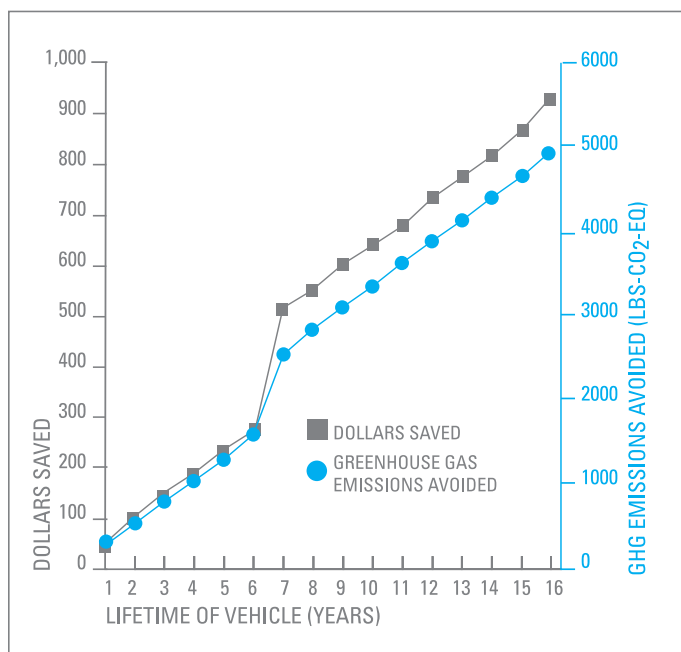


The global partnership formed in 1998 among the Society of Automotive Engineers (SAE), the Mobile Air Conditioning Society Worldwide, and EPA to reduce the climate impacts of mobile air conditioning (MAC) systems now includes most of the world's vehicle manufacturers and their suppliers, environmental and industry NGOs, and representatives from industrialized and developing country governments. The MAC Partnership has four goals:

- Promote cost-effective designs and improved service procedures to minimize refrigerant emissions.
- Promote next-generation MAC systems that are better for the environment while satisfying customer safety, cost, and reliability concerns.
- Communicate technical progress to policymakers and the public.
- Document current and near-term opportunities to improve the environmental performance of MAC system design, operation, and maintenance.

The partnership is now working to meet ambitious, quantitative goals announced in 2004 to reduce air conditioning fuel consumption by at least 30 percent and cut refrigerant emissions by 50 percent.

FIGURE 34. Over the lifetime of a vehicle, an IMAC* system will save more than \$900 and prevent almost 5,000 lbs of greenhouse gas emissions



* Improved Mobile Air Conditioning (IMAC) systems leak 50% less and are 30% more efficient than standard systems. Due to their leak-tight design, IMAC systems do not require the refrigerant recharging that regular mobile AC systems do.

In 2007, the Mobile Air Conditioning Climate Protection Partnership:

- Published the Global Refrigerants Energy & Environmental Mobile Air Conditioning Lifecycle Climate Change Performance—GREEN-MAC-LCCP¹⁷. The tool allows environmental and industry experts to compare alternative MAC refrigerants for the best climate performance.
- Issued a government-industry consensus report on how HFC-152a can be safely and efficiently used in MACs with secondary-loop technology and published guidelines for efficient secondary-loop HFC-152a MAC design.
- Formed an industry and government expert team to develop safety recommendations for R744, the industry term for CO₂-based vehicle air conditioners.

What to Expect in 2008 and Beyond for the Fluorinated Gas Programs

The fluorinated gas partnership programs for the industrial sector will continue to work with their partners and implement strategies to keep emissions below 1990 levels. EPA plans to:

- Continue to implement agreements with industry to reduce greenhouse gas intensity for the aluminum, magnesium, and semiconductor sectors through the Climate VISION effort.
- Continue recruiting companies to participate in the SF₆ Emissions Reduction Partnership for Electric Power Systems and training partners to ensure the collection and reporting of high quality data by electric power partners.
- Evaluate the technical feasibility and cost of continuous emissions monitoring (CEM) of F-gases from the electronics industry.
- Support efforts of magnesium partners to eliminate emissions of SF₆ by demonstrating alternative melt protection technologies for primary producers and secondary ingot casters.
- Announce plans in 2008 to introduce new AC technology using refrigerants with low global warming potentials.
- Translate the Web-based training module, Anode Effect Management, into other languages to facilitate global PFC emissions reduction efforts.
- Launch a PFC Management Demonstration Project in China to support efforts to reduce PFC emissions by the Asia Pacific Partnership for Clean Development and Climate. China is the largest global producer of primary aluminum.
- Maintain active partnerships with HCFC-22 chemical manufacturers to continue to reduce emissions of HFC-23.

¹⁷ To view the tool, please visit <http://epa.gov/cppd/mac/compare.htm>.

DEMONSTRATING PROGRESS: MEASURING RESULTS OF THE EPA CLIMATE PROTECTION PARTNERSHIP PROGRAMS

EPA's climate protection programs are an important component of the U.S. government's strategy to address climate change; they are expected to contribute about 70 percent of the emissions reductions necessary to reach the President's greenhouse gas intensity improvement goal in 2012. As such, EPA is committed to documenting quantifiable program results and using well-established methods to estimate the benefits of its programs. For each program, EPA has a robust process in place to regularly review and improve the program evaluation approaches.

The approaches used for each specific program are summarized in the sections below. They vary by program strategy, sector, availability of data, and market characteristics. In order to present the most realistic estimates of program benefits, EPA employs a common analytical framework across all of the individual program approaches:

- The benefits discussed represent the results attributable to EPA efforts above pre-existing trends or BAU scenarios.
- Program methods address data quality, potential double counting with other EPA programs, free ridership, the efforts of third-party actors, and other program-specific market effects.
- Where marginal uncertainty exists, EPA uses the best available information and best practices that yield conservative benefit estimates.
- Cumulative estimated benefits reflect the stream of energy savings that will persist through 2017 due to investments made through 2007. For this analysis, EPA assumes no new investments will be made through its programs in 2008 or beyond.
- Financial benefits are placed in present value terms.

Environmental and financial benefits for 2000 to 2007 are summarized in Table 1 on p. 3. The historical environmental benefits and cost effectiveness of these programs are summarized on the next page (see Table 27 and Figure 35). The information presented in this report is similar to much of the information used in the U.S. Office of Management and Budget (OMB) Program Assessment Rating Tool (PART), which found these EPA programs to be achieving their goals.

ENERGY STAR

Through the ENERGY STAR program, EPA helps U.S. businesses and consumers save money and reduce greenhouse gas emissions by labeling energy-efficient products, raising the bar of energy efficiency in new home construction, and encouraging superior energy management practices in the commercial and industrial sectors. The methods for estimating the benefits of each of these strategies are described below.

Products

- Sales of products due to the ENERGY STAR program are determined as those above and beyond established BAU purchases of these products.¹⁸ These sales are estimated by:
 - Collecting annual sales data on ENERGY STAR qualifying products from participating product manufacturers as a condition of partnership and supplementing these data by industry reports on total annual product sales as necessary. These data are screened and issues resolved.
 - Using established BAU baselines for annual product sales for each product category. These baselines use historic data and expert judgment, and they typically reflect increasing market shares for efficient products and increasing product efficiencies over time.
 - Applying a conservative estimate of the effect of market transformation to account for EPA efforts when product specifications are revised and qualified product shipments fall as manufacturers transition to the new specification.
- Annual energy savings are calculated using established values for the difference in annual energy use between a single ENERGY STAR product and a typically purchased product. For these values, EPA:
 - Assumes that ENERGY STAR products just meet the ENERGY STAR thresholds, even though there are some products that exceed this level.
 - Assumes the typically purchased product meets minimum efficiency standards where standards exist or uses the average energy use for the product category where there are no standards.

¹⁸ For more details on many aspects of this method, see Sanchez 2008 and Weber 2000.

TABLE 27. Overview of EPA's Climate Partnership Programs reviewed in this annual report with greenhouse gas reductions since 2000

PROGRAM	GHGs ADDRESSED	KEY SECTOR(S)	SCOPE OF PARTNERS AS OF 2007	GHG REDUCTIONS* (MMTCE)							
				2000	2001	2002	2003	2004	2005	2006	2007
Climate Leaders	All	Commercial, Industrial	155	Climate Leaders' reductions are reflected in the data shown for other programs.							
ENERGY STAR	CO ₂	Residential, Commercial, Industrial	12,000	15.2	17.7	21.3	25.0	28.5	32.2	36.1	42.4
Clean Energy-Environment State Partnership	CO ₂	State Government	15						N/A	N/A	N/A
CLEAN ENERGY SUPPLY											
Green Power	CO ₂	State & Local Government, Commercial, Industrial	850								
Combined Heat and Power	CO ₂	Commercial, Industrial	200	N/A	N/A	0.6	1.0	2.0	3.2	3.7	4.8
METHANE PROGRAMS											
Natural Gas STAR	CH ₄	Natural Gas	62% of industry	4.1	4.8	5.7	6.0	7.9	10.1	9.4	10.2
Coalbed Methane Outreach Program (CMOP)	CH ₄	Coal Mining	N/A	2.1	2.3	1.7	1.7	1.9	2.4	2.5	2.0
Landfill Methane Outreach Program (LMOP)	CH ₄	Waste Management	700	3.2	3.7	3.9	4.1	4.4	4.5	4.8	5.2
FLUORINATED GAS PROGRAMS											
Voluntary Aluminum Industrial Partnership	PFCs	Aluminum Smelting	99% of industry	2.0	2.1	1.8	2.2	2.2	2.3	2.4	2.5
HFC-23 Partnership	HFCs	Chemical Industry	100% of industry	4.7	5.1	4.5	6.1	6.4	6.2	7.0	7.0
Stewardship Programs	SF ₆ PFCs	Magnesium Production, Semiconductor Manufacturing, Electric Power Systems	50%–100% of industry	0.8	0.8	1.3	1.8	3.1	3.0	3.8	4.3
Mobile Air Conditioning (MAC) Partnership	CO ₂ HFCs	MAC Industry	N/A	Working toward technology improvement goals							

*These reductions reflect the most up-to-date data collected from EPA partners and may differ from reductions reported in previous annual reports.

N/A: Not applicable

FIGURE 35. EPA programs are highly cost-effective mechanisms for reducing greenhouse gas emissions

EPA's climate protection programs are a very cost-effective approach for reducing U.S. greenhouse gas emissions. Moreover, it is clear from sources such as the IPCC's Fourth Assessment Report and McKinsey's recent study that there are still great untapped opportunities for these programs to capture—meaning they will continue to be cost-effective far into the future (see Figure 5, p. 9). Every federal dollar spent on these partnership programs through 2007 means:

- Reductions in greenhouse gas emissions of 1.0 metric ton of carbon equivalent.
- Savings for partners and consumers of more than \$75 on their energy bills.
- Private sector investment of more than \$15.
- A net savings of more than \$60.

- Supports primary data collection, such as product metering to collect power use information, where additional information is necessary to estimate energy savings.
- Uses product-specific lifetimes that vary from 4 to 20 years. While those who purchase an ENERGY STAR qualified product are likely to replace it with one, EPA includes only a fraction of replacement purchases and investments in the program benefits.
- Peak power savings are estimated using product-specific factors that reflect the contribution of the annual energy savings from a product to peak load savings.
- Net energy bill savings is the present value (PV) of energy bill savings minus the PV of any incremental cost of purchasing an ENERGY STAR product above a standard model over the product lifetimes discussed above.¹⁹ All energy bill calculations use national sector-specific fuel prices.
- Avoided emissions of greenhouse gases for 2007 are determined using marginal emissions factors for CO₂ based on factors established as part of the U.S. government's reporting process to the UN Framework Convention on Climate Change, as well as historical emissions data from EPA's eGRID database.²⁰ For future years, EPA uses factors derived from energy efficiency scenario runs of the integrated utility dispatch model, Integrated Planning Model (IPM®).²¹
- Annual energy savings are calculated using established values for the energy savings from a home that meets the ENERGY STAR specification relative to a home built to code. Energy bill savings are calculated using a similar approach as for products and average national energy prices for the residential sector. The average lifetime of a home for both energy and bill savings is 30 years.
- Peak power savings and avoided emissions of greenhouse gases are determined using approaches similar to those described for products.

Commercial Buildings

- Annual electricity and natural gas savings are determined based on a peer-reviewed methodology developed for the commercial building sector.²² The methodology involves a counterfactual econometric analysis that forecasts state level electricity use in the absence of commercial building energy efficiency programs. Key determinants of electricity demand that are controlled for in the analysis include state energy prices, weather conditions, economic conditions, other federal programs—such as DOE's Rebuild and Federal Energy Management Program (FEMP)—and the long-term U.S. trend in commercial sector electronic technologies. Once the net national change in electricity use due to publicly funded energy efficiency programs is calculated, ENERGY STAR accomplishments are differentiated from other national and regional demand-side management (DSM) and market transformation programs. The methodology used for 2007 is an update of two former peer-reviewed methodologies used by EPA; nevertheless, the results of all three methodologies yield consistent estimates of ENERGY STAR accomplishments.²³
- The peak power savings are estimated using system-specific factors that reflect the contribution of the energy savings from lighting and other building improvements to peak load savings.

New Homes

- EPA receives data quarterly from third-party verifiers (home energy raters) on the number of homes they verified to be ENERGY STAR, as a condition of program partnership. These raters abide by a set of quality assurance practices to ensure data quality. In addition, EPA reviews the submitted data and resolves any data irregularities.
- EPA recognizes that some new homes that qualify for ENERGY STAR are not a direct result of the program and that many homes built to ENERGY STAR levels due to the program are not labeled or reported to the program. Currently, EPA estimates the former number of homes to be lower than the latter.

¹⁹ Calculated using a 7% discount rate and 2007 perspective.

²⁰ For more details on eGRID, see U.S. EPA, 2007.

²¹ For more details on IPM, see U.S. EPA, 2006.

²² For more details on many aspects of this method, see Horowitz, M.J., 2007 and 2008.

²³ For more details on many aspects of this method, see Horowitz, M.J., 2007.

- As with products, net energy bill savings reflect the incremental investment necessary to upgrade the building to ENERGY STAR specifications determined by using simple payback period decision criteria. EPA assumes most building and industrial facility improvements last at least 10 years and uses national commercial sector fuel prices.
- Avoided emissions of greenhouse gases are determined using marginal emissions factors for CO₂ as with products.

Industry

Annual industrial electricity and natural gas savings are determined using a peer-reviewed methodology similar to that used for the commercial sector.²⁴ The methodology distinguishes savings due to ENERGY STAR from those due to utility-run DSM programs and other market transformation programs such as DOE's Industrial Technology Program (ITP). Greenhouse gas emissions are calculated using marginal CO₂ emissions as with products.

The Clean Energy Supply Programs

Combined Heat and Power (CHP) Partnership

The CHP Partnership dismantles the market barriers stifling investment in environmentally beneficial CHP projects. Program partners such as project owners voluntarily provide project-specific information on newly operational CHP projects to EPA. These data are screened and any issues resolved.

Energy savings are determined on a project-by-project basis, based on fuel type, system capacity, and operational profile. Estimates of the use of fossil and renewable fuels are developed, as well as the efficiency of thermal and electrical use or generation, as appropriate.

Emissions reductions are calculated on a project-by-project basis to reflect the greater efficiency of onsite CHP. Avoided emissions of greenhouse gases from more efficient energy generation are determined using marginal emissions factors derived from energy efficiency scenario runs of IPM, and displaced emissions from boiler produced thermal energy are developed through engineering estimates. In addition, emissions reductions may include avoided transmission and distribution losses, as appropriate.

Only the emissions reductions from projects that meet the assistance criteria for the program are included in the program benefit estimates. EPA also addresses the potential for double counting benefits between this and other partnerships by having program staff meet annually to identify and resolve any overlap issues.

Green Power Partnership

The Green Power Partnership boosts supply of clean energy by helping U.S. businesses purchase electricity from green generation sources. As a condition of partnership, program partners submit data annually on their purchases of qualifying green power products. These data are screened and any issues resolved.

Avoided emissions of greenhouse gases are determined using marginal emissions factors for CO₂ derived from scenario runs of IPM.

The potential for double counting, such as counting green power purchases that may be required as part of a renewable portfolio standard or may rely on resources that are already part of the system mix, is addressed through a partnership requirement that green power purchases be incremental to what may already be required.

EPA estimates that the vast majority of the green power purchases made by program partners are due to the partnership, as partners comply with aggressive green power procurement requirements (usually at incremental cost) to remain in the program. Further, EPA estimates that its efforts to foster a growing voluntary green power market have likely led to additional voluntary green power purchases that have not been reported through the program.

²⁴ For more details on many aspects of the previous methods, see Horowitz, M.J., 2004 and 2001.

The Methane Programs

EPA's methane programs facilitate recovering methane from landfills, natural gas extraction systems, agriculture, and coal mines as well as using methane as a clean energy resource. The expenditures used in the program analyses include the capital costs agreed to by partners to bring projects into compliance with program specifications and any additional operating costs engendered by program participation.

Natural Gas STAR

As a condition of partnership, program partners submit implementation plans to EPA describing the emissions reduction practices they plan to implement and evaluate. In addition, partners submit progress reports detailing specific emissions reduction activities and accomplishments each year.

EPA does not attribute all reported emissions reductions to Natural Gas STAR. Partners may only include actions that were undertaken voluntarily, not those reductions attributable to compliance with existing regulations.

Emissions reductions are estimated by the partners either from direct before-and-after measurements or by applying peer-reviewed emissions reduction factors.

Landfill Methane Outreach

EPA maintains a comprehensive database of the operational data on landfills and landfill gas energy projects in the United States. The data are updated frequently based on information submitted by industry, LMOP outreach efforts, and other sources.

Reductions of methane that result from compliance with EPA's air regulations are not included in the program estimates. In addition, only the emissions reductions from projects that meet the LMOP assistance criteria are included in the program benefit estimates.

EPA uses emissions factors that are appropriate to the project. The factors are based on research, discussions with experts in the landfill gas industry, and published references.

Coalbed Methane Outreach

Through cooperation with the U.S. Mine Safety & Health Administration, state oil and gas commissions, and the mining companies themselves, EPA collects mine-specific data annually and estimates the total methane emitted from the mines and the quantity of gas recovered and used.

There are no regulatory requirements for recovering and using coal mine methane; such efforts are entirely voluntary. EPA estimates coal mine methane recovery attributable to its program activities on a mine-specific basis, based on the program's interaction with each mine.

The Fluorinated Gas Programs

Due to the small pool of potential partners for the F-gas programs, financial expenditures and savings are proprietary information of program partners and not included in the summary of economic benefits.

Voluntary Aluminum Industry Partnership

VAIP partners agree to report aluminum production and anode effect frequency and duration in order to estimate annual PFC emissions.

Reductions are calculated by comparing current emissions to a BAU baseline that uses the industry's 1990 emissions rate. Changes in the emissions rate (per ton production) are used to estimate the annual greenhouse gas emissions and reductions resulting from the program.

The aluminum industry began making significant efforts to reduce PFC emissions as a direct result of EPA's climate partnership program. Therefore, all reductions achieved by partners are assumed to be the result of the program.

HFC-23 Emission Reduction Program

Program partners report HCFC-22 production and HFC-23 emissions to a third party that aggregates the estimates and submits the total estimates for the previous year to EPA.

Reductions are calculated by comparing current emissions to a BAU baseline that uses the industry's 1990 emissions rate. Changes in the emissions rate are used to estimate the annual greenhouse gas emissions and reductions resulting from the program.

Subsequent to a series of meetings with EPA, industry began making significant efforts to reduce HFC-23 emissions. All U.S. producers participate in the program; therefore, all reductions achieved by manufacturers are assumed to be the result of the program.

Environmental Stewardship Programs

EPA's Environmental Stewardship Programs include the PFC and SF₆ Electric and Magnesium Reduction Partnerships. Partners report emissions and emissions reductions based on jointly developed estimation methods and reporting protocols. Data collection methods are sector specific, and data are submitted to EPA either directly or through a designated third party.

Reductions are calculated by comparing current emissions to a BAU baseline, using industry-wide or company-specific emissions rates in a base year. The reductions in emissions rates are used to calculate the overall greenhouse gas emissions reductions from the program.

The share of the reductions attributable to EPA's programs is identified based on a detailed review of program activities and industry-specific information.

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