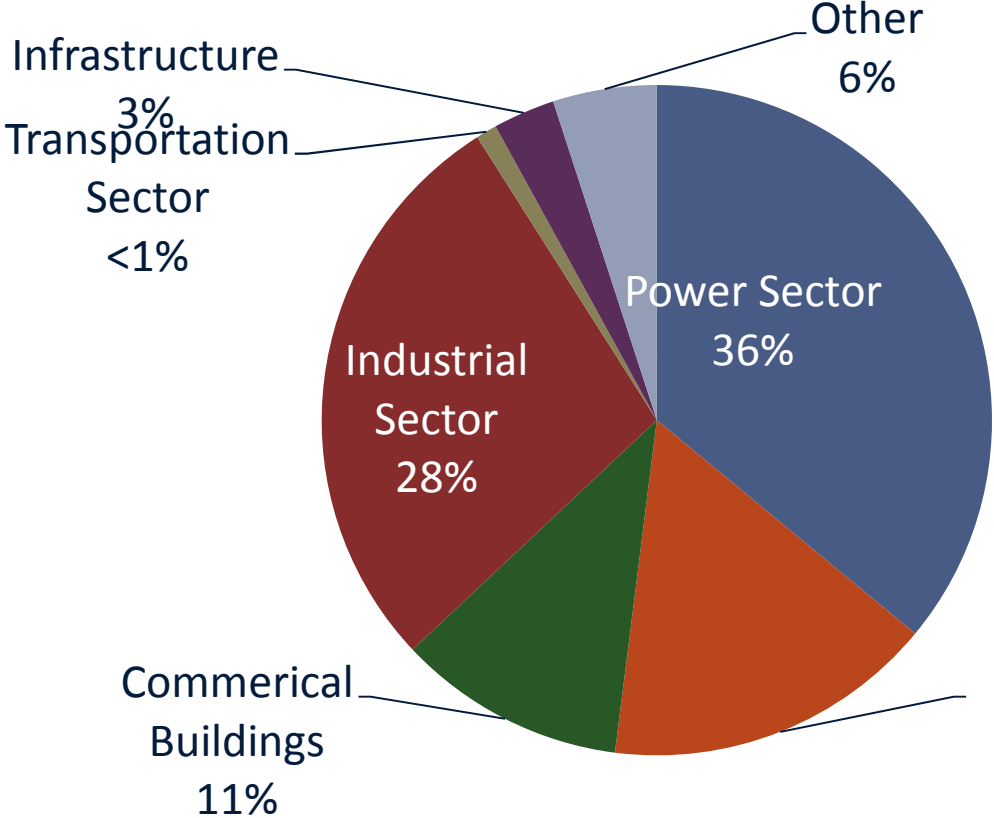


- **Substitution of natural gas for coal and oil can help reduce greenhouse emissions in the near and medium term**
- **Natural gas substitution cannot be our only climate strategy; zero-carbon energy sources, energy efficiency, and carbon capture and storage must also be advanced**
- **In order to realize the full climate benefits of natural gas, methane leaks must be measured and minimized**

# Every sector could benefit from fuel substitution



## Natural Gas Consumption by Sector, 2012

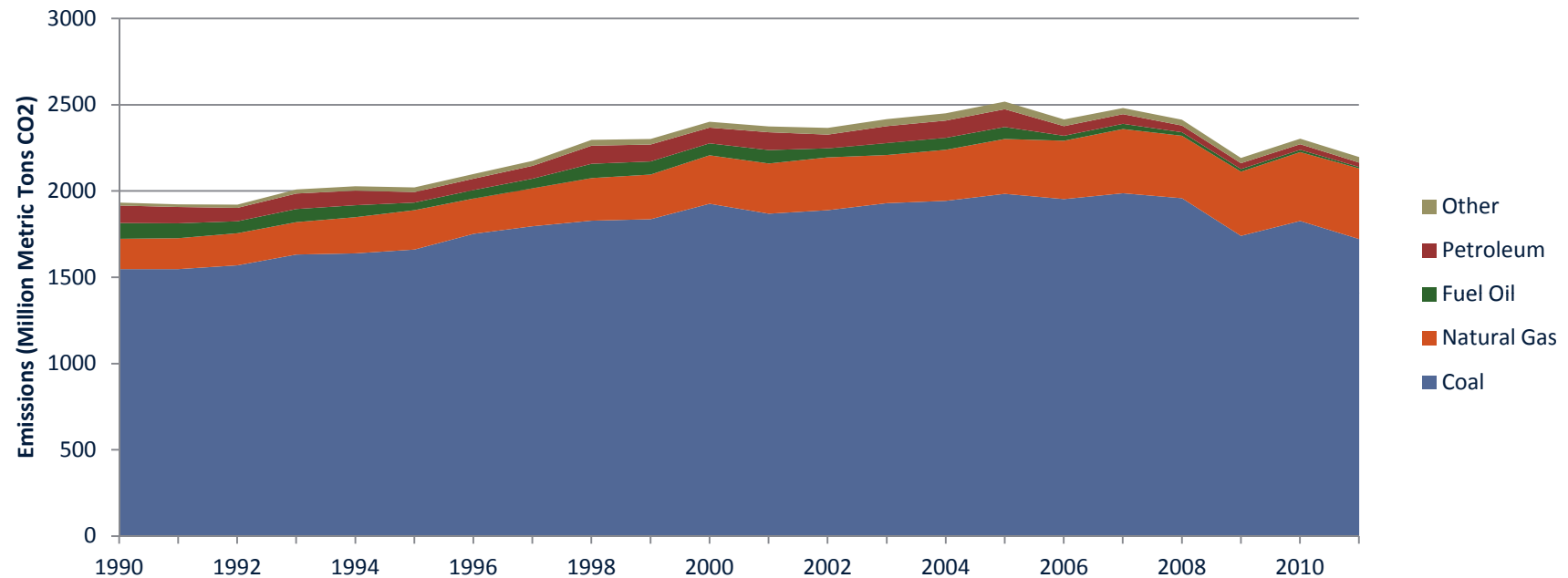


Source: Energy Information Administration, "Natural Gas Consumption by End Use," 2013.

# Natural gas contributes to lower emissions in the power sector



## US Power Sector Greenhouse Gas Emissions by Fuel



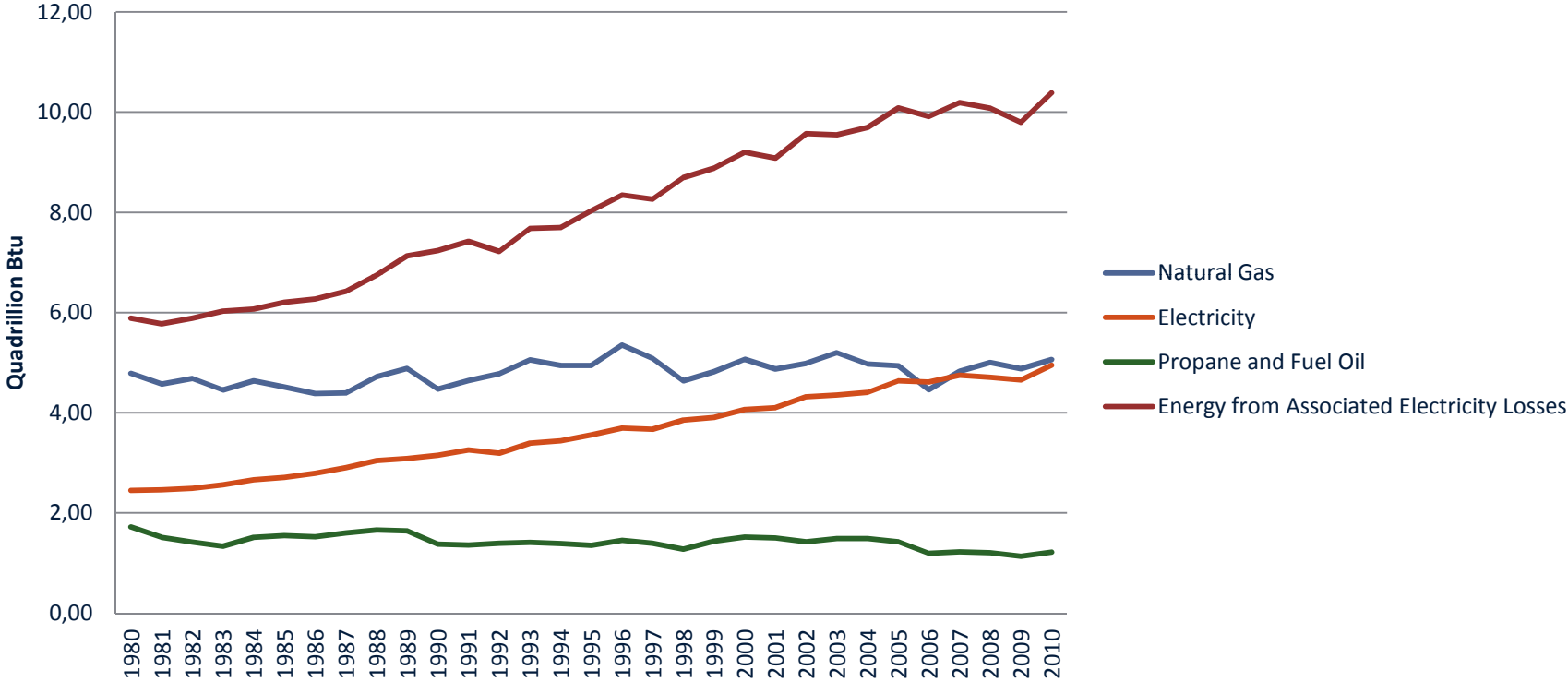
Source: US Energy Information Agency, Annual Energy Outlook 2013



# Natural Gas in Buildings



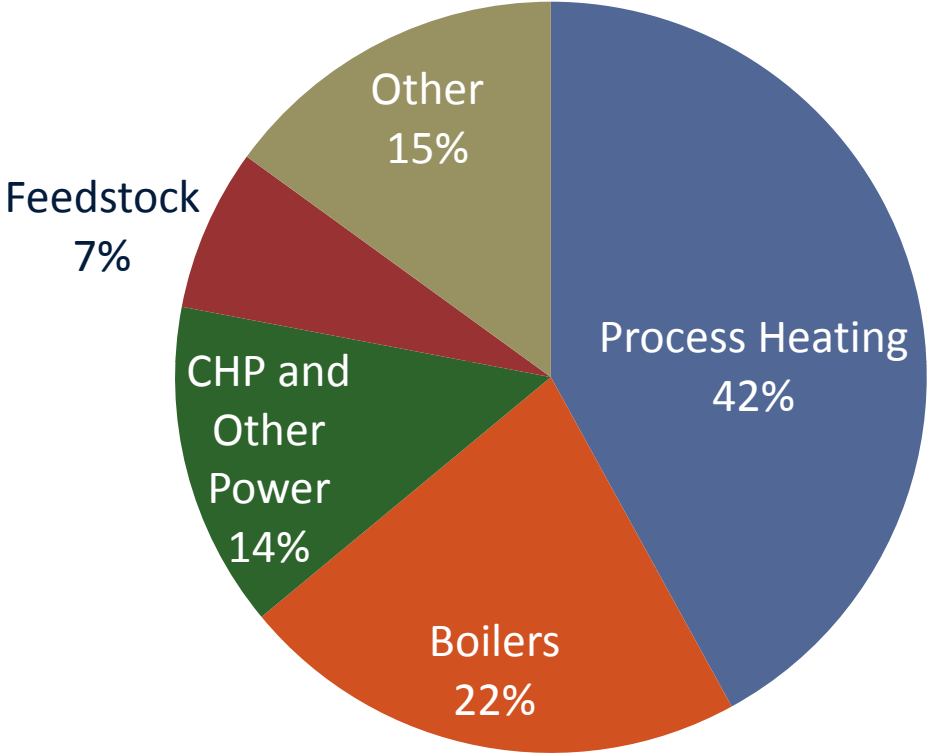
## Energy Use for U.S. Residences



Source: Energy Information Administration, "Today in Energy," March 6, 2013. Available at: <http://www.eia.gov/todayinenergy/detail.cfm?id=10251>



## Natural Gas Use in Manufacturing

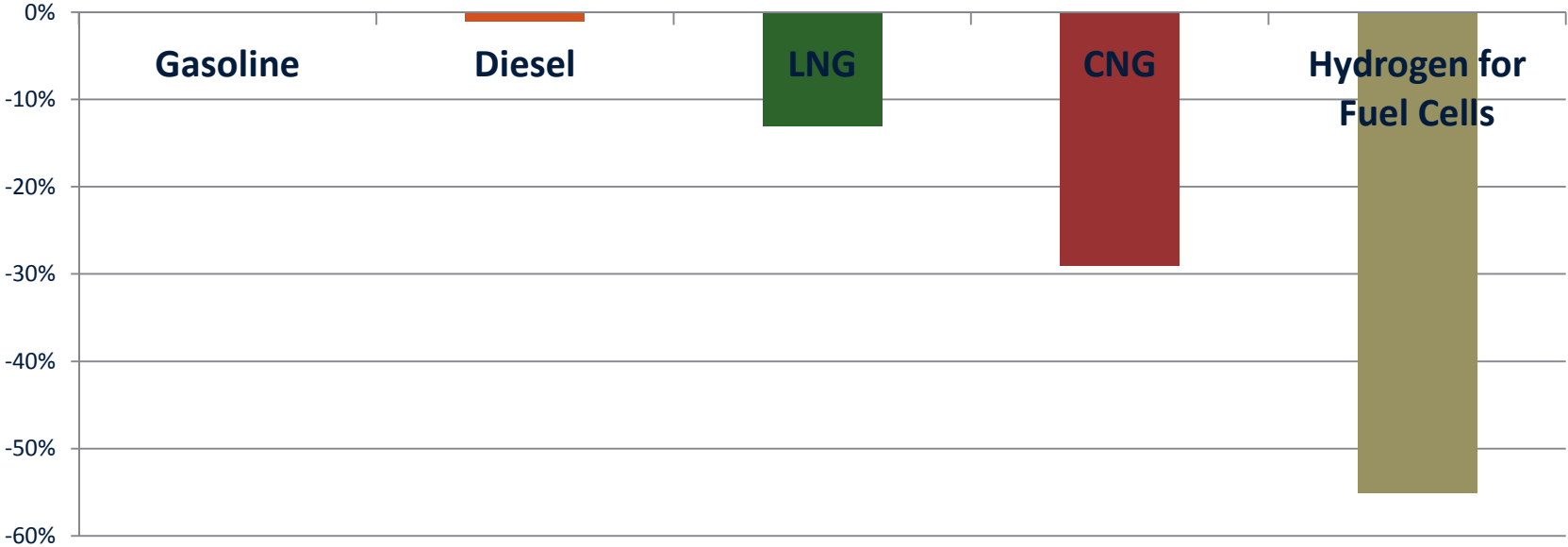


Source: Energy Information Administration, "Natural Gas Consumption by End Use," 2013.

# Natural Gas in Transportation



### Full lifecycle, total carbon intensity of selected transportation fuel options as a percentage reduction from gasoline carbon intensity



Source: California Air Resources Board, "Proposed Regulation to Implement the Low Carbon Fuel Standard," March 5, 2009. Table ES-8. Available at: [http://www.arb.ca.gov/fuels/lcfs/030409lcfs\\_isor\\_vol1.pdf](http://www.arb.ca.gov/fuels/lcfs/030409lcfs_isor_vol1.pdf)

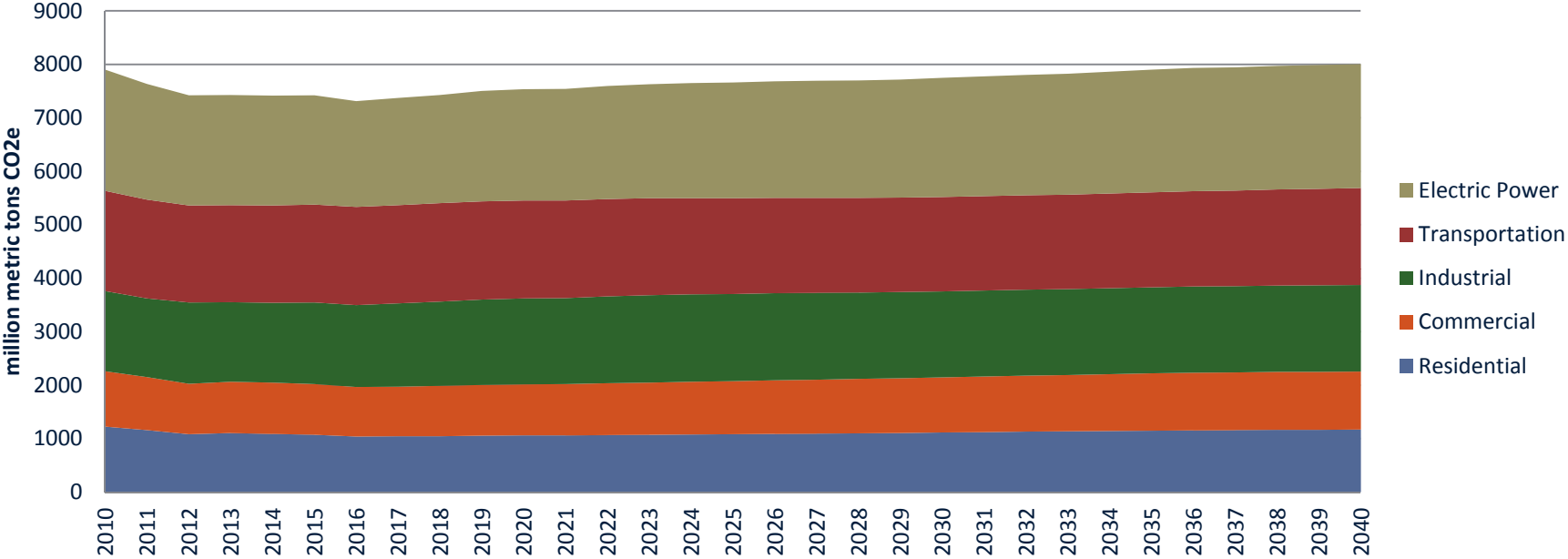
Notes:  
The carbon intensities compared in the graphic were calculated specifically for California's Low Carbon Fuel Standard program using the GREET model.

Results from the GREET model rely on the assumptions included in the model. Other models may use other assumptions and yield different results.

# More to be done in the long term



## Energy-Related Carbon Dioxide Emissions by Sector



Source: US Energy Information Agency, Annual Energy Outlook 2013



- **Natural gas cannot be the sole basis for efforts to reduce greenhouse gases**
- **Zero-carbon sources – renewables, nuclear, carbon capture and sequestration, and energy efficiency including fuel standards – must be supported.**
- **Policies are needed – e.g., a price on carbon**

## Methane leakage must be addressed



- Methane leaks can offset the potential climate benefit of fuel substitution
- Methane is much more potent than carbon dioxide
  - About 34 times more powerful at 100 years
  - About 86 times more powerful at 20 years
- Methane leakage rates are uncertain
- Emissions occur along the value chain



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