

# Reducing U.S. Greenhouse Gas Emissions: *How Much at What Cost?*



**US Greenhouse Gas Abatement Mapping Initiative**

April 22, 2008

McKinsey & Company

## Project objective and approach

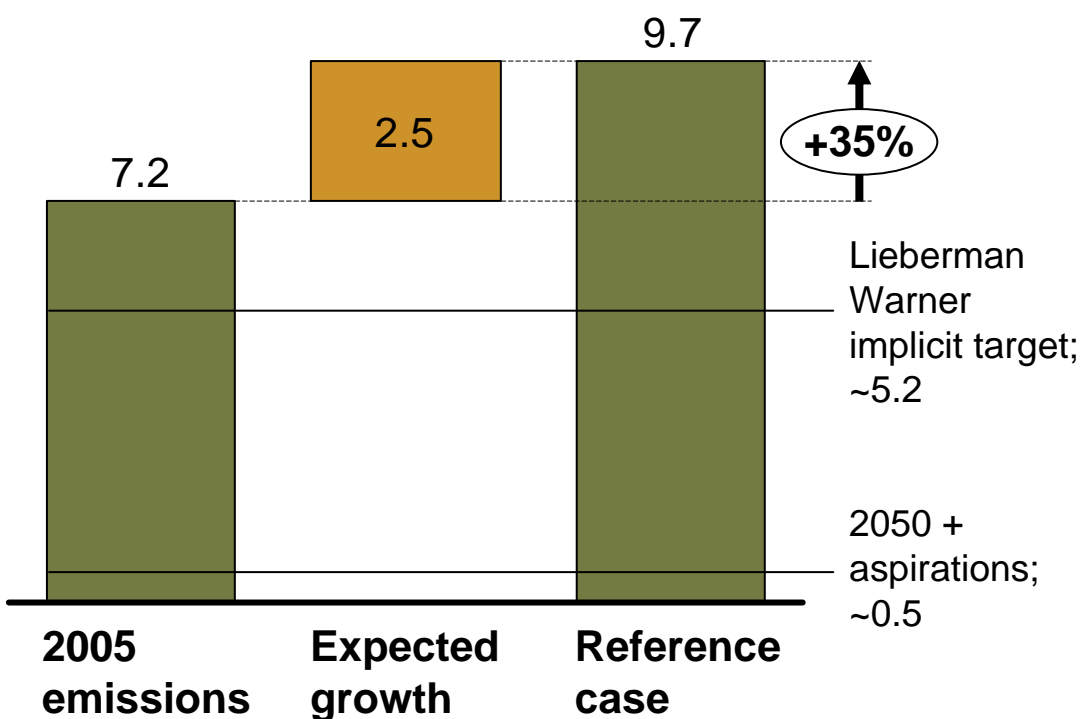
**Objective:** Develop a comprehensive, objective, consistent fact base to inform economically sensible approaches for reducing U.S. greenhouse gas (GHG) emissions

- Analyzed 250+ opportunities to reduce US GHG emissions by 2030
- Covered 7 sectors of the economy – buildings, power, transportation, industrial, waste, agriculture and forestry
- Constructed detailed “emissions reference case” based on US government agencies (e.g., DOE, USDA, EPA) for emissions forecasts
- Conducted interviews with 100+ leading authorities and companies, and leveraged McKinsey subject matter experts around the globe
- Received guidance and support from top academics and corporate and environmental sponsors (DTE Energy, Environmental Defense, Honeywell, National Grid, NRDC, PG&E, Shell). The Conference Board is co-publishing and disseminating the report.

# Government agencies forecast U.S. emissions to rise by 2030

Gigatons CO<sub>2</sub>e

## Projected GHG emissions



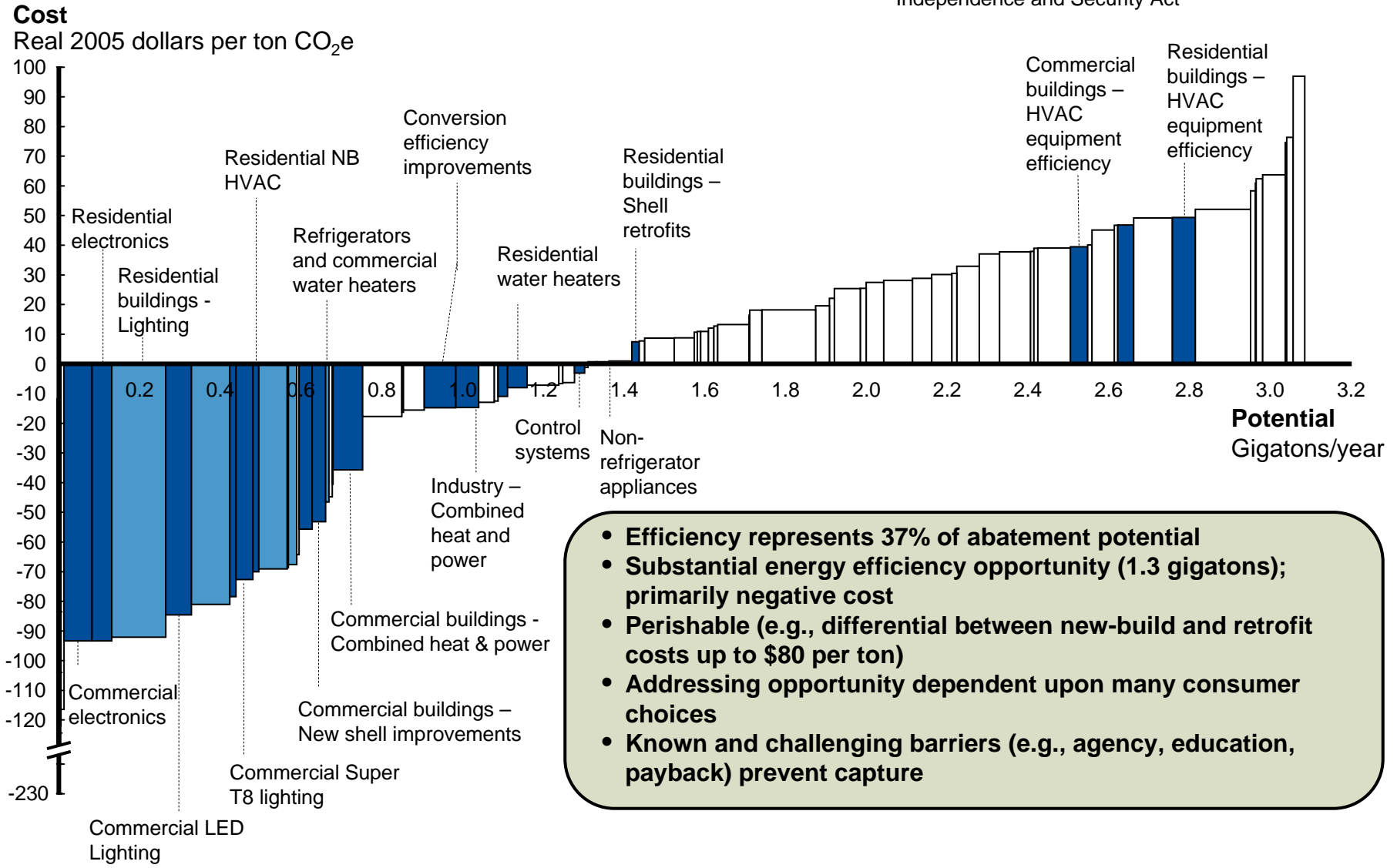
### Key growth drivers

- Expansion of U.S. economy and population
- Above-average growth in buildings and appliances
- Increased coal-fired power generation (without CCS)



# Energy efficiency opportunity profile

■ Energy efficiency-related opportunities  
■ Significant capture - 2007 Energy Independence and Security Act  
MID-RANGE CASE – 2030



- Efficiency represents 37% of abatement potential
- Substantial energy efficiency opportunity (1.3 gigatons); primarily negative cost
- Perishable (e.g., differential between new-build and retrofit costs up to \$80 per ton)
- Addressing opportunity dependent upon many consumer choices
- Known and challenging barriers (e.g., agency, education, payback) prevent capture

Source: McKinsey analysis

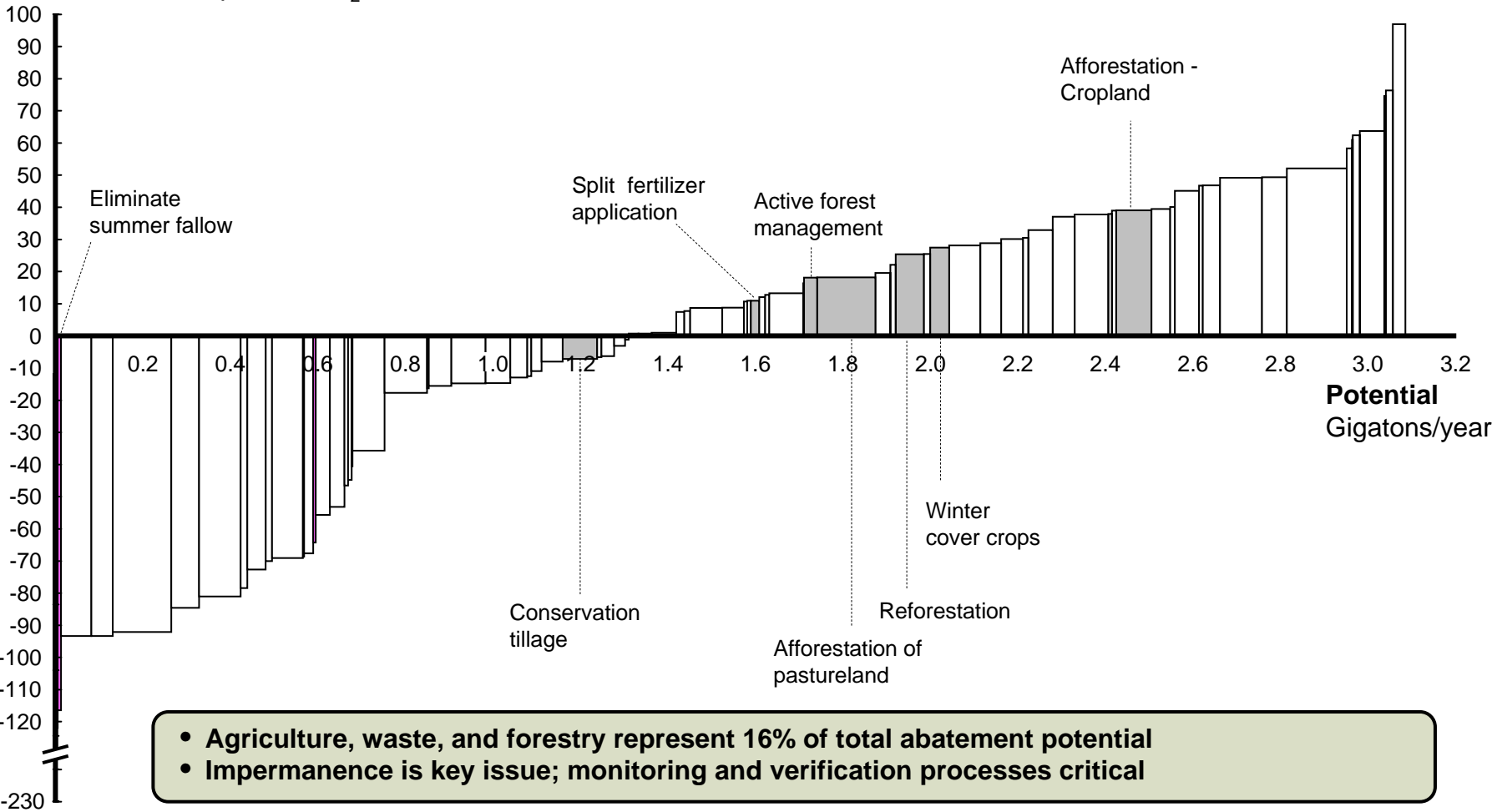
# Carbon sink opportunity profile

Carbon sink/offset

MID-RANGE  
CASE – 2030

**Cost**

Real 2005 dollars per ton CO<sub>2</sub>e

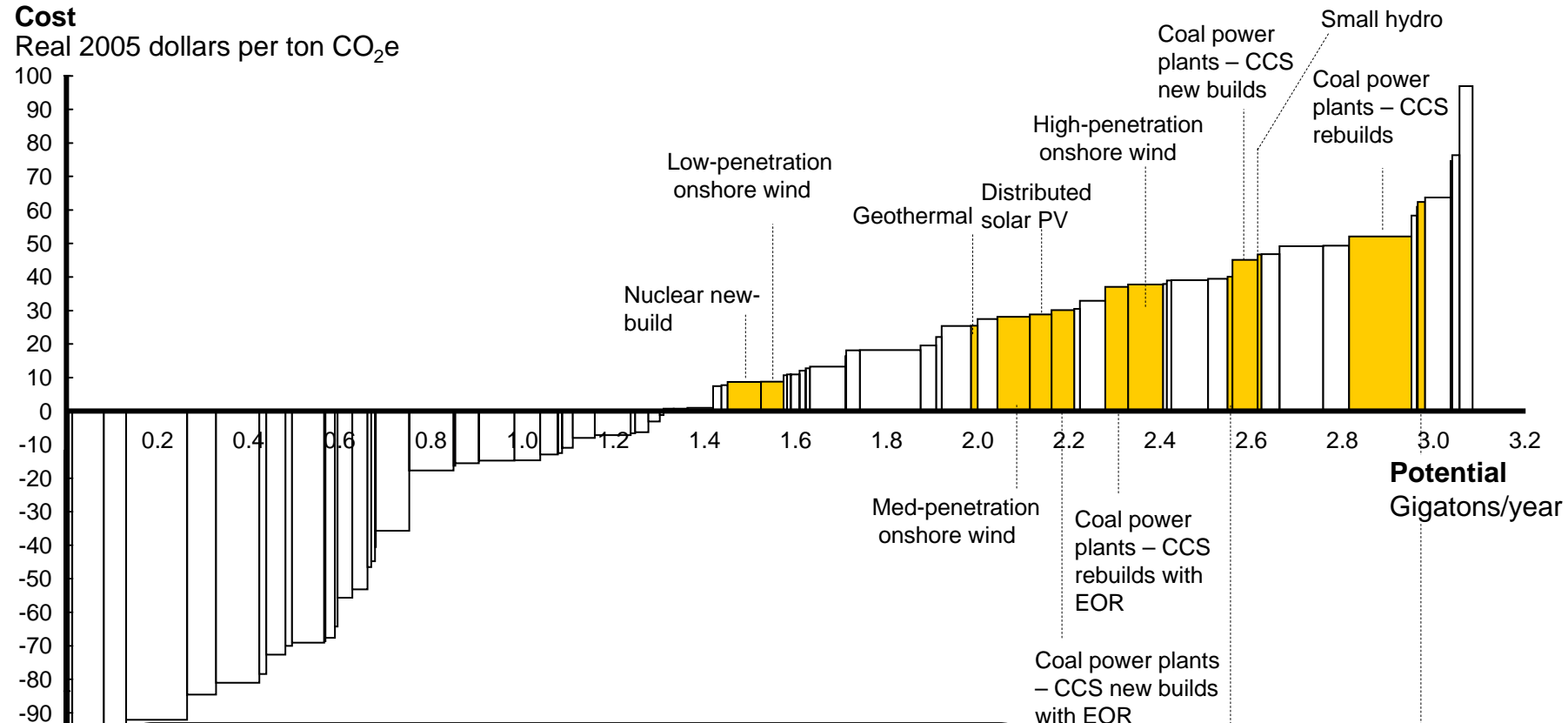


- Agriculture, waste, and forestry represent 16% of total abatement potential
- Impermanence is key issue; monitoring and verification processes critical

# Low-carbon power opportunity profile

Power sector opportunities

MID-RANGE CASE – 2030



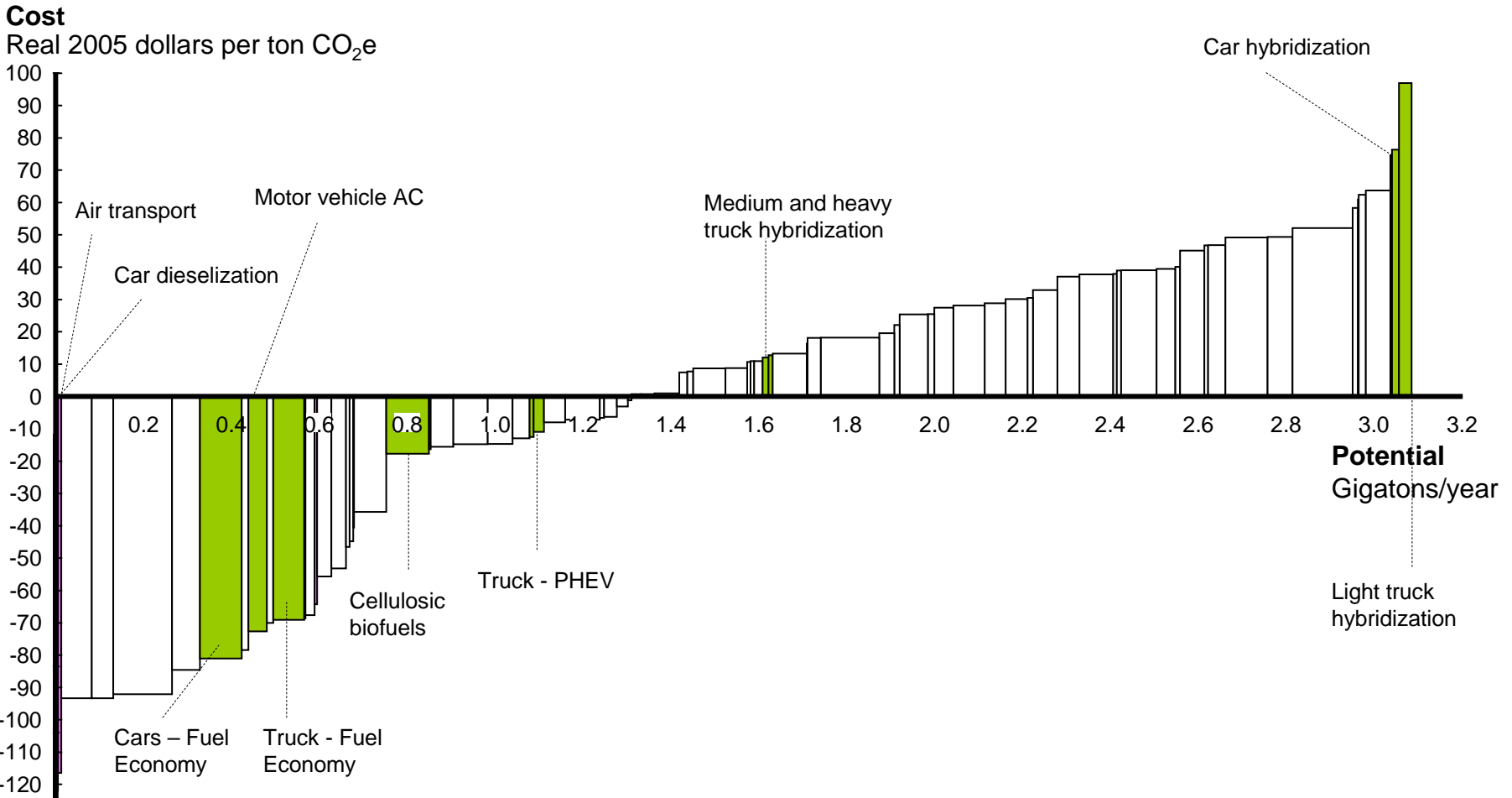
- Power sector represents 26% of abatement potential and is most capital-intensive
- Many high-potential technology options where current costs and/or business risks slow adoption
- Support required for
  - Research, development and deployment
  - Debottlenecking of business and regulatory processes

Source: McKinsey analysis

# Transport sector opportunity profile

MID-RANGE  
CASE – 2030

Transport sector options



- Transport sector represents 12% of total abatement potential
- Abatement potential of individual transport options is strongly influenced by carbon intensity of the electricity grid and penetration of biofuels in the fuel supply



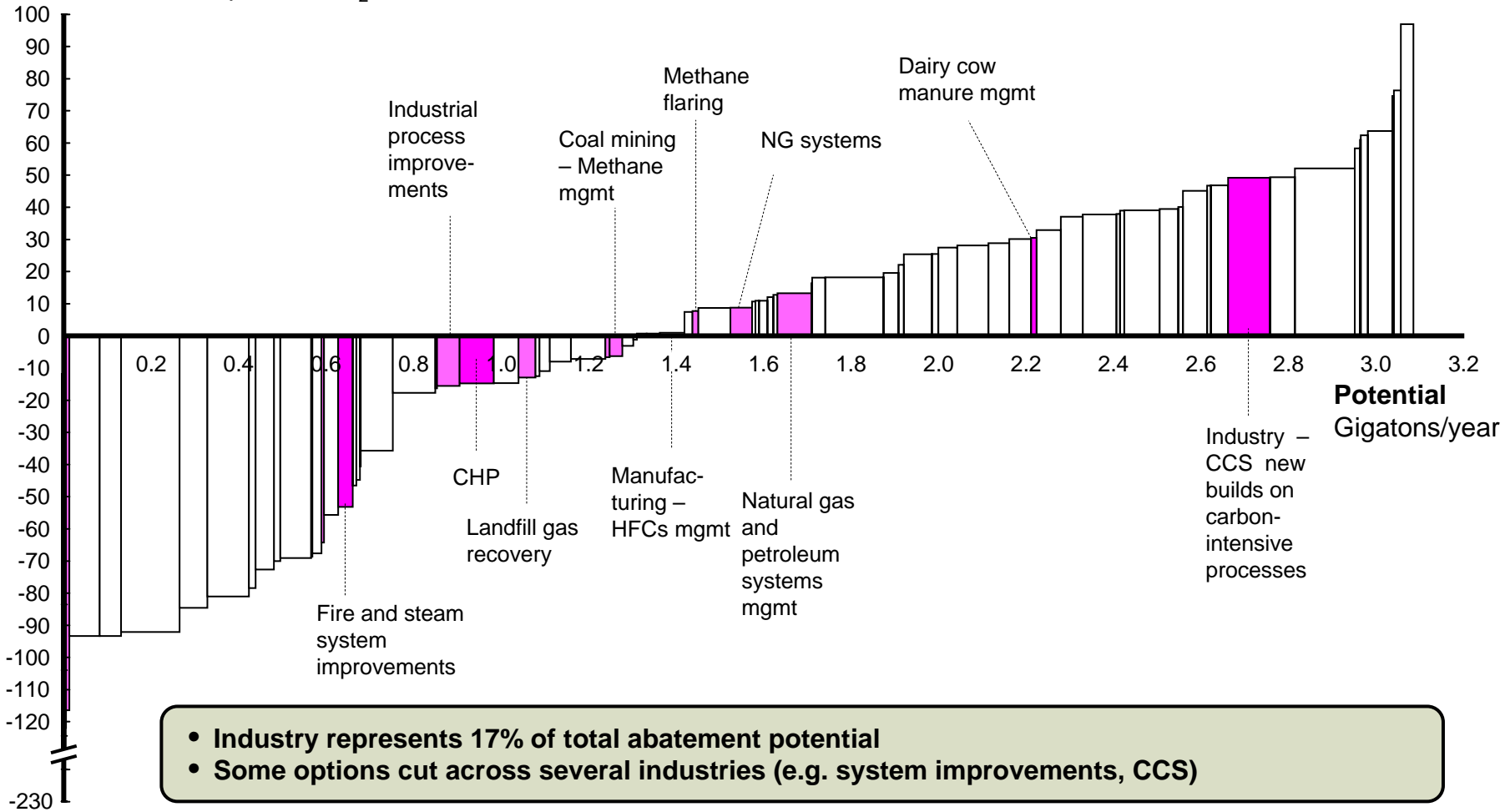
# Other industrial sector opportunity profile

MID-RANGE  
CASE – 2030

Industrial opportunities

**Cost**

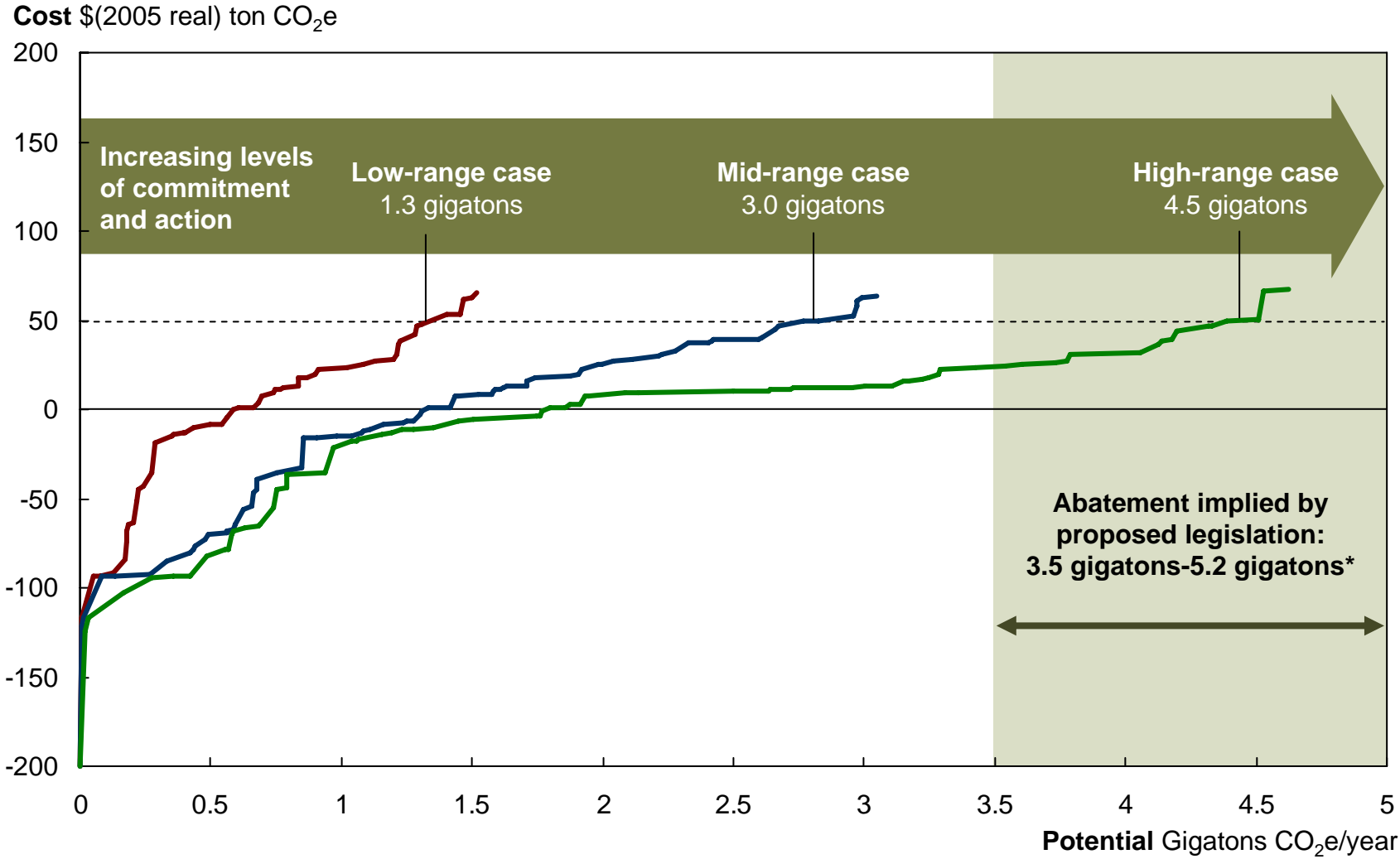
Real 2005 dollars per ton CO<sub>2</sub>e



- Industry represents 17% of total abatement potential
- Some options cut across several industries (e.g. system improvements, CCS)

Source: McKinsey analysis

# U.S. could reduce emissions in 2030 by 3.0 to 4.5 gigatons with sustained, economy-wide effort



\* Based on bills introduced in Congress that address climate change and/or GHG emissions on an economy-wide basis and have quantifiable targets; targets calculated off the 2030 U.S. GHG emissions of 9.7 gigatons CO<sub>2</sub>e/year (reference case)

## Key themes and reactions

### Themes

### Reactions

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- **Economy wide program required**

- There are no silver bullets
- Small role of power sector relative to expectations
- Need to integrate programs and priorities

- **Pursue energy efficiency**

- “Negative cost” concept misinterpreted
- Potential versus forecast. Substantial consumer behavior and market failure barriers need to be overcome
- Move faster

- **Innovation/technology is essential**

- Favorable response to nuclear, mixed on wind, surprised to skeptical on solar, hopeful but skeptical on CCS
- Short on solutions to spur innovation

- **Society costs could be reduced with energy efficiency**

- Confused about pending legislation issues versus cost curve analysis
- Benefit to society versus cost to individual players
- 2010 to 2030 transition issues
- Carbon price vs. cost