

CONDITIONS UNDERLYING THE DEVELOPMENT AND IMPLEMENTATION OF “BEST PRACTICE” POLICIES AND MEASURES IN THE U.S. INDUSTRIAL SECTOR¹

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Abstract: *This paper describes the necessary conditions for the development and successful implementation of "best practice" policies and measures in the United States industrial sector. Nine policies and measures are described that exemplify the qualities of "best practice." They are Motor Challenge, Energy Star, Climate Challenge, Climate Wise, the Voluntary Reporting of Greenhouse Gases program, Industrial Assessment Centers for small and medium-sized establishments, and the Industries of the Future and the Partnership for a New Generation of Vehicles programs. Also included is the Federal effort underway to develop a national framework for electricity restructuring (the Comprehensive Electricity Competition Act).*

Policies and measures containing elements of best practice satisfy the following necessary conditions:

- < *recognize sub-sectoral and regional diversity*
- < *promote win-win measures where multiple benefits can accrue (e.g., increased energy efficiency and greenhouse gas reductions, as well as dollar savings and productivity improvements)*
- < *match the policy design to the key attributes of the end-use markets & technologies*
- < *promote cost-effective implementation*
- < *ensure accountability*
- < *promote public education and outreach*
- < *focus continuously on long-term changes in technology*
- < *ensure policy cooperation at all levels of government*
- < *provide industry with a sense of "ownership" in the process of technical change*

Specific examples are selected to illustrate how these conditions are addressed by U.S. industrial policies and measures. U.S. industrial policies and measures have proven to be effective. This is evidenced by: (a) observed changes in end-use markets that reflect increased market impact, (b) behavioral and attitudinal changes favoring increased energy efficiency and emission reduction, (c) documented energy savings and greenhouse gas emission reductions, (d) cost-effective implementation, and (e) significant technical achievements that are a direct result of nationwide technology challenges. @

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1. Introduction

This paper examines several "best practice" policies and measures in the United States industrial sector, and identifies the conditions underlying their successful development and implementation. Nine industrial policies and measures that embody the key characteristics of "best practices" are briefly described.² They are Motor Challenge, Energy Star, Climate Challenge, Climate Wise, the Voluntary Reporting of Greenhouse Gases program, Industrial Assessment Centers for small and medium-sized establishments, and the Industries of the Future and the Partnership for a New Generation of Vehicles programs³. Also included is the Federal effort underway to develop a national framework for electricity restructuring (the Comprehensive Electricity Competition Act). These nine programs are not a comprehensive listing of U.S. industrial policies. After describing the range of best practice policies in the U.S. industrial sector, the paper focuses on a few of them to illustrate the conditions that underlie their successful performance.

In 1997, industrial energy consumption accounted for 37 percent of the total U.S. primary energy use and resulted in greenhouse gas (GHG) emission reductions of more than 490 million metric tons of carbon equivalent. The United States employs a variety of strategies to promote the efficient use of energy and the reduction of GHG emissions by industry. Multiple, complementary measures are employed -- such as, voluntary programs, technical assistance and information activities, research and development (R&D) collaboratives, and investment enabling programs. In the U.S., establishing cooperative relationships between government at all levels, industry, and the public has proven to be a productive way to achieve policy successes.

The next section briefly describes the "best practice" policies and measures for the U.S. industrial sector.⁴ The conditions underlying their development and successful implementation are discussed in Section 3. Specific examples of how policies address these conditions are highlighted. Section 4 shows how industrial policies and measures that satisfy the necessary conditions for "best practice" are producing results.

² The U.S. Environmental Protection Agency's HFC, PFC, and SF6 emission and methane reduction programs also exemplify qualities of "best practice" policies and measures. They are not addressed in this paper (see paper by Sally Rand and Reid Harvey).

³ The Partnership for a New Generation of Vehicles program is discussed further in the Transportation session (see presentation by Kevin Green).

⁴ These policies have been described in detail in the policies and measures documentation prepared for the G8 Environmental Futures Forum, 14-15 February 2000, and in the UN submission (UNFCCC/SBSTA/1999/MISC.10), August 1999.

2. "Best Practice" Policies and Measures⁵

The nine policies and measures are briefly described.

Motor Challenge program -- The Motor Challenge program was created by the Department of Energy (USDOE) in 1993 as an industry/government partnership designed to help industry tap into more than 100 billion kilowatt-hours per year of potential electricity savings. The goal of the Motor Challenge program is to achieve approximately 15% of this reduction potential by the year 2010. According to analysis by the USDOE, 11 to 18 percent of the energy currently used by plant motor systems (motors, drives, and motor-driven equipment) can be eliminated by use of mature, proven, cost-effective technologies.

The Motor Challenge program is directed at market transformation for motor systems. The Motor Challenge program is unique among initiatives addressing electric motors because it encourages a "systems approach."⁶ It is a market transformation program because it seeks to shift the market from an exclusive focus on motor efficiency upgrades to a whole system performance improvement.

Motor Challenge provides technical assistance, tools, training, and other resources to help plants identify opportunities to make operations as efficient as possible with today's best technologies and management practices. Motor Challenge offers its partners a broad array of information support tools, such as the MotorMaster+3 and ASDMaster decision support software tools, the Pump Systems Assessment Tool, regional conferences and technical/management training events, and audit services or assistance.

Several new Challenge programs -- the Steam Challenge, the Compressed Air Challenge, and the Combined Heat and Power Challenge -- have been developed as a result of the tremendous success of the Motor Challenge program.

Energy Star program -- Energy Star is a voluntary program designed to remove market barriers to the purchase of energy-efficient products and services in residential, commercial, and industrial sectors. It is administered jointly by the U.S. Environmental Protection Agency (USEPA) and the

⁵ This section draws heavily on the policies and measures descriptions prepared for the U.S. submission to the G8 Environmental Futures Forum, 14-15 February 2000.

⁶ The "systems approach" includes a focus on the full motor system savings opportunities (e.g., system optimization) rather than just motor efficiency upgrades (e.g., efficiency replacement or rewind practices). System efficiency measures include, for example, performance optimizations, reducing overall load via improved process/system design, improved match between load and component size, use of speed control, and better operations and maintenance. A breakdown of typical manufacturing motor system savings opportunities show that about 65 percent are system-related compared to only 15 percent obtainable from efficiency improvement of the motor component alone.

USDOE. Energy Star products are available for use in the industrial market, including computers and office equipment, lighting, roof materials, and transformers.

Studies show that many businesses could reduce their energy use by 30% by using proven, cost-effective products and investing in simple, profitable building upgrades. However, because of informational, financial and technical market barriers many businesses fail to take advantage of energy-saving opportunities. Energy Star is designed to address market failures that have resulted in under-investment in energy efficiency.

Energy Star offers a national label and logo that establish a common definition of energy efficiency for its targeted products. It provides consumer education via public service advertisements, media events, and other outreach materials. Decision support tools are developed for use by product manufacturers, retailers, and electric utility efficiency programs. A new building benchmarking tool allows building owners to determine whether their buildings have good or poor energy performance.

Climate Challenge, Climate Wise, and the Voluntary Reporting of Greenhouse Gases Programs --These three programs provide companies and businesses with the opportunity to create a public record of their commitments, planned actions, emissions, emission reductions, or sequestration achievements.

Climate Wise (manufacturing industry) and Climate Challenge (electric utility industry) are comprehensive voluntary programs that encourage and recognize companies that undertake energy-efficiency improvements and reduce their GHG emissions. Climate Challenge is a joint effort of the USDOE and the U.S. electric utility industry to reduce, avoid, or sequester greenhouse gases. In 1999, the Climate Challenge program comprised some 124 agreements, representing 71 percent of 1990 electricity generation. Climate Wise is a program of the USEPA that works with industrial companies to develop action plans, document cost savings, productivity benefits, and emission reductions. The program has more than 550 individual manufacturing companies participating, representing 13% of U.S. industrial energy use.

Climate Challenge and Climate Wise participants report through the Voluntary Reporting of Greenhouse Gases Program (also known as the 1605b program). The 1605b program establishes a national public reporting framework, forms, instructions, and guidelines. Private sector entities can create a public record of their emission reductions or sequestration achievements. Reductions reported through the 1605b program include emissions of all GHGs from 1987 onward, and emission reductions and sequestration achieved from 1991 onwards. Each gas is separately reported. Collateral information is also collected for ten categories of projects. For example, data is collected on energy consumed, saved, fuel switching, operating data, participation in other U.S. voluntary programs, and information on estimation methods used. The program has developed an integrated software system that links the electronic reporting form to data check routes and a public use database.

The Climate Challenge, Climate Wise, and the Voluntary Reporting of Greenhouse Gases programs complement each other. The Climate Challenge and Climate Wise programs provide a comprehensive framework for encouraging and recognizing reductions. Each program offers a range of tailored technical assistance services to participating companies. On the other hand, the 1605b program offers few support services. However, it establishes a standardized mechanism by which corporations, government agencies, individuals, trade associations and other organizations can voluntarily report any actions taken that have or are expected to reduce/avoid emissions of GHGs.⁷

Industrial Assessment Centers for small and medium-sized establishments -- The Industrial Assessment Center program (also called the IAC program) is administered by the USDOE. It is an audit program for small and medium-sized establishments with a "total systems" focus (i.e., energy, waste and productivity efficiency). Some thirty accredited universities across the U.S. serve as centers to undertake energy and industrial assessments. Assessments are done at no cost to the participating manufacturing plants by teams of engineering faculty and students. An average of twenty-five assessments is conducted by each center annually. More than 9,000 energy and industrial assessments have been undertaken since the program's inception in 1976. In addition to the assessments provided to manufacturing plants, the IACs also provide engineering students with hands-on industrial experience in identifying opportunities at plants for improving energy, productivity and waste efficiency.

Industries of the Future program -- The Industries of the Future (IOF) program, administered by the USDOE creates partnerships between industry, government, and supporting laboratories and institutions to accelerate technology research, development, and deployment. The IOF program is being implemented in nine energy and waste-intensive industries in the U.S. -- agriculture (bio-based feedstocks), aluminum, chemicals, forest products, glass, metal casting, mining, petroleum, and steel. These industries account for more than 80 percent of all U.S. manufacturing energy consumed and waste generated.

Each participating industry, with USDOE support, produces a *Vision* of its desired future that describes long-term (e.g., 20 years) industry-wide market and technical challenges, and identifies priority R&D needs. "Visions" are followed by the development of Technology Roadmaps that define the critical near-, mid-, and long-term technologies and prioritized research pathways. Based on the "Vision" and "Technology Roadmap" documents, coordinated national research projects are undertaken using shared funding and the scientific expertise of industry and USDOE and its national research laboratories. Research and development projects are designed to provide industry-wide benefits, rather than focus on technologies for specific products that would benefit only a few companies.

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Entities voluntarily report to the USDOE's Energy Information Administration.

The IOF approach has proven to be an effective model of an industrial policy approach designed to reduce the cost and risk of R&D through coordinated access to scientific resources aimed at specific technology goals.

Partnership for a New Generation of Vehicles -- In 1993, the United States Government (seven federal agencies) and the Chief Executive Officers of the three major domestic automakers -- Daimler-Chrysler, Ford, and General Motors -- announced a cooperative research effort called the Partnership for a New Generation of Vehicles (PNGV). Other partners in the program include the U.S. Council for Automotive Research (USCAR) and 20 national research laboratories.

PNGV established an unprecedented technical challenge for the automobile industry to develop and produce by 2004 multiple production-ready prototype automobiles (midsize cars) able to achieve 80 miles per gallon without compromising emissions, safety, performance, and affordability.

Government and industry jointly fund R&D on the very high efficiency passenger automobile designs. The research addresses, for example, vehicle engineering technology, engine and drivetrain efficiency improvements, fuel cells, power electronics, lightweight body parts, and manufacturing processes.

Electricity Restructuring -- Twenty-four states in the U.S. have restructured their electricity markets. At the Federal level, the Comprehensive Electricity Competition Act (CECA) has been introduced. The CECA recognizes local experience and expertise by building upon state restructuring plans implemented to date. The CECA is designed to address the need for a national framework for management of electricity restructuring, while also recognizing that states have historically regulated their electric utility industry in ways that meet local circumstances. The CECA would require states to implement retail competition by 2003, but would give them considerable flexibility to address their unique needs. For example, a state would be permitted to **opt-out** of the Federal restructuring requirement, if the it determines an alternative policy better serves electricity consumers.

The CECA policy relies on market forces to improve efficiency, thereby delivering environmental benefits. As such, it contains seven specific complementary instruments designed to promote investments in energy efficiency, renewable energy, distributed power and combined heat and power (CHP) technologies. The seven instruments are (1) renewable portfolio standard, (2) tradable renewable electricity credits, (3) a public benefits fund, (4) consumer information disclosure requirements, (5) net metering, (6) tax incentives to promote clean energy, and (7) removal of regulatory barriers to the greater adoption of CHP systems.

\$ Renewable Portfolio Standard -- A Federal Renewable Portfolio Standard would be adopted to require all electricity sellers to cover a percentage of their electricity sales (up to 7.5% by 2010) with generation from non-hydroelectric renewable technologies.

- \$ Tradable Renewable Energy Credits -- A system of tradable renewable energy credits would be used to ensure implementation of the Renewable Portfolio Standard at least cost.
- \$ Public Benefits Fund -- A public benefits fund of up to US\$3 billion would be established to provide matching funds to states to support low-income assistance programs, consumer education, and encourage development of renewable and energy-efficiency programs.
- \$ Consumer Information Disclosure -- Electricity suppliers would be required to disclose basic information on prices, terms and conditions of service, fuel sources used, and generation emissions profile. Consumers could then make informed purchase decisions based on this information. The information could also serve to facilitate the creation of "green markets" that could lead to significant penetration of low- and no-carbon technologies in the electric sector.
- \$ Net Metering -- This provision would allow consumers to offset their purchases from retail electricity providers with electric energy generated by the consumer at a small, on-site renewable generating facility (less than 20KW) and delivered to the distribution system. Distribution service providers would be required to allow the facilities to interconnect subject to appropriate safety standards.
- \$ There are two tax proposals in the CECA intended to promote the use of clean energy. One would establish a depreciation schedule for distributed power technologies used in industrial, commercial or residential applications.⁸ The other would provide an 8 percent investment tax credit for CHP systems placed in service in 2000 through 2002.
- \$ Removal of regulatory barriers to greater adoption of CHP systems may be necessary. Regulatory reform actions could include creating a uniform interconnection standard for all generators, streamlining permitting procedures for these technologies and clarifying air permitting rules.

3. Necessary conditions for "Best Practices"

The policies and measures in the U.S. industrial sector contain the following elements of best practice. They,

- < recognize sub-sectoral and regional diversity
- < promote win-win measures where multiple benefits can accrue
- < match the policy design to the key attributes of the end-use markets & technologies
- < promote cost-effective implementation

⁸ The provision would be assigned a 15-year recovery period for the purposes of depreciation. In general, distributed power systems are currently assigned a 39-year lifetime.

- < ensure accountability
- < promote public education and outreach
- < focus continuously on long-term changes in technology
- < ensure policy coordination between government at all levels
- < provide industry with a sense of ownership in the process of technical change

For each of these conditions, specific examples of policies and measures (drawn from those listed in Section 2) are selected to illustrate how the conditions for **Best practice** are satisfied.

Recognize sub-sectoral and regional diversity

In the United States, "best practice" policies and measures operate under the principle that "one size does not fit all." They recognize diverse industries and range of technologies, and deal with the realities of sub-sectors on their own terms.

For example, the Industries of the Future (IOF) program is organized around sub-sectoral boundaries, in part, because of the diverse source and nature of energy consumption and waste generation in industry sub-sectors, as well as differing long-term market and technical challenges.

The Comprehensive Electricity Competition Act (CECA) builds a national yet flexible framework that can fit different regional circumstances of the States (e.g., different resource endowments, structures of electric retail consumer markets, and types of utilities -- investor-owned, cooperatives, publicly-owned) that effect electricity restructuring implementation decisions. The CECA encourages states to implement retail competition and pursue environmental programs while providing them with flexibility to meet their unique, local needs.

Promote win-win measures where multiple benefits can accrue

"Best practice" policies and measures take a broad view of benefits the policies can bring (e.g., reductions in energy use and GHG emissions, reduced waste, dollar savings, and productivity improvements). Moreover, they encourage industries to integrate efficiency measures into their corporate structures.

For example, in addition to saving energy and reducing carbon dioxide emissions, companies participating in Climate Wise are undertaking more than 500 waste reduction, water conservation, and pollution prevention actions. Small and medium-sized establishments participating in the Industrial Assessment Center (IAC) program implement recommended actions that result in energy and dollar savings, as well as waste reduction and productivity improvement measures. Likewise, companies in the Motor Challenge program have demonstrated that non-energy (i.e., productivity improvement) cost benefits can be equal or greater than energy-related cost benefits.

Match the policy design to the key attributes of the end-use markets & technologies

Policies and measures that exhibit elements of best practice account for different end-use and technology market conditions, and address specific market dynamics and barriers. The Motor Challenge and Energy Star programs are two good examples of this. Each program was designed

to remove specific informational, financial and technical market barriers for their targeted technologies/products.

Motor Challenge attacks specific market barriers that inhibit the more widespread adoption of the "systems approach" to motor applications. During the early phases of implementation of Motor Challenge, three years of extensive field research was undertaken to determine why energy-efficient motor systems were not more prevalent among industrial end-users. Five market deficiencies were identified -- (1) inadequate coordination and leadership among diverse motor efficiency programs, (2) information deficiencies, (3) weaknesses in the functioning of the electric motor system market segments (e.g., markets for motors, pumps, fans and blower, and air compressor systems, and adjustable speed drives), (4) lack of broad-based technical expertise, and (5) lack of a long-term economics focus in end-user decision-making. Motor Challenge was built on specific strategies designed to directly address these market barriers.

Energy Star addresses three market barriers that have resulted in under-investment by consumers and manufacturers in energy efficiency: (1) lack of objective information, (2) confusion in the definition of efficiency and comparability of competing products, and (3) higher purchase prices for many efficient products.

Promote cost-effective implementation

Both the Climate Challenge and the Climate Wise programs help companies identify and implement cost-effective activities. Although companies traditionally use payback rates for energy investment decision-making, "best practice" programs encourage them to undertake investments based on life-cycle cost. U.S. policies and measures themselves promote cost-effective implementation. Programs must prove to be cost-effective at, for example, leveraging private sector investments against Federal expenditures with the aim of achieving significant energy savings and emission reductions, nationwide.

Ensure Accountability

"Best practice" policies and measures in the United States have mechanisms to facilitate the collection and archiving of information to quantitatively track progress. This includes information systems, methods/tools for evaluation and performance tracking, demonstration of energy savings or emission reductions, and in some cases external review or oversight by a domestic institution.

Information systems –

C The IAC program maintains an extraordinary and extensive database of information on more than 9,000 assessments conducted to date. This database provides plant and sector-specific actual data on recommendations and their implementation. Anyone interested in a particular type of manufacturing industry can access data that shows the most frequently recommended and implemented opportunities for improving energy, waste, and productivity efficiency. This information is used to help small and medium-sized establishments prioritize their energy savings, waste reduction and productivity improvement investments. The information can also be used for benchmarking.

- C The 1996 Industrial Electric Motor Systems Market Opportunities Assessment -- conducted by the Motor Challenge program -- provides a detailed and highly differentiated portrait for baseline motor inventory, energy use, and operating practices in the industrial end-user markets. For a statistically representative sample of manufacturing facilities, the profile of the stock of motors and motor-driven equipment used in manufacturing is now known. In addition, the Market Assessment provides the first ever profile of current motor system "practices" for motor replacement patterns, rewind vs. replacement decisions, purchase practices, maintenance practices, practices concerning the use of system efficiency measures, and motor sizing practices. The Market Assessment data provides the Motor Challenge program with a strong statistical basis for characterizing national motor systems baseline conditions. It thus provides the information needed to model the change in the motor systems inventory and purchase and maintenance practices over time. The market transformation effects associated with the Motor Challenge program can be measured against the baseline conditions.

- C For the Energy Star program, the USEPA has developed a database -- called the Strategic Tracking And Recruiting (STAR) database -- that tracks the overall progress of its program participants. STAR can be used to evaluate whether company equipment upgrades are generating the expected energy savings and emission reductions. The USEPA collects facility-by-facility and technology specific reports on actions taken by Energy Star participants. The company or business reports what technology has been installed and what it is replacing. From this and other reported data, USEPA can calculate the energy savings, cost savings and carbon savings associated with each upgrade. The STAR database currently maintains information on more than 80,000 organizations. All data undergo a quality assurance and control review by USEPA technical staff. An automated electronic inspection checks the information provided to STAR to ensure the integrity of reported energy savings numbers and to document trends in overall achievements and accomplishments.

- C One of the most important purposes of the Voluntary Reporting of Greenhouse Gases program (1605b program) is data preservation. Reporting to the program allows reporters to archive information on their GHG emissions and their efforts to reduce these emissions (or offset them by sequestering carbon) in a public database. By preserving data, reporters are seeking to avoid being penalized under any such future scheme for actions to reduce emissions undertaken now on a voluntary basis. Like the USEPA's STAR data system, information reported to the 1605b database is also checked to ensure its integrity. The USDOE's Energy Information Administration reviews the reported information for plausibility, internal consistency, accuracy of calculation, and comparability with other sources of information.

Methods/tools for evaluation and performance tracking" --

- \$ The Climate Wise program has developed an innovative Emissions Tracking Software tool designed to help companies monitor their GHG emissions and track the results of their emissions reduction projects. The software enables companies to easily generate Climate Wise Action Plans and Voluntary Reporting of Greenhouse Gases reports.

- C MotorMaster+3 decision support software, available to Motor Challenge program participants, contains a Savings Tracker designed to help companies document energy savings and illustrate the energy, dollar and environmental benefits of in-plant motor systems.

Demonstration of energy savings or emission reductions --

- C The Motor Challenge program encourages participating companies to demonstrate the benefits of efficient systems. Some twenty companies have provided detailed case studies of how they have undertaken improvements in their electric motor systems and verified the energy savings and associated waste reduction and productivity improvements. These case studies are widely disseminated and provide direct examples of the range of benefits that can be captured from efficiency upgrades and application of motor system optimization concepts. Other companies are encouraged to document their savings, thus creating a stronger market for efficient motor systems.

External review or oversight --

- C The National Research Council (NRC) **B** the operating agency of the U.S. National Academy of Sciences and the National Academy of Engineering -- provides external oversight of the PNGV program. Annual independent technical reviews by the NRC of the PNGV program are publicly available. This external oversight helps ensure the effective implementation of the PNGV program.
- C The Climate Wise and Climate Challenge programs include an Action Plan review process to help ensure plans contain aggressive strategies and goals that are appropriate for each company.

Promote public education and outreach

The Energy Star Program produces public service advertisements, media events, brochures, and other outreach materials to educate consumers about the economic and environmental benefits of energy-efficient products.

The Consumer Information Disclosure provision of the CECA, besides helping consumers make informed decisions would also serve to create new markets for "green" power.

Climate Wise has developed a model for information dissemination -- called the Climate Wise Peer Exchange Partnership -- that facilitates **A**business to business@exchanges. Companies meet on a quarterly basis to share information on successful projects and approaches to industrial energy efficiency. Each meeting is held at the site of a different partner company. Each host presents their action plan and the elements that have been most successful.

Focus continuously on long-term changes in technology

The Industries of the Future (IOF) and the Partnership for a New Generation of Vehicles (PNGV) programs offer innovative and emerging approaches for addressing national technological challenges over the 2004 and beyond time frame. These two programs have pursued technical challenges by establishing national research efforts based on coordinated funding and scientific

resources. Government, national laboratory experts, companies, and supplier levels are all focused on producing specified advanced technologies.

Ensure policy coordination between government at all levels

Effective government-to-government coordination is a condition satisfied by **A**best practice@ policies and measures.

Federal government agencies working in a mutually consistent manner to achieve a common goal is an example of effective policy coordination. The USEPA is working to identify and remove regulatory barriers to greater adoption of combined heat and power systems. Examples of barriers are: environmental permitting processes that fail to account for the increased energy efficiency of combined heat and power systems and inconsistent standards for connecting new generators to the transmission grid. Policy coordination between the USEPA and the USDOE is necessary for the success of electricity restructuring (e.g., the proposed CECA) and the implementation of the new Combined Heat and Power Challenge program.

Some Federal programs are effective in coordinating with government agencies at the state-level. For example, thirty Climate Wise State and Local Government Allies are building technical assistance capacity at the state and local level and forming productive partnerships with hundreds of local businesses. A second example is the IOF program, where some twenty states are actively involved in the program and have developed industry-specific action plans and R&D project proposals. The IOF program also works with states to facilitate the development of state/region-specific approaches to technology research and transfer.

Providing industry with a sense of "ownership" in the process of technical change

The Motor Challenge program -- which focuses on available best technologies and management practices -- brings together industry, market supplier and service agents, and associations to facilitate efficient market development. For example, the program has attracted more than 200 Allied Partners. Non end-users -- such as original equipment manufacturers, distributors, utilities, State energy agencies, and engineering firms -- actively support the program. Allied Partners have disseminated program information and offered related motor system initiatives to well over 10,000 customers. For market transformation to succeed on a national scale, end-users (e.g., customers) and non end-users must work cooperatively toward mutual **A**win-win@ goals. Motor Challenge facilitates active stakeholder involvement in the process of market transformation.

Both the IOF and PNGV programs act as a catalyst in bringing together many firms and national laboratories and others to pool risk, investment, and expertise in developing advanced technologies. They show what can be accomplished when government and industry cooperate. Each is built on a strong foundation of stakeholder involvement, particularly in the early stage of policy formulation (e.g., regular Government-industry dialogue, industry consultation processes, public hearings). One specific example is the IOF program where the USDOE works actively with multiple research organizations and industry associations to establish R&D collaboratives. For example, the effort to develop the U.S. Chemical Industry's **A**Technology Vision 2000"

document involved participation by the American Chemical Society, the American Institute of Chemical Engineers, the Chemical Manufacturers Association, the Council for Chemical Research, and the Synthetic Organic Chemical Manufacturers Association. By giving industry a sense of "ownership" in the process of technical change, the IOF strategy obtains industry commitment to research, and facilitates industry cost sharing. Moreover, industry's involvement essentially ensures adoption and use of the successful energy-efficient technologies.

4. Our "Best Practice" Policies and Measures are Working

U.S. industrial policies and measures are effective because they satisfy the conditions outlined in Section 3. That U.S. industrial policies and measures are working is evidenced by:

- (1) changes in end-use markets that reflect increased market impact;
- (2) behavioral and attitudinal changes favoring increased energy efficiency and emission reduction;
- (3) documented energy savings and GHG emission reductions;
- (4) cost-effective implementation; and
- (5) significant technical achievements that are a direct result of nationwide technology challenges.⁹

Evidence that markets are changing

Motor Challenge (motor systems) and Energy Star (lighting and building technologies) are programs that comprehensively address factors necessary to ensure long-term, sustainable markets for energy-efficient technologies/products.⁹ There is evidence over the past four or more years that change is occurring in the motor systems and the lighting/building technology markets. For example,

- \$ With the Motor Challenge program there has been an emergence of "system optimization" services. Training curriculum and communication programs to help professionals become more proficient in the use of system optimization practices have been developed by State energy centers (e.g., Energy Center of Wisconsin) and trade associations (e.g., Hydraulic Institute). Several thousand plant managers and energy service professionals have received a motor system optimization training over the past four to five years. Demand for "systems optimization" skills is rapidly growing.
- \$ The Energy Star program assists in the transformation of the industrial sector to the production of more climate-friendly products. For example, more than 98% of all office equipment sold meets energy star levels of performance, up from nearly zero before the start

⁹ The factors necessary to establish sustainable market transformation include: service availability and marketability, availability of adequate technical expertise in the marketplace, information management and technical accessibility, and tracking and evaluation.

of the program. In this way, industrial manufacturers upgrade the quality and performance of their products and the potential to increase market share.

Evidence of behavioral and attitudinal changes favoring increased energy efficiency and emission reduction

Companies are much more focussed on energy efficiency and emissions reduction. For example, Climate Challenge, Climate Wise, and the Industrial Assessment Center (IAC) programs have produced significant shifts in the corporate culture and philosophy of U.S. companies.

The following are just a few examples of behavioral and attitudinal changes that have occurred as a result of policy interventions.

- C A recent IAC program impact evaluation offers preliminary results that suggest this policy intervention is accelerating the shift to more advanced energy efficiency decision-making habits in small and medium-sized establishments. The preliminary findings (based on a small sample of plants) suggest that because of the IAC policy intervention, the energy-savings investment habits of small and medium-sized plants over time are moving from a state of "little or no" energy savings decision-making to more advanced stages of decision-making (e.g., "routinization", "inculturation", or "continual, vigilant")¹⁰. One result reported was that before the IAC policy intervention only 5% of client plants in the sample were categorized in the advanced stages of decision-making regarding energy savings investments. After the IAC intervention some 62 percent of client plants in the sample were categorized as having advanced decision-making habits.

- C The IAC program has also trained more than 1,500 engineering students who have participated in the program as auditors. For example, many students who participated in the program have used their IAC experience in the jobs they later find in industry. Based on a recent survey of a sample of IAC alumni and their employers, the alumni appear to be particularly successful in helping their companies achieve cost and energy savings (e.g., by establishing in-house conservation programs). The benefits of the IAC program appear to go beyond the energy and industrial assessments undertaken as part of the direct program intervention at plants.

Over the years, the number of companies reporting emission reduction actions and emission reductions to voluntary industry programs has grown significantly.¹¹

¹⁰ i.e., where identification and implementation of energy savings opportunities is done increasingly more and more on a routine, continuous improvement basis.

¹¹ It should be noted that the totals cited below are based strictly on claims of emissions reduction by companies, as reported to the various voluntary programs. However, Climate Wise and Climate Challenge do perform reviews of Action Plans, and the 1605b program undertakes consistency checks to help ensure the integrity of reported emission actions and reductions.

- \$ In 1998, Climate Wise Partners reported reduced GHG emissions by nearly four million metric tons of carbon equivalent and US\$500 million in savings. Climate Wise Action Plans document more than 2,600 energy efficiency and environmental performance measures.
- \$ Electric utilities estimate their pledged emissions reductions to the Climate Challenge program to be as much as forty-seven million metric tons of carbon equivalent by the year 2000.
- \$ During 1995, the first reporting cycle year of the Voluntary Reporting of Greenhouse Gases program, 108 entities submitted reports on GHG emissions reduction actions in 1994 with corresponding claims totaling 74 million metric tons of carbon equivalent (MMTCE). During the 1997 reporting cycle year (reports on actions taken during 1996), these numbers increased to 149 entities and 154 MMTCE reductions. These totals reached 189 entities and reductions of 253 MMTCE, for actions taken during 1998, which were reported to the program during the 1999 reporting cycle year.

Although U.S. policies and measures do not claim to be a catalyst for industry action in all cases, by raising the "energy savings/emission reductions" awareness of management in corporations throughout the U.S., they have had an influence on behavior. Examples include:

- \$ The DuPont Corporation was the first company to join the Climate Wise Program in 1994. DuPont developed an aggressive action plan designed to reduce GHG emissions by eighteen million metric tons of carbon dioxide by the year 2000. In 1995, DuPont undertook a wide range of energy efficiency and environmental performance measures at fifteen facilities. Most of the actions required little or no capital investment, but resulted in more than US\$31 million in cost savings annually. In 1999, the corporation reported that despite a 35 percent growth in production, energy use remained flat over the entire decade. DuPont has also announced an emissions reduction target of 65 percent below 1990 levels by 2010.
- \$ The Mobil Corporation has realized tremendous success as a partner in the Energy Star program. By completing comprehensive lighting upgrades, it has saved more than \$1 million a year and is preventing emissions equal to more than 50,000 metric tons of carbon dioxide. Mobil Corporation's management has embraced the principles of Energy Star and set up their own 'Energy Management Plan' that included all of their facilities around the globe. With this new plan, Mobil is committed to reaching a goal of \$125 million in energy cost savings in five years.
- \$ The IOF program, through its relationship with industry groups, has successfully developed a cooperative framework leading to the establishment, by its IOF partners, of industry-wide performance goals. For example, the Metalcasting Industry seeks to improve productivity by 15 percent, reduce energy use by 20 percent, and increase recycling to 100 percent. The Glass Industry goals by 2020 include the following: (1) operate with production costs at least 20% below 1995 levels; recycle 100% of all glass products in the manufacturing process; (2) reduce process energy use from present facility levels by 50% toward theoretical energy use limits; and (3) recover, recycle and minimize 100% of the available post consumer glass.

Selected energy, environmental, and productivity goals have been established by the other seven IOF industries, as well.

Documented energy savings and GHG emission reductions

Examples of documented savings include:

- \$ In the Motor Challenge program, demonstration projects have been completed by companies such as 3M Company, Bethlehem Steel, General Dynamics, Peabody Coal, and other companies. Over thirteen well-documented demonstrations have shown that motor system efficiency improvements of 33 percent, on average, are achievable by participating companies.
- \$ In 1999, annual reductions of carbon were 0.7 MMTCE for the IAC Program. To date, the total cumulative dollar savings for implemented savings opportunities is US\$428 million, and nearly half of this cost savings are non-energy benefits (associated with waste reduction and productivity improvements). The focus on productively efficiency improvements, in addition to energy, clearly proves why promoting win-win measures where multiple benefits can accrue is one of the conditions for "best practice."

Cost-effective implementation

- \$ The IAC program has proven to be extremely cost-effective, with a benefit cost ratio of about 5.5 to 1 and a leveraging effect of 8 private investment dollars for every 1 public dollar spent.
- \$ Similarly, the Energy Star program has leveraged 15 private dollars for every 1 public dollar spent.

Significant technical achievements that are a direct result of nationwide technology challenges

The PNGV program provides an excellent example of a Government-industry R&D collaborative where major technological breakthroughs are occurring. The recent breakthroughs made by Ford, General Motors, and Daimler-Chrysler in hybrid vehicle technology design are a direct result of the PNGV program. In early 2000, three concept vehicles were unveiled by the PNGV auto-manufacturer partners -- (a) Ford Prodigy, a hybrid diesel and electric family sedan that gets 80 mpg, (b) General Motors Precept, a hydrogen fuel-cell sedan that gets 108 mpg, and (c) Daimler-Chrysler ESX3's 72 mpg diesel-electric hybrid family sedan.

Finally, in the IOF program, industry-wide technology **AVision** and **ARoadmap** documents have been completed by the participating industries. The industries have set specific goals and established portfolios of major R&D activities. Research and development projects are underway.