Slideshow

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

McKinsey & Company has worked with leading institutions and experts to develop a framework and fact base to understand the costs and potentials of options for reducing greenhouse gas (GHG) emissions – first at a global level, then through country-specific analyses for major GHG-emitting nations. In February 2007, the U.S. Greenhouse Gas Abatement Mapping Initiative (US GHG AMI) was launched in collaboration with leading U.S.-based companies and environmental NGOs.

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PROJECT BACKGROUND

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
- Relied on US government agencies for emissions forecasts
- Conducted interviews with 100+ leading authorities
- Solicited guidance and support from top academics and corporate and environmental sponsors

Not intended to advocate specific policies or approaches. All content and conclusions solely the responsibility of McKinsey & Company

The research team examined more than 250 options to reduce or prevent GHG emissions, including efficiency gains, investments in low-carbon energy supply, and expanded carbon sinks. The project covered seven sectors of the economy: buildings, electric power, transportation, industrial, waste, agriculture, and forestry.

PROJECT APPROACH

We did look at:

- Emissions from human activity within US borders
- Opportunities with marginal costs less than $50/ton of CO_2e
- Technologies and approaches with predictable costs and development paths
- Net capital, operating and maintenance costs

We did not look at:

- "Imported" carbon
- Policy implementation or transaction costs (e.g., enforcement)
- Dynamics of a potential carbon "price" (e.g., tax, cap and trade)
- Changes in consumer lifestyles
- Broader societal costs or benefits

Source: McKinsey analysis

This project looked at emissions from human activity in the U.S. and evaluated abatement options with marginal costs below $50 per ton. It assumed no major technology breakthroughs. It focused on measures that are reasonably understood and likely to be commercially available before 2030. The project assumed no material changes in consumer lifestyles and did not attempt to estimate broader societal costs or benefits.

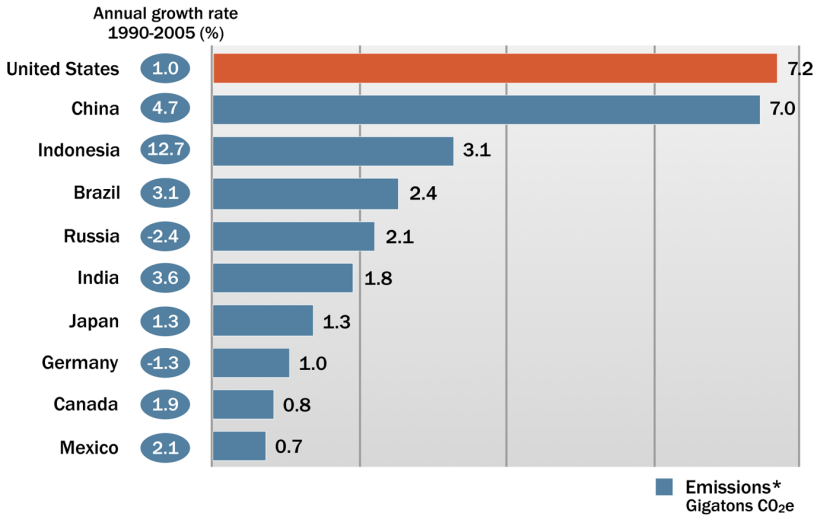
MAJOR FINDINGS AND CONCLUSIONS

- Government sources project US GHG emissions to rise 35 percent by 2030
- Our project identified 3.0 gigatons (mid-range) to 4.5 gigatons (high-range) of CO_2e reductions vs. the 2030 reference case emissions forecast of 9.7 gigatons
- Low cost opportunities are distributed widely across sectors and geographies
- 40 percent of reductions identified could generate net savings to the economy
- Savings can substantially offset the remaining total capital, operating, and maintenance costs
- Five major "clusters" of reduction potential identified
- Success requires strong, coordinated, economy-wide action that begins in the near future

Source: McKinsey analysis

The U.S. could reduce GHG emissions in 2030 by 3.0 to 4.5 gigatons vs. the reference case emissions forecast of 9.7 gigatons, using tested approaches and high-potential emerging technologies. Abatement opportunities are highly fragmented and widely spread across the economy, with almost 40 percent of the potential available at negative cost. Making reductions at the lowest cost to the economy will require strong, coordinated economy-wide action that begins in the near future.

U.S. THE LARGEST GREENHOUSE GAS EMITTER IN 2005

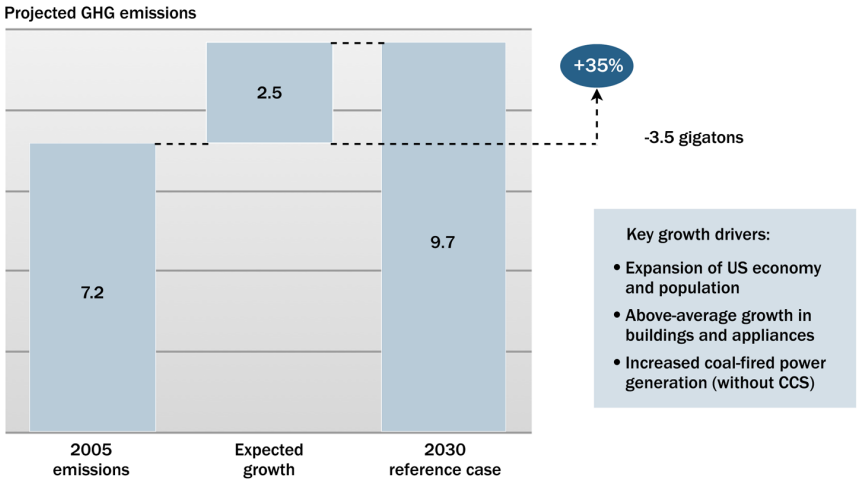


*Includes emissions associated with deforestation and land-use changes
Source: IEA; EPA; WRI; UNFCCC; McKinsey analysis

The United States is home to 5 percent of the world's population and produces nearly 18 percent of global GHG emissions. As of 2005, the U.S. produced more emissions per year than any other nation, although China may now be the largest emitter, based on projected growth rates for GHG emissions.

GOVERNMENT AGENCIES FORECAST US EMISSIONS TO RISE 35% BY 2030...

Gigatons CO_2e per year



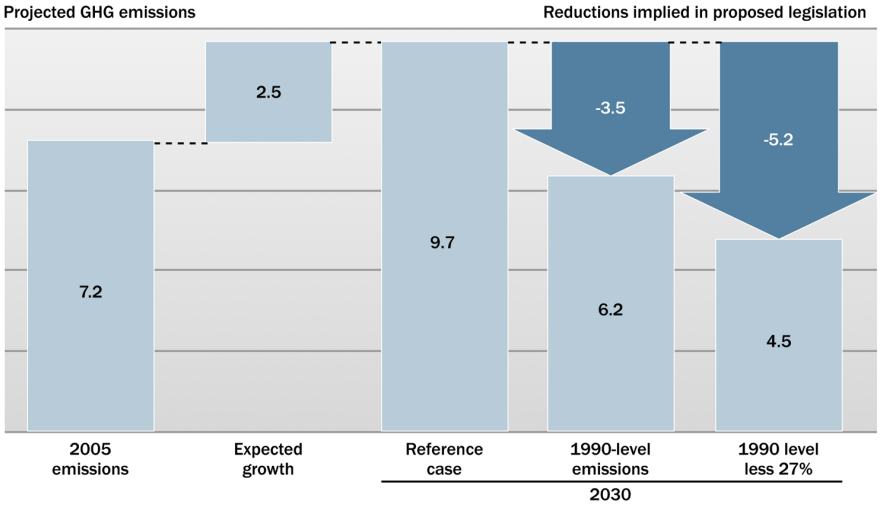
* Based on bills introduced in Congress that address climate change and/or GHG emissions on an economy-wide basis and have quantifiable targets

Source: U.S. EIA Annual Energy Outlook (2007) "Reference case," U.S. EPA; Pew Center On Global Climate Change; McKinsey analysis

Annual GHG emissions in the U.S. are projected to rise from 7.2 gigatons in 2005 to 9.7 gigatons in 2030 – an increase of 35 percent. The main drivers of emissions growth are continued expansion of the U.S. economy, a population increase of 70 million, and increased use of carbon-based power in electricity generation. Over this period, absorption of carbon by U.S. forests and agricultural lands is forecast to decrease slightly.

...EXCEEDING PROPOSED LEGISLATIVE TARGETS BY A WIDE MARGIN

Gigatons CO_2e

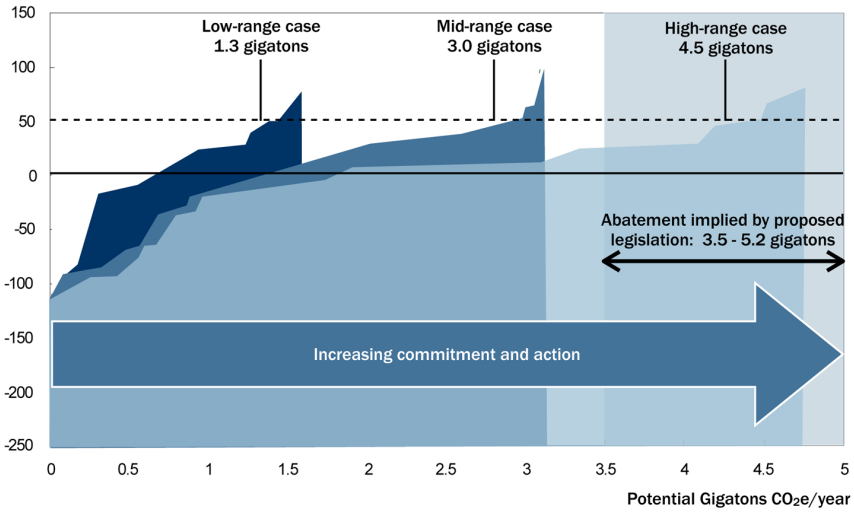


* Based on bills introduced in Congress that address climate change and/or GHG emissions on an economy-wide basis and have quantifiable targets

Source: U.S. EIA Annual Energy Outlook (2007) "Reference case," U.S. EPA; Pew Center On Global Climate Change; McKinsey analysis

On this path, with emissions rising and carbon absorption starting to decline, annual U.S. emissions in 2030 would exceed GHG reduction targets contained in economy-wide climate-change bills currently before Congress by 3.5 to 5.2 gigatons.

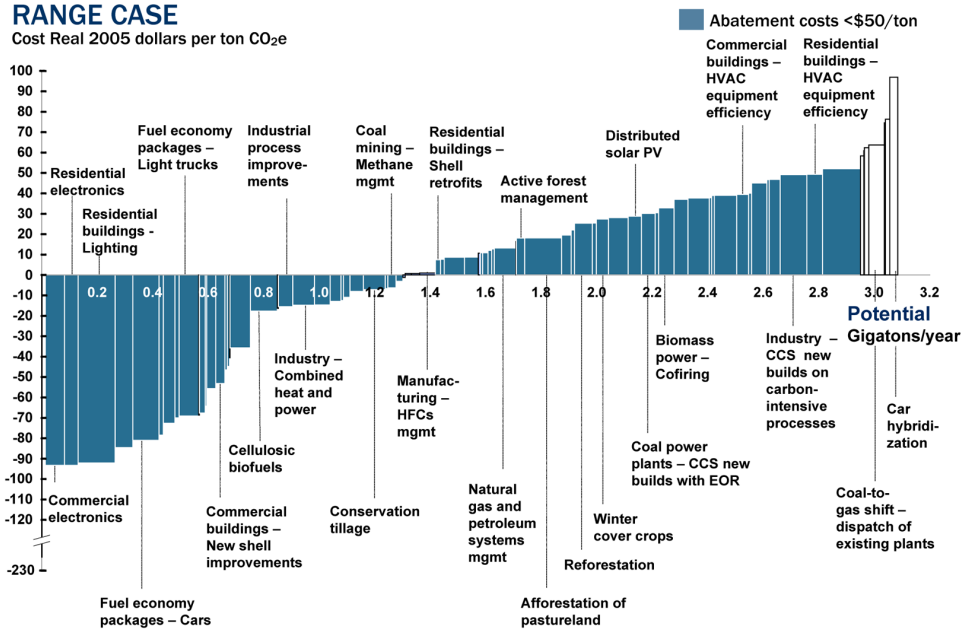
3.0 TO 4.5 GIGATONS OF REDUCTION POTENTIAL AVAILABLE WITH CONCERTED ECONOMY-WIDE ACTION



*Based on bills introduced in Congress that address climate change and/or GHG emissions on an economy-wide basis and have quantifiable targets
Source: McKinsey analysis

The research team defined a range of outcomes for each option and for analytical purposes integrated the values into three abatement supply curves (or "cases"): the low-range case involves incremental departures from current practices; the mid-range case involves concerted action across the economy; and the high-range case involves urgent national mobilization. The cases illustrate an envelope of abatement potential for the U.S. by 2030.

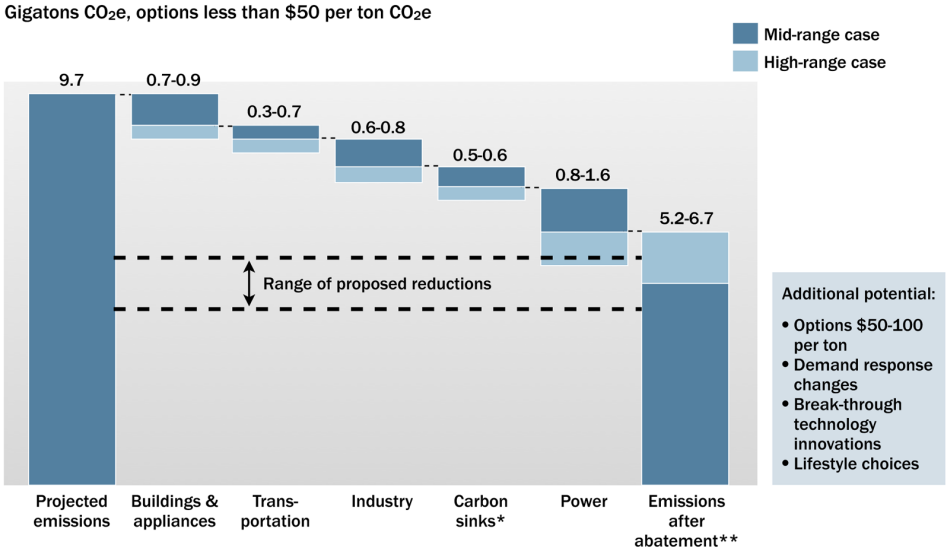
GHG REDUCTION OPPORTUNITIES WIDELY DISTRIBUTED - 2030 MID-RANGE CASE



The analysis found that abatement options are highly fragmented and widely spread across the economy. Almost 40 percent of abatement could be achieved at "negative" marginal costs, i.e., the savings over the lifecycle of these options would more than pay for the incremental investment, operating, and maintenance costs. Realizing the potential of many negative-cost options would require overcoming persistent barriers to market efficiency.

FIVE "CLUSTERS" OFFER SIGNIFICANT POTENTIAL

Gigatons CO_2e, options less than $50 per ton CO_2e



*Including abatement in the agriculture sector beyond expanding carbon sinks
**Adjusted for cumulative rounding errors
Source: U.S. EIA, EPA, USDA, McKinsey analysis

The 250 abatement options examined by McKinsey fall into five broad clusters. Ordered from lowest to highest average cost per ton CO2e, the five clusters are:
1) Improving the energy efficiency of buildings and appliances
2) Encouraging higher energy efficiency in vehicles while reducing carbon intensity of vehicles
3) Pursuing range of targeted measures in energy-intensive sectors of the industrial sector
4) Expanding and enhancing carbon sinks

WIDE VARIETY OF OPTIONS TO REDUCE GHG EMISSIONS

Cluster	Representative opportunities
Improved energy efficiency in buildings & appliances	• Advanced lighting • Reduced in-use consumption and stand-by losses for electronic devices
Energy efficiency in vehicles & reduced carbon in fuels	• Improvements for conventional cars and light trucks • Commercialization of biofuels
Targeted measures in the industrial sector	• Recovery and/or destruction of non-CO_2 GHGs • Carbon capture and storage (CCS) on select processes
Expanded carbon sinks	• Forestation of degraded pastureland • Improved management of forests
Reduced carbon intensity of electric power	• CCS on new and rebuilt coal-fired plants • Wind power at attractive sites • New nuclear power plants

Source: McKinsey analysis

The theme of greater energy productivity pervades these clusters. Greater efficiency in the buildings-and-appliances and industrial sectors could offset some 80 percent of the projected incremental demand for electricity in 2030. Improved vehicle efficiency could roughly offset the increased emissions of a growing population, while providing net economic gains.
Although the net cost of achieving 3.0 to 4.5 gigatons of abatement could be quite low on a societal basis, issues of timing and allocation would likely lead various stakeholders to perceive the costs very differently – particularly during the transition to a lower carbon economy.