



AMERICAN PETROLEUM INSTITUTE

# CLIMATE CHALLENGE

A PROGRESS REPORT



## Energy improves our lives.

Energy increases mobility and living standards, spurs economic activity and job creation, and helps fuel every productive social activity from education to medical care to agriculture. By using energy efficiently and limiting impacts on the environment, we enjoy its blessings responsibly.

America's oil and natural gas companies have long considered the potential climate impacts of energy use an important environmental challenge. In January 2003, American Petroleum Institute members established the API Climate Challenge Programs to step up their efforts addressing this issue. Working with government, academic research groups, and others, member companies have been:

- Increasing energy efficiency and promoting alternative energy use to reduce emissions,
- Establishing rigorous, industry-wide tools and procedures for estimating and tracking emissions, and
- Helping develop new technologies, such as hydrogen fuel cells and carbon capture technology, that can eliminate or sequester emissions.

**The API Climate Action Challenge** focuses on voluntary greenhouse gas emissions reductions. The oil and natural gas industry has invested \$58 billion, which is 44 percent of all low and zero carbon technology investments, in the U.S. between 2000 and 2008. This is more than what the federal government or all other industries combined are investing.

**The API Climate Greenhouse Gas Estimation and Reporting Challenge** aims at creating a state-of-the-art, technically sound basis for measuring emissions reduction progress. API has developed and tested tools to accomplish this, which are gaining wide acceptance internationally as well as at home.

**The API Climate R&D Challenge** focuses on promoting the research and development that will lead to better energy technology and lower greenhouse gas emissions. Companies are now exploring, developing and implementing new approaches for reducing and capturing emissions.



“While uncertainties remain in our understanding of climate science, we know enough to act now to put ourselves on a path to slow and, as the science justifies, stop and then reverse the growth of greenhouse gases.”

– G8 Statement  
2005 meeting at Gleneagles, Scotland

Without accurate emission estimation tools, it is impossible to establish benchmarks and track emission reduction progress.

In recent years, as the industry increased efforts to reduce emissions, it determined that existing estimation protocols were inadequate. They did not produce consistent results for the same facilities and activities. That led to the establishment of the *API Compendium of Greenhouse Gas Emissions Methodologies for the Oil and Gas Industry*.

Companies now employ the *Compendium*, and those participating in API's Greenhouse Gas Estimation and Reporting Challenge are integrating GHG estimation into their operating procedures and will report their GHG emissions and GHG intensity of operations to API. After adequate and representative data have been collected and the accuracy and comparability of the data ensured, API will begin public reporting of aggregate GHG emissions and GHG intensity of operations. At the same time, API will provide participating companies with sector specific reports to aid benchmarking and tracking progress toward company goals.

API also has provided case studies for using the *Compendium* in estimating emissions from refinery heater/boiler combustion tuning; cogeneration; pneumatic device retrofit or replacement; dehydration process optimization; production tank flashing losses; flaring production vent streams; fugitive leak detection and repair; and geologic carbon sequestration.

To provide answers to the unique and complex emissions accounting and reporting questions related to the petroleum industry, API, the International Petroleum Industry Environmental Conservation Association (IPIECA) and the International Association of Oil and Gas Producers (OGP) created *Petroleum Industry Guidelines for Reporting Greenhouse Gas Emissions*.

In addition, API provides a software tool as one way companies in the oil and natural gas industry can estimate GHG emissions. Developed and donated by Chevron, this tool uses the *Compendium's* methodologies to create an auditable inventory of GHG emissions and energy use. API is developing an add-in tool for automatically calculating emissions across all of a company's facilities.



**The API Compendium of Greenhouse Gas Emissions Methodologies for the Oil and Gas Industry** provides companies with industry-wide methods for estimating CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O emissions that represent the vast bulk of greenhouse gas emissions from oil and gas industry operations. It is available for free on API's website, [www.api.org](http://www.api.org). The U.S. Department of Energy's 1605b voluntary GHG emissions reporting program referenced the *API Compendium* for use by the entire U.S. oil and gas industry.



"GHG reporting is expected to have several benefits....The resulting data would enhance understanding of GHG emissions and reduction options, and highlight opportunities to reduce energy use and eliminate other types of waste."

—Pew Center on Global Climate Change



It takes vast amounts of energy to provide the gasoline, heating oil, jet fuel and other oil and natural gas products consumers demand.



By using less energy, companies can reduce their greenhouse emissions while also trimming operational costs. This is critical for refiners whose energy costs make up 44 percent of operating expenses. Refineries use sophisticated software to optimize energy consumption and reduce energy costs. Oil producers and refiners employ combined heat and power technology, which turns waste heat into energy, to improve energy efficiency. Combined heat and power is a critical strategy for meeting the API challenge program's ten-percent-energy-efficiency-improvement goal for refiners.



Many companies have made tremendous progress improving energy efficiency. Here are some examples:

- API members, including Amerada Hess, Anadarko, Aramco, Baker Hughes, BHP Billiton, BP, Chevron, Devon, Enbridge, Kinder Morgan, Marathon, Occidental, TEPCO and Williams, have facilities that participate in EPA's Best Workplaces for Commuters program that reduces greenhouse emissions by reducing traffic congestion.
- BP is implementing a company-wide five-year program to increase the efficiency of its energy use at a cost of \$350 million. Total energy use in 2004, the first year of the program, was 1.34 billion GJ compared with 1.36 billion GJ in 2003. This reduction occurred at the same time BP increased total production of gas and liquids by more than ten percent.
- Through cogeneration, BP eliminates about 6 million tons of carbon dioxide emissions annually from its worldwide operations that would have been produced had the electricity been purchased from less efficient local or national grids.
- ConocoPhillips has constructed a 730-megawatt cogeneration plant in North Lincolnshire, England that supplies electricity to two refineries with excess amounts fed into the nation's electricity grid.
- Through a variety of strategies, including the increased use of cogeneration, optimization of existing equipment and use of new technology, Dow Chemical reduced the amount of energy it needed to produce a pound of product by 20 percent between 1990 and 1994 and another 20 percent between 1994 and 2004.



- Over the past four years, ExxonMobil refineries improved their energy efficiency at a rate three times greater than the historical industry average, recording a nearly 10 percent energy-efficiency improvement since 1990. ExxonMobil uses cogeneration technology to reduce greenhouse gas emissions at more than 85 operating units at 30 refineries, chemical plants, and natural gas processing plants worldwide, including those in the United States.
- Chevron participates in cogeneration projects that produce enough electricity to power more than one million homes, electricity that through conventional means of production would result in substantial greenhouse gas emissions.
- In 2002 Shell achieved its promise to reduce its greenhouse gas emissions by 10 percent relative to 1990, reducing them from 114 million tons to 94 million tons. The reduction came in the context of business change that would, had no program been implemented, have seen emissions rise to 140 million tons.
- Occidental's cogeneration facilities are estimated to reduce greenhouse gas emissions by almost four million metric tons per year when fully utilized, or 20 percent of what the company's combined direct and indirect emissions otherwise would be. Occidental's OxyChem operation has decreased energy use per pound of production by more than 40 percent since 1995.

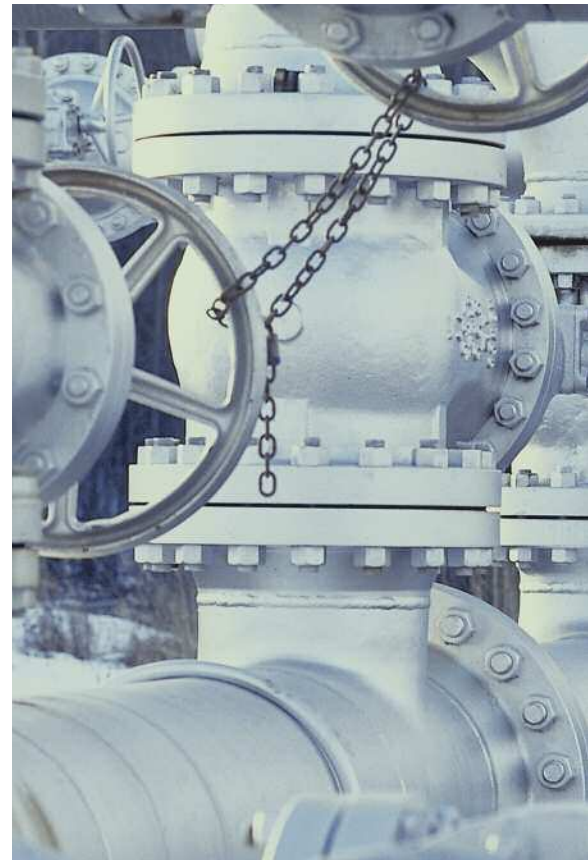
U.S. refiners participating in the API Climate Action Challenge are reducing greenhouse gas emissions by using less energy to make gasoline and other energy products. The oil and natural gas industry has invested \$58 billion, which is 44 percent of all low and zero carbon technology investments, in the U.S. between 2000 and 2008. This is more than what the federal government or all other industries combined are investing.



Photo: ConocoPhillips

Burning the fuel needed to produce energy products generates tremendous heat. Through a process called “co-generation” or “combined heat and power,” companies have learned to harness that heat to produce electricity. This reduces and sometimes eliminates the need to purchase power off the grid, substantially reducing greenhouse emissions.

By producing more natural gas, the fossil fuel with the lowest greenhouse emissions, while also reducing emissions during oil and gas production, companies address climate change in two ways.



Through the U.S. EPA's Natural Gas STAR program, API members accounting for 97 percent of member natural gas volumes have employed improved technology and management practices to eliminate hundreds of billions of cubic feet of methane greenhouse emissions.

API members also participate in EPA's new "Methane to Markets Partnership," which is seeking to reduce methane emissions internationally through projects involving the private sector, including the U.S. natural gas industry

BP, Chevron, ExxonMobil, Marathon, Shell and Total are also participating in a partnership with the World Bank to find opportunities for natural gas markets to further reduce flaring and venting of gas.

Created in late 2004, the partnership is improving awareness of methane emission reduction opportunities, advancing use of better technology and management practices, and improving markets and conditions for project development.

ExxonMobil reduced natural gas flaring by 73 percent between 2002 and 2004 at its Baytown, Texas refinery and expects substantial further improvement in 2005. Beginning in 2006, its Nigeria East Area Project will reinject natural gas that is currently being flared, enabling the recovery of additional oil reserves while dramatically reducing flaring.

A second ExxonMobil project to be completed in 2008 will enable extraction of natural gas liquids for sale and will use the remaining dry gas as fuel. As a result, greenhouse gas emissions from the company's Nigerian operations are expected to decrease by about 7 million metric tons per year, representing about 5 percent of its worldwide greenhouse gas emissions.







Chevron estimates it has reinjected about 22 million metric tons of natural gas into natural gas reservoirs in the United States. Chevron's Escravos natural gas plant in Nigeria can now process about 300 million cubic feet of gas per day for use in power generation in the country, thus reducing use of more carbon-heavy fuels that produce more greenhouse gas emissions. The company also has major flaring reduction projects in Angola and Kazakhstan.

Shell will eliminate continuous flaring of gas from oil production by 2008 and send more gas to markets, reducing Shell's own emissions by 30 million tons per year and trimming emissions downstream at power plants by a further 20 to 30 million tons per year.

In recent years, in large measure because of EPA's Natural Gas STAR partnership program aimed at reducing methane emissions in the oil and natural gas industry, U.S. methane emissions have been lower than methane emissions in 1990. According to the EPA, "Since the Program began in 1993, Natural Gas STAR partners have eliminated 338 billion cubic feet of methane emissions...This is the equivalent of removing more than 30 million cars from the road for one year or planting more than 41 million acres of trees. At the same time, these companies have saved over a \$1 billion by keeping more gas in their systems for sale in the market."



Oil and natural gas are likely to provide a large proportion of the world's energy for several more decades.



As a result, oil and natural gas companies are testing the feasibility of injecting greenhouse emissions into underground geologic formations. They are also involved in programs to grow more trees and other vegetation, which remove CO<sub>2</sub> from the air to support plant growth. Many carbon capture efforts are already paying off:

- Anadarko's enhanced oil recovery efforts in Wyoming are breathing new life into aging oil fields by injecting into the oil reservoirs CO<sub>2</sub> that otherwise would have been vented into the atmosphere. The company expects to sequester about 29 million tons of CO<sub>2</sub> over the lifetime of its Salt Creek and Monell projects.

- In 2004, BP launched a CO<sub>2</sub> capture and storage project in the In Salah gas field in the Algeria desert. Approximately 10 percent of the gas in the reservoir consists of CO<sub>2</sub>. Rather than venting it to the atmosphere, BP compressed and injected it in wells 1,800 meters deep. About one million tons of CO<sub>2</sub> will be injected every year, reducing greenhouse gas emissions by the equivalent of taking 200,000 cars off the roads.
- BP, Chevron, Encana and Shell support an international \$50 million effort, the CO<sub>2</sub> Capture Project, which is developing new technologies to reduce the cost of capturing CO<sub>2</sub> from combustion sources and safely storing it underground. These technologies will eventually apply to a large number of CO<sub>2</sub> sources globally, such as power plants and other industrial processes.





- Chevron is a founding member of GEODISC, a program that researches and develops underground CO<sub>2</sub> storage technology. In conjunction with several U.S. government laboratories, Chevron is also working to develop monitoring technologies for the safe underground storage of CO<sub>2</sub>. And, it is a member of the \$26 million International Energy Agency Weyburn CO<sub>2</sub> Monitoring and Storage Project, which aims to predict and verify the ability of an oil reservoir located in western Canada to securely and economically store CO<sub>2</sub>.



- Chevron also is funding an effort by the U.S. Nature Conservancy and Brazil's Society for Wildlife Research and Environmental Education to plant hundreds of thousands of indigenous seedlings at the site of a former forest near the town of Antonina in Parana. The partners want to restore the native forest and its indigenous wildlife while uncovering important scientific secrets about nature's power to clean the atmosphere of CO<sub>2</sub>. In Louisiana's Tensas National Wildlife Refuge, Chevron planted 450,000 trees on fallow farmlands. Over the next 70 years, the project is expected to remove some 800,000 metric tons of CO<sub>2</sub> from the atmosphere.

Oil and gas companies drill for oil and gas in deep underground formations. They are able to reinject carbon dioxide into these formations for permanent storage. Often, injected carbon dioxide helps enhance oil production by chemically modifying the oil, which reduces friction against the rock and increases oil flow. Carbon sequestration may also be possible in coal seams or deep under the ocean floor.



Photo: Anadarko Petroleum Corporation

## U.S. oil and natural gas companies are developing and marketing alternative energy.



Every day the oil and natural gas industry provides consumers with more than 20 million barrels of oil and some 60 billion feet of natural gas. Accomplishing this requires innovative technologies plus over-the-horizon vision so that the next generations of Americans have ample energy supplies and a cleaner environment. Company research and development in biofuels, geothermal energy, hydrogen energy, solar energy and wind power are part of this effort. Some marketing of alternatives, which contribute to reducing greenhouse emissions, is already occurring:

- BP and Chevron own a wind farm near Rotterdam in the Netherlands that is capable of generating 22.5 megawatts of electricity – equal to the amount used by 20,000 households – thus displacing 20,000 tons of CO<sub>2</sub> per year. Also, solar technology provides electricity to some Chevron facilities in the U.S. and the U.K.

- BP, ConocoPhillips, and Shell are participating in a project that would convert natural gas to hydrogen and carbon dioxide, then use the hydrogen gas as fuel for a 350MW power station and export the carbon dioxide to a North Sea oil reservoir for increased oil recovery and ultimate storage.
- Chevron is improving hydrogen production technologies that make hydrogen from natural gas. These include steam methane reforming, single-step reforming, and autothermal reforming. In cooperation with the U.S. Department of Energy, Chevron is opening demonstration hydrogen energy stations in California and Florida, where hydrogen will be reformed on site.



Photo: Ballard Power Systems

- ExxonMobil has been developing technology to produce hydrogen on vehicles from conventional fuels, which would avoid huge hydrogen infrastructure costs. It estimates this technology can halve greenhouse gas emissions compared with conventional vehicle technology.
- As members of the California Fuel Cell Partnership, BP, Chevron, ExxonMobil and Shell are testing hundreds of fuel cell cars and buses and building hydrogen refueling stations to prepare for the commercialization of fuel cell vehicles.
- BP, Chevron, ConocoPhillips, ExxonMobil and Shell are partners in the U.S. Department of Energy's FreedomCAR initiative, which is conducting research to reduce the costs and increase the practicality of hydrogen fuel cell technology for motor vehicles.



- ExxonMobil is researching new approaches to traditional gasoline engines, including the development of new ignition systems, to reduce fuel use and emissions. The new ignition technology – homogeneous charge compression ignition – may be able to increase fuel efficiency by 30 percent, reducing greenhouse and other emissions proportionately.
- In a new joint venture, Chevron is developing and advancing commercialization of technology to store hydrogen in metal hydrides.
- BP is expanding commercialization of solar energy to reduce greenhouse emissions from electricity production. Since 2001, it has increased sales of solar panels by 78 percent.
- ConocoPhillips is partnering with DOE in the department’s National Hydrogen Fleet and Infrastructure Demonstration and Validation Project.
- In Europe, BP has begun marketing low carbon bio-fuels.
- Dow Chemical is a member of the World Resources Institute’s Green Power Market Development Group, which creates new markets for renewable energy. The use of more renewable energy to create electricity will help reduce greenhouse gas emissions.
- Chevron is involved in projects that produce more than 1,000 GWh of renewable energy, which have reduced greenhouse gas emissions by about 72 million tons of CO<sub>2</sub> equivalent when compared to a coal- and gas-fired generation mix. Chevron is also the world’s largest developer of geothermal energy.

“Many, including the U.S. oil and natural gas industry, are working for technological advances to facilitate large cuts in emissions at much lower cost....Indeed without new technology, dramatic cuts in emissions may be extremely difficult, if not impossible, to achieve. A group of scientists writing in the journal *Science*... called the task ‘Herculean.’”

– *API Testimony*

“Addressing global climate change will require a sustained effort, over many generations. My approach recognizes that sustained economic growth is the solution, not the problem – because a nation that grows its economy is a nation that can afford investments in efficiency, new technologies, and a cleaner environment.”

– *President George W. Bush*

“In the past decade, we have seen dramatic innovation in developing the cleanest possible energy technologies. The Edisons of today, in labs around the world, are generating breakthroughs in energy production technologies. As these technologies advance and gain strength, so do our opportunities to succeed.”

– *Jeffrey Immelt*  
*Chief Executive Officer, GE*  
 and  
*Jonathan Lash*  
*President, World Resources Institute*

Photo: Nissan North America, Inc.



## API and its members work with a wide range of private and public organizations addressing climate change.

Broad-based partnerships and scientific consortia encourage the development and dissemination of good ideas, resulting in greater progress.

BP, Chevron, ExxonMobil and Murphy Oil help fund the Massachusetts Institute of Technology Joint Program on the Science and Policy of Global Change, which conducts science and economics policy research on global climate issues.

ExxonMobil is investing \$100 million in a long-term research program at Stanford University (the Global Climate and Energy Project) that involves scientists from around the world in the development of technologies fostering a global energy system with low greenhouse emissions. Hydrogen, renewable energy, CO<sub>2</sub> capture and storage, geoengineering, advanced transportation and advanced nuclear power are some of the research areas addressed by this project.

BP supports and helps fund the Carbon Mitigation Initiative at Princeton University, a 10-year, \$20 million project aimed at identifying technologies and

pathways that can lead to stabilization of CO<sub>2</sub> concentrations in the earth's atmosphere. At the Chinese Academy of Sciences and Tsinghua University, it sponsors a 10-year, \$10 million program for developing and deploying new clean energy technologies for China and the rest of the world. It also created a five-year program at Imperial College, London, to investigate the use and storage of energy by buildings, and how energy may be supplied to buildings in the future.

API members have cooperative relationships with other organizations, including the U.S. Department of Energy; the U.S. Environmental Protection Agency; the Harvard-Smithsonian Center for Astrophysics; Carnegie-Mellon University; the Nature Conservancy; the European Union; the California Fuel Cell Partnership; and the International Energy Agency. API also has sponsored or co-sponsored workshops covering emissions estimation, climate science research, new energy technology and many other related issues.



For more information about the industry's climate change initiatives, please visit [www.api.org](http://www.api.org).







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Printed in the U.S.A. on recycled paper.

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