



# The Climate is Right for Action

## Voluntary Programs to Reduce Greenhouse Gas Emissions



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OFFICE OF AIR AND RADIATION

# THE CLIMATE IS RIGHT FOR ACTION

## VOLUNTARY PROGRAMS TO REDUCE GREENHOUSE GAS EMISSIONS

As part of its ongoing effort to prevent air pollution, the United States Environmental Protection Agency is expanding its voluntary programs. These programs bring significant benefits in reduction of overall air pollution—and particularly in controlling greenhouse gas emissions. This plan describes the voluntary air pollution prevention programs already underway and provides a blueprint for future action.

In reviewing this blueprint for action, it is important to remember four key items:

1. **Air Pollution Prevention:** EPA's programs described here reduce emissions of greenhouse gases such as carbon dioxide (CO<sub>2</sub>) and methane (CH<sub>4</sub>), and they also significantly reduce other types of air pollution, including sulfur dioxide (SO<sub>2</sub>)—a primary component of acid rain, and nitrogen oxides (NO<sub>x</sub>)—a contributor to both acid rain and smog.
2. **Sound Economics:** EPA's voluntary greenhouse programs make sense independent of environmental concerns. The actions described here are good ideas on economic grounds alone. Energy efficiency is indeed "no regrets."
3. **Multiple Efforts:** The voluntary efforts described here are but one component of the Federal government's activity in reducing the risk of climate change. The Department of Energy, Department of Agriculture, and other U.S. agencies have programs underway in this important effort.
4. **Public/Private Partnerships:** Most importantly, the success of EPA's voluntary programs depends upon widespread participation by U.S. companies and citizens. Join EPA in these programs to prevent pollution—*The Climate Is Right!*

*"These programs are the cornerstone to limiting greenhouse gas emissions—pairing environmental protection and economic growth."*

William K. Reilly, EPA Administrator

# CLIMATE CHANGE IN RIO

At the **United Nations Conference on Environment and Development** (UNCED) in Rio de Janeiro, Brazil, the U.S. recently joined with 153 nations in signing the *United Nations Framework Convention on Climate Change*, which calls upon each signatory to mitigate climate change by limiting its emissions of greenhouse gases.

The U.S. takes this commitment seriously—in fact, Senate ratification of the climate treaty on October 7th makes the U.S. the first industrialized nation to become a signatory. And the EPA is already translating this commitment into concrete action and measurable results. EPA’s greenhouse programs pair the “green” of environmentalism with the “green” of profit to combat air pollution and stimulate economic growth, through the new environmentalism of voluntary corporate action.

EPA’s voluntary greenhouse programs consist of a series of initiatives modeled on successful programs already underway, such as **Green Lights** and the utility-sponsored “**Golden Carrot™**” **Super-Efficient Refrigerator Program**, which EPA helped develop.

EPA envisions a rapid roll-out of these new programs. In fact, in the days following Rio EPA launched its next

effort—**Energy Star Computers**—with leading manufacturers who represent ~35 percent of the domestic market for desktop computers.

EPA’s voluntary greenhouse programs are highlighted in *U.S. Views on Global Climate Change*, published by the Department of State prior to Rio. Also featured prominently in *U.S. Views* are: full implementation of the National Energy Strategy, which defines a new, more efficient energy path for the United States; the new transportation law which will greatly improve the efficiency of moving people and goods by autos, rapid transit, and other means; and the world’s most stringent clean air legislation, which will also contribute to greenhouse emissions reduction. The strategy also emphasizes the role of cooperative action—technical and financial—with developing countries and countries with economies in transition. In Rio the U.S. challenged all countries to develop national action plans and pledged to issue the next publication of the U.S. national action strategy for climate change in January 1993. This U.S. strategy will include EPA’s voluntary programs and other efforts.

## GREENHOUSE INITIATIVES TIMELINE

Historical Milestones



**January 1991:**

Launched Green Lights



**May 1991:**

First Green Lights State Government Partners (California and Maryland)



**September 1991:**

Consortium for Energy Efficiency (CEE) established and incorporated



**January 1992:**

Green Lights Partner commitments exceed 2 billion ft<sup>2</sup> of facility space

# UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE

## OBJECTIVE

The ultimate objective of this Convention and any related legal instruments that the Conference of the Parties may adopt is to achieve, in accordance with the relevant provisions of the Convention, stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner.

## ARTICLE 4: COMMITMENTS

2.(a) Each of these Parties shall **adopt national policies and take corresponding measures** on the mitigation of climate change, **by limiting its anthropogenic emissions of greenhouse gases and protecting and enhancing its greenhouse gas sinks and reservoirs.** These policies and measures will demonstrate that developed coun-

tries are **taking the lead in modifying longer-term trends in anthropogenic emissions** consistent with the objective of the Convention, recognizing that the return by the end of the present decade to earlier levels of anthropogenic emissions of carbon dioxide and other greenhouse gases not controlled by the Montreal Protocol would contribute to such modification...

(b) In order to promote progress to this end, each of these Parties shall communicate, within six months of the entry into force of the Convention for it and periodically thereafter, and in accordance with Article 12, detailed information on its policies and measures referred to in subparagraph (a) above, as well as on its resulting **projected anthropogenic emissions** by sources and removals by sinks of greenhouse gases not controlled by the Montreal Protocol for the period referred to in subparagraph (a), with the aim of returning individually or jointly to their 1990 levels of these anthropogenic emissions of carbon dioxide and other greenhouse gases...



**February 1992:**

Chlorofluorocarbon (CFC)-free refrigerator with improved energy efficiency developed



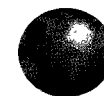
**March 1992:**

EPA/Chinese non-CFC insulated refrigerator prototypes developed



**April 1992:**

*U.S. Views on Global Climate Change* published by U.S. State Department



**June 1992:**

Earth Summit in Rio: *United Nations Framework Convention on Climate Change* signed



**June 1992:**

Energy Star Computers kick-off—35% of market share participating on 1st day!

# EPA'S VOLUNTARY GREENHOUSE PROGRAMS— A NEW PERSPECTIVE

While scientific uncertainty over the nature of climate change remains, the public is raising other important questions: "What can we do about climate change?" and "How much will it cost?"

The success of programs implemented by EPA suggests not only that significant reductions of greenhouse gases are achievable at low cost—but that they can be profitable! EPA's voluntary greenhouse programs seek to strategically enhance the market. These programs provide mechanisms for improving energy efficiency, which leads to reduced fossil fuel use and lower carbon dioxide emissions, as well as capturing and using methane, a powerful greenhouse gas.

This document describes EPA's voluntary greenhouse programs for industry, state and local governments, and others within the energy and environmental community. The early assistance and involvement of these organizations is essential to the development and continuing success of EPA's greenhouse programs. Public/private partnerships that increase the efficiency with which we use our resources can reduce greenhouse gas emissions and other air pollution, save consumers money, and increase the competitiveness of our businesses.

## VOLUNTARY GREENHOUSE PROGRAMS

EPA envisions a rapid rollout of its voluntary greenhouse programs, as illustrated by the timeline beginning on the previous page. Other events supporting the voluntary efforts are included in the timeline as well.

- 

Green Lights



Consortium for Energy Efficiency
- 

Corporate Purchasing



New Technology
- 

Energy Star



Reports
- 

Advisory Committee



Mass Purchases
- 

Regulatory/  
Legal Support



Environmental Best Practices
- "Golden Carrot™"



International Cooperation

Dates prior to July 1992 are historical; those following the fall of 1992 are subject to significant uncertainty and are included to provide a template for EPA's anticipated actions.



**June 1992:**

EPA Greenhouse Programs Advisory Sub-Committee selection begins



**June 1992:**

EPA testifies in Georgia hearing on utility regulatory reform

**July 1992:**

Utilities commit ~\$30 million in "Golden Carrot™" Refrigerator incentives, RFP issued



**July 1992:**

Brief Ohio Public Utility Commission

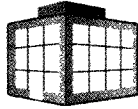


**July 1992:**

U.S.-Russian natural gas meeting in Moscow

# KEY ELEMENTS OF EPA'S VOLUNTARY GREEN PROGRAMS

1) **Encourage corporate-wide purchasing** frameworks so that energy efficiency and full life cycle cost considerations are incorporated up front. This helps to overcome internal organizational barriers (for example, departments responsible for purchasing equipment would consider energy costs in their decisions—even when their department does not pay the electricity bills).



2) **Identify energy-efficient products** so that consumers can make educated purchasing decisions. Unfortunately, the lack of good information makes it difficult to choose the most cost-effective products.



3) **Promote mass purchases** of energy-efficient technologies in order to improve economies of scale and reduce prices. Once organizations begin to purchase efficient technologies, prices for these products often fall below their less energy-efficient alternatives.



4) **Encourage industry to commercialize** more resource-efficient technologies by demonstrating that these products will sell. Clear “market-pull” signals to manufacturers can help get products off the drawing board and onto store shelves.

*“It takes not much imagination to see that environmental concern is not just a fad, but a serious trend. It will shape the future of our business, and to learn to understand it and shape it is really in our interest.”*

Stephan Schmidheiny  
Business Council for Sustainable Development



**August 1992:**

Green Lights: over 600 participants



**September 1992:**

NBC program on Green Lights airs



**September 1992:**

EPA develops initiative with India for super-efficient, non-CFC refrigerators



**September 1992:**

EPA/Chinese development of non-CFC Lorenz Cycle refrigerators



**September 1992:**

New super compressor technology prototype for home refrigerators

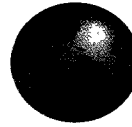
5) *Promote sensible utility regulation and legal frameworks* to



encourage cost-effective investments in energy conservation and methane-recovery programs. Too often, regulatory barriers prevent potential efficiency investments and increase capital requirements.

Ensuring that companies and consumers can indeed profit from wise use of resources—by improving energy efficiency or capturing and using methane for energy—leads to a more productive and less polluting economy.

6) *Create Environmental Best Practices* agreements to integrate



environmental considerations into the design and planning of products and services. Placing environmental concerns in a primary role can lead to well-designed products, cost-effective manufacturing processes, and a wiser use of scarce natural resources (for example, capturing leaking methane from a variety of sources and using it for energy).

7) *Expand international markets* for resource-efficient U.S.



technologies. EPA, the Department of Energy (DOE) and the Department of Commerce are all working to promote resource- and energy-efficient U.S. technologies worldwide to create additional business opportunities for U.S. industry, while helping protect the global environment. EPA's voluntary greenhouse programs often create such opportunities, many of which are described herein.

*“Innovative green programs such as Green Lights, Energy Star Computers, and the ‘Golden Carrot’<sup>TM</sup> Refrigerator Program are critical to achieving national goals for reducing greenhouse gas emissions. Economically sound programs like these are absolutely necessary for achieving the environmental goals of the 1990’s.”*

Rafe Pomerance, Senior Associate  
World Resources Institute



September 1992:

EPA manual for chiller refrigerant containment, conservation, and conversion for developing countries



October 1992:

EPA/DOE Memorandum of Understanding (MOU) finalized



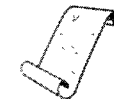
October 1992:

Green Buildings—Variable Speed Drives (VSDs) (air handlers) corporate pilot program launched



October 1992:

Energy Star Printers MOU released



October 1992:

EPA promulgates incentive regulations for energy efficiency

# EPA VOLUNTARY GREEN PROGRAMS EXPLAINED

## I. CORPORATE PURCHASING STRATEGIES




### *Flagship Program: Green Lights*

EPA's Green Lights Program is changing the way that companies light their offices and factories across the United States. Lighting accounts for over 20 percent of total U.S. electricity consumption and was responsible for 120 million metric tons of carbon emissions in 1990. Available technology can reduce the electricity used for lighting 50-70 percent. These efficient technologies also provide excellent investment opportunities—in fact, a typical lighting upgrade yields an internal rate of return of 20-30 percent—a payback of about 3-4 years.

Green Lights provides companies and governments with a framework for seizing these efficiency opportunities. Through Green Lights, organizations make a corporate-wide decision to invest in energy-efficient lighting, thus giving individual build-

## GREEN LIGHTS UPGRADES SURPASS ESTIMATES OF TECHNICAL POTENTIAL

When EPA launched Green Lights in early 1991, published engineering calculations estimated the largest possible lighting electricity savings to be 25-54 percent. Many of the first lighting upgrades completed under Green Lights exceed these estimates of "maximum technical potential."

		
The Gillette Company	Whirlpool Corporation	Jantzen
Santa Monica, CA	Lavergne, TN	Vancouver, WA
50,000 ft <sup>2</sup>	125,000 ft <sup>2</sup>	45,000 ft <sup>2</sup>
61% Energy Savings	54% Energy Savings	71% Energy Savings
37% IRR*	72% IRR	36% IRR

\*internal rate of return (IRR)  
Source: Green Lights Upgrade Reports.



**October 1992:**

Green Lights has over 3 billion ft<sup>2</sup> committed



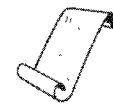
**November 1992:**

CEE executive director hired



**November 1992:**

Appalachian Coalbed Methane Environmental and Economic Benefits Study released



**November 1992:**

EPA publishes Conservation Verification Protocol



**November 1992:**

EPA report on the economic and environmental benefits of natural gas generation released



ing managers nationwide a mandate to pursue the optimal lighting designs.

By signing a partnership agreement with EPA, Green Lights participants commit to survey and upgrade 90 percent of all domestic facilities with the most energy-efficient lighting systems that are profitable, within 5 years of signing the agreement.

As of September 30, 1992, Green Lights participants number 651, including 296 corporate Partners, 24 state and local government Partners, 42 utilities, 195 lighting manufacturers, 55 lighting management companies, and 40 Endorsers. These organizations have committed over 2.8 billion square feet of facility space to the program, over 3 percent of the national total—far exceeding the leasable office space in the metropolitan areas of New York City, Los Angeles, Chicago, San Francisco, Washington DC, Philadelphia, and Dallas.

## GREEN LIGHTS TODAY & TOMORROW

*Estimates include the Green Lights Program as well as other promising DOE and utility programs to promote energy-efficient lighting.*

### **Green Lights Today: 1992**

2.8 billion  
square feet committed

### **Expected From These Commitments—**

12.4 BkWh/yr Energy Savings

2.3 MMT Avoided  
Carbon Emissions

67,500 Metric Tons  
Avoided SO<sub>2</sub> Emissions\*

28,700 Metric Tons  
Avoided NO<sub>x</sub> Emissions

\$870 Million Reduced  
Electricity Bills\*\*

### **Green Lights Tomorrow: 2000**

24-60 billion  
square feet committed

### **Expected From These Commitments—**

104 - 226 BkWh/yr Energy Savings

22 - 55 MMT Avoided  
Carbon Emissions

1.3 MMT  
Avoided SO<sub>2</sub> Emissions\*

600,000 Metric Tons  
Avoided NO<sub>x</sub> Emissions

\$7 - 15.8 Billion Reduced  
Electricity Bills\*\*

Source: EPA and *U.S. Views on Global Climate Change*, calculated using the following emissions factors: 1992 Carbon = .186 MMT/BkWh; 2000 Carbon = .243 MMT/BkWh; SO<sub>2</sub> = 5.8g/kWh; NO<sub>x</sub> = 2.5g/kWh.

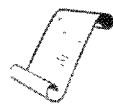
\* As a result of the Clean Air Act, these reductions may lead to SO<sub>2</sub> allowance credits, worth an estimated \$300-1000/ton, rather than actual emissions reductions.

\*\* At 7.0 cents/kWh.



**November 1992:**

National Association of Regulatory Utility Commissioners endorse-ment of EPA Energy Star Computers program



**November 1992:**

Issue final rule reducing land-fill methane emissions



**November 1992:**

Green Lights Partners adver-tising co-op places ads in major business magazines



**November 1992:**

Agreement for Energy Star Fax Boards



**November 1992:**

Launch outreach program on methane energy recovery from landfills to industry/states/municipalities/utilities

## *Future Corporate Purchasing Programs*

Following the flagship Green Lights Program, EPA is planning the introduction of similar programs, targeting the following technical opportunities:

**Industrial Motors**  
**Buildings Technologies**  
**Commercial Cooking**  
**Better Refrigerants**  
**Industrial Electrolytics**

As technologies evolve and market conditions change, EPA will modify and expand this list.

EPA helps to get the Green Lights job done with technical support from start to finish, including: state-of-the-art software to assist in upgrade decision-making; information on financing energy-efficient lighting through a large national data base; "consumer reports" of lighting products through the National

Lighting Product Information Program; and networking through lighting manufacturers, lighting management companies, and utilities. EPA also provides opportunities for public recognition, including public-service advertisements, news articles, marketing materials, broadcast specials, and videotapes.

## 2. PRODUCT IDENTIFICATION STRATEGIES

### *Flagship Program: Energy Star Computers*

The EPA Energy Star Computer program is helping to create a market for energy-efficient desktop computers, by providing a clear market incentive for manufacturers to improve the

*"EPA should be congratulated for its creative and inspired solution."*

*InfoWorld*



**November 1992:**

Mobile Methane Monitor transferred to Russia



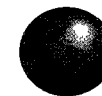
**November 1992:**

Kick-off Federal Green Lights Program



**December 1992:**

EPA Residential Heating and Cooling Report released



**December 1992:**

Launch voluntary program on methane emission reductions from natural gas systems



**December 1992:**

Initiate Animal Waste Demonstration Project

efficiency of their products and an effective mechanism for consumers to make informed purchasing decisions.

Currently, computer systems consume 5 percent of all commercial electricity—and this number could grow to 10 percent by the year 2000. Research suggests that 30-40 percent of all computers are left on at night and over weekends, and that even during the day computers are active less than 20 percent of the time. This provides a clear opportunity for dramatic reductions in energy use, costs, and greenhouse gas emissions.

Manufacturers who sign the EPA Energy Star Computers program agreement will introduce personal computers that automatically “power-down” when they are not being used. This feature was pioneered for use in portable applications, and could cut the energy used by personal computers in half—at no additional cost!

The EPA Energy Star logo will be used to identify machines

capable of “powering-down,” so that consumers and businesses know that they can save money and cut air pollution when they purchase this equipment.

The EPA Energy Star Computers program was developed with industry leaders and launched June 17, 1992. Current participants in Energy Star Computers make 40 percent of all personal computers and workstations sold in the U.S., and EPA is expanding the program to include other manufacturers. As of September 1992, participating manufacturers include:

- Acer America
- Apple Computer
- Compaq Computer
- Digital Equipment
- EMPaC International
- Hewlett-Packard
- Hyundai Electronics America
- IBM
- NCR
- Silicon Graphics
- Smith Corona
- Zenith Data Systems



**December 1992:**  
Green Lights Residential Program announced



**December 1992:**  
CEE Board of Trustees instated



**December 1992:**  
1,000 Green Lights upgrades underway



**December 1992:**  
1992 EPA/Sweden discuss incorporation of Energy Star Computers guidelines into Swedish strategy

**December 1992:**  
“Golden Carrot™” Refrigerator finalists announced

## *Future Energy Star Product Identification Programs*

Following the flagship Energy Star Computers program, EPA is planning the introduction of similar programs in conjunction with the DOE appliance standards program, targeting the following technical opportunities:

- Low-flow Showerheads**
- Residential Room Air Conditioning**
- Residential Cooking Equipment**
- Residential Space Conditioning and Shell Improvements**
- Miscellaneous Residential and Commercial End-Uses**

As technologies evolve and market conditions change, EPA will modify and expand this list.

## 3. MASS PURCHASING STRATEGIES

### *Flagship Program: Green Buildings—Variable Speed Drives*

EPA's Green Buildings initiative will stimulate the market for highly efficient heating, ventilation, air conditioning (HVAC), and water heating technologies. The program's first technology target will be variable speed motor drives for ventilation systems.

Every year, roughly 50,000 air handling motor drives are purchased to move air through buildings and factories. Of these, less than 20 percent have fans capable of operating at variable speeds—that is, adjusting their power based on the needs of the building occupants at any particular time or



**Winter 1993:**

Voluntary Green Programs  
Advisory Sub-Committee  
meets



**Winter 1993:**

Green Buildings - Ventilation  
launched



**Winter 1993:**

Green Industrial Motors  
launched



**Winter 1993:**

Energy Star Low-flow  
Showerhead Program  
launched



**Winter 1993:**

Coalbed methane recovery  
and use case studies

# THE EXPLODING MARKET FOR ENERGY EFFICIENCY

Energy efficiency is BIG business. Sales for efficient products targeted by these four flagship greenhouse programs alone are expected to total \$53 billion by the end of the decade—comparable to the entire domestic paper producing industry.

*Sales of Efficient Products (\$ million)*

	<u>Historical</u>		<u>Projected</u>	
	1985	1990	1995	2000
Lighting <sup>1</sup>	*	340	2,000	10,000
Personal Computers	*	3,400	25,000	37,000
Variable Speed Motor Drives for Ventilation	*	50	115	400
Refrigerators <sup>2</sup>	*	*	4,200	5,200

\* Negligible

<sup>1</sup> Includes only compact fluorescents, T-8 lamps, and electronic ballasts.

<sup>2</sup> Efficient refrigerators are defined to be ≤ 700 kWh/yr, the level of the 1993 DOE standard.

Source: EPA estimates derived from Electric Power Research Institute, International Data Corporation, manufacturers, and Bureau of the Census data.

any particular weather circumstance. Most fans either operate continuously at one speed regardless of building needs or use less efficient mechanical means to control air flow. Furthermore, fans are usually oversized in order to meet demands under the most extreme conditions (i.e. the hottest hour of the hottest day), with an additional margin of safety.

Variable speed drives (VSDs) have been demonstrated in the HVAC marketplace for over 10 years and are capable of reducing electricity consumed for air handling by 40 percent or more. Why is VSD market share so small? According to manufacturers, the answer is simple: first cost. Even though the payback is only 1-3 years, most consumers have been unwilling to make the initially higher investment for the more efficient—and money saving—products.



**Winter 1993:**

Identify Russian natural gas pilot projects



**Winter 1993:**

Clean Air Act (CAA) Amendment Utility Energy Savings Evaluation Project begins



**Winter 1993:**

Green Lease MOU released



**Winter 1993:**

General Services Administration procurement guidelines for Energy Star Computer products

Through a mass purchase, however, it is possible to reduce the risk to manufacturers to invest more heavily in VSD production. A group buy will signal that VSDs are no longer a “niche product”—that it is time to gear up to larger product lines in order to meet a large and growing demand. This drives down prices—in fact, it is reasonable to believe that large markets enhanced by EPA’s Green Buildings program and other utility rebate initiatives will make the first cost of the most efficient products comparable to the first cost of the least efficient ones.

### *Future Mass Purchasing Programs*

Following the flagship VSD mass purchase, EPA is planning the introduction of similar programs, targeting the following technical opportunities:

- Green Buildings Technologies**
- Solar Thermal Water Heaters**
- Amorphous Core Transformers**

As technologies evolve and market conditions change, EPA will modify and expand this list.

## 4. STRATEGIES TO ENCOURAGE COMMERCIALIZATION OF RESOURCE-EFFICIENT TECHNOLOGIES

### *Flagship Program: “Golden Carrot™” Super-Efficient Refrigerator Program*

Appliance manufacturers often report that it is technically possible to produce more energy-efficient products. From a business standpoint, however, investing in this production has often appeared unwise, since the most efficient products currently on store shelves are not purchased in large quantities. Why invest in the next generation?

The “Golden Carrot™” is why. By aggregating a large pool of appliance rebate money, utilities are giving appliance manufacturers a financial incentive—the most powerful market signal they can send—to make the most energy-efficient appliances possible.

The flagship “Golden Carrot™” appliance is the refrigerator. Refrigerators consume 20 percent of all residential electric-

**Winter 1993:**

Launch commercial rooftop air conditioning “Golden Carrot™” initiative



**Winter 1993:**

Launch Animal Waste Outreach Program to states/livestock producers/rural electric coops



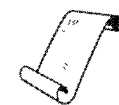
**Spring 1993:**

VSD for air handlers group buy



**Spring 1993:**

Amorphous core transformer group buy



**Spring 1993:**

Launch outreach program on “Nega-allowances”

*“This utility consortium deserves high praise for an initiative that is pro-energy efficiency, pro-environment, and pro-economy...It will provide utilities with a low-cost conservation option to help meet growth in electricity demand. It will benefit industry by enhancing the market for innovative technologies and increasing American competitiveness.”*

William K. Reilly, EPA Administrator, in response to the public announcement of the Super-Efficient Refrigerator Program

ity. On average, refrigerators consume ~1,200 kilowatt hours per year (kWh/yr) of electricity. The best widely-available model on the market now uses ~800 kWh/yr, and the 1993 DOE refrigerator performance standard is ~700 kWh/yr. The “Golden Carrot™” Super-Efficient Refrigerator Program is focusing manufacturer research and development toward energy efficiency in a manner never before seen for refrigerators,

and will lead to the introduction of units 25-50 percent more energy-efficient than the 1993 DOE performance standards.

Under the program, which EPA helped develop with utilities and others, utilities have pooled almost \$30 million in rebate incentives to the refrigerator manufacturer that can produce the superior product. The manufacturer that can build the largest number of the most efficient, chlorofluorocarbon (CFC)-free refrigerators the quickest and cheapest wins the contract. The environmentally superior product will be available to consumers at a utility-subsidized price beginning in 1994 or 1995. The “Golden Carrot™” Super-Efficient Refrigerator Program will ultimately save consumers \$240-480 million in annual electricity payments. This translates into annual electric bill savings of 10 percent to 35 percent for an average household.

Utilities usually create individual, uncoordinated incentive programs with unpredictable life spans. The “Golden Carrot™” coordinates and aggregates utility incentives in a long-term strategy that allows manufacturers to plan ahead. The result is a more rational investment strategy than before, that leads to



**Spring 1993:**

“Golden Carrot™” Refrigerator prototypes available

**Spring 1993:**

Launch key state programs in coal mine methane recovery



**Summer 1993:**

Debut of Energy Star logo on computer equipment



**Summer 1993:**

Energy Star logo available for windows, insulation, and other building products

**Summer 1993:**

“Golden Carrot™” Refrigerator winning manufacturer announced

more efficient products at a lower price than would otherwise be the case. Ultimately this translates into healthier corporate bottom lines, lower consumer costs, and significantly reduced carbon dioxide emissions and other air pollution from electricity generation.

### *Future Programs to Encourage Commercialization of Resource-Efficient Technologies*

The Consortium for Energy Efficiency (CEE) has been established by utilities, EPA, and several environmental groups to roll out future “Golden Carrot™” programs for other promising technologies. EPA and utility members are advising CEE staff in new program areas, including:

- **Advanced Heat Pumps**
- **Residential Central Air Conditioning**
- **Clothes Washers**
- **Clothes Dryers**

As technologies evolve and market conditions change, EPA and CEE will modify and expand this list.

## 5. REGULATORY AND LEGAL SUPPORT STRATEGIES

### *Flagship Program: Utility Reform*

For too long, utility regulation has encouraged investments in power plants and discouraged investment in efficiency. In fact, utilities and their stockholders have lost money when they conserve electricity. At the same time, ratepayers have been concerned about whether real savings are actually occurring. The result has been an inefficient mix of resources, inflated costs, and unwarranted air pollution.

On the other hand, where utility regulations allow it, utilities often find that it is more cost-effective to invest in energy efficiency than supply. This investment in energy efficiency—or demand-side management (DSM)—complements EPA’s voluntary programs and other efforts to increase energy efficiency.

A movement is underway nationwide, supported in the National Energy Strategy (NES), to level the playing field and encourage economically justifiable investments in energy efficiency. The basic premise is that utilities should be able to make as much money on



**Summer 1993:**

Conservation and Renewables Incentive Allowance Program begins

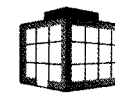
**Summer 1993:**

Washer/Dryer “Golden Carrot™” launched



**Summer 1993:**

EPA/European Community (EC) meeting to discuss Energy Star Computers—Europe



**Summer 1993:**

Green Buildings - Cooling launched



**Fall 1993:**

HCFC-free energy-efficient air conditioner prototype developed



energy saved as energy sold when savings are properly verified. This philosophy was formally embraced in the 1990 Clean Air Act (CAA) Amendments. The Act provides incentives for utilities to reduce compliance costs through the use of renewable energy and energy efficiency, where:

*The state regulatory authority...has established rates and charges which ensure that the net income of such electric utility after implementation of specific cost-effective energy conservation measures is at least as high as such net income would have been if the energy conservation measures had not been implemented.*

*“We need to reform the rate-making process so that saving energy is more profitable to utilities than selling it.”*

Ron Eachus

Chairman, Oregon Public Utility Commission Chair, Energy Conservation Committee, National Association of Regulatory Utility Commissioners

While EPA recognizes that each state will need to develop its own very specific utility regulations, in general the Agency encourages inclusion of three broad principles:

- Eliminating the incentive to sell electricity by separating (or “decoupling”) profits from sales
- Creating an incentive to save electricity—accomplished through programs in which utilities and their stockholders can actually profit from successful investments in conservation
- Verifying energy efficiency measures to ensure that actual energy savings are realized

As of July 1991, at least one dozen states have adopted comprehensive regulatory mechanisms to encourage conservation. EPA will publish final rules on the CAA incentives and guidance on verifying conservation in the fall of 1992. EPA, DOE, and other Federal agencies are working across the U.S. to encourage the implementation of regulations that will benefit ratepayers and stockholders and prevent pollution. These regulatory changes, by encouraging an increase in DSM investment in energy efficiency, will strengthen EPA’s voluntary programs.



**Fall 1993:**

Green Lights has over 1 billion ft<sup>2</sup> of upgrades underway

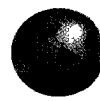


**Fall 1993:**

Launch national certification program for architects and lighting consultants

**Fall 1993:**

“Golden Carrot™” residential central air conditioner program launched



**Fall 1993:**

Five additional VA mines recovering methane (total = 11)

**Winter 1994:**

Mass market debut of “Golden Carrot™” rooftop air conditioners

### *Flagship Program: Methane Recovery at Coal Mines*

Methane, a significant greenhouse gas, can be recovered from coal mines and used for energy instead of being wasted and released into the atmosphere. A variety of proven technologies are available to recover and use this waste gas, but prospects are hampered by legal and regulatory barriers. Some of the principal barriers include legal questions about who owns the gas released by coal mining, the unwillingness of utilities and pipelines to buy the electricity or gas produced by these facilities, and the existence of regulatory frameworks that discourage the use of the recovered gas. These barriers can be addressed through legislative actions at the state or Federal level, incentive programs, and outreach to coal mines, operators, utilities, pipeline companies, states, and municipalities.

EPA has been working with the U.S. coal industry to identify the barriers to methane recovery and assist in their removal. The key focus of current activities is the Appalachian region, which has the largest potential for methane recovery and could most benefit from actions to address ownership issues and

*“These voluntary programs exemplify how we can achieve environmental protection, economic growth, and energy security. As such, they represent a new environmentalism that is broader, cleaner, and even profitable.”*

William G. Rosenberg  
EPA Assistant Administrator for Air and Radiation

remove other hurdles. EPA has efforts underway to ensure that the full benefits of methane recovery at coal mines—in terms of environmental protection, employment, and revenues—are recognized by coal mine operators, as well as by states and other Federal agencies.

EPA’s activities to expand the recovery of methane from coal mines also have a major international component. U.S. companies lead the world in the development of technologies to recover and use methane from coal seams. Thus, there are



**Winter 1994:**

Energy Star logo debut on residential cooking appliances



**Winter 1994:**

Energy Star Room Air Conditioner Program launched



**Winter 1994:**

Green Buildings - Water and Space Heating launched



**Winter 1994:**

80% of potential for reducing methane from landfills achieved



**Spring 1994:**

Solar thermal water heater group-buy

many opportunities for U.S. companies to export technologies and develop international joint venture projects. EPA is facilitating such projects through the preparation of resource assessments and investment opportunity analysis, the creation of international technology transfer centers, and the organization of seminars, workshops, and conferences on coalbed methane that showcase the achievements of U.S. companies. EPA plans to continue these efforts in several countries—including the People’s Republic of China, Russia, Ukraine, Poland, and the Czech and Slovak Federal Republic. As a result, U.S. coal and gas companies will have additional business opportunities in coalbed methane and methane emissions from the world’s coal mines will be reduced.

### *Future Programs for Regulatory and Legal Support*

Following the flagship Utility Regulatory Reform and Coalbed Methane programs, EPA is planning the introduction of similar programs, targeting the following opportunities:

#### **Landfill Methane Recovery Tire Inflation**

As technologies evolve and market conditions change, EPA will modify and expand this list.

## 6. ENVIRONMENTAL BEST PRACTICES STRATEGIES

### *Flagship Program: Green Nylon Manufacturing*

The United States produces about one-third of the world’s nylon in a manufacturing process that releases the greenhouse gas nitrous oxide (N<sub>2</sub>O).

Nitrous oxide emissions can be reduced during the manufacturing process through the addition of a reductive furnace to adipic acid plants, the factories used in the production of nylon. This technology, which recycles nitrous oxide and saves energy and raw materials, is being developed now and is expected to be fully commercialized by mid-decade.

EPA is working with major U.S. nylon manufacturers to expand the use of these reductive furnaces. By incorporating environmental concerns into design and manufacturing processes, EPA and nylon manufacturers are leading the way toward a more environmentally sound—and more competitive—economy.



**Spring 1994:**

Energy Star logo on most personal computers and printers sold



**Spring 1994:**

Green Commercial Cooking launched



**Summer 1994:**

42 State Partners in Green Lights



**Summer 1994:**

CEE/EC Summit on “Golden Carrot™” opportunities for Europe



**Summer 1994:**

Launch Energy Star program for large consumer appliances

## *Future Programs for Environmental Best Practices*

Following the flagship Green Nylon Manufacturing program, EPA is planning the introduction of similar programs, targeting the following opportunities:

### **Livestock Waste Lagoon Methane Recovery Livestock Dietary Strategies**

As technologies evolve and market conditions change, EPA will modify and expand this list.

## **7. STRATEGIES TO EXPAND INTERNATIONAL MARKETS**

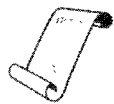
### *Flagship Program: Natural Gas Pipelines in Russia*

EPA's experience in its voluntary programs often points naturally to international opportunities, many of which are mentioned in this document. For example, EPA's natural gas experience in the U.S. led to an initiative in Russia, the largest natural gas producer in the world. Current estimates suggest that about 5 percent of the gas produced in the former

U.S.S.R—approximately 25 Teragrams (Tg) of methane—is released into the atmosphere. EPA and Russian gas specialists are working together to reduce leakage of this greenhouse gas to 2 percent by adopting existing and profitable Western technology and work practices.

EPA and GAZPROM (the Russian Gas Association) have established a working group of experts from both countries and are developing projects to increase the efficiency of the natural gas system in Russia. Projects will be chosen from several areas, including: enhanced field maintenance; upstream refining of gas; leak detection and mapping; pipeline construction and rehabilitation; compressor upgrades; power generation; and improved measurement and control devices. The Russian Natural Gas Pipeline project expects to transfer a mobile methane monitor to Russia in late 1992, and identify pilot projects early in 1993.

The Russian Natural Gas Pipeline project could reduce methane emissions 15 Tg, the equivalent of 90 million metric tons of carbon—while providing additional capital resources for new economic development projects in Russia, and creating further export and investment opportunities for U.S. industry.



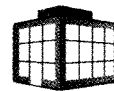
#### **Summer 1994:**

Expert panel updates CAA Amendment Conservation Verification Protocol



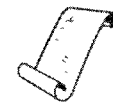
#### **Fall 1994:**

EPA helps Brazil produce high-efficiency compressors



#### **Fall 1994:**

Green Buildings Partners commit 1 billion ft<sup>2</sup>



#### **Winter 1995:**

Phase I utilities can earn "reduced utilization" conservation credit

#### **Winter 1995:**

Mass market debut of "Golden Carrot™" washer/dryers

# THE CLIMATE IS RIGHT FOR ACTION

As we move forward at EPA, it becomes increasingly obvious that environmentalists and business leaders are often pursuing the same goals. Only by incorporating environmental concerns can economies truly prosper; only by taking advantage of economic forces can environmental protection goals be realized. Through the voluntary programs to reduce greenhouse gases, EPA and its private-sector partners seek to do both—by embracing sound, cost-effective pollution reduction opportunities and enhancing natural market forces to save energy, reduce pollution, and mitigate the risk of climate change. In fact, EPA’s greenhouse programs, along with other U.S. actions, have the potential to significantly reduce greenhouse gas emissions.

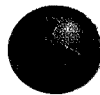
*“We came to Rio with an action plan on climate change ...My administration published a detailed program of specific measures that the U.S. was prepared to undertake to address climate change... Let us join in translating the words spoken here into concrete action to protect the planet.”*

President George Bush  
June 12, 1992, Rio de Janeiro, Brazil



**Winter 1995:**

~1 million homes insulated/heated with Energy Star products



**Winter 1995:**

Green Gas Partners commit 30% of natural gas transmission and distribution



**Winter 1995:**

All states remove legal barriers hindering methane recovery at mines



**Spring 1995:**

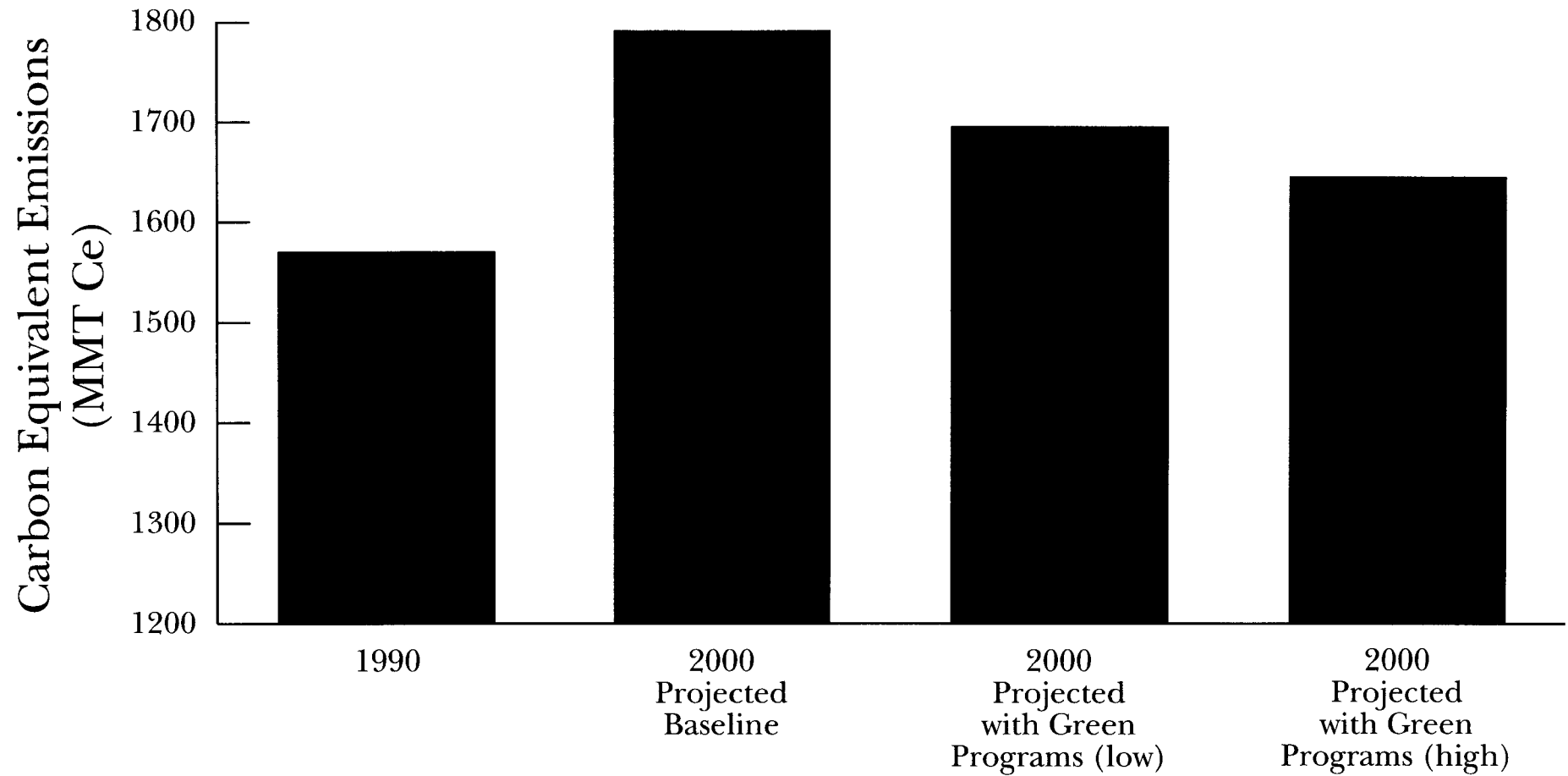
EPA Energy Star logo debut on room air conditioners



**Spring 1995:**

Mass market debut of “Golden Carrot™” heat pumps

# IMPACT OF EPA GREEN PROGRAMS ON U.S. GREENHOUSE GAS EMISSIONS



Note: Green Programs benefits calculation includes additional complementary demand side management programs. These estimates do not include the other parts of the U.S. Action Plan, e.g., the National Energy Strategy, Clean Air Act, Forests for the Future, and others.

**Spring 1995:**

Mass market debut of "Golden Carrot™" Refrigerators



**Spring 1995:**

Green Buildings Partners commit 2 billion ft<sup>2</sup>



**Spring 1995:**

Major swine producers recover methane from animal wastes

**Spring 1995:**

Mass market debut of "Golden Carrot™" heat pumps

**Summer 1995:**

Chinese market super-efficient non-CFC refrigerator

# U.S. ACTIONS TO CURB CARBON DIOXIDE EMISSIONS

*U.S. Views on Global Climate Change, Department of State, April 1992*

Action/Description	Potential Technical Improvement	Year 2000 Market Penetration	Electric Energy Savings (BkWh)	Year 2000 Carbon Reduction (MMT C)
<b>Demand-Side Management (DSM)/Green Lights</b>				
- Commercial/Industrial	65%	25%-62%	81-203	17.0-50.1
- Residential	75%	27%	23.4	4.9
DSM/Green Computers	57%	65%	26.3	5.5
DSM/Green Industrial Motors	30%	16%	39.5	8.3
DSM/Green Buildings (HVAC)	53%	17%	41.9	8.8
"Golden Carrot™" Refrigerators	57%	3%	3.0	0.6
Residential Clothes Washers	96%	3%	1.3	0.3
Residential Clothes Dryers	65%	3%	1.2	0.3
Low-flow Showerheads	58%	11%	10.2	3.4
Solar Thermal Water Heaters	70%	2% <sup>1</sup> - 3% <sup>2</sup>	4.8	1.4
Advanced Heat Pumps	20%	n/a	1.8	2.5
Appliance Standards	n/a	n/a	22.2	4.7

<sup>1</sup> Homes with gas heaters  
<sup>2</sup> Homes with electric heaters



**Summer 1995:**

Mass market debut of "Golden Carrot™" central air conditioners



**Summer 1995:**

Five additional Appalachian mines recovering methane (total 16)



**Fall 1995:**

Launch Energy Star program for small consumer appliances



**Fall 1995:**

Green Commercial Cooking - 15 national restaurant chains commit

# U.S. ACTIONS TO CURB CARBON DIOXIDE EMISSIONS

*U.S. Views on Global Climate Change, Department of State, April 1992 (continued)*

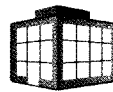
Action/Description	Potential Technical Improvement	Year 2000 Market Penetration	Electric Energy Savings (BkWh)	Year 2000 Carbon Reduction (MMT C)
<b>Residential Space Heating</b>				
- New	20%	8%		
- Old	10%	10%	2.4	0.5
<b>Residential Central Air Conditioning</b>	29%	40%	9.6	2.0
<b>Residential Room Air Conditioning</b>	19%	40%	1.2	0.3
<b>Residential Cooking</b>	8%	40%	1.2	0.3
<b>Commercial Cooking</b>	20%	30%	1.8	0.4
<b>Industrial Electrolytics</b>	20%	13%	1.8	0.4
<b>Amorphous Core Transformers</b>	70%	25%	9.0	1.9
<b>Miscellaneous Residential and Commercial End Uses</b>	13%	40%	15.0	3.1
<b>Better Refrigerants</b>	5%	80%	8.2	1.8
<b>Tire Inflation, Auto Inspection and Maintenance, etc.</b>	n/a		n/a	3.0
<b>1991 Transportation Act</b>	n/a	n/a	n/a	4.0
<b>Subtotals: Gross Additional Carbon Actions</b>			<b>306-429</b>	<b>75-108</b>

<sup>1</sup> Homes with gas heaters  
<sup>2</sup> Homes with electric heaters



**1996:**

India markets super-efficient non-CFC refrigerator



**1996:**

Green Buildings Partners reach 4 billion ft<sup>2</sup>



**1996:**

Green Lights Partners upgrading 10 billion ft<sup>2</sup>



**1996:**

500,000 solar thermal water heaters installed nationwide



**1996:**

Utilities installing amorphous core transformers approach 10% of total



## ACTIONS TO CURB CARBON DIOXIDE EMISSIONS—SUBTOTALS

	Electric Energy Savings (BkWh)	Year 2000 Carbon Reduction (MMT C) <sup>1</sup>
Gross Additional Carbon Actions	306-429	75-108
Less:		
National Energy Strategy Integrated Resource Planning	-116	-24
Consumer Response to Lower Prices <sup>2</sup>	-38	-8
<b>Additional Carbon Actions (Net of NES and Consumer Response)</b>	<b>152-275</b>	<b>43-76</b>
Plus:		
Actions in President Bush's NES Proposals		
— Efficiency Improvements and Integrated Resource Planning		
— Natural Gas Regulatory Reform		
— Expanded Use of Biofuels		
— R&D for Renewables, Transportation, and Energy Efficiency		
— Provide Framework for Additional Actions (previous pages)	128	45
<b>Total Carbon Reductions</b>	<b>281-402</b>	<b>87-121</b>

Carbon Sinks  
— “America the Beautiful” and Other Forestry Programs

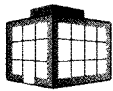
<sup>1</sup> Reductions are in millions of metric tons of carbon equivalent in the year 2000. These projections are sensitive to assumptions regarding energy prices, economic growth, and technology penetration over the next decade. Future projections will change as the actions list is updated, as events affecting the energy markets and the economy unfold, and as the effects of current actions are seen.

<sup>2</sup> This value (12% to 20% of the electricity savings) is included as an adjustment for increases in demand for energy services that will result as the introduction of these efficient technologies lower consumer costs. The actual “rebound” effect may vary significantly from this value.

## ACTIONS TO CURB METHANE AND NITROUS OXIDE EMISSIONS

	Year 2000 Carbon Equivalent Reductions (MMT C) <sup>1</sup>	
	@CH <sub>4</sub> GWP = 11	@CH <sub>4</sub> GWP = 22
Methane		
Methane Capture/Landfills	19	39
Methane Capture/Livestock Waste Lagoons	3	7
Methane Capture/Coal Mines	0-3	0-6
Livestock Dietary Program	3	6
<b>Total Methane Reduction</b>	<b>25-28</b>	<b>52-58</b>
Nitrous Oxide		
Green Nylon Program	8-12	8-12
<b>Total Other Gases</b>	<b>33-40</b>	<b>60-70</b>
<b>Total Greenhouse Gas Emissions Reductions (Carbon and Other)</b>	<b>125-170</b>	<b>152-200</b>

<sup>1</sup> Reductions are in millions of metric tons of carbon equivalent in the year 2000. These projections are sensitive to assumptions regarding energy prices, economic growth, and technology penetration over the next decade. Further projections will change as the actions list is updated, as events affecting the energy markets and the economy unfold, and as the effects of current actions are seen.



1997:

Energy-efficient heating, ventilation, air conditioning (HVAC) technologies installations in 5% of nation's space



1997:

50 million Americans cook with improved efficiency products



1998:

Green Motors penetrates 10% U.S. market



1998:

Energy-efficient room air conditioners hit 20% of market

1998:

“Golden Carrot™” heat pumps cut electric bills \$70 million