



Introduction to U.S. Policies to Improve Industrial Efficiency

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This study was commissioned by the Energy Foundation China Sustainable Energy Program to provide Chinese policymakers and industrial energy efficiency practitioners information about U.S. industrial energy efficiency programs and policies. This report was prepared by ACEEE and does not necessarily represent the views of the Energy Foundation. We hope that this information will allow Chinese policymakers and practitioners to learn from what the U.S. has been and is doing, and in the process inform discussions about appropriate programs and policies for China. To serve this objective, both English and Chinese versions of this report are available. A companion report on programs and policies for the buildings sector is being published concurrent with this report.

We expanded upon the original concept of this report to also write for Americans who are new to energy efficiency policies. In that vein, this report is also designed to serve as an “Industrial Energy Efficiency Policy 101” introduction for those who are new to the industrial energy efficiency field and could benefit from a quick tutorial on many of the major programs.

In compiling this report we received information and assistance from many people who are involved in running these different programs. We are very appreciative of their assistance. Helpful comments on a review draft of this report were provided by staff at the Center for Climate and Energy Solutions (C2ES), Energy Pathways LLC, Institute for Industrial Energy Efficiency Network (IEEN), Industrial Productivity (IIP), Pacific Gas & Electric (PGE), World Resource Institute (WRI), and staff and experts associated with the China Sustainable Energy Program. We thank them for their comments and suggestions.

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ABSTRACT

The United States has had a variety of programs to encourage improved energy efficiency in the industrial sector. These programs are operated by the federal government as well as states, utilities, municipalities, and nonprofit organizations. Some of these programs are decades old, though many are more recent.

The federal government has created mandatory minimum performance standards, as well as voluntary standards, both of which result in improved energy efficiency. Though covered only superficially in this report, federal, state, and local governments also provide a wide array of tax incentives to encourage investments in energy efficiency. Generally, these result in a decrease in the taxpayer's income tax or property tax liability.

This report summarizes many of the major efforts, but also includes summaries of less high profile efforts. This study was written with two audiences in mind. First, it was commissioned by the Energy Foundation China Sustainable Energy Program so that Chinese policymakers and energy efficiency practitioners can learn more about U.S. energy efficiency programs and policies, allowing them to learn from what the U.S. has been and is doing, helping to inform discussions about appropriate programs and policies for China. Second, it is designed to serve as an "Industrial Energy Efficiency Policy 101" introduction for Americans who are new to the energy efficiency field and could benefit from a quick tutorial on many of the major programs. To serve these dual objectives, both English and Chinese versions of this report are available.

INTRODUCTION

The United States has an ever increasing variety of policies and programs intended to encourage improved energy efficiency in the industrial sector. The industrial sector, comprised of manufacturing, agriculture, mining, and construction, is different than the residential and commercial sectors in that in general, the organizations are larger, the facilities are more energy-intensive, and how energy is used varies significantly among facilities. As such, industrial facilities have a greater interest in managing their energy costs, and in an effort to do so, have become more educated consumers of energy and more proactive purchasers of energy efficiency services. In addition, because these firms require greater technical knowledge for their core business, they generally have more ready access to expertise that allows them to actively participate in energy management than do most residential and commercial customers.

Government influences the use of energy in the industrial sector in three distinct ways: it creates programs that encourage more effective use of energy; it creates standards for the energy performance of products that companies manufacture or purchase; and it creates regulations that require actions that will result in industrial facilities using more or less energy.

Developing programs to encourage energy efficiency in the industrial sector can be challenging. Although energy savings in the industrial sector often comes at a lower per unit price, programs serving this sector have the challenge of meeting the needs of a heterogeneous mix of customers across widely divergent sectors. Projects can be complex, have demanding timelines, and be required to meet strict rates of return.

To encourage industrial firms to prioritize energy efficiency projects, many government agencies, energy utilities, public benefit funds, and nonprofit organizations have created financial and technical assistance programs. The number and variety of programs has increased in recent years as the success of older programs has proven their worth.

Over the past forty years, many performance standards have been created that establish the efficiency of consumer and commercial products. This has had a profound impact on the energy consumption of the nation and the industrial sector is no exception.

Government agencies have the authority to set minimum performance standards for common industrial products such as motors, fans, pumps, and compressors. In addition to legislated performance requirements, many trade, technical, and professional organizations establish voluntary testing and labeling standards that drive customer expectations and thereby improve the average efficiency of products in the marketplace.

While some regulations directly impact energy use through efficiency mandates, other regulations affect energy use indirectly and not always for the better. For example, safety and environmental requirements often require the installation of additional energy-consuming equipment such as exit signs (for employee safety) and pollution control systems. Though the net benefit to people and the environment is greater, energy use can increase. There are also positive indirect efficiency benefits from non-energy-related policies and programs. A recent change in an air pollution regulation allows

facilities to substitute combustion efficiency for the installation of control systems. Programs that help manufacturing companies implement advanced manufacturing practices also help them reduce energy use.

The intent of this report is to provide a summary of the major national and regional efforts to promote energy efficiency in the industrial sector, and provide illustrative examples of statewide and local programs. The volume of local programs is such that all of them could not be identified or described within a report of this size. Instead, we provide a general description and two or three examples—ideally, enough to provide the reader with an understanding of the concept and source of the program or policy. It is important to keep in mind that although the more locally focused programs and initiatives are limited in geographic scope, they collectively contribute the majority of the nation’s non-regulatory industrial energy efficiency efforts.

STRUCTURE OF REPORT

The body of this report is divided into three sections: I. National; II. Regional, State, and Local; and III. Market Actors. The first two focus on programs and policies, while the third focuses on organizations that exist outside the government sphere, but drive change in the marketplace. In each subsection we describe the program, program dates, budgets, and results. In addition we provide references and links for more information on each program and policy.

There is overlap between programs and between layers. Many federal programs often fund state or regional organizations that tailor product offerings to meet local needs. Some programs such as the ENERGY STAR® program are a result of cooperation between two or more federal agencies. Few programs focus exclusively on research, development, deployment, financial, or technical assistance, and so are likely to show up in multiple subsections.

The multitude of resources, overlapping of programs, and the labyrinth of policies all combine to a rich offering of programs, but make a search for assistance complicated and challenging. This is true whether one seeks to understand the network of programs and regulations for policy purposes or is searching for help to reduce energy use. Table 1 below is intended to simplify this search by providing an overview of the many program types covered in this report and lists the organizations or types of organizations likely to provide them. Readers may find it useful to refer back as they progress through this report.

Table 1: Matrix of Resources by Source and Type

Entity	Financial Assistance - Rebates	Financial Assistance - Grants	Financial Assistance - Financing	Technical Assistance - Assessments	Technical Assistance - Training	Technical Assistance - Process Improvement	Technical Assistance - Energy Management	R&D - Financing	R&D - Expertise	R&D - Collaboration	Standards - Product	Standards - Process
Federal Government												
Department of Energy		X	X	X				X	X	X	X	X
Department of Defense		X	X						X	X	X	
Department of Commerce		X		X	X	X						
Department of Agriculture		X	X	X								
Department of Labor					X							
Environmental Protection Agency				X		X	X				X	X
National Science Foundation		X								X	X	
NASA		X								X	X	
State Government		X	X	X	X							
Local Government			X									
Utilities	X	X	X	X	X	X	X	X	X			
Public Benefit EE Programs	X	X	X	X	X	X	X	X	X	X	X	
Regional Networks				X	X	X	X			X	X	
Professional Organizations					X					X	X	X
Trade Organizations					X					X	X	X
Non-Government Organizations												X

This matrix is intended to provide the reader a better understanding of the most common sources of specific types of programs and policies. It is important to keep in mind that programs change and the level of involvement of a particular organization in a one sector is likely to vary over time. In some regions, a single entity might be engaged in all activities while in others, a similar type of organization might be involved in only a few.

The energy sector is replete with jargon and many acronyms. To aid the reader, a glossary is included and the first time a word contained in the glossary is used, it will be bolded. A summary of the energy efficiency provisions in several significant pieces of federal legislation is also included as an appendix.

Section I: Federal Programs and Policies

Authority over energy issues is split between the federal and state levels with more responsibilities lying with the states than is common in other countries. If authority to regulate something is not specifically given to the federal government, then it is the responsibility of the states to manage it. For example, establishment and enforcement of equipment standards happens at the national level while regulation of utilities and environmental regulation happens predominately at the state level. It is

important to appreciate this division of authorities in order to understand how energy efficiency is supported in the U.S.

Federal policies and programs are geared toward regulation of energy using equipment, providing information, tools, and technical assistance to end users, and financial support for research and innovation. In contrast to most other countries, most direct financial support of energy efficiency is provided at the state level. The details of this activity, which is largely delivered through non-governmental organizations, will be covered in detail in Section II.

The federal government plays a number of key roles in promoting industrial energy efficiency. These include: providing information and education, technical and financial assistance, establishing performance standards, and investing in research that paves the way for new technologies and processes. The federal government provides many of these services directly though it also has created tax incentives to encourage them in the private sector.

Many federal agencies are involved with elements of promoting energy efficiency in the industrial sector. As might be expected, the Department of Energy (DOE) is the lead agency for energy efficiency, yet it is also true that many other agencies without a clear energy connection to energy, such as the Department of Labor (DOL) and the Department of Commerce (DOC), are also providing programs that drive energy efficiency. Some of these programs are focused on research and development of technologies that are specifically designed to be more energy efficient, while others encourage economic or workforce development that indirectly results in less energy-intensive factories. Though there has been a recent effort to coordinate these disparate efforts, for the most part, they still operate independent of each other.

Many federal agencies are involved in creating regulations and standards that aid interstate commerce and by extension in some small way contribute to improved use of energy. Common measurements and methods of evaluation reduce acquisition costs and increase interoperability. Environmental regulations influence the energy consumption of many systems while safety regulations often require controlled and monitored emissions. By requiring safer and cleaner working environments, these regulations indirectly encourage energy efficiency. More recently, several agencies have supported the development of management systems that encourage organizations to take a systematic approach to managing quality, environmental compliance and now energy. All of these regulations and standards have the potential to positively affect energy use in the industrial sector.

The biggest influence the federal government has on energy efficiency is through its research and development programs, technical assistance, and regulations and standards. The first drives technological advancements that lead to new technologies that use much less energy than existing technology; the second encourages adoption of energy efficiency technologies and practices, and the third establishes minimum energy performance requirements that raise the average level of efficiency.

The largest energy-focused research programs are operated by the DOE followed by the Department of Defense. The largest energy-focused technical assistance efforts are provide by DOE and the

Environmental Protection Agency (EPA) with the Departments of Commerce and Labor engaged energy related workforce training and economic development.

RESEARCH & DEVELOPMENT

Science and technology are key drivers of economic growth, improving health and quality of life in the United States and throughout the world. Innovation in energy efficiency includes high efficiency vehicles, appliances, buildings, and industrial processes. We have seen historically that there are places in the innovation process where market failures inhibit innovation: for example the incentive to invest in pre-commercial R&D is undermined by market emphasis on short term profits. Federally funded RD&D and collaborating with other organizations dilutes the risk and increases the market acceptance of new innovations. Federal energy efficiency research, development, and demonstration (RD&D) programs have helped to improve the energy efficiency of buildings, industry and transportation. This section will look into federal RD&D programs and the benefits they have provided to the energy efficiency sector (Vaidyanathan et al. 2013).

SMALL BUSINESS ADMINISTRATION

The US Small Business Administration (SBA) has two long-running and successful research and development programs that facilitate innovation and invention by dedicating a portion of federal research investments to public/private sector partnerships between small businesses and research institutions. The SBA serves as the coordinating agency for the Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programs that award financial assistance through **competitive solicitations**. SBA collects information from all of the participating agencies and publishes it in a **pre-solicitation** announcement (PSA). Once projects are selected and awarded, SBA directs the other agencies' implementation of SBIR/STTR projects, reviews their progress, and reports annually to Congress on its operation. (SBA 2013) SBA is also the information link to SBIR/STTR program.

Small Business Innovation Research Program (SBIR)

SBIR is a highly competitive program that encourages domestic small businesses to engage in Federal Research/Research and Development (R/R&D) that has the potential for commercialization. Through a competitive awards-based program, SBIR enables small businesses to explore their technological potential and provides the incentive to profit from its commercialization. By including qualified small businesses in the nation's R&D arena, high-tech innovation is stimulated and the United States catalyzes entrepreneurship and development of new businesses as it meets its specific research and development needs. Small businesses that receive awards enter into a three-phase award process with the SBA.

The SBIR program has a budget 2.5% of the extramural research budget for all agencies with a budget greater than \$100 million per year. There are currently eleven agencies funding SBIR projects (SBA 2013a).

The SBIR program was established under the Small Business Innovation Development Act of 1982 (P.L. 97-219) with the purpose of strengthening the role of innovative small business concerns in Federally-funded research and development (R&D). Through FY2009, over 112,500 awards have been made totaling more than \$26.9 billion (SBA 2013a). In December 2000, Congress passed the Small Business Research and Development Enhancement Act (P.L. 102-564), reauthorizing the SBIR program until September 30, 2000. The program was reauthorized until September 30, 2008 by the Small Business Reauthorization Act of 2000 (P.L. 106-554) (SBA 2013a). Subsequently, Congress passed numerous extensions, the most recent of which extends the SBIR program through 2017.

Small Business Technology Transfer (STTR)

This program also provides financial assistance through competitive solicitations. Its most important role is to bridge the gap between performance of basic science and commercialization of resulting innovations and accomplishes this by expanding funding opportunities in the federal innovation research and development (R&D) arena by requiring responding public/private sector partnerships to include in their joint ventures opportunities for small businesses and nonprofit research institutions. The program requires formal collaboration with a research institution in the first two phases of a three phase project. In addition to the funding, recipients receive technical assistance and guidance from federal agencies (SBA 2013).

The program is funded by five federal departments and agencies. Each agency is required to reserve a portion of their respective R&D funds every five years for awards to small business and nonprofit research institution partnerships. The agencies designate the R& D topics and accept proposals. Awards are based on the partnership qualifications, degree of innovation, and future market potential. Small businesses that receive awards enter into a three-phase award process (SBA 2013b).

The STTR is a set-aside program to facilitate cooperative R&D between small business concerns and U.S. research institutions—with potential for commercialization. 0.3% of the extramural research budget for all agencies with budget greater than 41 billion per year.

Modeled after the Small Business Innovation Research (SBIR) program, STTR was established as a pilot program by the Small Business Technology Transfer Act of 1992 (Public Law 102-564, Title II). Government agencies with R&D budgets of \$1 billion or more are required to set aside a portion of these funds to finance the STTR activity. In 2001, Congress passed the Small Business Reauthorization Act of 1997 (P.L. 105-135). The program was reauthorized again until September 30, 2009, by the Small Business Technology Transfer Program Reauthorization Act of 2001 (P.L.107-50). Subsequently, Congress has passed numerous extensions, the most recent of which extends the STTR program through 2017 (2013b). The goal of the STTR program is to facilitate the transfer of technology developed by a research institution through the entrepreneurship of a small business concern.

Funding Agencies:

SBIR: Eleven federal agencies fund the program: Department of Defense (DOD), Department of Energy (DOE), Department of Health & Human Services (DHHS), National Aeronautics and Space

Administrations (NASA), and National Science Foundations (NSF), USDA, Department of Commerce (DOC), Department of Education (DOEd), Department of Homeland Security (DHS), Department of Transportation (DOT), and the Environmental Protection Agency (EPA).

STTR: Five federal agencies fund the program: The Department of Defense (DOD), Department of Energy (DOE), Department of Health & Human Services (DHHS), National Aeronautics and Space Administrations (NASA), and National Science Foundations (NSF).

Three-Phase Award Process

Funding, technical assistance and administration is provided by both programs for research and development projects and is organized in a three-phase process.

Phase I: Startup phase: an award of up to [150,000 (SBIR);\$100,000 (STTR)] for a term of approximately [six months (SBIR);one year (STTR)] is used to fund exploration of scientific, technical and commercial feasibility of an idea or technology.

Phase II: An award of up to [\$1,000,000 (SBIR);\$750,000 (STTR)] for a term of up to [one year (SBIR);two years (STTR)] is provided to expand on Phase I results. During this period, the R&D work is performed and the developer begins to consider commercial potential. Only phase I award winners are considered for Phase II awards.

Phase III: is the period during which Phase II innovation moves from the laboratory to the marketplace. No SBIR or STTR funds can be used to support this phase. The business must find funding in the private sector or other non-SBIR/STTR funding. Examples of recently funded projects:

- DOE has identified heat exchangers as one of the greatest potential for improving process energy efficiency in the industrial sector, so in FY 2008, through the SBIR program and its Office of Basic Energy Sciences, it funded research and development activities to improve heat exchanger efficiency. One of the projects was NEI Corporation's development and demonstration of its SuperCondenser™ technology. Their coating technology is targeted at electrical utilities and process industries that can benefit from improved heat transfer in heat exchangers (DOE 2013b).
- DOE has focused on improving the efficiency of refrigeration and air conditioning systems for many years. Through an SBIR award, DOE funded Mainstream Engineering Corporation to explore practical, cost-effective methods to reduce the energy consumption of residential and small commercial air conditioning systems. As a result of this research, Mainstream created the QwikSEER+WattSaver™, an electronic control board that optimizes airflow by controlling the speed of the blower motor. Energy consumption is improved as is humidity and mold control (DOE 2013c).

NATIONAL SCIENCE FOUNDATION

The National Science Foundation (NSF) is an independent federal agency created by Congress in 1950 with the purpose of promoting science that advances national health, prosperity, and welfare

and secures the nation's defense. NSF had an annual budget of about \$6.9 billion FY 2011, and it provides funding for approximately 20 percent of all federally supported basic research conducted by colleges and universities (NSF 2012). The Foundation allocates funding through a competitive merit review and funding for mathematic and scientific research went to nearly 2,000 institutions, primarily academic, across the country (Vaidyanathan et al. 2013). A company in the private sector performing basic research should partner with an academic institution when seeking NSF funding.

DEPARTMENT OF DEFENSE (DOD) DEFENSE ADVANCED RESEARCH PROJECTS AGENCY (DARPA)

In 1958, shortly after the U.S. unexpectedly found itself surpassed in rocket technology by the Soviet Union's launch of Sputnik, the world's first artificial satellite, the Defense Advanced Research Projects Agency (DARPA) was established. It was realized that conventional research and development practices at the time were incremental and that a new type of research and development program was needed if the U.S. was to avoid being surprised again. In the midst of the Cold War, there were serious ramifications to not being the technological leader. Thus DARPA was created "to prevent strategic surprise from negatively impacting U.S. national security and create strategic surprise for U.S. adversaries by maintaining the technological superiority of the U.S. military." (DARPA 2012).

To achieve these goals, DARPA identifies current practical problems and then funds research, both basic and applied, that is usually multi-disciplinary, often non-conventional, and always innovative. Its scientific investigations range from laboratory experiments to full-scale technology demonstrations. Fields of interest include biology, medicine, computer science, chemistry, physics, engineering, mathematics, material sciences, social sciences, and neurosciences (DARPA 2012a). Funding in 2012 for research and development exceeded \$2.8 billion (DARPA 2012b).

DARPA works with defense contractors, academic institutions through direct solicitations and connects with small businesses through the SBIR program. Since a significant portion of Department of Defense's operating budget is for fuels, many recent research and development projects have targeted energy efficiency for military vehicles and forward operating bases.

DEPARTMENT OF ENERGY NATIONAL LABORATORIES

The Department of Energy is the administrative agency for the 17 National Laboratories that comprise a preeminent federal research system, providing the nation with strategically scientific and technological capabilities. Beyond basic research, the laboratories execute long-term government scientific and technological missions, often with complex security, safety, project management, or other operational challenges.

Each of the laboratories has developed unique scientific capabilities that are beyond the scope of academic and industrial institutions. Their projects are often multi-disciplinary in design, and the results have cross-functional potential. This results in a multitude of discoveries that benefit the nation. The laboratories also serve to develop and sustain critical scientific and technical capabilities to which the government requires assured access.

Many of the labs are engaged in energy related research. Some of the research is applications oriented and involves manufacturing companies. The labs may seek engagement with industrial firms directly or through many of the federal agencies. Programs that channel this engagement, such as the SBIR and STTR programs, are described earlier in this report.

Figure 1: National Laboratories



Source: DOE 2013a

MANUFACTURING DEMONSTRATION FACILITIES

Still in development, the DOE's Office of Energy Efficiency and Renewable Energy (EERE) is working to create a network of *Manufacturing Demonstration Facilities* (MDFs) where domestic manufacturers can gain access to tools, skills and knowledge beyond their ability to secure privately. The MDFs will form collaborative with local government agencies, educational institutions, manufacturing companies and trade organizations. Each facility will acquire a unique set of technologies and specializations. The first MDF, at DOE's Oak Ridge National Laboratory, is developing both low-cost carbon fiber technologies and additive manufacturing (also called 3D printing). The MDFs will share a common infrastructure that is designed to provide innovative companies with timely, affordable access to tools and people that to enable them to demonstrate new materials and processes. The DOE is interested in making these capabilities available to small and medium-sized businesses that on their own could not acquire them (DOE 2012d).

DEPARTMENT OF ENERGY (DOE) ADVANCED RESEARCH PROJECTS AGENCY—ENERGY (ARPA-E)

The Advanced Research Projects Agency—Energy (ARPA-E) is an agency within the Department of Energy (DOE) that has funded the development and deployment of next generation and transformational energy technologies and systems since 2009. The *America COMPETES Act of 2007*, signed into law by President George W. Bush, authorized the establishment of ARPA-E within the DOE, but ARPA-E did not come into existence until early 2009 when it received \$400 million through the *American Recovery and Reinvestment Act of 2009*. ARPA-E focuses on high-risk energy-related concepts with potentially high rewards. The mission of ARPA-E is to overcome the long-term and high-risk technological barriers in the development of energy technologies and help new technologies make the transition from laboratory research and to developing commercial products by proving market viability through meaningful demonstration and validation. To achieve this mission, ARPA-E aims to enhance the economic security of the U.S. through the development of energy technologies and to help ensure that the U.S. maintains a technological lead in developing and deploying advanced energy technologies. ARPA-E was appropriated \$275 million for Fiscal Year (FY) 2012 (October 1, 2011 through September 30, 2012) (ARPA-E 2012 and Vaidyanathan et al. 2013).

FOR ADDITIONAL INFORMATION

ARPA-E website: <http://arpa-e.energy.gov/>

DARPA website: <http://www.darpa.mil>

DARPA SBIR/STTR webpage:

http://www.darpa.mil/Opportunities/SBIR_STTR/Programs/Small_Business_Innovation_Research_Program_Overview.aspx

NSF website: <http://www.nsf.gov>

SBIR website: <http://www.sba.gov/content/small-business-innovation-research-program-sbir-0>

STTR website: <http://www.sba.gov/content/small-business-technology-transfer-program-sttr-0#>

US DOE SBIR webpage: <http://science.energy.gov/sbir/>

FINANCIAL AND TECHNICAL ASSISTANCE

Many federal programs provide some combination of technical assistance through staff consultation and mentoring, and financial assistance, either in the form of direct financial allocation or in a subsidized service. For example, many companies may not be in a financial position to pay for worker energy efficiency training. A federal program may provide the training directly for free, it may provide funds to a third party to provide it for free or at a discounted cost, or it may provide grants to companies to purchase training from a qualifying vendor. The net impact to the company may on its face appear to be the same, but there are often transactions costs that favor one form of assistance over another.

The reasons for federal government provision of assistance may vary by program but in general, the intent is to either amplify existing market forces to accelerate the adoption of superior technologies and practices, or to overcome a market failure that prevent the same from gaining market acceptance.

DEPARTMENT OF COMMERCE PROGRAMS

Charged with facilitating trade and assisting domestic companies, the DOC has created programs that facilitate commerce and that assist manufacturers to become more efficient and successful. A leader in this effort is the National Institute of Standards and Technology (NIST).

NIST is a non-regulatory federal agency within the U.S. Department of Commerce (DOC) that was founded in 1901 to promote U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology in ways that enhance economic security and improve our quality of life. NIST establishes and maintains standard units of measure for science and business.

Manufacturing Extension Partnership Centers

The DOC NIST Hollings Manufacturing Extension Partnership (MEP) works with small and mid-sized companies to improve their overall competitiveness. Each state and territory has at least one MEP Center, and while they vary on their energy expertise and focus, they generally have excellent connections and relationships with local industry and the services they render result in more efficient manufacturing facilities.

Administration of centers is determined at the state level and there are many business models for running a center. A key focus of the MEP program nationally and MEP centers locally is assisting small and medium sized manufacturers to implement continual improvement programs such as *Lean Manufacturing*, *Total Quality Management* and *Six Sigma*¹. The MEPS encourage firms to adopt a systematic approach to improving production processes and product quality, lowering the energy intensity of these companies. MEP centers are covered in more detail later in this report.

NIST MEP has partnered with the Department of Energy, Environmental Protection Agency, Department of Agriculture and Small Business Administration to provide companies with economic, energy, and environmental opportunity assessments through the E³ program (which is covered in more detail in the EPA subsection) NIST is also the coordinating agency for Manufacturing.Gov, a clearinghouse, where companies can find information on all advanced manufacturing-focused federal government initiatives.

¹ Lean Manufacturing is a production practice that considers any effort or material not tied to value perceived by customers to be waste; Total Quality Management is the practice of including everyone in an organization in that practice; and Six Sigma is a methodology for identifying root causes and eliminating defects.

Sustainable Manufacturing Initiative

The International Trade Administration is home to the Sustainable Manufacturing Initiative (SMI) that assists domestic manufactures through its website, on-line tools and staff consultations. Part of this work includes promoting energy efficiency and sustainable practices that seek to lower the bottom line. Its free toolkit provides a set of 18 internationally applicable, common and comparable key performance indicators to measure and track environmental impacts of facilities and products. It is intended for all types and sizes of companies and is designed for the non-expert to use (ITA 2013).

The website also hosts a **public-private** dialogue that aims to identify sustainable manufacturing challenges and coordinate public and private sector efforts to address those challenges.

For Additional Information

NIST Website: <http://www.nist.gov>

Manufacturing.Gov website: <http://www.manufacturing.gov>

Sustainable Manufacturing Initiative website:

<http://www.trade.gov/competitiveness/sustainablemanufacturing/index.asp>

DOE-ADVANCED MANUFACTURING OFFICE (AMO)

This Department of Energy program is part of the Office of Energy Efficiency and Renewable Energy (EERE) and has responsibilities related to development, demonstration, and deployment of leading edge technologies and practices related to industrial energy efficiency. It is one of the few federal programs that exclusively targets manufacturing, and does so with a mix of technical and financial assistance initiatives.

The name of the office and its mix of programs have changed a number of times in recent years, migrating from providing best practices training and implementation assistance and targeting specific energy-intensive industries with financial incentives for R&D demonstration projects, towards helping companies to implement energy management practices and funding projects that provide commercial demonstration of next generation manufacturing techniques and next generation materials. Since these discoveries usually have value in multiple industries, they are often referred to as cross-cutting technologies.

In addition to research and development focused programs AMO is heavily engaged in facilitating market uptake of best practices and best technologies. They refer to these programs as Deployment and they represent approximately half of AMO's responsibilities and a third of its budget.

AMO has been engaged in developing and deploying the ISO 50001 energy management standard from its inception. The ISO 50001 standard, which is explained in more detail later in this report, establishes a protocol by which energy use is measured, monitored, and forecasted. More recently it has funded the development and deployment of the *Superior Energy Performance* (SEP) energy

performance standard. SEP is a separate but complementary standard from ISO 50001. SEP requires compliance with the ISO standard and adds a performance improvement metric. Dozens of companies have participated in a demonstration of the ISO 50001 and SEP standards over the past few years having much of the cost of training absorbed by AMO in exchange for participating in DOE's *Save Energy Now LEADER* initiative (now called *Better Building/Better Plants Program and Challenge*). Participation in the LEADER/Challenge program requires a commitment to reduce a facility's energy intensity by 25% over a ten year period.

AMO also supports the *Industrial Assessment Centers* (IACs) and *Clean Energy Regional Application Centers* (CEACs) (formerly known as the Combined Heat and Power (CHP) *Regional Application Centers* or RACs) that are described in more detail later in this report. (This program is now being rebranded again as the regional CHP Technical Assistance Partnerships (CHP TAPs)².) These deployment activities provide technical services directly to U.S. manufacturers to help them identify and understand energy savings opportunities.

Deployment Programs

Many of AMO's deployment programs are delivered through regional partners. These programs are summarized below and described in more detail in the Regional, State and Local section of this report.

Better Buildings, Better Plants

A company becomes a program partner by signing a pledge to reduce the energy intensity of its operations by 25% over a ten-year period and in exchange get access to an AMO supported Technical Account Manager (TAM) who works with them to analyze energy use and develop performance metrics. The TAM also teaches company staff how to use AMO's portfolio of on-line tools. Partners are listed in a national registry.

Energy Resource Center

Provides free on-line tools for assessing opportunities to save energy, implement an energy management system, and track progress towards a performance goal. The website also has many technical resources that address best practices by system and by industry.

Industrial Assessment Centers

Small and medium sized manufacturers may be eligible to receive a no-cost energy assessment by one of 24 university based teams. Student teams spend a day on-site analyzing energy use and provide the company with a report identifying potential energy savings opportunities. All reports are confidential.

Clean Energy Application Centers

Provide combined heat and power (CHP) feasibility studies to industrial, commercial and institutional facilities. Also provide analysis of market viability of CHP in different sectors, industries, and regions. Work with state public utility commissions to create CHP friendly regulations and educate utilities and legislators on the benefits of CHP and waste heat recovery.

² <https://eere-exchange.energy.gov/Default.aspx#FoaIdb5b8be32-a36a-465a-bf53-e0471bd357cf>

Budget

AMO budget for FY2012 totaled \$116 million which was split between the following categories (Trombley 2012):

- Industrial Assessment Center (IAC) program (\$6 million)
- Deployment (\$12 million) not including the IAC program
- Next Generation Materials (\$34 million)
- Next Generation Manufacturing Processes (\$64 million)

Results

Technology R&D

AMO and its predecessor programs have realized considerable success over the years: from 1990 to 2010, it has co-funded over 54 research and development projects that have resulted in commercialization of 229 new technologies, and awarding of 251 patents (AMO 2012f). AMO has focused its few research dollars on energy intensive industries such as steel, glass, chemicals and forest products, and on technologies that have applicability across multiple business sectors such as combustion efficiency, high-temperature materials, advanced controls, and sensors. These cross-cutting technologies represent AMO's recent R&D program focus.

Deployment

The on-line tools available through AMO's website have been used to identify over \$1.6 billion in annual energy savings and the training courses taught by DOE Qualified Specialists have helped thousands of workers to identify opportunities and implement projects (AMO 2012).

The IACs have trained over 3000 students and performed over 15,000 audits since 1980 and the CEACS have educated over 25,000 people on CHP and provided technical support to more than 700 CHP projects that represent 1.5 Gigawatt (GW)³ of installed or developing capacity.(AMO 2012c and d)

DOE's is currently evaluating its future involvement with the propagation of SEP. In the short term, it will continue to promote and support the standard. Over the long term, it intends to transfer administration to another organization that will be better suited to facilitate broad acceptance and implementation of the standard.

For Additional Information

Advanced Manufacturing Office website: <http://www1.eere.energy.gov/manufacturing/>

Better Buildings, Better Plants website:

www1.eere.energy.gov/manufacturing/tech_deployment/betterplants/index.html

³ A GigaWatt is one billion Watts of energy. This unit of energy and others are defined in the Glossary.

Energy Resource Center website:

http://www1.eere.energy.gov/manufacturing/tech_deployment/ecenter.html

Industrial Assessment Center program website:

http://www1.eere.energy.gov/manufacturing/tech_deployment/iacs.html

Clean Energy Application Center program website:

<http://www1.eere.energy.gov/manufacturing/distributedenergy/ceacs.html>

ENVIRONMENTAL PROTECTION AGENCY

The U.S. EPA is the regulatory agency for ensuring the safety of the nation's land, water and air resources. In addition to regulatory actions that govern emissions to achieve these goals, it also establishes voluntary labeling standards for a broad scope of consumer products, provides guidance on performance for commercial products and provides free technical resources.

ENERGY STAR Program

The ENERGY STAR® program, located within the Office of Atmospheric Programs, sets performance standards for household appliances such as dishwashers and refrigerators, and commercial products such as computers and copiers. Companies can work with EPA to produce products that earn the ENERGY STAR label and upgrade the efficiency of their manufacturing facilities to become ENERGY STAR Certified Plants. These mandatory and voluntary standards are covered in more detail in the companion report *Introduction to U.S. Policies to Improve Building Efficiency* (Nadel 2012) and later in this report in the Standards section.

The ENERGY STAR program also offers all businesses and organizations a portfolio of tools and technical resources that can help them identify opportunities to reduce energy consumption, evaluate options, and implement solutions. All of these on-line tools and resources are available at no charge through the ENERGY STAR for Industry program. This facility recognition program is a voluntary and is the portion of the much large ENERGY STAR program that is covered in this section.

ENERGY STAR for Industry

To assist its manufacturing partners, EPA often functions as a convener bringing together representatives from companies within the same and related industries. Each of these companies has the opportunity to benefit through the sharing of non-competitive technical information



and best practices. EPA serves as a technical resource providing information on all types of compliance and efficiency topics. It offers training and marketing resources to aid each company in its efforts to promote their respective ENERGY STAR products. EPA recognizes its partners annually and works with them to implement best practices at their manufacturing plants.

A key component of this effort is its energy management program: ENERGY STAR for Industry. This program emphasizes corporate energy management programs as EPA has found that only

through systemic approaches to energy management can energy savings be sustained and increased over the long term. Available to all manufacturers, this program includes access to all the free on-line benchmarking and tracking tools and technical assistance from program staff (EPA 2013)

To become a Partner, a company must join at the corporate level. Over 3000 companies and organizations have become Partners. Motivations vary, but many have found that the public commitment drives performance. Additionally, Partners get additional access to technical assistance and are often recognized publically for their involvement in the program.

The Energy Management Guidance contains several tools that can help a company implement an energy management program (EPA 2013b):

- Guidelines for Energy Management: provides a framework for how to implement an energy program that is based on the ISO's "plan-do-act-check" approach
- Energy Program Assessment Matrix: evaluates energy management practices and program to identify gaps
- Facility Energy Assessment Matrix: evaluates a facility's energy management practices to identify gaps
- Energy Strategy for the Road Ahead: helps companies to develop long-term strategies for addressing energy risks to the business
- Teaming up to Save Energy: guidance on how to build an energy team
- Partner Networking Web Conferences: monthly series showcasing successful energy management strategies among the partnership
- Communication Resources: posters, promotional materials, and tools to help drive change
- Plant Energy Performance Indicators (EPIs): scores the energy performance of specific industrial sites against the industry nationally. EPIs have been created for 16 different industries: Cement Manufacturing, Corn Refining, Food Processing, Glass Manufacturing, Motor Vehicle Manufacturing, Petrochemical Manufacturing, Petroleum Industry, Pharmaceuticals, Pulp & Paper, Steel, Metal Casting, and Dairy Processing
- Energy Tracking Tool: helps establish production-based energy intensity metrics, set goals, and track performance
- Portfolio Manager: scores the energy performance of selected commercial buildings and warehouses. This web-based energy tracking system is for buildings only and does not capture the energy use of production processes.

Once a company has participated in the program and fulfilled its obligations, it will be recognized by EPA as an ENERGY STAR Certified Plant. The Energy Star program provides recognition of energy performance in three ways (EPA 2013).

- ENERGY STAR Partner of the Year: provided to world-class corporate energy management programs
- ENERGY STAR Plant Label: recognizes plants that score in the top 25 percent (score of 75 or higher) on the ENERGY STAR energy performance scale based on the use of an ENERGY STAR plant Energy Performance Indicator. EPA is currently recognizing plants in the

following industries: Auto Assembly, Cement, Food Processing, Glass Manufacturing, Petroleum Refining, Pharmaceuticals, and Wet Corn Milling

- ENERGY STAR Challenge for Industry: recognizes sites that reduce energy intensity by 10%

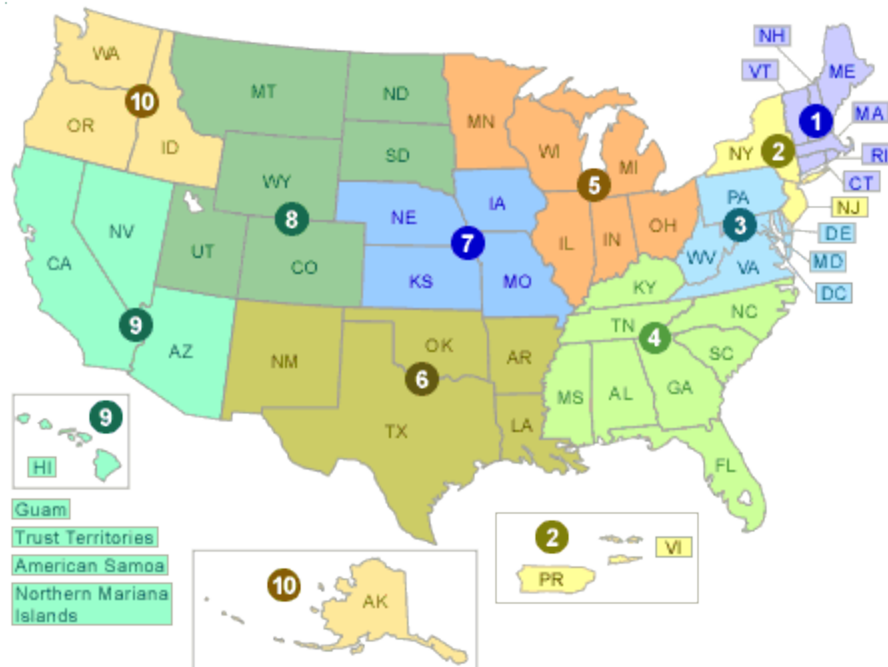
Performance of ENERGY STAR Program

In the Focus Industry initiative, EPA analyzes historical data for each industry to determine if investments in better technologies and better practices are having an effect on the energy intensity of each industry. 110 plants from 13 major industries, and ten sub-industries, have participated in the Industrial Focus initiative to share ideas and work towards reducing the energy intensity of their respective sectors (EPA 2013e).

Pollution Prevention

Within EPA’s Office of Chemical Safety and Pollution Prevention (OCSPP) is the Office of Pollution Prevention and Toxics (OPPT) which works with EPA Regional Offices and state counterparts to provide local training and technical assistance to companies and institutions on a no-charge or cost-recovery basis. Many of EPA’s national programs are managed through its regional offices (EPA 2013f). This regional structure allows programs and financial assistance to be structured to regional needs and characteristics.

Figure 2: EPA Regional Offices (<http://www.epa.gov/aboutepa/where.html>)



OPPT has partnered with other federal agencies on two programs that work with state delivery partners to advance the adoption of energy efficiency and pollution prevention best practices and best technologies.

- E3 program
- Green Suppliers Network

EPA is interested in energy consumption because pollution prevention (P2) often overlaps with energy efficiency (E2) and so assisting companies to do one helps achieve goals related to the other. P2 is the reduction or elimination of wastes at or close to the source through modification of products or the processes that produce them. It often involves redesign of manufacturing processes to use non-toxic or less-toxic materials and more efficient processes. All of these efficiencies—less raw material, less toxic material, more efficient processes—result in reduced energy use on site and throughout the supply chain.

Green Supplier Network (GSN) and Economy, Energy and Environment (E3) Initiatives

The Green Supplier Network (GSN) started as collaboration between the EPA-OPPT, the DOE's Industrial Assessment Centers, and the Department of Commerce Manufacturing Extension Partnership (MEP) centers to help small and medium-sized manufacturers to become more competitive by learning how to reduce the creation of environmental wastes through application of Lean Manufacturing tools and techniques.



The GSN program worked with large original equipment manufacturers (OEMs) to target and engage key suppliers with on-site training and P2 opportunity identification and analysis. GSN services were delivered by state MEP centers with P2 technical guidance provided by state environmental protection agency staff.

The goal of the GSN program was to help OEM and their suppliers to:

- See immediate results through hands-on training on the shop floor
- Reduce overhead and manufacturing costs
- Reduce environmental footprint
- Improve supply chain relationships
- Meet customer expectations and be better positioned in the green global marketplace
- Improve profitability

The training and analysis provided under the Green Supplies Network is now incorporated into the E3—Economy, Energy, and Environment Initiative. Funded and coordinated at the national level, the E3 program uses state and local organizations to help communities work with their manufacturing base to improve competitiveness through reduced energy use and environmental impacts.

A joint collaboration among five U.S. federal agencies: the Department of Agriculture (USDA), the Department of Commerce (DOC), the Small Business



Administration (SBA), the Department of Labor (DOL), the Department of Energy (DOE), and the Environmental Protection Agency (EPA), E3 combines each agencies' resources and expertise into a

single coordinated initiative to assist small and medium sized manufacturing facilities identify opportunities to reduce operating expenses and improve productivity(EPA 2013 c and d).

Programs are managed on the state level and each of the thirty nine states that have a program in place have tailored it to the needs and funding sources specific to their situation. What many of them have in common is leveraging Industrial Assessment Centers (IAC), state environmental pollution prevention offices, and NIST Manufacturing Extension Partnership (MEP) Centers to provide manufacturers E3 assessments.

For Additional Information

ENERGY STAR website: <http://www.energystar.gov>

ENERGY STAR website of Resources for Manufacturers:
http://www.energystar.gov/index.cfm?c=manuf_res.pt_manuf

ENERGY STAR benchmarking tools: <http://www.energystar.gov/industrybenchmarkingtools>

Green Supplier Network website: <http://www.greensuppliers.gov>

E3 program website: <http://www.e3.gov/>

Office of Pollution Prevention and Toxics website: <http://www.epa.gov/oppt/>

SMALL BUSINESS ADMINISTRATION (SBA) LOAN PROGRAM

This US Department of Commerce funded program enables local banks to provide more and larger business loans to small and start-up businesses than they could under normal circumstances. SBA loans are obtained through conventional banks and are only provided when conventional borrowing has proven to be insufficient for the borrower's needs. The SBA program enables the lender to provide either a larger loan or a loan with a lower interest rate.

The SBA has several loan programs though the one with the greatest applicability is the SBA 504 Loan Program. 504 Loans are promoted through a local Certified Development Company (CDC) that has been certified by SBA. There are 260 CDCs nationally. 504 loans are typically structured with SBA providing 40% of total project costs, a participating lender covering up to 50% of total project costs, and the borrower contributing the balance. Total project costs can reach \$1 million and can include buildings, land, renovations, furniture, equipment and some soft costs. The bank will have the first lien, SBA the second and the borrower must front the 10% in cash (SBA 2013c).

For Additional Information

Loan program information: <http://www.sba.gov/category/navigation-structure/loans-grants/small-business-loans/sba-loan-programs>

Links to local SBA Offices: <http://www.sba.gov/local-assistance>

DEPARTMENT OF LABOR (DOL)

Since 2008, DOL has focused on increasing the number of workers with skills to meet the needs of manufacturing and installation companies in the renewable and energy efficiency sectors. Often referred to as “green jobs” (DOL 2013a), DOL is providing financial and technical assistance to companies creating these jobs, to organizations creating training for them, and for workers to preparing for these new occupations.

In 2010 to 2012, the Department of Labor awarded nearly \$500 million training grants to prepare workers for careers in the energy efficiency and renewable energy industries (DOL 2013b). These grants were part of DOL’s activities funded by the *American Recovery and Reinvestment Act* (ARRA). The training provided is intended to prepare workers for jobs that had been identified as the most in-demand across the country.

For Additional Information

DOL training programs: <http://www.dol.gov/dol/topic/training/>

Environmental Justice: <http://www.dol.gov/asp/ej/>

Bureau of Labor Statistics green jobs: <http://www.bls.gov/green/>

DEPARTMENT OF AGRICULTURE (USDA)

The United States Department of Agriculture (USDA) offers grants and financing to help rural small businesses and agricultural producers to make investments, which include the installation renewable energy and energy efficiency systems, and conduct energy audits and feasibility studies. USDA has three long-running programs that have helped companies and communities improve their energy resources and invest in energy efficiency (USDA 2012).

Rural Economic Assistance Program (REAP) Financial Assistance

The REAP Energy Efficiency Improvement Grant provides grants from \$1,500 up to a maximum of 25% of eligible project costs, or \$250,000, whichever is less, to cover costs associated with energy audits and providing information on renewable energy development assistance. The program was created to encourage energy efficiency improvements such as installing efficient irrigation pumps or replacing ventilation systems (USDA 2012a).

In addition to grants, the REAP program also offers different loan options, one of which is described below.

The REAP Guaranteed Loan program provides loans of \$5,000 to \$25 million to businesses or agricultural operations for energy savings measures such as replacement of inefficient equipment, retrofitting, insulation, or other projects recommended by an approved energy savings assessment. The program provides guarantees to commercial lenders engaged in lending to rural small businesses

and agricultural producers. Rates and terms of loans are not dictated by USDA, but are negotiated between the lenders and borrowers (USDA 2012b).

- The following guarantee limits apply:
- 85 percent for loans of \$600,000 or less
- 80 percent for loans greater than \$600,000 up to \$5 million
- 70 percent for loans greater than \$5 million up to \$10 million
- 60 percent for loans greater than \$10 million up to \$25 million

Example

Alaska Brewing Company, LLC (ABC) in Juneau was the 12th largest craft brewery by sales volume in the U.S. when it applied for a USDA REAP grant to fund a new steam boiler. The boiler qualified for the \$450,000 grant in part because it uses wet grain also known as “spent grain” that is left over from the brewing process, as fuel. The total project cost for the boiler upgrade was \$1.8 million and it is projected to reduce the company’s fuel oil consumption in brewhouse operations by over 65 percent and save the company the cost of shipping “spent grain” back to Washington State by barge (Yerich 2013).

Rural Development

The USDA advocates for and assists the nation’s farms and rural businesses. Program activities include job training and providing education and technical resources to communities and organizations to assist cooperative business development, community economic development, and new business development. It has also engaged in expanding access to broadband communications, facilitating renewable energy development, developing regional food systems and natural resource restoration (USDA 2012c).

Rural Electric Service

Under the *Rural Electrification Act of 1936*, the Electric Programs of USDA make direct loans and loan guarantees to electric utilities to serve customers in rural areas. The loans and guarantees initially intended to finance the construction of electric distribution, transmission and generation facilities for rural electric cooperatives has expanded into a community development tool frequently used in small communities to construct and upgrade energy generation, transmission and distribution facilities (USDA 2012d).

For Additional Information

REAP website: http://www.rurdev.usda.gov/BCP_Reap.html

Rural Development website: <http://www.rurdev.usda.gov/Business.html>

Rural Electric Service website: http://www.rurdev.usda.gov/Utilities_Assistance.html

REGULATIONS, STANDARDS AND LABELING

Standards and labeling aid commerce by simplifying the decision making process for consumers. Unless a customer has the time and ability to evaluate all options, initial cost will be a primary driver of purchasing decisions. This means that benefits that are difficult to discern, such as energy efficiency, may not be properly valued by customers. Standards are a mechanism to overcome this market failure and provide customers with information that enables them to better assess the value of a product.

Some standards are voluntary and some are mandatory. The prior tend to be testing and labeling standards and provide a mechanism for customers to evaluate the performance of a product and by correlation for a manufacturer to differentiate its products. Each country has an organization responsible for enforcing International Standards Organization (ISO) standards and in the United States; it is the American National Standards Institute (ANSI). It is the authorizing agency that sets the protocols other organizations must adhere to when developing and administering standards.

Government agencies or non-governmental organizations may develop voluntary labeling or performance standards. The federal government has been involved in developing and implementing regulations and standards to aid interstate commerce since the Nation Bureau of Standards was created in 1901. That mission continues today with the successor entity the National Institute of Standards and Technology (NIST), which resides within the Department of Commerce. NIST has supported the development of test and performance standards that contribute to reducing the energy needed to run many common industrial systems.

Since the 1980s, the DOE has been authorized to establish minimum efficiency energy performance standards (MEPS) for a variety of consumer, commercial and industrial products.

Beginning in the 1990s, the ENERGY STAR program, a joint effort between DOE and EPA, began labeling of the most energy efficiency products for homes and businesses. The ENERGY STAR label is one of the mostly widely recognized performance labels in the world, now being used by countries outside the U.S.

The majority of mandatory standards are developed or approved by the federal government, though some have been set at the state level. At the Federal level, Congress first grants a federal agency, such as the Department of Energy, the regulatory authority to set minimum efficiency performance standards for a specific product category. The agency then determines whether or not the standard is practical and cost effective, and the economic benefits from such a standard is large enough to warrant proceeding with a standard. If such a determination is made, the agency begins a regulatory process that will lead to the development of the MEPS and associated testing procedure. In many cases, such as electric motors (discussed below), the agency builds its MEPS on well-established voluntary standards. Where existing voluntary standards do not exist, the agency will develop test procedures and efficiency levels.

Mandatory MEPS set a baseline of performance and stipulate an input such as energy or an output such as pollution. Regulatory standards can affect manufacturers in a couple of ways. The products

they manufacture are required to meet certain performance standards, or the equipment they purchase and use in their processes are required to meet performance standards. In both instances, the regulated variable may be tied to an input or an output.

By requiring that all appliances sold in the United States meet a minimum efficiency, standards make it easy for consumers to save energy and money. The impact over time can be equal to the generation of dozens if not hundreds of power plants. Authorizing a federal agency to establish national standards avoids the potential for market confusion resulting from inconsistent state standards. A national standard also provides consistency for manufacturers and thereby lowers their cost of compliance.

Companies manufacturing these products may need to design new products and change their manufacturing processes to produce products that meet the new MEPS. However it is more frequently the case that manufacturers already make compliant products and will only need to discontinue the manufacture of non-compliant products and ramp up production of the compliant products. While there is certainly a cost to these investments and changes in product mix, experience has shown that companies and consumers purchasing these products ultimately save considerably more over the collective products' lifetimes (Lowenberger et al. 2012).

These types of performance standards limit what can be sold in the U.S. but do not apply to products already in use. If a company already has a non-compliant appliance or motor, it can continue to use it. Since the rules dictate what can be sold but not what can be manufactured, conceivable, a manufacturer could make a non-compliant product and sell it outside of the U.S., though that is not likely.

ENERGY STAR Products

ENERGY STAR is a voluntary government partnership program that was established by the Environmental Protection Agency (EPA) in 1992 to help address climate change and provide consumers an easy method to identify and purchase energy-efficient products that offer savings on energy bills without sacrificing performance, features, or comfort. The program focuses on energy efficiency of consumer and office products, homes, and commercial buildings, industrial plants. The ENERGY STAR logo has become a symbol for energy efficiency in the U.S. and around the world.

This report covers the two components of the ENERGY STAR program that affect energy efficiency for manufacturers. Other parts of the ENERGY STAR program are covered in the companion *Introduction to U.S. Policies to Improve Building Efficiency* (Nadel 2012) report.

A previous section of this report discussed how an organization can have its facilities and processes certified by ENERGY STAR for Industry™. This section describes how a manufacturer can register its products with the ENERGY STAR program.

Products can earn the ENERGY STAR label by meeting the energy efficiency requirements set forth in ENERGY STAR product specifications. EPA establishes these specifications based on the following set of key guiding principles:

Product categories must contribute significant energy savings nationwide.

- Qualified products must deliver the features and performance demanded by consumers, in addition to increased energy efficiency.
- If the qualified product costs more than a conventional, less-efficient counterpart, purchasers will recover their investment in increased energy efficiency through utility bill savings, within a reasonable period of time.
- Energy efficiency can be achieved through broadly available, non-proprietary technologies offered by more than one manufacturer.
- Product energy consumption and performance can be measured and verified with testing.
- Labeling would effectively differentiate products and be visible for purchasers.

The qualifications for an ENERGY STAR label can increase over time as technologies improve and the product mix within a category becomes more energy efficient. Generally, a market share of ENERGY STAR qualified products in a particular category of 50 percent or higher will prompt consideration for a specification revision. However, there are other factors that weigh into the decision, such as:

- A change in the Federal minimum efficiency standards.
- Technological changes with advances in energy efficiency which allows a revised ENERGY STAR specification to capture additional savings.
- Product availability
- Significant issues with consumers realizing expected energy savings
- Performance or quality issues
- Issues with Test Procedures

Any company that manufactures a product that fits within one of the product classifications addressed by ENERGY STAR labeling program can join the program and go through the ENERGY STAR labeling process.

To qualify, new products that meet ENERGY STAR specifications must be certified by an EPA recognized certification body before the product can be labeled with the ENERGY STAR mark. Upon verification of performance, the certification body will notify the partner that the product meets the requirements and will submit the qualified product data to EPA for listing on its program website. Once certified by a certification body, use of the ENERGY STAR logo is permitting according to program guidelines.

Manufacturers of ENERGY STAR labeled products are required to report annually their qualified product unit shipment data. EPA collects unit shipment data to determine the market penetration of ENERGY STAR products and evaluate the overall performance of the program.

The ENERGY STAR program has been very successful at reducing national energy consumption and saving consumers money. For example, the EPA estimates that ENERGY STAR



office equipment has saved more than 500 TWh (terawatthours) of energy in the U.S., resulting in energy-bill savings of more than \$50 billion. In a second example, the U.S. Energy Information Agency (EIA), conducted a study of 41 million households in 2009 and found that 36 percent of all U.S. households had ENERGY STAR qualified clothes washers in their homes. As a result of these purchases, approximately 30 billion kWh and 110 trillion **Btu** of energy have been saved, and **greenhouse gas emissions** from power plants have been reduced by more than 25 million metric tons (EPA 2013a).

For additional information

To learn how to manufacture ENERGY STAR products:

http://www.energystar.gov/index.cfm?c=manuf_res.pt_manuf

Third-party certification requirements and a list of EPA-recognized Certification Bodies:

<http://www.energystar.gov/3rdpartycert>

ENERGY STAR Products 20 Year of Helping America Save Energy Save Money and Protect the Environment,

http://www.energystar.gov/ia/products/downloads/ES_Anniv_Book_030712_508compliant_v2.pdf?82d4-55f0

Industrial Motors and Motor Driven Equipment Standards

Collectively, motors consume more electricity than any other end use in the United States. Electric motors are the default mechanism in every sector of the economy (except for transportation) at turning energy into motion. Motors are very reliable: a well-designed and well-maintained electric motor can convert over 90% of its input energy into useful shaft power, 24 hours a day, for decades. It is this ubiquity and ability to run constantly that makes electric motor systems such an important potential source of energy savings (ACEEE 2012). Because as much as 60% of all electricity used in industry flows through them, even modest improvements in their design and operation can yield tremendous energy and energy cost savings.

To realize the potential energy savings, the Congress directed the Department of Energy to develop MEPS for industrial motors. DOE's standards are supported by test and certification procedures developed by the National Institute of Standards and Technology (NIST) building upon voluntary standards developed by National Electrical Manufacturers Association (NEMA) and Institute of Electrical and Electronics Engineers (IEEE). The majority of industrial motors sold in the U.S. must be compliant with these standards.

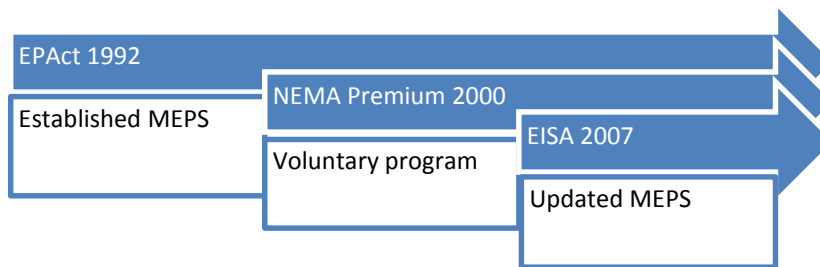
Regulated products can also be labeled as being compliant with even more stringent standards set by trade or professional organizations, but are not legally required to do so. Products that meet the higher voluntary standards are allowed to display the respective labeling for those standards. An example of how a series of voluntary standards created by a trade organization became the basis for a series of mandatory standards is described below.

The *Energy Policy Act of 1992* (EPAct) sought to comprehensively address national energy needs including energy efficiency. The Act included authorization for DOE to create MEPS for common industrial systems such as motors, pumps, fans and compressors. As a result, DOE has already established MEPS for industrial motors and is currently in the process of establishing standards for pumps, fans and compressors.

One of the first efforts DOE conducted under its new authority was to bring together representatives from industry, trade organizations and testing laboratories to create a definition of electric motors and determine MEPS for this type of equipment. A widely used National Electrical Manufacturers Association (NEMA) energy efficiency labeling standard became the foundation for a new DOE standard that was ultimately enacted for certain electric motors between 1 and 200 horsepower (hp) in size (Trombley 2010). This label was based on test procedures that were developed by IEEE.

In June 2003, NEMA issued a voluntary label NEMA Premium® establishing the requirements motors at efficiency levels beyond the EPAct mandated MEPS level.

Figure 3: History of Motor Standards



As manufacturers have realized the value of product differentiation, participation in voluntary labeling programs such as NEMA Premium® program has grown. As energy efficiency advocates have realized the energy savings of high-efficiency motors, they have created financial assistance programs targeting these motors.

In 2007, Congress passed the *Energy Independence and Security Act of 2007* (EISA) which directed DOE to enhance the existing standards to a level that approaches the NEMA Premium level of performance, and extend coverage at a lower level to additional categories of motors..

Results from National Minimum Efficiency Standards

ACEEE estimates that motor standards in *Energy Policy Act of 1992* (EPAct) have saved about 2.6 Quadrillion Btus of energy per year between 2000 and 2010. It is also estimated that 15 to 25% of current U.S. electricity usage could be eliminated through optimizing the performance of electric motors driven systems

Since 2009, DOE has issued or codified efficiency standards for more than 30 products, which will result in more than \$45 billion in collective savings by 2015 and \$390 billion by 2030. DOE is currently in the process of finalizing an additional nine standards by the end of 2013 (DOE 2013d).

FOR ADDITIONAL INFORMATION

ACEEE motors website: <http://www.aceee.org/topics/motors>

ACEEE analysis of motor standards: <http://www.aceee.org/blog/2010/10/aceee-delivers-statement-doe-electric-motors-efficiency>

ACEEE *Energy-Efficient Motor Systems: A handbook on technology, program and policy opportunities, 2nd Edition*. <http://www.aceee.org/ebook/energy-efficient-motor-systems>

Appliance Standards Awareness Project (ASAP): <http://www.appliance-standards.org/>

Department of Energy Motors program:
http://www1.eere.energy.gov/manufacturing/tech_deployment/training_motor_systems.html

Department of Energy standards website: <http://energy.gov/savings/energy-goals-and-standards-federal-government>

Department of Energy *Industrial Electric Motor Systems Market Opportunities Assessment*:
http://www1.eere.energy.gov/manufacturing/tech_deployment/pdfs/mtrmkt.pdf

Motor Decisions Matter website: <http://www.motorsmatter.org/index.asp>

NEMA motors standards website: <http://www.nema.org/Standards/About-Standards/Documents/FAQ-Motors.pdf>

Washington State University website: <http://www.energy.wsu.edu/IndustrialEfficiency.aspx>

ENERGY MANAGEMENT SYSTEMS

Energy efficiency can be achieved through the use of more efficient devices or through more efficient practices. The greatest efficiency is achieved when both are done simultaneously. The challenge with employing best practices is that over time, workers change, projects get rushed and best practices are dropped in the name of expediency. Manufacturers have found over the past forty years that for best practices to take hold there must be a system in place that encourages them by documenting any deviation from standard operating procedure.

In the past ten years, several organizations have developed systems for managing energy use and for investing in energy efficiency. The three systems-based programs covered in this report are:

- U.S. EPA ENERGY STAR for Industry
- ISO 50001 Energy Management System

- Superior Energy Performance (SEP)

These three systems can be used in isolation or in combination. The ENERGY STAR program mentioned above is an excellent tool for a company to begin the management of energy in a systematic fashion. The ENERGY STAR Plant Certification however is a labeling program that recognizes performance and not a standard that certifies it. By contrast, ISO 50001 is the international standard for measuring and documenting energy use.

As explained in more detail below, the ISO 50001 standard is based in a large part on the Management System for Energy (MSE) developed by Georgia Institute of Technology (GIT) for American National Standards Institute (ANSI). The MSE 2000-2008 standard was the first comprehensive ANSI compatible energy management standard created specifically for industry.

The DOE worked with GIT and industry to create the Superior Energy Performance (SEP) standard. It is based on the ANSI MSE 2000-2008 standard and requires ISO 50001 as a starting point. SEP provides a company with a systematic method setting an energy-intensity target and measuring progress towards that goal so when combined with ISO 50001, a company has the ability to measure, monitor, and forecast energy consumption as well as the ability to set targets and assess progress.

ISO 50001 Energy Management Standard and Superior Energy Performance (SEP)

ISO 50001 is based on the management system model of continual improvement also used for other well-known standards such as ISO 9001 and ISO 14001. It can easily be integrated into a company's existing system to improve quality and environmental management.

ISO 50001:2011 provides a framework of requirements for organizations to:

- Develop a policy for more efficient use of energy
- Fix targets and objectives to meet the policy
- Use data to better understand and make decisions about energy use
- Measure the results
- Review how well the policy works, and
- Continually improve energy management.

The ISO 50001 energy management standard is an international standard that creates a framework for industrial plants, commercial facilities or entire organizations to manage energy. It addresses all aspects of energy procurement and use. The standard provides organizations and companies with system to create procedures, document performance and develop strategies that decrease energy intensity (energy input per unit of production).

Companies adopting the ISO system demonstrate to customers, employees and stakeholders that the plant or company is dedicated to improving energy performance and using energy management best practices. The first step is to complete an analysis of baseline of energy use. This enables the company to develop an energy intensity metric (energy use per unit of production). Once fully incorporated, the system will enable the following:

- Optimization of existing energy-consuming equipment.
- Benchmarking against contemporaries, measuring, documenting, and reporting energy intensity improvements.
- Creation of a transparent communication process to inform management of energy performance.
- Promotion of energy management best practices and reinforcement of good energy management behaviors.
- Evaluating and prioritizing implementation of new energy-efficient technologies
- A framework for promoting energy efficiency throughout the supply chain.
- Measurement and documentation of Greenhouse Gas (GHG) emissions and reductions that result from improvements in energy use.

The ISO 50001 does not require a company to improve its energy performance, only to develop an energy plan and track energy usage. Setting a goal and measuring progress against it requires an additional protocol. That is where SEP comes in. It captures a facility's improvement in the use of both primary energy use (on-site) and secondary energy sources (e.g., energy conversions such as fuel to electricity performed off-site in a power plant).

The U.S. Department of Energy started working with manufacturing companies in 2008 to demonstrate the value of the ISO 50001 and ANSI MSE 2000-2008 programs. Staff and technical assistance were provided to these companies as they learned and implemented these new systems. Support and promotion of ISO 50001 and SEP systems are now a fundamental component of how DOE's Advanced Manufacturing Office (AMO) engages large manufacturing companies. Companies that seek assistance from AMO are segmented into two categories: those with and those without energy management systems. On-site technical assistance is available to those with management systems or seeking to implement one. Those without can access on-line tools and information.

A facility must demonstrate conformance to ISO 50001 before it can seek to qualify for Superior Energy Performance accreditation. Additional requirements include documenting and achieving proscribed energy performance improvements. Facilities are required to re-certify themselves to the energy management standard every three years.

DOE is in the process of transferring management of the SEP program implementation to a third party entity. Once complete, companies will contact the certifying body and go through a registration process similar to that for ISO 9001 and ISO 14001.

For Additional Information

ISO 50001 was published as an International Standard in June 2011 and copies may be purchased from the American National Standards Institute (ANSI). The website for the standard is:

<http://www.iso.org/iso/home/standards/management-standards/iso50001.htm>

Additional information on Superior Energy Performance can be found at:

<http://www.superiorenergyperformance.net/ems.html>

Information on Georgia Institute of Technology's involvement in developing the ANSI MSE and ISO50001 standards and information on implementation and verification of programs that adhere to those standards is available on the GIT website: <http://gamep.org/services/energy-management/>

FEDERAL TAX INCENTIVES

The primary purpose of the U.S. tax laws is to raise sufficient funds to run the government, however, the Internal Revenue Code is replete with provisions, known as “tax expenditures,” that have been enacted to promote various economic or social goals. Some of these provisions are broad based, such as the current accelerated depreciation system that is designed to encourage investment in productive property. Other provisions are targeted tax incentives intended to promote particular activities or investments. There are several targeted tax expenditures that apply to energy production, but relatively few that apply to energy efficiency, particularly in the industrial sector. This section provides a summary of key incentives.

This section is not comprehensive in its coverage of U.S. tax incentives for the industrial sector, nor does it explain the fundamentals of the corporate income tax system. The reader is provided with several references at the end of this section that provide much greater depth of information on these topics.

ACCELERATED DEPRECIATION

The Modified Accelerated Cost-Recovery System (MARCS) and Bonus Depreciation (2008-2012) provisions in the federal corporate tax code allow companies to expense up to a certain amount of assets each year. These changes to the depreciation schedule were made to stimulate the overall economy by encouraging additional investments by businesses. The value of accelerated depreciation is equal to that of a zero-interest loan on the difference in annual depreciation expense. It is valuable to small and medium size businesses because it improves their short term cash flow and reduces risk associated with a greater level of capital investment. It has less value to larger companies that have superior borrowing capability and are at less risk to cash flow issues (Sachs et al. 2012).

ENERGY CREDIT FOR COMBINED HEAT AND POWER SYSTEMS

Corporations are eligible for a tax credit for installing distributed generation technologies such as solar panels, fuel cells, microturbines and Combined Heat & Power (CHP) systems.

- Business Energy Investment Tax Credit (ITC)
 - 30% for solar, fuel cells (>0.5kW) and small wind (up to 100kW)
 - 10% for geothermal, microturbines(<2MW) and CHP (<50MW)
 - Maximum incentive for fuel cells: \$1,500 per 0.5kW
 - Maximum incentive for microturbines: \$200/kW
 - 10% for Combined Heat & Power (CHP)

Section 48 of the tax code provides a ten-percent credit for CHP property placed in service before January 1, 2017 (Farley, Rogers & Bell 2012).

CHP systems are of particular interest to the industrial sector because of their potential to reduce overall energy consumption. The tax code defines CHP systems as property which uses the same energy source for the simultaneous or sequential generation of electrical power, mechanical shaft power, or both, in combination with the generation of steam or other forms of useful thermal energy (including heating and cooling applications); that has an electrical capacity that does not exceed 50 **megawatts** or a mechanical energy capacity that does not exceed 67,000 horsepower or an equivalent combination of electrical and mechanical energy capacities; which produces at least 20 percent of its total useful energy in the form of thermal energy which is not used to produce electrical or mechanical power, and at least 20 percent of its total useful energy in the form of electrical or mechanical power (or combination thereof); and the energy efficiency percentage of which exceeds 60 percent.

For a system that would otherwise qualify, the credit is reduced to the extent that CHP property has an electrical capacity or mechanical capacity in excess of any applicable limits. The credit is also reduced for systems whose fuel source is at least 90 percent open-loop biomass but fail to meet the efficiency standards.

ENERGY-EFFICIENT COMMERCIAL BUILDING DEDUCTION

The energy efficiency commercial tax deduction (created as a temporary change to the tax code in the *Energy Policy Act of 2005* and renewed twice since) provides companies that have upgraded existing buildings or built new building to a standard greater than recommended by the ASHRAE 90.1-2001 standard from \$0.30 to \$1.80 per square foot of floor space (Farley, Rogers and Bell 2012).

The provision frequently referred to by as *Section 179D* referring to the Internal Revenue Service (IRS) code provides for a deduction for an amount equal to the cost of energy-efficient commercial building property placed in service during the taxable year. Energy-efficient commercial building property is defined as property:

- which is installed on or in any building located in the United States that is within the scope of Standard 90.1 of the American Society of Heating, Refrigerating, and Air Conditioning Engineers and the Illuminating Society of North America (ASHRAE/IESNA),
- which is installed as part of (1) the interior lighting systems, (2) the heating, cooling, ventilation, and hot water systems, or (3) the building envelope, and
- which is certified as being installed as part of a plan to reduce the total annual energy and power costs with respect to the interior lighting systems, heating, cooling, ventilation, and hot water systems of the building by 50 percent or more in comparison to a reference building which meets the minimum requirements of Standard 90.1-2001, as in effect on April 2, 2003).

The deduction is limited to an amount equal to \$1.80 per square foot of the property for which such expenditure is made, and it allowed in the year in which the property is placed in service.

If a building fails to meet the overall building requirement of a 50-percent energy savings, a partial deduction is allowed with respect to each energy-efficient building system that is certified by a

qualified professional as meeting or exceeding the applicable system-specific savings targets established by the Secretary of the Treasury. The separate building systems are (1) the interior lighting system, (2) the heating, cooling, ventilation and hot water systems, and (3) the building envelope. The maximum allowable deduction is \$0.60 per square foot for each separate system.

FOR ADDITIONAL INFORMATION

An analysis of provisions in the U.S. corporate tax code that target industrial energy efficiency is included in ACEEE publication *Industrial Energy Efficiency and Tax Reform*. Farley, Rogers and Bell. 2012. <http://www.aceee.org/research-report/ie125>

ASHRAE 90.1-2010 standard can be previewed and purchased on the ASHRAE website at <http://www.ashrae.org>

FAQ: http://www.efficientbuildings.org/about_the_provision.html

EPA ENERGY STAR: http://www.energystar.gov/index.cfm?c=tax_credits.tx_comm_buildings

TREATMENT OF SMART METERS AND SMART GRID PROPERTY

Section 168 of the IRS code provides for a reduction of the recovery period from 20 to ten years for qualified smart electric meters and qualified smart electric grid systems (Farley, Rogers & Bell 2012). The term “smart electric meter” means any time-based meter and related communications equipment which is capable of being used by the taxpayer as part of a system that:

- measures and records electricity usage data on a time-differentiated basis in at least 24 separate time segments per day,
- provides for the exchange of information between supplier or provider and the customer’s electric meter in support of time-based rates or other forms of demand response,
- provides data to the supplier or provider so that the supplier or provider can provide energy usage information to customers electronically, and
- provides net metering.

The term “smart grid property” means electronics and related equipment that is capable of:

- sensing, collecting, and monitoring data of or from all portions of utility’s electric distribution grid,
- providing real-time, two-way communications to monitor or manage such grid, and
- providing real-time analysis of and event prediction based upon collected data that can be used to improve electric distribution system reliability, quality and performance.

QUALIFIED ENERGY CONSERVATION BONDS

Section 54D of the IRS code provides for the issuance of *Qualified Energy Conservation Bonds*

(QECBs) by state and local governments for qualified conservation purposes. QECBs are a tax credit bond, which means that a taxpayer holding a QECB is entitled to a credit against federal income taxes. The bonds are subject to a national volume cap of \$3.2 billion. Allocations are made to the states, with sub-allocations to large local governments (Farley, Rogers & Bell 2012).

The term “qualified conservation purpose” means:

- Capital expenditures incurred for purposes of (a) reducing energy consumption in publicly owned buildings by at least 20 percent; (b) implementing green community programs (including the use of loans, grants or other repayment mechanisms to implement such programs); (c) rural development involving the production of electricity from renewable energy resources; or (d) any facility eligible for the production tax credit under section 45 (other than Indian coal and refined coal production facilities);
- Expenditures with respect to facilities or grants that support research in: (a) development of cellulosic ethanol or other non-fossil fuels; (b) technologies for the capture and sequestration of carbon dioxide produced through the use of fossil fuels; (c) increasing the efficiency of existing technologies for producing non-fossil fuels; (d) automobile battery technologies and other technologies to reduce fossil fuel consumption in transportation; and (e) technologies to reduce energy use in buildings;
- Mass commuting facilities and related facilities that reduce the consumption of energy, including expenditures to reduce pollution from vehicles used for mass commuting;
- Demonstration projects designed to promote the commercialization of: (a) green building technology; (b) conversion of agricultural waste for use in the production of fuel or otherwise; (c) advanced battery manufacturing technologies; (d) technologies to reduce peak-use of electricity; and (e) technologies for the capture and sequestration of carbon dioxide emitted from combusting fossil fuels in order to produce electricity; and
- Public education campaigns to promote energy efficiency (other than movies, concerts, and other events held primarily for entertainment purposes).

The use of QECBs at the state and local level is discussed in the Development Finance sub-section of Section II. Examples of active programs are provided as well as resources with more in depth information on bond financing.

Section II: Regional, State and Local Programs and Policies

Although some energy efficiency activities are directed at the national level, local programs and policies are critical to driving industrial energy efficiency implementation—companies are more receptive to local providers, programs can more easily leverage local resources, and policies can be responsive to the diversity of a region’s industrial base. Different regions have different needs, so a one-size-fits-all national program is not always the best approach. Many state agencies, such as state energy offices (SEOs) and public utility commissions (PUCs) work with local utility providers to encourage customer investments in energy efficiency. In some instances, state programs have come together to form regional organizations to coordinate short and long-term programmatic activities.

The largest of these programs offer technical and financial assistance to help energy users implement projects that reduce their energy use. They may be managed by a state government agency, energy or natural gas utility, or by a non-governmental organization created to administer them.

Many state and local governments have expanded their economic development efforts to include energy efficiency. In addition to encouraging manufacturers of clean energy related industries to locate in their communities, they provide local companies incentives to expand their facilities and improve the skills of their workers. These efforts often leverage the resources of national programs and policies.

In this section, our explanation of sub-national programs will start with a primer on state level energy regulatory structure. With this understanding the reader will understand the underlying mechanics of how energy efficiency resource acquisition programs function in the following section. In terms of funding, these programs represent the largest segment of the industrial energy efficiency sector of the U.S., having invested \$737 million in industrial energy efficiency in 2010 (Chittum and Nowack 2012). We'll summarize the extensive program offering of these programs and provide several examples.

We will then discuss programs operating at the regional level. Several networks have evolved that function as catalysts that drive market transformation by educating members of state legislatures, utility commissions, and executive branches, and connecting people from all sectors with the national, regional and local resources that can help them become more efficient.

We will also look at federal programs that are delivered through regional and state partners. This arrangement enables the tailoring of programs to local needs and results in more program innovation. Next is a summary of common initiatives provided or managed by state agencies. There is some continuity to these across the country as many are funded in part by their federal counterparts.

Some state organizations fill multiple roles in the energy efficiency sector and are therefore hard to characterize. Though many of these organizations were created to fulfill only a state mission, they have evolved to the point that they now have a regional or national impact. We've titled these Centers of Excellence and describe three well know examples.

The section concludes with an explanation of several new financing tools local governments and utilities are employing to assist companies to invest in energy efficiency. The theory behind many of these tools is that the loan payments can be made with the increased cash flow resulting from energy cost savings.

PUBLIC UTILITY COMMISSION (PUCs)

Most of the regulations that affect the generation, transmission and distribution of electricity and natural gas are established at the state level by state **Public Utility Commissions** (PUCs); also called Public Service Commissions (PSCs). These quasi-judicial government agencies were established at the beginning of the electrification of America to provide each state with a single entity that could resolve the competing interests of utilities and customers.

A full analysis of the details of PUCs, common tariffs, and the administrative rulings is beyond the scope of this report, however a fundamental understanding of how they operate and their importance to state-level energy efficiency programs is required.

In the U.S., utility regulation happens predominately at the state level. Each state has at least one PUC with the authority to regulate utilities. In addition to electric utilities, most PUCs also regulate natural gas delivery, and telecommunications, and in some states other services such as water and waste management. The level of regulation an individual utility is subject to varies by state, sector and degree of local competition. Historically, most utilities were regulated monopolies with defined service territories. All rates and investments by the regulated utilities required PUC approval. In many states, utilities were required to forecast customer demands and submit plans to meet them. As the energy sector has evolved over the past thirty years, the structure of many utilities and the regulations they are subject to have changed, but the need to forecast future demand and plan accordingly has not. As the cost of new generation increases and the cost of energy efficiency decreases, more and more PUCs are requiring utilities to meet future demands through investments in energy efficiency. This requirement is sometimes codified in the form of an **Energy Efficiency Resource Standard (EERS)** that legally requires each utility to meet a specific energy savings goal. Currently 25 states have some form of EERS with some established by legislation and others by regulation.

Not all utilities are subject to PUC rulings. Most rural electric cooperatives and municipal utilities are exempt from PUC oversight. These utilities have locally elected boards that oversee their operation and approve rates and tariffs. In addition, there are a number of state and federally chartered electric power authorizes that are regulated by the chartering body. These include such entities such as the Tennessee Valley Authority, New York Power Authority, and Santee-Cooper Authority (in South Carolina).

Investor owned utilities (IOUs) comprise the majority of the electric generation, transmission and distribution capacity of the North America and in many states have been tasked by the PUCs of the states in which they operate to make significant investments in energy efficiency. The California Public Utility Commission (CPUC) has been one of the more proactive PUCs and has required each of the four major IOUs in California (Pacific Gas & Electric (PG&E), Southern California Edison (SCE), Southern California Gas Company, and San Diego Gas & Electric (SDG&E)) to establish tariffs and programs to encourage energy efficiency. It describes its mission to encourage energy efficiency as in the following statement:

Energy Efficiency and Demand Response are the first priority in California's loading order for energy resources. Pursuant to applicable Public Utilities Code sections, the CPUC regulates the IOUs' energy efficiency programs. Energy efficiency typically refers to the installation of energy efficient technologies or measures to reduce energy usage and eliminate energy losses in homes, businesses, and new construction. An energy efficient home or business can help consumers reduce energy usage while maintaining comparable service, thereby saving money on utility bills. On September 24, 2009, the CPUC approved funding and programs for the

2010-2012 energy efficiency program cycle. These energy efficiency programs are projected to save 7000GWh, 3460MW, and 150 MMTherms⁴ and follow the 2006-2008 program cycle, which resulted in savings of over 6000GWh, 1175MW, and 84MMTherms. The funding is 42% higher than the prior three-year cycle (2006-2008) and will support programs designed to produce deeper and more comprehensive savings that the Commission believes California's utilities can and will achieve. These programs and related energy savings are a key component of California's broader energy policies and greenhouse gas mitigation strategies. [CPUC's] Energy Division's Demand-side Management (Evaluation, Measurement and Verification and Integrated Demand-side Analysis), and Residential and Non-Residential Programs sections work with the IOUs to develop and evaluate these energy efficiency programs. (CPUC 2013a)

In addition to requiring utilities to invest in customer side energy efficiency, a PUC can also require utilities to create tariffs that encourage customer investments in distributed generation technologies such as solar, geothermal, combined heat and power, and biomass. To enable more distributed generation, PUCs work with utilities to establish **interconnection standards** that standardize and thereby reduce the cost of connecting to the electric grid.

The next section provides an overview of the types of energy efficiency resource acquisition programs common to regulated utilities across the country. It will include examples of programs in several states, one of which is in California so that the reader can link back to CPUC goals quoted above.

UTILITY CUSTOMER ENERGY EFFICIENCY PROGRAMS

A majority of states have determined that a cost effective method to meet existing and future regional power needs is to invest in demand-side energy efficiency. In contrast to supply-side planning that only focuses on meeting customer demands through investments in generation, transmission, and distribution assets, demand-side planning recognizes the value of providing financial and technical assistance to energy consumers to make investments in more efficient equipment and practices. These programs are often referred to as energy efficiency resource acquisition programs for as the name implies efficiency can be procured to meet system capacity just as reliably as supply-side investments. Administrators of these programs are given energy savings targets and are held to them with the same strictness as a production target for a generator.

In some states, regulated utilities are given the responsibility to create and manage energy efficiency resource programs, while in others; new organizations are created for these tasks. The programs fund industrial energy efficiency projects through a variety of means, including direct grants, low-interest loans, technical assistance, rebates, tax credits, and direct customer incentives. Some of this money may go directly to industrial companies that make energy efficiency investments, while some may go to third-party contractors who make the capital investments at industrial facilities. A few programs

⁴ Therm is an abbreviation for 100,000 British Thermal Units (BTUs) and approximately the energy in one hundred cubic feet of natural gas. MM is the Roman notation for one million, so one MMTherm is 1×10^{11} BTUs or 1.05×10^{14} joules.

cover the salaries of engineering professionals who identify and solve energy efficiency opportunities at customer sites (Chittum, Elliott & Kaufman 2011).

Companies seeking assistance are likely to have many options to choose from. Some programs have hard targets and verify energy savings while others only attempt to catalyze existing market forces through education and training. We will examine the latter first.

PUBLIC OUTREACH, EDUCATION, TRAINING, AND TECHNICAL ASSISTANCE

These programs take many forms, but all have the goal of increasing the knowledge of workers and decision makers at industrial facilities. Some of these efforts are quite simple involving websites that clients can access and technical fact-sheets that can be handed out or downloaded. Other initiatives include best practices workshops, visiting technical representatives, and energy management system implementation assistance.

These programs offer low-cost or no-cost energy audits and assessments that identify opportunities for clients to reduce energy costs and energy use. Program staff or contracted specialist conduct the audits and provide reports to clients.

More recently, utility programs have been providing training on energy management systems such as the new ISO 50001 energy management standard and the Superior Energy Performance (SEP) program with its requirement for long-term energy-intensity reduction.

RESOURCE ACQUISITION

These types of program all have a goal of achieving specific energy savings. This may be motivated by the need to mitigate the construction of new generation or transmission—from a planning perspective, a decrease of 100 kW in future demand by a facility has the same net impact as 100 kW in new generation in terms of balancing demand and supply. To achieve these *negawatts*⁵ utilities have developed many methods of encouraging energy efficiency investments in the industrial sector. What is important to the program administrator is the ease of managing the program, calculating energy savings, and confirming the certainty of those savings once investments have been made.

Prescriptive Incentive Program

These programs provide financial rebates upon proof of purchase of qualifying equipment, such as *NEMA Premium*[®] motors for use in a production process. The rebates in most prescriptive programs are paid directly to the client however some programs provide the funds to the vendor.

Example

Pacific Gas & Electric (PG&E), a large investor owned utility in California, offers rebates to businesses on over a hundred different items. These incentives are set at a level that is intended to be sufficient to

⁵ A *negawatt* is a unit energy saving created by Amory Lovins in 1989, <http://www.loe.org/shows/segments.html?programID=08-P13-00013&segmentID=4>.

drive demand, but be less than the cost of the energy saved. A sampling of prescriptive rebates available to business customers is contained in Table 2 (CPUC 2012c).

Table 2: Example of Prescriptive Rebates (PG&E)

Rebate Code	Description	Rebate / Unit of Measure
A102	Infrared film for greenhouses	\$0.05/sq.ft.
B36	Wall insulation (final R value>13)	\$0.50/sq.ft.
H15	Steam process boiler	\$2.00/Mbtuh
H201	Industrial low pressure steam traps (15PSIG or less)	\$100/unit
F188	Commercial convection oven (natural gas)	\$500/oven
F178	ENERGY STAR commercial glass door freezer with internal volume 50ft ³ or greater	\$1000/unit
L1014	Interior existing 400 Watt lamp <244 Watt new Fixture (Tier 1)	\$75/fixture

Standard Offers and Custom Incentive Programs

These programs offer a financial incentives to customers for projects with an energy efficiency component that are too complicated to take advantage of prescriptive rebates. These projects can include new construction, upgrade, retrofit or replacement of a building or a production process. The amount of the financial assistance may be related to the amount of energy saved or be a percentage of the overall project cost. When based upon energy savings, the more common method, the incentives are usually allocated on an amount per amount per unit of energy saved (\$/kWh, \$/MMBtu) and the total amount is based on either a calculated potential energy savings or realized energy savings. There is usually a cap to the amount of the incentive based on available funds and/or a percentage of overall project cost.

Examples

Northern Indiana Public Service Company (NIPSCO) custom electric program provides incentives based on electricity reductions in kWh through qualified efficiency improvements at a rate of \$0.06/kWh for lighting projects and \$0.09/kWh for other projects (NIPSCO 2012a). On the natural gas side of the business, an incentive of \$0.60/therm is available for qualified efficiency projects (NIPSCO 2012b).

Xcel Energy-Colorado has a Standard Offer that provides an incentive of \$250/kilowatt for demand reduction and \$0.05/kWh for consumption reduction projects. It also includes a rebate of up to 50% off the cost of an energy audit (which is required) to identify and quantify opportunities (Xcel 2013).

CenterPoint Energy's Standard Offer incentives that are paid on a per kW or kWh reduction basis and that vary by energy savings measure. Forty percent of the incentive is paid upon installation and the balance upon approval of the savings report. All savings must be either predetermined (deemed) or verified by some level of measurement and verification (CenterPoint 2013).

Self-Direct Program

Similar to a custom incentive program, these programs provide flexibility to larger, more energy-intensive customers to invest in complex projects with significant potential to reduce energy use or energy intensity. The customer typically “self directs” the energy efficiency fees it pays as part of its utility bills towards projects it determines will save energy. In such programs, the program administrator often collects the energy efficiency fees and then returns them to the customer to invest in projects. The administrator usually withholds a small percentage to cover the cost of verifying savings and reporting them to the commission.

The amount of the financial assistance may be related to the amount of energy saved or be a percentage of the overall project cost. It may also be limited by the amount of energy efficiency fee the customer has historically paid. In some cases, if all of the set-aside funds are not used, the program may make the remainder available to other customers for investment. In some states, customers are given the option to not participate in any energy efficiency programs (“Opt Out”) if they can prove or will testify that they are already investing in a certain level of energy efficiency. States vary in the degree to which they evaluate this claim. In some service territories, self-direct programs are optional, while in others, customers of a specific size or class are automatically enrolled.

One other type of energy efficiency program targeted toward larger users, called Reverse Auction, allows a company to bid in an amount of energy savings for a desired financial incentive. For example, a company with a project that doesn't quite make the internal hurdle rate for internal approval might bid in the energy savings of that project and ask for the amount of financing that would enable the project to make the internal hurdle rate. Such a bid in terms of energy saved per dollar incentive could be competitive and thus selected for funding by the program administrator. By contrast a project with minimal energy savings and a significant funding request would not be competitive. Reverse Auctions award grants to the bidders asking for the lowest cost per kWh or other measure of energy savings. By using a competitive bidding market mechanism, such a program structure provides the dual advantages of maximizing energy savings and minimizing **free riders**. Unfortunately, it also tends to skew the mix of projects towards low-cost, high return with significant projects with greater savings and longer paybacks not getting funded.

Energy Manager / Energy Management Programs

Energy manager and management programs are broadly viewed as those that support an individual or an internal organizational management structure responsible for paying attention to and advocating for the energy efficiency opportunities within a given firm or facility. Energy manager programs focus on identifying and empowering an individual to be the actual energy manager onsite, while an energy management program looks to integrate energy-saving actions into a firm's or facility's overall management structure. Many of these programs are based upon existing energy management or quality control standards.

These programs take two primary forms: support for the hiring of an in-house energy manager at a facility, or support for the implementation of an energy management program facility- or company-wide. These programs frequently address the human behavior of those tasked with operating equipment or managing a facility's internal activities, and the impact such behavior has on energy use (Chittum, Elliott and Kaufman 2011).

An energy manager program may or may not include the implementation of an energy management system such as ISO 50001 or Strategic Energy Management (SEM) such as provided by NEEA.

Example

Bonneville Power Administration (BPA) launched a new two-year “Energy Smart Industrial” program in 2009. In 2011 the program successfully delivered over three times the savings capacity delivered from an earlier BPA industrial program during 2007-9. The Program includes a strong emphasis on developing energy efficiency programs with key industrial clients including three interrelated new initiatives: (i) financial and technical support for placement of Energy Project Managers in key enterprises, (ii) the Track and Tune program, and (iii) the High Performance Energy Management (HPEM) program (BPA 2009, 2010).

The ESI program had placed 23 Energy Project Managers working in 32 separate industrial facilities by the end of FY2011 (many of the managers work at more than one site). The Energy Project Managers are employees of the industrial companies. They work with ESI program support to help their facilities develop their own new energy savings goals. The ESI program co-funds their salaries, but after the first year, ESI funding is dependent on the facility's achievement of their previous year's goals (BPA 2011a, 2011b).

Track and Tune is designed to financially and technically help Industrial energy users to “do the little things well”, as well as to install a system that tracks and performance and savings over multiple years. The program's system can be applied to an entire facility or targeted sub-systems.

The HPEM program provides training and support to end-users for implementation of continuous-improvement energy management into their core business practices. ESI program management emphasizes that the ESI program must be viewed as a complete package, as the different elements feed off of each other.

New Construction and Major Renovation Incentives

As the name suggests, these programs provide financial incentives for builders of new industrial buildings to build to a level of energy efficiency greater than is the industry norm. Major retrofits may qualify as well.

Distributed Generation Interconnection and Incentives

Electric utilities are in the business of generating electricity and therefore many of their incentives are tied to maximizing efficiency of generation. Customer side generation can be problematic for them as it has the potential to decrease sales and add complexity to the control of their distribution grid.

Where a PUC has found a public benefit to distributed generation that outweighs the direct cost to utilities, it will enable the utilities to get cost recovery for additional expenses incurred as a result of customer-side generation and for incentives to create pro-renewable energy and pro-CHP programs.

California is a state in which the PUC has established an incentive program to encourage customer-located generation. The CPUC's Self-Generation Incentive Program (SGIP) provides financial incentives to support existing, new, and emerging distributed energy resources in the form of rebates. Each of California's four IOUs provides incentives for qualifying technologies which include wind turbines, CHP, waste heat to power technologies, pressure reduction turbines, internal combustion engines, microturbines, gas turbines, fuel cells, and advanced energy storage systems (CPUC 2013b).

RESULTS

The Consortium for Energy Efficiency (CEE) conducted a study of the 2010 and 2011 expenditures by utilities and public benefit funds on energy related programs. CEE estimates that American and Canadian energy efficiency commercial and industrial (C&I) programs saved over 124 TWh of electricity and 1.3 million MMBtu⁶ of natural gas in 2010 (CEE 2012). Utilities often use the same programs to address commercial and industrial facilities and do not differentiate energy savings between those two groups. Therefore, it cannot be known with any degree of accuracy what fraction of the values mentioned above can be attributed to the industrial sector.

In a survey by the Southwest Energy Efficiency Project (SWEET) of the seven major utilities in the six states it serves, the life cycle cost of saved energy for commercial and industrial programs ranged from \$0.01 to 0.05 per kWh with an overall average of \$0.022/kWh (SWEET 2012). This is significantly less than the average price for these same customers.

Energy resource acquisition programs often have a budget set as a part of overall utility sales (e.g., 1% of sales shall be spent on EE programming). The portion allocated to industrial programs may be set or the utility may have discretion on how much to spend to achieve the desired level of savings.

⁶ MMBtu is a unit of measure of energy. MM is Roman notation for one million and Btu is an abbreviation of British thermal unit (equal to 1055 joules). One MMBtu is approximately the energy contained in one thousand cubic feet of natural gas.

According to CEE, natural gas utilities spent \$313.1 million on commercial and industrial energy efficiency and electric utilities spent \$2.6 million on C&I programs in 2011 (CEE 2012). An analysis by ACEEE in 2012 determined that electric utilities and public benefit funds spent \$737,000,000 on industrial energy efficiency programs in 2010 (Chittum, Nowak, 2012).

FOR ADDITIONAL INFORMATION

CEE analysis of utility expenditures on energy efficiency: <http://www.cee1.org/ee-pe/2011AIR.php3>

Robert Taylor, Daniel Trombley, and Julia Reinaud, *Energy Efficiency Acquisition Program Models*. Paris, France. Institute for Industrial Productivity (IIP), December 2012.

Chittum, Anna and Seth Nowak, *Money Well Spent: 2010 Industrial Energy Efficiency Program Spending*. Washington, DC: America Council for an Energy-Efficient Economy. April 2012

Geller, Biewald, Goldberg, Nadel, Molina, Neubauer, Schlegel, Wilson, and White, *The \$20 Billion Bonanza: Best Practice Electric Utility Energy Efficiency Programs and Their Benefits for the Southwest*. Boulder, CO: Southwest Energy Efficiency Project (SWEEP). October 2012

Wallace, and Forster, *State of the Efficiency Program Industry: Budgets, Expenditures, and Impacts 2011*, Boston, MA: Consortium for Energy Efficiency. March 2012

REGIONAL NETWORKS

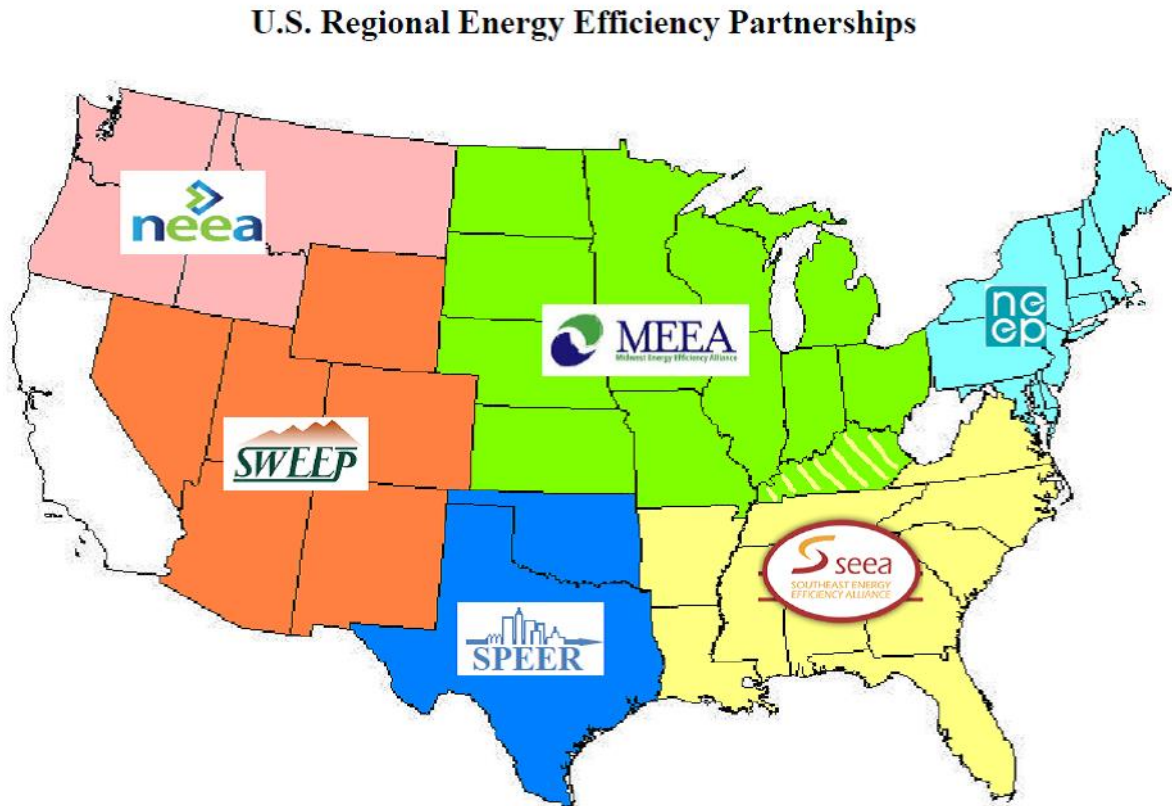
Most individual energy-intensive industries are concentrated in one or two regions of the country. Because of this and other geographic effects, a regional approach has proven to be an effective method of addressing the needs of many manufacturing sectors. ACEEE has worked with the regional energy efficiency organizations (REEO) to build their capacity and engagement with the industries in their regions. The REEOs include:

- The Northwest Energy Efficiency Alliance (NEEA)
- The Southwest Energy Efficiency Project (SWEEP)
- The Midwest Energy Efficiency Alliance (MEEA)
- The Southeast Energy Efficiency Alliance (SEEA)
- The Northeast Energy Efficiency Partnerships (NEEP)
- The Industrial Energy Efficiency Network (IEEN)
- The South-central Partnership for Energy Efficiency as a Resource (SPEER)
(www.EEPartnership.org)

Of the major manufacturing states, only California is not covered by an established REEO. West Virginia and Kentucky are covered by both SEEA and MEEA. Since California is a leader in energy efficiency, and is investing in the same types of programs at the same rate as REEOs, it is not viewed as being in great need of inclusion in a regional organization.

Regional networks are useful at bringing representatives from organizations together to discuss common problems and explore opportunities to collaborate on pre-commercial research, development and market analysis. These organizations tend to be loose-knit and membership is voluntary. They provide value to their members by being a connection to resources and information beyond their internal capabilities.

Figure 4: Regional Energy Efficiency Organizations and the State They Serve



FEDERAL PROGRAMS—REGIONAL/STATE DELIVERY

Many federal programs are delivered through state and regional organizations. Coordination between centers and overhead funding is managed by a federal agency while service delivery is managed at the local level. Some centers also receive funding from state agencies and charge for services to cover all of their expenses.

Depending on the program, the federal agency may contract an entity in each state or select a few organizations and assign each a geographic territory. What separates these types of programs from those funded federally and administered by state agencies and covered in the next section is that they operate autonomously from state governments and that performance metrics are approved at the federal level.

The four programs examined in this section are the Department of Energy’s Industrial Assessment Centers and Clean Energy Application Centers, the Department of Commerce’s Manufacturing Extension Partnership Centers, and the Department of Agriculture’s Cooperative Extension Program.

INDUSTRIAL ASSESSMENT CENTERS (IACs)

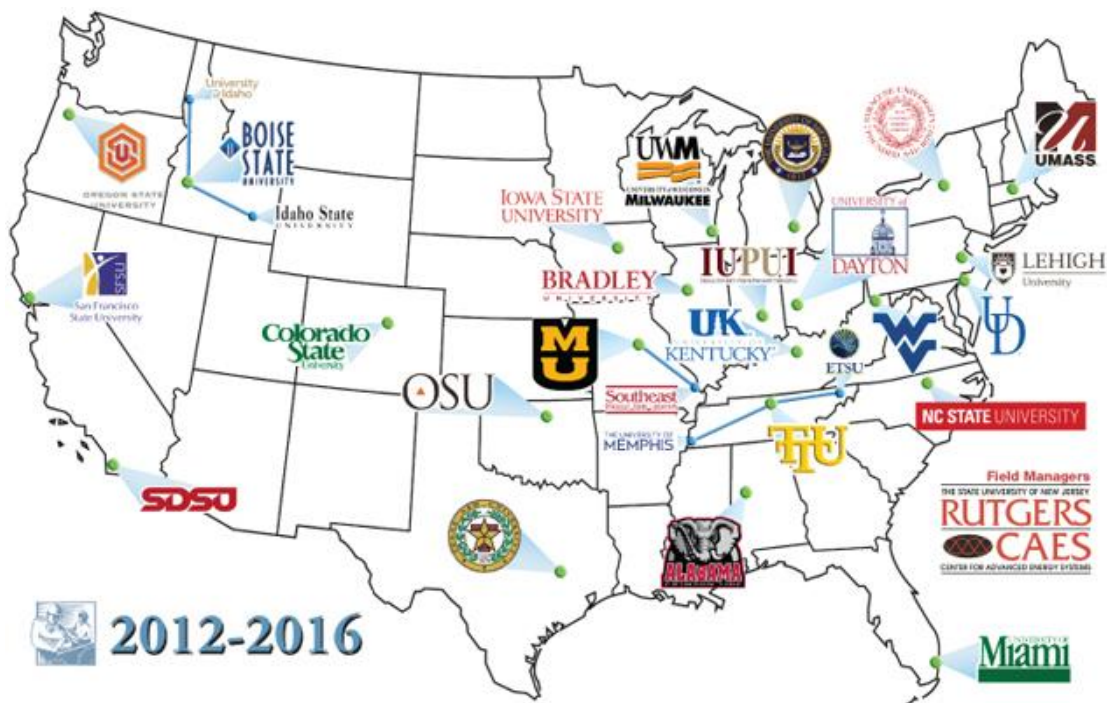
This U.S. Department of Energy program works with twenty-four universities across the country to train students in industrial energy efficiency and to help medium sized manufacturing firms to become more energy efficient. DOE funds each school to provide a given number of free energy audits to qualifying facilities each year. The audits are performed by students enrolled in the IAC program lead by a professor with an expertise in industrial energy efficiency.

To be eligible for consideration, manufacturers must meet the following criteria:

- Belong to one of the industries identified in the 20-39 Standard Industrial Codes (SIC)
- Located less than 150 miles of an IAC
- Gross annual sales below \$100 million
- Fewer than 500 employees at the plant site
- Annual energy bills of more than \$100,000 and less than \$2.5 million
- No professional in-house staff to perform the assessment

IAC assessments lead by faculty and staffed with students. The audit team will analyze a facility’s potential to reduce energy use, energy expenditures, water use, and minimize pollution.

Figure 5: Location of Industrial Assessment Centers



Prior to the on-site assessment, students will contact the facility to conduct a remote survey. This will help them understand the scope of the plant and be better prepared to conduct the audit. During the on-site visit, the audit team performs a detailed process analysis and develops specific recommendations with estimates of costs, performance, and payback times. Within 60 days, the IAC will send the plant a confidential report detailing the analysis, findings, and recommendations. It will also follow up within six months to verify what recommendations have or will be implemented.

The benefits of the program are three fold: the facility receives an energy audit that helps them identify projects to reduce utility costs. The students receive field training in energy efficiency, and the larger manufacturing community has a supply of trained workers that it can hire and who come with excellent credentials. Each year, approximately 250 engineering students participate in the IAC program.

Thousands of undergraduate and graduate engineering students have participated over the years, conducting assessments at over 15,000 U.S. manufacturing plants. IAC students find that they gain several key skills that are crucial to future job success.

- More than 78% of IAC alumni reported that IAC participation improved their written communication skills and ability work in teams.
- More than 70% of IAC alumni noted an increased ability to solve problems within time, money, and human resources constraints.
- More than 50% of IAC alumni are registered Professional Engineers (PE) or Engineers-in-Training (EIT).
(AMO 2012c)

DOE funds 24 schools on a five year cycle. The current centers are identified in Figure 5. DOE has budgeted \$30 million each year to fund the IACs from 2012-2016. Each center performs about two dozen assessments per year. Companies interested in receiving an assessment need only contact their local IAC, submit information about their facility and energy use, and ask to be put on the audit schedule (AMO 2012c).

CLEAN ENERGY APPLICATION CENTERS

This is a national program coordinated by DOE’s Advanced Manufacturing Office (AMO) and delivered through regional centers staffed by subject matter experts. The Regional Clean Energy Application Centers (CEACs), formerly called the Combined Heat and Power (CHP) Regional Application Centers (RACs), and soon to be rebranded as the regional CHP Technical Assistance Partnerships (CHP TAPs), promote and assist in transforming the market for CHP, waste heat recovery, and district energy technologies throughout the United States. Each center advocates for greater adoption of these technologies in their regions by providing technical and policy information to end-users, legislatures, and public utility commissions.



Key services of the Regional Clean Energy Application Centers include:

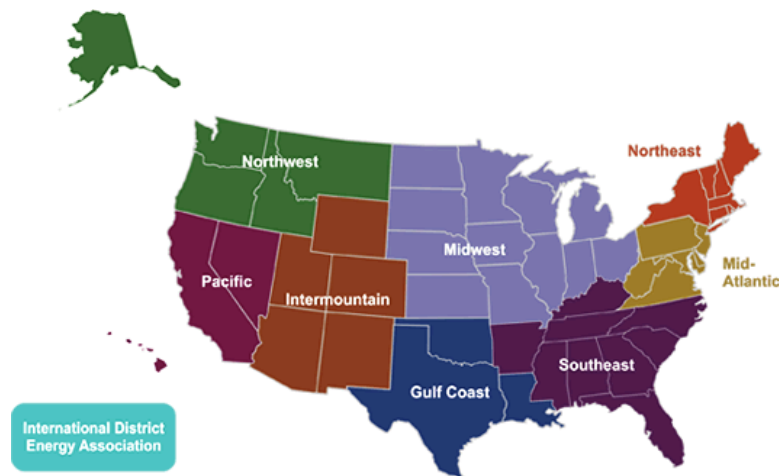
Market Assessments—Supporting analyses of CHP market potential in diverse sectors, such as, health care, industrial sites, hotels, and new commercial and institutional buildings.

Education and Outreach—Providing information on the benefits and applications of CHP to state and local policy makers, regulators, energy end-users, trade associations, and others.

Technical Assistance—Providing technical information to energy end-users and others to help them consider if CHP, waste heat recovery or district energy makes sense for them. This includes performing site assessments, producing project feasibility studies, and providing technical and financial analyses.

In 2013, the CEACs will in cooperation with EPA offer technical assistance to the more than 650 major source facilities impacted by the Boiler MACT regulation. In 2012, the EPA finalized the reconsideration process for its Clean Air Act pollution standards, National Emissions Standards for Hazardous Air Pollutants for Major Sources: Industrial, Commercial, and Institutional Boilers and Process as Boiler and Process Heaters (commonly known as Boiler MACT). This Act applies to large and small boilers in a wide range of facilities and institutions. DOE is making available through its CEACs technical assistance to ensure that major sources burning coal or oil have information on cost-effective clean energy strategies for compliance, such as natural gas combined heat and power (CHP), and to promote cleaner, more efficient boilers to cut harmful pollution and reduce operational costs. The CEACs will make site visits to discuss strategies and provide information on potential funding and financing opportunities

Figure 6: Clean Energy Application Centers (CEACs)



Source: AMO 2012d

- Midwest, Intermountain, Northwest, and Pacific Regions
- Mid-Atlantic Region
- Northeast Region
- Southeast and Gulf Coast Regions

MANUFACTURING EXTENSION PARTNERSHIP CENTERS (MEPs)

Each state has at least one MEP Center and they are all funded in part by the National Institute of Standards and Technology's (NIST) *Hollings Manufacturing Extension Partnership* (MEP) program. The purpose of MEP centers is to assist small and mid-sized U.S. manufacturers create and retain jobs, increase profits, and save time and money. The nationwide network provides a variety of services, from mentoring the implementation of continuous improvement programs and green manufacturing practices, to adoption of research and development strategies that bring new products to market quicker and cheaper.

The MEP program has over 1,400 technical experts. The function as trusted business advisors, focused on solving manufacturers' challenges and identifying opportunities for growth. MEP services fall into five critical categories:

- Technology acceleration
- Supplier development
- Sustainability
- Workforce
- Continuous improvement

Since the 1980s, MEP Centers have helped manufacturers implement continuous improvement programs such as Lean Manufacturing, ISO 90001 quality programs and Six Sigma system optimization. All of these programs involve empowering the workforce to identify and solve problems. MEP specialists work on-site with production workers mentoring them through the process so that they ultimately become continuous improvement experts too.

A more recent focus of the MEP program is to help companies innovate. Companies that continually innovate are more successful and competitive in the global market place. MEP Centers can connect manufacturers with research at federal laboratories and educational institutions.

For Additional Information

NIST Manufacturing Extension Partnership home page: <http://www.nist.gov/mep/>

Location of MEP Centers: <http://www.nist.gov/mep/find-your-local-center.cfm>

MEP involvement in E3 program: <http://www.nist.gov/mep/e3.cfm>

COOPERATIVE EXTENSION PROGRAM

The USDA provides funding to at least one "land grant" university in each state so that it can engage in agricultural extension services. Land grant universities are institutions that receive government funding to engage in agricultural research for the public good. The primary goal of the cooperative extension program is to distribute knowledge of best practices from land grant universities, ensuring

that farmers and rural Americans have access to the most up-to-date agricultural information. In the word "Extension", USDA means "reaching out," and in addition to teaching and research in the agricultural field, land-grant institutions "extend" their resources, solving public needs with college or university resources through non-formal, non-credit programs (USDA 2012e).

These programs are largely administered through thousands of county and regional extension offices. The universities and their local offices are supported by *National Institute of Food and Agriculture* (NIFA), the federal partner in the *Cooperative Extension System* (CES). It plays a key role in the land-grant extension mission by distributing annual congressionally appropriated formula grants to supplement state and county funds. NIFA affects how these formula grants are used through national program leadership to help identify timely national priorities and ways to address them.

Created in the 1860s, the program's engagement with farms and rural businesses have helped make possible the American agricultural revolution in the Twentieth Century, the results of which were dramatically increased farm productivity and reduced environmental impact:

- In 1945, it took up to 14 labor-hours to produce 100 bushels of corn on 2 acres of land.
- By 1987, it took just under 3 labor-hours to produce that same 100 bushels of corn on just over 1 acre.
- In 2002, that same 100 bushels of corn were produced on less than 1 acre.

That increase in productivity has allowed fewer farmers to produce more food and at the same time using less energy. As productivity increases, the diesel fuel farmers use in their planting and harvesting equipment decreases. In addition to providing education to agribusinesses to help them become more productive, many extension programs, such as the one hosted by Cornell University, and referenced below, provide education on renewable energy, energy efficiency, and pollution prevention.

For Additional Information

USDA page for Extension Program: <http://www.csrees.usda.gov/qlink/extension.html>

Tomkins County, New York / Cornell University Extension program's energy page: <http://ccetompkins.org/energy>

University of Missouri Extension program energy webpage: <http://extension.missouri.edu/main/DisplayCategory.aspx?C=71>

STATE ASSISTANCE PROGRAMS

Many state agencies provide free technical assistance to companies within their borders. Their staff and web based resources can assist companies to stay in compliance with local, state and federal regulations, train their workers, and identify opportunities to reduce energy use, energy expenditures, and pollution. These agencies are often a gateway to federal programs and financial assistance to demonstrate emerging technologies and practices. The better funded programs often fund demonstration projects of their own.

Other technical assistance programs are provided by universities. These programs may use faculty and students to provide services or have dedicated staff. The Agricultural Extension program is one of the largest and oldest in the country.

STATE ENERGY OFFICES (SEOs)

Some SEOs are hosted by the state's department of commerce while others are hosted by the department of natural resources or environmental management. A list of SEOs is available on the website of the National Association of State Energy Officers (NASEO)⁷. Most SEOs offer some type of technical assistance to the manufacturing base of their state.

Each SEO portfolio of grant programs is different, so a quick visit to an SEO's website is a prudent first step. Financial assistance programs can be similar to utility prescriptive and custom rebate programs, or may be provided on a competitive basis. They may be ongoing programs last multiple years, or be short term opportunities that exist only as long as funds are available.

Competitive solicitations are singular events that require a response within a specified time with a proposal for a specific type of project. Funding opportunities range from thousands to millions of dollars and target simple to large investments. The issuing agency will stipulate the number of awards or grants it intends to make as well as all the information it will require in a response.

Timing can be an issue with competitive solicitations as an applicant must have all the project proposal analysis completed at the time of application but cannot start implementing the project until after notice of award—which can often be months after initial application. Applicants should also be mindful most programs require post implementation reports that document the amount of energy and energy cost saved, and funding can be cancelled for any number of reasons.

Between 2009 and 2012, many SEOs used funding provided the *American Recovery and Reinvestment Act of 2009* (ARRA) to fund Clean Energy Financing Programs. Each state created a funding mechanisms such as revolving loan funds (RLF) to provide lasting capacity to energy efficiency and renewable energy projects. As loans are repaid, the fund is replenished and available to made additional loans. Interest rates and other loan conditions are generally more favorable than commercially available terms.

Currently, 39 states and territories have more than \$545 million in RLFs. Many of the states are leveraging private sector capital to expand the programs and provide low-cost loans to projects beyond those suggested by DOE (DOE 2012c).

STATE POLLUTION PREVENTION TECHNICAL ASSISTANCE PROGRAMS

Many states have an office, often within the state agency responsible for enforcement of environmental regulations, which provides pollution prevention technical assistance. The concept of

⁷ <http://www.naseo.org/members/states/default.aspx>

these programs is that pollution can be reduced more cost effectively if facilities with the potential to pollute are more educated on pollution prevention and waste mitigation practices and technologies. These programs are supported by the U.S. EPA's Office of Pollution Prevention and Toxics.

List of EPA Region 1 OPPTAs: <http://www.epa.gov/p2/pubs/assist/resourceguide01.htm>

EPA P2 Program: <http://www.epa.gov/p2/pubs/assist/index.htm>

STATE WORKFORCE TRAINING PROGRAMS

State departments of labor have responsibility for providing training to displaced and incumbent workers. A focus for many states in the past four years has been renewable energy and energy efficiency training. These programs may provide training directly or contract it to a third party. The training may be provided at little or no cost to workers or their employers.

It is common for a state's department of labor and department of commerce to work together to provide workforce training grants to new employers and those that are growing their workforce. The type of training that is eligible for assistance varies by state. Generally, training that is required by law, such as OSHA safety training, is not eligible. Skills training for emerging technologies, or that result in **transportable credentials** are often targeted by state programs.

Examples:

Nebraska Department of Labor: State Energy Sector Partnership (SESP) grants:

<http://dol.nebraska.gov/center.cfm?PRICAT=3&SUBCAT=3W>

"Green Jobs in Indiana, Employment Prospects in the Green Economy:

<http://drivingworkforcechange.org/reports/indianagreenjobs.pdf>

List of SESP grants: http://www.doleta.gov/pdf/SESP_Summaries_FINAL_20204010.pdf

CENTERS OF EXCELLENCE

Several institutions have developed a level of expertise in one or more areas that they are recognized nationally as centers of excellence in those areas. Though local or regional in focus, they have a national reputation and are frequently asked to participate in national panels and studies. These centers engage in one or more of the following activities:

- Research—usually applied research, seeking solutions to local challenges
- Development—turn a concept into something that can be field tested
- Demonstration—field testing of a new technology
- Deployment—encouraging adoption of new technologies through awareness, education, technical and financial assistance

These centers may be modest in size with a single focus such as the Department of Energy's Clean Energy Application Centers, or may be large state institutions such as NYSERDA with significant staffs and funding. The latter tend to engage in multiple disciplines and cover the full gamut of

RDD&D. Center may be standalone institutions or part of a network that collectively provide a wide range of services.

There are over 200 centers across the country, most of which are members of the Association of State Energy Research and Technology Transfer Institutions (ASERTTI), a coordinating organization that is described in greater detail later in this report. The structure of these centers is as varied as they are numerous. Three different examples are described below.

NYSERDA

NYSERDA is one of the nation's largest and most accomplished state energy offices. It benefits from being the primary organization in the state of New York with responsibilities for energy related issues: energy efficiency and renewable energy research and development, energy efficiency awareness, education and demonstration, and administration of the most of the state's public benefit funded energy efficiency resource acquisition programs.

Service Offerings

NYSERDA administers many of its programs under the **New York Energy SmartSM** brand, and works with a network of contractors to implement the programs. NYSERDA offers several programs for its large commercial and industrial customers.

- **Existing Facilities Program:** Offers a portfolio of prescriptive and custom financial incentives to offset the cost of energy improvements in existing commercial and industrial facilities across New York State.
- **Industrial and Process Efficiency (IPE):** Provides performance-based incentives to manufacturers and data centers implementing energy efficiency and process improvements to reduce costs.
- **FlexTech Program:** Provides commercial, industrial, institutional, government, and not-for-profit sectors with objective and customized information to help make informed energy decisions.

Most programs that target industry also are intended for the commercial sector. Custom incentives in the Existing Facilities program range from 12 cents to 16 cents/kWh, depending upon location of customer. Under the IPE program, industrial process improvements are eligible for the same 12 to 16 cents/kWh incentive. NYSERDA also offers incentives for natural gas projects and specifically targets Combined Heat and Power (CHP) systems for assistance.

In order to fully support the complex needs of large industrial and data center customers, NYSERDA has implemented a Key Account Manager strategy that assigns a dedicated project manager to be the main point of contact and develop a long term relationship with the customer. These relationships allow the NYSERDA project manager to work with the industrial site to identify the energy efficiency component of a process improvement project when funding for the next cycle is being considered. (Taylor, Trombley and Reinaud 2012)

Funding

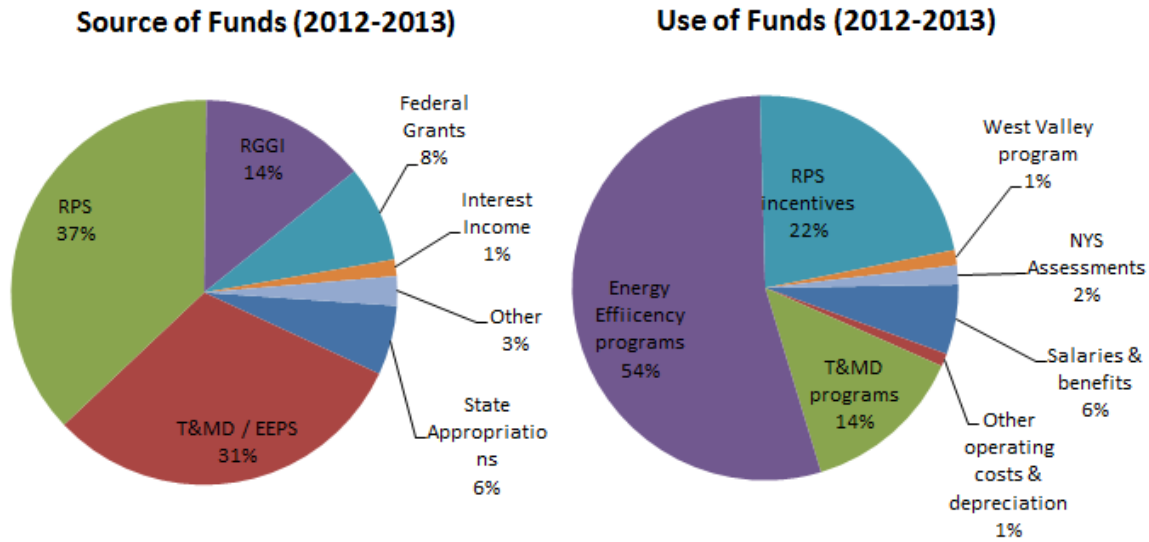
New York funds much of their energy efficiency programs through **system benefits charges** (SBC) authorized by the New York State Public Service Commission (PSC). An SBC, sometimes referred to as a public benefit charge, is a common way to pay for energy efficiency or renewable energy activities. It is a specific line-item added to the electric or natural gas bills paid by all consumers within one or more customer classes. Fees are usually assessed on a volumetric basis such as \$/kWh. A state may have one or more SBCs and each one is likely to target a specific policy goal such as increasing deployment of renewable energy, or market acceptance of energy efficiency. New York utilities collect four separate SBC charges from their customers, each of which is kept in a separate account and then utilized by the utilities and NYSERDA to administer specific programs.

NYSERDA receives funds from several other sources. As the state energy office, it receives an associated federal grant from the U.S. Department of Energy and funds from the state. It also applies to competitive federal solicitations to fund research, development and deployment projects and programs. But the majority of its revenues come from the four system benefit charges (NYSERDA 2012).

- Renewable Portfolio Standard (RPS)—These funds are focused on acquiring renewable energy and growing the renewable energy supply chain, workforce, and demand markets
- Energy Efficiency Portfolio Standard (EEPS)—These funds are focused on acquiring energy efficiency savings and helping New York achieve its “15 by 15” energy efficiency target.
- Statutory Research & Development (R&D)—These funds are focused on energy technology development and demonstration.
- Technology & Technology Development Program (T&MD)—These funds are focused on technology and market development.
- Regional Greenhouse Gas Initiative (RGGI)—RGGI is a cap and trade program to reduce greenhouse gas emissions in participating Northeast and Mid-Atlantic States. Currently 9 states take part in the program. Money is raised by auctioning CO₂ “credits” for large emitters. Revenue from the program is given to the states, which use it to further encourage emissions reductions through programs and services (RGGI).

The pie charts below show NYSERDA’s funding and expenditures for the 2012-2013 fiscal year.

Figure 7: NYSERDA Funding and Spending Budgets for FY 2012-13



Source: NYSERDA. "Fiscal Year 2012-13 Budget and Financial Plan." 2012

OHIO EDISON TECHNOLOGY CENTERS

In Ohio, the state government funds a network of centers, each serving the needs of local manufacturers. The six centers are located around the state and provide a variety of product and process innovation and commercialization services to both established and early-stage technology-based businesses. The centers help companies with product design by providing rapid-prototyping, expertise in materials selection and material handling. They can help a company save energy and production costs by assisting them to design plant layouts, and adopt quality and information management systems. Each of the six centers has its own portfolio of services.

1. **MAGNET—Cleveland, Ohio:** MAGNET is a regional center focused on manufacturers. It provides manufacturing process and productivity improvement services, product design and development services, and fee-for-service training. It brokers commercial and university intellectual property (IP) in selected manufacturing areas, and delivers federal/state Manufacturing Small Business Assistance programs.
2. **Edison Welding Institute—Columbus, Ohio:** This is a membership-based, internationally-recognized institution focused on materials joining technology. The Institute conducts research and development for both industry and government.
3. **CIFT—Toledo, Ohio:** CIFT is statewide center focused on food technology, particularly in processing/packaging (e.g., blow molding and wrap technology).
4. **BioOhio—Columbus, Ohio:** BioOhio is a statewide center focused on promoting the bio-life sciences industry in Ohio, including pharmaceutical and medical device development. Its principal efforts are in assisting small- to medium-sized entrepreneurial organizations to develop and commercialize bio-life sciences technology.
5. **TechSolve—Cincinnati, Ohio:** TechSolve is a regional center focused on manufacturers. It provides advanced manufacturing process and system services and productivity improvement

training. It is a nationally-recognized center in machining technology, and delivers federal/state Manufacturing Small Business Assistance programs.

6. **PolymerOhio—Westerville, Ohio:** PolymerOhio is a networking group committed to the global competitiveness and growth of Ohio's polymer industry. Members include Ohio polymer companies, leading polymer academic agencies, and service providers (Ohio Third Frontier 2012).

The MAGNET and TechSolve centers are also NIST MEP Centers. This overlap of programs is not unusual. For example, North Carolina State University (discussed below) is host to a NIST MEP Center, a DOE Industrial Assessment Center (IAC), and the North Carolina Solar Center.

NORTH CAROLINA STATE UNIVERSITY

Solar Center

This center is an innovation and technical resource for the renewable energy and energy efficiency sectors. Located on the main N.C. State University campus, it advances a sustainable energy economy through educating, demonstrating and providing support for clean energy technologies, practices, and policies. The Center engages in demonstration of clean energy technologies, providing technical assistance, outreach and training and it also administers the Database of Incentives for Renewables & Efficiency (DSIRE), an on-line (www.DSIREUSA.org) resource providing financial incentives and policies. The Center offers companies the following energy efficiency and renewable energy related services (NCSU 2012).

Energy Assessments

- Renewable Energy Assessments
- Subsidized Renewable Energy Site Assessments

Combined Heat & Power, District Energy and Waste to Heat Power Assessments

- Industrial Energy Efficiency Assessments
- Clean Transportation Fleet Assessments

Design Assistance

- Commercial, Institutional and Residential Building Design Reviews
- Green Building Verification Assistance

ATEC

Also located on the NCSU campus is the Advanced Transportation Energy Center (ATEC) which provides testing of power electronics and power systems. It performs analysis of semiconductors, batteries, motors, and drives for manufacturers and certifying agencies. Many of the methods used to determine energy performance of industrial and transportation equipment components has been developed at ATEC.

MEP & IAC

The services offered by NCSU's IAC and MEP Center are covered in other section of this report and so are not described in detail here. In summary, small and medium sized manufacturers are provided advice, training, mentoring and technical assistance to help them become more efficient.

Though all four centers are all located on NCSU property in Raleigh, they have separate hierarchies and therefore their activities and efforts to assist North Carolina companies is not coordinated. Still, the concentration of so many resources under one organization has established NC State University as a center of excellence in the energy efficiency sector.

FOR ADDITIONAL INFORMATION

ACEEE performed an analysis of several different energy efficiency service delivery models. NYSERDA is prominently featured in this report: Taylor, Trombley and Reinaud. 2012. *Energy Efficiency Resource Acquisition Program Models in North America*.

More information on the New York Department of Public Services can be found on its website: <http://www.dps.ny.gov>.

The details of the nation's first regional greenhouse gas trading initiative can be found at the RGGI website: <http://www.rggi.org>.

Ohio provides funding to the Edison Centers through its Third Frontier program: https://development.ohio.gov/bs_thirdfrontier/etc.htm.

A list of all research centers that belong to ASERTTI can be found at: <http://www.asertti.org/researchcenters> and is also available in report form: "2011-2012 National Guide to State Energy Research Centers," State & Local Energy Report and ASERTTI and can be downloaded at: http://www.asertti.org/researchcenters/ASERTTI_State_Research_Guide.pdf.

The NCSU webpages describing the Solar Center can be found at: <http://www.ncsc.ncsu.edu/index.php/about-ncsc/>.

Database of Incentives for Renewables & Efficiency (DSIRE) is an online resource providing financial incentives and policies (<http://www.DSIREUSA.org>).

LOCAL DEVELOPMENT FINANCING

These state and local programs and institutions seek to grow their economies by providing local companies with access to greater financing than what is available conventionally. These programs may enable companies to borrow more, get better terms, or forgive some or all of a loan under certain conditions. These programs help counteract the perception many investors have that renewable energy and energy efficiency projects are riskier than other traditional investments.

Many communities are using creative financing to assist local companies invest and grow. Common financing tools include loans, loan guarantees, loan collateral, gap funding, credit enhancement,

equity, tax abatements, and tax credits. It can even include direct incentives such as grants, and indirect incentives such as environmental remediation. Whatever the program, it is likely funded through bonds just as are most roads, bridges and schools. Bonds are a way governments borrow. Bonds are sold to the investing public and then paid off with the future tax revenues which are often greater due to the increased tax base that results from the investment. (CDFA)

There are many kinds of bonds that can be used to fund capital investments. Industrial Development Bonds (IDBs); 501 c-3 bonds for not-for-profits; exempt facility bonds for municipal facilities, which can include energy generating facilities; Enterprise Zone Bonds (EZBs); Clean Renewable Energy Bonds (CREBs) that can fund renewable energy public power producers (PPPs); and Qualified Energy Conservation Bonds (QECBs) that enable the issuers to provide tax credits from the federal government for qualified conservation purposes.

It is not important that the incentive seeker understand all the details of these financial instruments, only that they may be available in their locality. Most of them will not specifically single out energy efficiency, but so long as they are designed to encourage capital investment or facility improvement, an efficiency project may qualify (ACEEE research).

QUALIFIED ENERGY CONSERVATION BONDS (QECBs)

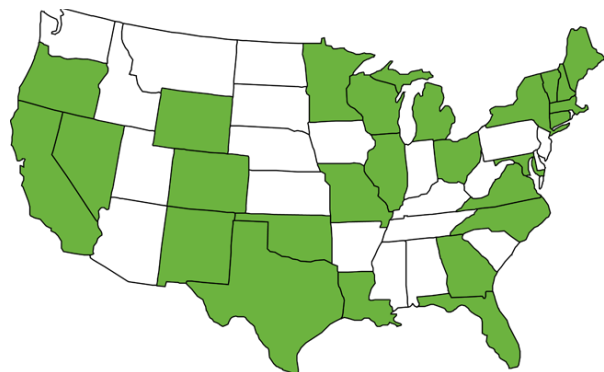
In 2008, Congress authorized the issuance of subsidized Qualified Energy Conservation Bonds (QECBs) as a mechanism for state and local governments to finance renewable energy and energy efficiency projects. QECBs function as if the interest rate on a state or local bond issuance was bought down by the federal government (Bellis 2012). The bonds are tax credit bonds, however instead of providing a tax credit to bondholders, issuers can choose to receive a direct cash subsidy instead.

The legislation requires a 20% energy savings from projects financed with QECB and Internal Revenue Code 179D explains how to determine savings realized by building performance improvements. QECBs can be issued by “green community programs” which is a community that promotes “energy conservation, energy efficiency or environmental conservation initiatives related to energy consumption broadly construed” (Bellis 2012). In 2009, total funding for states, territories, and “large local governments” increased to \$32 billion. As of July 23, 2012, at least \$673 million of QECBs have been issued (Bellis 2012).

PROPERTY ASSESSED CLEAN ENERGY (PACE)

A form of special district financing that targets energy efficiency is PACE, which provides upfront capital for energy efficiency and renewable energy investments. Loans are paid back through a special assessment on participants’ property taxes. An attractive feature to borrowers and lenders is that PACE financing is tied to the property and not the

Figure 8: States with PACE Programs (ASE 2012)



property owner, so if the property is sold, payments stay with the organization receiving the energy cost-savings benefit.

PACE programs require state legislation that enables municipal governments to offer a specific bond to investors, and to subsequently loan the money to consumers and businesses for energy efficiency improvements. The loans are repaid through an annual assessment on the borrower's property tax bill. PACE legislation was first introduced in Berkeley, California in 2008 and has since been adopted by 26 states (DSIREUSA 2012). The value of the funding mechanism is its ability to overcome several recognized barriers to the adoption of energy efficiency: high first costs, high transaction costs involved in deciding on and financing projects, and payback times that often exceed expected occupancy.

PACE can be utilized in residential, commercial, or industrial markets. Most recent activity has been concentrated in commercial markets due to regulatory barriers discussed below.

A debate surrounding commercial PACE is whether or not it is necessary for the mortgage lender to give consent to property owners prior to the owner taking on a PACE assessment. In a PACENow lender support study, surveyed lenders unanimously agreed that consent was essential citing that many loan documents require notification of alterations to property as well as reserves and guarantees for alterations, completion guarantees, and escrow of assessment payments). Lenders that have provided approvals for PACE assessments have verified that generally the projects have been small relative to the building value—about 1-2% of the property value, and were an “insignificant” risk to the mortgage (PACENow 2012).

ON-BILL FINANCING

On-bill financing allows utility customers to invest in energy efficiency improvements and repay the funds through an additional charge on their utility bill. If structured properly, an on-bill program can substantially reduce the cost of and improve access to financing. In many cases, energy savings are sufficient to cover the monthly payments for the financing so that the total monthly charge on utility bills is less than or equal to the pre-investment amount. Capital for on-bill programs comes from a variety of sources including but not limited to utility ratepayer funds, public benefit funds, and third-party financial institutions. Recently, third-party financial institutions have begun offering on-bill repayment programs so it appears likely that the market will support growth of these services.

Several of the states (Illinois, Hawaii, Oregon, California, Kentucky, Georgia, South Carolina, Michigan, and New York) have legislation in place that supports or requires the creation of a utility-based financing program that allows for repayment through an on-bill tariff. A tariff can refer to any number of rates or charges imposed by a utility. An on-bill tariff is a mechanism for charging customers for energy efficiency investments or upgrades provided as a service by the utility.

Tariff financing is a type of on-bill financing structure. On-bill tariffs assign a financial obligation to a property (often by tying the service to the building's meter), allowing the benefits resulting from the investment to transfer to subsequent owners or renters. In many states tariffs are not considered loans and thus are subject to different laws and regulations. In addition, tariffs address gaps in energy

finance for rental customers and also allow the flexibility to match financing terms to the extended payback period for some energy efficiency improvements. Over two dozen states have or are about to implement on-bill financing programs in one or more utility service territories (Fuller 2009).

EXAMPLES OF STATE LOAN PROGRAMS

The details of each state loan program are influenced by goals of originating legislation, structure of state institutions, and political realities when enacted. Below are three examples of state loan programs that target the manufacturing sector.

- Alabama Saves (www.alabamasave.com) uses ARRA money to subsidize loans via a loan loss reserve and interest rate buy down that result in loans of \$50,000 to \$4 million for 1% for projects with payback from energy cost savings of ten years or less. The Alabama program was funded by federal dollars provided to the state for the specific purpose of developing an energy-efficiency focused loan program.
- Colorado provides financing to manufacturers for a variety of projects that could include distributed generation systems using the proceeds of a “manufacturing mini bonds.” The program is administered by the Colorado Housing and Finance Authority.
<http://www.chfainfo.com/business/manufacturers/manufacturers.icm>
- Pennsylvania Pollution Prevention Assistance Account (PPAA) offers low-interest loans to help small businesses (<100 FTE) to implement energy efficiency and pollution prevention projects. Loans may be up to 75% of the project costs or \$100,000, whichever is less, with terms of up to ten years. This program is funded through the agency’s budget.
http://www.portal.state.pa.us/portal/server.pt/community/financial_assistance/10495/ppaa_loan/553247

Although all three of these programs have different funding mechanism, the industrial customer receives the same service: a loan for investments in energy efficiency equipment at an attractive rate and terms.

FOR ADDITIONAL INFORMATION

CDFA issued a resource guide in 2012: Primer on Development Finance, Toby Rittner

CDFA: <http://www.cdfa.net/cdfa/cdfaweb.nsf/pages/about.html>

NASEO offers a great deal of information to its members on the use of QECBs to finance energy efficiency projects: <http://www.naseo.org/resources/financing/qecb/index.html>

A fact sheet on PACE is available through the Alliance to Save Energy:
http://ase.org/sites/default/files/PACE_factsheet_0.pdf

Below are links to three of the two dozen state PACE programs

- New Mexico PACE Financing:
http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=NM28F&re=0&ee=0
- Colorado PACE financing:
<http://www.dsireusa.org/incentives/index.cfm?re=0&ee=0&spv=0&st=0&srp=0&state=CO>
- Minnesota PACE Financing:
http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=MN142F&re=0&ee=0

STATE AND LOCAL TAX INCENTIVES

Just about every state has some type of tax incentive for renewable energy. Under these incentives, a taxpayer's state and/or local tax liability is decreased if qualifying investments are made. A few have incentives for energy efficiency and CHP. The incentive will change one of the following: state income tax, state property tax, state sales tax, local property tax, or local real estate tax. In exchange for engaging in the desired activity—usually investing in specific types of energy-efficient equipment—the taxpayer's tax liability is reduced.

For example, Arizona established a property tax exemption for renewable energy systems in 2006 and expanded it to include CHP and energy-efficient building components in 2009. The property owner must provide the county tax assessor with documentation affirming the price, purchase, and installation of eligible equipment (DSIRE 2013 and AZ DoR 2013).

In New Mexico, a corporate tax credit was established for sustainable buildings that have been registered and certified by the US Green Building Council at LEED Silver or higher for new construction (NC), existing buildings (EB), core and shell (CS), or commercial interiors (CI) are eligible for a tax credit. The amount of credit varies according to the square footage of the building and the level of certification achieved (DSIRE 2013a).

Kentucky offers a corporate energy efficiency tax credit of 30% up to \$500 for energy-efficient **heating, ventilating, and air conditioning** (HVAC), hot water, and interior lighting systems. See guidance issued by the Kentucky Department of Revenue (DOR) for additional information (Kentucky DoR 2013).

STATE SALES TAX

Several states including Maryland, Missouri, Texas and Virginia have offered a “sale tax holiday” on high-efficiency residential appliances such as ENERGY STAR clothes washers, while a few others such as Connecticut have an on-going exemption from sales tax and use tax for residential products ranging from window and door weather strips, to high-efficiency water heaters.

Energy Efficiency Powerful Smart for Texans: a sales tax holiday in Texas from May 26 through 28, 2012 on ENERGY STAR products
(<http://www.texaspowerfulsmart.org/incentives/taxfree.php>)

Connecticut law temporarily suspending sales tax on products used to weatherize residential properties: <http://www.ct.gov/drs/cwp/view.asp?a=1514&q=384952>

LOCAL PROPERTY TAX ABATEMENTS

More and more municipalities are getting into promoting economic development and energy efficiency projects are eligible for consideration even if not specifically targeted. Cities are encouraging local investment through changes to income tax, property tax, real-estate tax, and sales tax rates.

Property tax abatements have become a tool of choice for counties and local governments to attract new business. They are available to companies within Tax Increment Finance (TIF) districts and encourage new businesses and job creation by exempting from the tax roll all or a portion of new or increased assessed value of real and/or personal property.

The possible terms of abatements vary state and community, but usually are granted for one to ten years. The way an abatement works is that in the first year, the entire assessed value of the new investment is exempted from property tax. In each subsequent year during the abatement term, the ratio of the value of the asset subject to tax increases until the full value of the asset is taxable.

A company located in a TIF district or considering locating in one should contact the administrating agency to learn what is and isn't eligible for financial assistance.

Section III: Non-Governmental Market Actors

NON-GOVERNMENTAL ORGANIZATIONS (NGOs)

There are many Non-Governmental Organizations (NGOs) engaged in promoting and bringing awareness to energy efficiency practices, technologies and demonstration projects. Some NGOs receive all or some of their funding from government agencies, though are still independent of government. They often perform educational activities, engage in analysis of economic data, and advocate policies. It is often easier and more efficient for an NGO to organize an event or form a working group that brings interested parties together. As a result, they accelerate awareness and adoption of innovated technologies and techniques.

Many organizations are membership based and serve a specific industry such as Steel or Glass, or profession such as electrical engineering or facility management. Professional organizations serve their membership through education and professional development, often developing professional certification programs.

Trade organizations often develop voluntary certification and labeling programs such as the NEMA Premium Motor. These types of differentiating credentials often become industry standards resulting in more efficient systems and buildings around the world.

Some NGOs focus on advancing policies and may also engage in lobbying activities while others abstain from lobbying activities and instead focus on organizing collaborative events or performing research and becoming a technical resource.

As noted in previous sections, states and utilities are a major player in funding energy efficiency programs at the local level. At the national level, the federal government tends to be the lead. Bringing these groups together and providing continuity over time is a role filled by NGOs. In the energy efficiency sector, there are five major groups that represent the entities:

NATIONAL ASSOCIATION OF STATE ENERGY OFFICIALS (NASEO)

As its name implies, the National Association of State Energy Officials (NASEO) membership is comprised of state energy offices. It was formed by the states and through an agreement with the National Governors Association in 1986 and each state is represented by an appointee of the respective state or territory governor. The organization's purpose is to improve the effectiveness and quality of state energy programs and policies, provide policy input and analysis, share successes among the states, and to be a repository of information to states and their citizens. NASEO is an instrumentality of the states and is funded primarily by appropriations from member states and the federal government.

Membership also includes affiliates from the private and public sectors. Member state agencies work on an extremely wide range of energy programs and policies, including:

- Energy efficiency in homes, commercial/public buildings, industry and agriculture;
- Renewable energy, such as solar, wind, geothermal and biomass;
- Residential, commercial and institutional energy building codes;
- Transportation and heating fuel supplies, pricing and distribution;
- Oil, natural gas, electricity and other forms of energy production and distribution;
- Energy-environment integration (such as using conservation to reduce air emissions);
- New and emerging high efficiency transportation fuels and technologies; and
- Energy security and emergency preparedness, and many other energy matters.

ASSOCIATION OF STATE ENERGY RESEARCH AND TECHNOLOGY TRANSFER INSTITUTIONS (ASERTTI)

ASERTTI is a nonprofit organization whose mission is to increase the effectiveness of energy research efforts in contribution to economic growth, environmental quality, and energy security, through collaboration on research projects with state, federal, and private partners, and sharing technical and operational information among members and associates.

It shares membership and management with NASEO and as a result its events and initiatives bring together a broad spectrum of stakeholders the benefits of which are a fluid exchange of ideas and information throughout the energy sector.

- ***Collaboration*** Members support energy efficiency and renewable energy research and deployment through participation and sponsorship.

- **Communication** Members exchange information on emerging energy technologies and practices.
- **Implementation** The investments members make in energy programs and projects within their respective states can leverage ASERTTI resources and staff expertise.

Members have access to regional and national R&D resources that can support their work as well as support broader tech transfer than could be achieved individually. There are four areas of research collaboration:

- Building Technologies
- Energy Storage
- Renewable Energy
- Industrial Energy Efficiency

NASEO and ASERTTI are the designated associations of the state government energy agencies, with NASEO membership coming from state energy offices and program efforts focused on deployment and ASERTTI membership comprised of research and development organizations and program efforts focused on basic and applied research. The two entities share leadership which has resulted in improved coordination of state government activities associated with industrial energy issues. In recent years, both organizations have developed greater technical capability and have expanded their reach with the hiring of regional staff. Both organizations support and work closely with regional energy efficiency networks.

CONSORTIUM FOR ENERGY EFFICIENCY (CEE)

The CEE is a nonprofit public benefits corporation that develops initiatives that promote the manufacture and purchase of energy-efficient products and services. Its membership includes utilities, statewide and regional market transformation organizations, environmental groups, research institutions, and state energy offices in the U.S. and Canada. It coordinates events, develops advocacy campaigns, and sponsors research. It also serves as a forum for its members to exchange information and ideas.

ELECTRIC POWER RESEARCH INSTITUTE (EPRI)

EPRI is an independent, nonprofit organization made up of scientists, engineers, and experts from academia and industry representing over 1000 organizations worldwide. It brings together electric utilities, vendors, research organizations and government agencies to conduct research, development and demonstration of technologies relating to the generation, delivery and use of electricity.

EPRI has its own research staff and facilities and the RD&D work it sponsors will leverage some combination of those resources and those of its membership. It has developed a rigorous advisory protocol for its work that engages its membership and over 1400 experts in the electricity field in validating the quality and efficacy of its work.

Members participate in several advisory councils and committees that help direct and inform the development of the organization's research portfolio and individual projects. There are currently four sectors of the energy sector upon which EPRI is focusing its research:

- Nuclear Power
- Fossil Fuel Generation
- Environment and Renewable Energy
- Power Delivery and Utilization.

GAS TECHNOLOGY INSTITUTE (GTI)

GTI is the leading research, development and training organization for the natural gas portion of the energy sector. It and its predecessor organizations have been involved over seventy years advancing the use of natural gas through developing technologies that expand the market for natural gas. Research focuses on developing the supply, delivery and use of natural gas. GTI has been very involved in developing and demonstrating CHP and other distributed generation technologies.

EPRI and GTI are both funded by utilities to conduct collaborative technology research and provide technical assistance to customers of member utilities. They often work with regional energy efficiency networks, clean energy application centers and academic institutions to develop and demonstrate cutting edge technologies.

FOR ADDITIONAL INFORMATION

ASERTTI: <http://www.asertti.org/>

List of state energy research centers: <http://www.asertti.org/researchcenters/>

CEE: <http://www.cee1.org>

EPRI: <http://www.epri.com>

GTI: <http://www.gastechnology.org>

NASEO: <http://www.naseo.org/>

There are dozens of organizations involved in energy efficiency on a national basis and any list is likely to be incomplete. The following is a list of other NGOs that have recently been active in the

industrial energy efficiency sector sponsoring national events, conducting research, or advocating for legislation.

- American Council for an Energy-Efficient Economy (ACEEE)
- Alliance to Save Energy
- C2ES
- Center for Clean Air Policy
- CERES
- Council on Competitiveness
- Environmental Defense Fund (EDF)
- Industrial Energy Consumers of America (IECA)
- National Association of Clean Air Administrators (NACAA)
- Natural Resources Defense Council (NRDC)
- Pew Charitable Trust
- The Blue-Green Alliance (BGA)
- The Center for American Progress
- World Resources Institute (WRI)

TRADE ORGANIZATIONS

With access to technical information, policy ideas, and a direct line to manufacturing companies trade associations are important partners in the development of standards and new technologies. Anti-trust laws prevent multiple companies within a single field from working together but through trade organizations, they can engage in enabling activities such as pre-commercial research and development, economic data collection, and lobbying. Pre-commercial RD&D is often conducted in partnership with government agencies, benefiting from technical from national laboratories and financial assistance from various agencies. By distributing the cost of these activities, the risks associated with investing in energy technology innovation are reduced the technology's rate of adoption in to the market place is accelerated (Vaidyanathan et al. 2013).

The following are just a few of the organizations that routinely bring together multiple manufacturers and government agencies to conduct R&D, create new standards, and advance new labeling programs.

- American Chemistry Council (ACC)
- American Forest and Paper Association (AF&PA)
- American Foundry Society (AFS)
- American Gas Association (AGA)
- American Iron & Steel Institute (AISI)
- Air Movement and Control Association (AMCA)
- American Petroleum Institute (API)
- American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE)
- Compressed Air and Gas Institute (CAGI)
- Energy Solution Center

- Glass Manufacturing Industry Council (GMIC)
- Illuminating Engineering Society of North America (IESNA)
- Hydraulic Institute (HI)
- National Manufacturers Association (NAM)
- National Electrical Manufacturers Association (NEMA)
- Portland Cement Association (PCA)
- Steel Founders Society of America (SFSA)
- U.S. Combined Heat & Power Association (USCHPA)
- U. S. Green Building Council (USGBC)

Many trade organizations such as ASHRAE are also professional organizations providing training classes and professional certificates for engineers. They may also be intimately involved in developing standards and labeling programs. ASHRAE standards for building heating and air-conditioning systems have been cited or incorporated into most state building codes, making them in practice legal requirements. Similarly, trade association such as NEMA, AMCA and HI develop voluntary testing and labeling standards which are accepted by ANSI and ISO.

PROFESSIONAL ORGANIZATIONS

Dozens of professions have created professional organizations, or societies, to promote individual development and expansion of the craft. The energy sector is dominated by engineering societies and associations that provide cutting edge training for their members as well as professional certifications that improve employment prospects and grow membership. A list of key professional organizations is included below.

- American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE)
- American Society of Mechanical Engineers (ASME)
- Association of Energy Engineers (AEE)
- Institute of Electrical and Electronics Engineers (IEEE)
- Society of Manufacturing Engineers (SME)
- American Institute of Chemical Engineers (AIChE)

In addition to representing their respective professions, these organizations also serve as voluntary standards development organizations. Through this additional activity, these professional societies advance their industry, the profession of their membership, and the influence of both.

SUMMARY

This report has attempted to identify the public resources most widely available and most commonly used in the U.S. by the industrial sector to reduce energy consumption and associated costs. As demonstrated by many of the descriptions above, there are overlapping and intermingling service offerings. Federal programs often fund regional and state initiatives. Local programs can have national impacts; technical assistance can look like financial assistance, and utilities that provide electricity and natural gas are frequently the organizations that provide the greatest amount of financial assistances to companies to invest in energy efficiency. This makes for a confusing and

complicated search for help. Fortunately, many of the organizations identified in this report also have within their responsibilities the task of directing companies to available and applicable resources.

Since policies and programs constantly change, the reader will likely find this guide most useful over long term as a tool to identify the types of organizations that provide a particular type of service, or are responsible for enforcing a specific policy. Table 1, located in the introduction can guide that search for the would-be assistance seeker.

The reader seeking to understand the structure of U.S. industrial energy efficiency assistance may be challenged to find it within the patchwork of programs that currently exist. That is because it has evolved over several decades; each agency and each locality developing its programs as needed. It is in many ways representative of the American system of experimentation and learning through trial and error. Although there is increasing cooperation and coordination at the federal level, and integration of services at the local level, the matrix of policies and programs is complex and is likely to remain so for the foreseeable future. All the same, there are more programs today than ever before and an industrial company seeking assistance to become more energy efficient has many places to look.

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APPENDIX A: GLOSSARY

AMERICA COMPETES ACT OF 2007 created several initiatives to grow the economy through investments in innovation. It requires the White House Office of Science and Technology to coordinate federal activities in support of Science, Engineering and Math (STEM) education. Reauthorized in 2010, it provides funding and direction to several federal agencies including DOC NIST, DOE ARPA-E, and NSF.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI) An institute that oversees the creation, promulgation and use of norms and guidelines that impact businesses in nearly every sector of the economy. It is engaged in accrediting programs that assess conformance to standards—including globally-recognized cross-sector programs such as the ISO 9000 (quality), ISO 14000 (environmental) and ISO 50000 (energy) management systems.

AMERICAN COUNCIL FOR AN ENERGY-EFFICIENT ECONOMY (ACEEE) A nonprofit, 501(c)(3) organization that acts as a catalyst to advance energy efficiency policies, programs, technologies, investments, and behaviors. ACEEE conducts in-depth technical and policy analyses; advises policy makers and program managers; convenes conferences and workshops, primarily for energy efficiency professionals; and works collaboratively with businesses, government officials, public interest groups, and other organizations.

AMERICAN RECOVERY AND REINVESTMENT ACT OF 2009 (ARRA) An economic stimulus package enacted by the 111th United States Congress in February, 2009 as a response to the economic recession, ARRA was estimated to cost \$787 billion which went into infrastructure, education, health, and energy, federal tax incentives, and expansion of unemployment benefits and other social welfare provisions.

AMERICAN SOCIETY OF HEATING, REFRIGERATING, AND AIR-CONDITIONING ENGINEERS (ASHRAE) An organization of over 50,000 individuals in the air-conditioning, heating, refrigerating and ventilating fields. ASHRAE supports the integration of increased energy-efficiency in building design via technological enhancements of these systems. Also establishes commercial building energy codes, such as ASHRAE 90.1 2001/2004, that provide the minimum requirements for the building envelope and systems and equipment for electrical power, lighting, heating, ventilating, air-conditioning, service water heating and energy management.

ASSOCIATION OF STATE ENERGY RESEARCH AND TECHNOLOGY TRANSFER INSTITUTIONS (ASERTTI) An organization committed to increasing the effectiveness of energy research efforts in contribution to economic growth, environmental quality, and energy security. ASERTTI focuses on applied research, technology development, demonstration and deployment with a strong interest in end use efficiency and conservation, as well as supply-side interests, including fossil fuels and renewable resources.

AVERAGE MEGAWATT Is a measure of energy used primarily in the northwestern United States to describe the impact of energy efficiency measures. Total annual megawatt hours / 8,760 hours per year = average megawatts.

BRITISH THERMAL UNIT (Btu) A basic unit of energy; amount of energy required to raise the temperature of one pound of water by one degree Fahrenheit. A Million Btu is abbreviated **MMBtu**: 1,000,000 Btu, roughly equivalent to 293 kilowatt-hours of electricity or 8 gallons of gasoline. A quadrillion Btu = 1,000,000,000,000,000 Btu, is abbreviated **Quad**. A Quad is about 1 percent of current U.S. total energy use on an annual basis; enough energy to heat about 22 million homes for one year or to power 15.7 million cars annually (driving an average of 14,000 miles per year at 27.5 miles per gallon).

CHAMBER OF COMMERCE (COC) A non-governmental lobbying group that represents the interests of businesses and trade associations.

COMBINED HEAT AND POWER PLANTS (CHP) Also known as co-generation, a system by which multiple usable energy outputs (both electricity and steam/heat) are derived, from a single fuel supply using an integrated system. It generates electricity and useful thermal energy in a single, integrated system.

COMMUNITY DEVELOPMENT BLOCK GRANT (CDBG) A program within the U.S. Department of Housing and Urban Development (HUD) that provides communities with resources to address a wide range of unique community development needs. It provides annual grants on a formula basis to 1209 general units of local government and States.

COMPETITIVE SOLICITATION See Solicitation or Request for Proposal (RFP).

DEPARTMENT OF ENERGY (DOE) A Cabinet-level department of the United States government concerned with the United States' policies regarding energy and safety in handling nuclear material. Its responsibilities include the nation's nuclear weapons program, nuclear reactor production for the United States Navy, energy conservation, energy-related research, radioactive waste disposal, and domestic energy production.

DEPARTMENT OF TRANSPORTATION (DOT) A Cabinet department of the United States government concerned with transportation. The mission of the Department is to “serve the United States by ensuring a fast, safe, efficient, accessible and convenient transportation system that meets our vital national interests and enhances the quality of life of the American people, today and into the future.”

EMERGENCY ECONOMIC STABILIZATION ACT OF 2008 (EESA) A law enacted in response to the subprime mortgage crisis authorizing the United States Secretary of the Treasury to spend up to \$700 billion to purchase distressed assets, especially mortgage-backed securities, and supply cash directly to banks.

ENERGY EFFICIENCY AND CONSERVATION BLOCK GRANT (EECBG) A formula grant program administered by HUD and funded by ARRA 2009, intended to assist U.S. cities, counties, states, territories, and Indian tribes to develop, promote, implement, and manage energy efficiency and conservation projects and programs.

ENERGY EFFICIENCY RESOURCE STANDARDS (EERS) Also known as an Energy Efficiency Portfolio Standards (EEPS), it is a simple, market-based mechanism to encourage more efficient use of electricity and natural gas. An EERS consists of electric and/or gas energy savings targets for utilities, sometimes with flexibility to achieve the target through a market-based trading system. All EERS's include end-user energy savings improvements that are aided and documented by utilities or other program operators. Some

EERS's include distribution system efficiency improvements. It is sometimes used in conjunction with a Renewable Portfolio Standard (RPS).

ENERGY INDEPENDENCE AND SECURITY ACT OF 2007 (EISA) Enacted by the 110th Congress the purpose of the bill was to move the United States to greater energy independence by increasing renewable energy, and efficiency products, buildings, and vehicles.

ENERGY POLICY ACT OF 1992 (EPACT 1992) Enacted by the 102nd Congress the bill consists of twenty-seven titles detailing various measures designed to lessen the nation's dependence on imported energy, provide incentives for clean and renewable energy, and promote energy conservation in buildings. EPACT 1992 set goals, created mandates, and amended utility laws to increase clean energy use and improve overall energy efficiency in the United States. It reformed the Public Utility Holding Company Act and amended parts of the Federal Power Act of 1935. EPACT 1992 addressed these items and several others: energy efficiency, energy conservation and energy management; natural gas imports and exports; alternative fuels and requiring certain fleets to acquire alternative fuel vehicles; electric motor vehicles; radioactive waste; coal power and clean coal; and renewable energy. For energy efficiency, the bill added standards for some fluorescent and incandescent reflector lamps; plumbing products; electric motors; commercial water heaters; and heating, ventilation, and air conditioning (HVAC) systems. EPACT 1992 allowed for the future development of standards for many other products. The law also provided for voluntary testing and consumer information programs for office equipment, luminaries, and windows.

ENERGY POLICY ACT OF 2005 (EPACT 2005) Enacted by the 110th Congress, the bill changes United States energy policy by providing tax incentives and loan guarantees for various types of energy production, primarily innovations that avoid greenhouse gases such as nuclear power, biofuels, clean coal initiatives, wind and other renewable energy sources, tidal power, geothermal power, and others. For energy efficiency, the bill established a number of energy management goals for Federal facilities and fleets. It also amended portions of the National Energy Conservation Policy Act (NECPA) and established minimum efficiency standards for 15 products.

ENERGY POLICY AND CONSERVATION ACT OF 1975 (EPCA) signed by President Gerald R. Ford, the bill was enacted for the purpose of serving the nation's energy demands and promoting conservation methods when feasibly obtainable. The Act mandated vehicle fuel economy standards, extended oil price controls to 1979, and directed the creation of a strategic petroleum reserves.

ENERGY RESEARCH AND DEVELOPMENT AUTHORITY (ERDA) The replacement policy for Atomic Energy Commission (AEC), which was created to focus the federal government's energy research development activities into one unified agency, which was also to include AEC's nuclear energy defense activities.

ENERGY SERVICE COMPANIES (ESCOs) A business that develops, installs, and arranges financing for projects designed to improve the energy efficiency and maintenance costs for facilities typically over a seven to twenty year time period.

ENVIRONMENTAL PROTECTION AGENCY (EPA) An Agency of the United States government which was created for the purpose of protecting human health and the environment. The agency conducts environmental

assessments, research, and education. It has the responsibility of writing, maintaining and enforcing national standards and regulations under a variety of environmental laws, in consultation with state, tribal, and local governments. EPA has enforcement powers and works with industries and all levels of government in a wide variety of voluntary pollution prevention programs.

EXECUTIVE ORDER (E.O.) An order or directive issued by the head of the executive branch, commonly applied to orders by the President.

FEDERAL TRADE COMMISSION (FTC) An independent agency of the United States government, which promotes consumer protection and eliminates anti-competitive business practices, such as coercive monopoly. They administered the Energy Guide labeling program for appliances.

FREE RIDERS Is a title given to utility customers that unduly benefit from a financial incentive program by taking advantage of financial assistance to help finance a project that they would proceed with even if the financial assistance was not available.

GREENHOUSE GASES (GHG) A gas in the atmosphere that absorbs and emits radiation within the thermal infrared range. These gases include water vapor, carbon dioxide, methane, nitrous oxide, and ozone.

GOVERNMENT ACCOUNTABILITY OFFICE (GAO) Part of the Legislative Branch, the audit, evaluation, and investigative arm of the United States Congress, the mission of the Office is to “support the Congress in meeting its constitutional responsibilities and to help improve the performance and ensure the accountability of the federal government for the benefit of the American people. We provide Congress with timely information that is objective, fact-based, nonpartisan, nonideological, fair, and balanced.”

HEATING, VENTILATION, AND AIR CONDITIONING SYSTEMS (HVAC) The technology of indoor and automotive environmental comfort (e.g., heating and cooling units and systems).

INDEPENDENT SYSTEM OPERATOR (ISO) An organization that coordinates, controls, and monitors the operation of the electrical power system, usually within a region but sometimes a single U.S. State. Under FERC rules, ISO are to be independent from owners of the transmission grid.

INTERNATIONAL STANDARDS ORGANIZATION (ISO) Founded in 1947, it is the world’s largest developer of voluntary international standards for technology, business, and health. These standards facilitate international trade through common rules and measures.

ISO 50001 An internationally recognized framework for organizations to voluntarily implement an energy management plan that includes measurement, forecasting and management of energy use, and continual improvement in energy performance.

INTEGRATED RESOURCE PLANNING (IRP) A planning process under which both energy supply resources (e.g., new power plants, transmission lines, etc.) and energy demand-side resources (energy efficiency, load management/demand response, etc.) are examined together. The plan integrates energy supply resources and energy-demand resources in ways that minimizes costs while meeting other objectives (e.g., reliability, robust across a range of possible futures).

INTERCONNECTION and INTERCONNECTION STANDARDS For all distributed generation—solar, wind, CHP, fuel cells, etc., interconnection with the local electric grid provides back-up power and an opportunity to participate in net-metering schemes when they are available. It's important to most distributed generation projects to be interconnected with the grid, but adding small generators at spots along an electric grid can produce a number of safety concerns and other challenges for a utility. To resolve these issues, utilities work with their state-level regulatory bodies to develop interconnection standards that clearly delineate the manner in which distributed generation systems may be interconnected.

INTERNATIONAL ENERGY CONSERVATION CODE (IECC) A building code created by the International Code Council in 2000. It is a model code adopted by many countries and U.S. States to establish design and construction requirements for energy efficiency.

INVESTOR-OWNED UTILITY (IOU) Also known as a private utility, IOU's are utilities owned by investors or shareholders. IOU's can be listed on public stock exchanges.

JOINT COMMITTEE ON TAXATION (JCT) A Committee of the U.S. Congress that is composed of ten Members: five from the Senate Finance Committee and five from the House Ways and Means Committee. The Committee: investigates the operation, effects, and administration of internal revenue taxes; investigates measures and methods for the simplification of taxes; makes reports on the results of those investigations and studies and make recommendations; and reviews any proposed refund or credit of taxes in excess of \$2,000,000.

LAWRENCE BERKELEY NATIONAL LABORATORY (LBNL) A DOE National Laboratory that conducts scientific research, located at the University of California Berkeley.

MEASUREMENT AND VERIFICATION (M&V) The process of using measurement to reliably determine actual savings created within an individual facility by an energy management, energy conservation or energy efficiency project or program.

NATIONAL ACTION PLAN FOR ENERGY EFFICIENCY (NAPEE) A private-public initiative to create a sustainable, aggressive national commitment to energy efficiency through the collaborative efforts of gas and electric utilities, utility regulators, and other partner organizations.

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST) A non-regulatory federal agency within the U.S. Department of Commerce that promotes innovation and commerce by advancing measurement science, standards, and technology.

OAK RIDGE NATIONAL LABORATORY (ORNL) A multi-program science and technology national laboratory managed for the United States Department of Energy (DOE) based at the University of Tennessee. Its programs focus on materials, neutron science, energy, high-performance computing, systems biology and national security.

OFFICE OF ENERGY EFFICIENCY AND RENEWABLE ENERGY (EERE) Office at DOE that invests in clean energy technologies that strengthen the economy, protect the environment, and reduce dependence on foreign oil.

OUTPUT-BASED EMISSIONS REGULATIONS Air quality regulations that take the useful energy output of CHP systems into consideration when quantifying a system's total emissions. Many states employ emissions regulations for generators by calculating levels of pollutants based upon the fuel input into a system. For CHP systems, electricity *and* useful energy outputs are generated from a single fuel input; calculating emissions based solely on input ignores the additional power created by the system, using little or no additional fuel. Output-based emissions acknowledge that the additional useful energy output was created in a manner generally cleaner than separate generation of electricity and thermal energy.

ORIGINAL EQUIPMENT MANUFACTURERS (OEM) Manufacturers that source components, parts and raw materials from other firms and build equipment such as appliances, transportation equipment, tools, and machinery for sale to end-use customers.

POWER PURCHASE AGREEMENTS (PPAs) A contract between two parties, one who generates electricity for the purpose of sale (the seller) and one who is looking to purchase electricity (the buyer).

PRE-SOLICITATION ANNOUNCEMENT (PSA) Are notices given by government agencies to alert likely respondents that a request for proposal or bid is pending. By giving respondents more time to prepare, the agency can often shorten the overall time between concept development and final award.

PROPERTY ASSESSED CLEAN ENERGY (PACE) Programs that help home and business owners pay for the upfront costs of green initiatives, such as solar panels or comprehensive energy efficiency retrofits, which the property owner then pays back by increasing property taxes by a set rate over about 20 years.

PUBLIC BENEFIT CHARGE A fee assessed, usually on a per unit of energy consumed, though sometimes as a fixed monthly amount that is used to fund investments determined by a PUC or state legislature to be in the public interest. A large percentage of utility managed energy efficiency programs are funded by revenues collected via a SBC: also referred to as **System Benefit Charges (SBC)**.

PUBLIC-PRIVATE PARTNERSHIP Is an arrangement between one or more government (public) and one or more private organizations to accomplish a mutually beneficial task. These partnerships are common in the execution of research, development, demonstration and deployment activities.

PUBLIC UTILITY COMMISSION (PUC) A state or local level quasi-judicial government entity with responsibility for regulating and providing oversight to utilities. Also call **Public Service Commissions (PSCs)**, each state commission has authority and responsibility to ensure adequate, safe, reliable and affordable utility services for the citizens of that state. In addition to electricity and natural gas utilities, PUCs may also have authority over water, sewer, telecommunications and insurance companies.

PUBLIC UTILITIES REGULATORY POLICIES ACT (PURPA) Enacted in 1978 by Congress as part of the National Energy Act with the goal to reduce dependence on foreign oil, to promote alternative energy sources and energy efficiency, and to diversify the electric power industry.

QUALIFIED ENERGY CONSERVATION BONDS (QECBs) A debt instrument that enables qualified state, tribal and local government issuers to borrow money to fund energy conservation projects.

REGIONAL TRANSMISSION ORGANIZATIONS (RTO) An organization, created by FERC, that is responsible for moving electricity over large interstate areas. An RTO coordinates, controls, and monitors an electricity transmission grid that is larger with much higher voltages than the typical power company's distribution grid. RTOs need to follow FERC rules.

REQUEST FOR COMMENT (RFC) A public request for response to a question or proposal by a government agency. A common use of RFC is in the development of standards. The Department of Energy will issue a request for comments on a proposed rule.

REQUEST FOR PROPOSAL (RFP) A form of solicitation in which a government agency makes a public request for suggestions on how a task or project might be accomplished (example: research project, management of a program, formulation of a regulation). Issuance of an RFP does not guarantee issuance of an award. Also referred to as a **Request for Application (RFA)**, **Request for Quotation (RFQ)** or a **Funding Opportunity Announcement (FOA)**.

RESEARCH AND DEVELOPMENT (R&D) Refers to creative work undertaken on a systematic basis that increases the stock of knowledge and the use of that knowledge to devise new applications. R&D contributes to advancing energy efficiency by promoting the creation, development, and commercialization of new, energy-efficient technologies and practices.

SOLICITATION A request by a public entity for a proposal and bid to perform a specific task, provide a service, or provide information. Government agencies often procure services from the private sector through competitive solicitation in which one or more organizations respond to a **Request for Proposal (RFP)** and the government agency scores the responses and makes an award to the highest scoring response. Solicitations may or may not include funding opportunities.

STATE AND LOCAL ENERGY EFFICIENCY ACTION NETWORK (SEE ACTION) A state and local effort facilitated by the federal government that helps states, utilities, and other local stakeholders take energy efficiency to scale.

STATE ENERGY PROGRAM (SEP) A program that provides financial and technical assistance to states through formula and competitive grants.

Superior Energy Performance (SEP) A transparent and systematic method that manufacturers can use for verifying improvements in energy performance and management practices through application of the internationally accepted ISO 50001 energy management standard.

SYSTEM BENEFIT CHARGE (SBC) A fee assessed, usually on a per unit of energy consumed, though sometimes as a fixed monthly amount that is used to fund investments determined by a PUC or state legislature to be in the public interest. A large percentage of utility managed energy efficiency programs are funded by revenues collected via a SBC. They charges are also referred to a **Public Benefit Charge (PBC)**.

Transportable Credentials a certification, certificate, or professional acknowledgement that has industry recognition and belongs to the worker (vs. the employer) and can aid a worker in professional advancement.

WATT (W) A basic unit of power and especially electrical power (=1 J/sec, or 0.74 Ft-lbs/sec). A **kilowatt** is 1000 watts and a **megawatt** is one million watts, or one thousand kilowatts. A kilowatt-hour (kWh) is the basic volumetric unit of measure of electrical energy consumed and equal to the amount of energy a 1000 Watt demand will consume over an hour of time. It is equivalent to 3,412 Btu. Electrical energy and power (measured in Watt-hours and Watts, respectively) follow SI prefixes (kilo (k), Mega (M), Giga (G), Tera (T), etc.)

APPENDIX B: SUMMARIES OF MAJOR U.S. ENERGY EFFICIENCY LAWS

This section contains summaries of the major U.S. energy efficiency laws. They were prepared by the Congressional Research Service at time of passage and downloaded from the Library of Congress Website—<http://www.thomas.gov>. They are not copyrighted. Included are the following laws:

- Energy Policy and Conservation Act of 1975
- National Energy Conservation Policy Act of 1977
- National Appliance Energy Conservation Act of 1987
- Energy Policy Act of 1992
- Energy Policy Act of 2005
- Energy Independence and Security Act of 2007
- American Recovery and Reinvestment Act of 2009

Many of these laws deal with both energy efficiency and other energy subjects. In these cases we just include summaries of the energy efficiency sections. Sections not related to industrial energy efficiency have been omitted.

Energy Policy and Conservation Act of 1975

S.622

Latest Title: Energy Policy and Conservation Act

Sponsor: Sen Jackson, Henry M. [WA] (introduced 2/7/1975) Cosponsors (13)

Related Bills: H.R.7014, S.349, S.677, S.1883

Latest Major Action: 12/22/1975 Public law 94-163.

Link: <http://thomas.loc.gov/cgi-bin/bdquery/z?d094:S622>:

SUMMARY AS OF:

12/9/1975--Conference report filed in House

Energy Policy and Conservation Act—Requires the Administrator to direct the development of test procedures for the determination of estimated annual operating costs for home appliances.

States that effective 90 days after a test procedure rule applicable to a covered product is prescribed under this title, no manufacturer, distributor, retailer, or private labeler may make any representation in writing (including a representation on a label), or any broadcast advertisement, respecting the energy consumption of such product or cost of energy

consumed by such product, unless such product has been tested in accordance with such test procedure and such representation fairly discloses the results of such testing.

Directs the Federal Trade Commission to prescribe labeling rules applicable to all covered products, except to the extent that the Administrator determines that test procedures cannot be developed which meet the requirements of this title; or the Commission determines that labeling is not technologically or economically feasible.

States that a rule prescribed under this title shall require that each covered product bear a label which discloses the estimated annual operating cost of such product.

Provides that, not later than 180 days after the date of enactment of this Act, the Administrator shall, by rule, prescribe an energy efficiency improvement target for each type of covered product, which shall be designed so that, if met, the aggregate energy efficiency of covered products which are manufactured in calendar year 1980 will exceed the aggregate energy efficiency achieved by products of all such types manufactured in calendar year 1972 by a percentage which is the maximum percentage improvement which the Administrator determines is economically and technologically feasible, but which in any case is not less than 20 percent.

Sets forth the procedure by which an energy efficiency standard shall be prescribed.

Provides that the provisions of this Act relating to home appliances and the labeling thereof shall supersede any State regulation insofar as such State regulation may provide for the disclosure of information with respect to any measure of energy efficiency or energy use of a covered product.

Prohibits importation of such appliances not meeting the requirements of this Act.

Makes it unlawful for any manufacturer or private labeler to distribute in commerce any new covered product unless such covered product is labeled in accordance with this Act; or for any manufacturer or private labeler to distribute in commerce any new covered product which is not in conformity with an applicable energy efficiency standard.

Allows any person to commence a civil action against any manufacturer or private labeler who is alleged to be in violation of any provision of this title or any rule thereunder; or any Federal agency which has a responsibility under this title where there is an alleged failure of such agency to perform any act or duty under this part which is not discretionary.

Directs the Administrator to carry out a program of consumer education regarding the significance of estimated annual operating costs; and to report annually to the President on the progress of the program relating to home appliances and labeling.

Authorizes appropriations through fiscal year 1978 to carry out such program.

Provides that the Administrator shall, by rule, within 60 days after the date of enactment of this Act, prescribe guidelines for the preparation of a State energy conservation feasibility report; and shall invite the Governor of each State to submit, within 3 months after the effective date of such guidelines, such a report. Requires such report to include: (1) an assessment of the feasibility of establishing a State energy conservation goal, which goal shall consist of a reduction, as a result of the implementation the State energy conservation plan described in this title, of 5 percent or more in the total amount of energy consumed in such State in the year 1980 from the projected energy consumption for such State in the year 1980; and (2) a proposal by such State for the development of a State energy conservation plan to achieve such goal.

Provides that the Administrator shall, by rule, within 6 months after the date of enactment of this Act, prescribe guidelines with respect to measures required to be included in, and guidelines for the development, modification, and funding of, State energy conservation plans. Requires the Administrator to invite the Governor of each State to submit, within 5 months after the effective date of such guidelines, a report which shall include a proposed State energy conservation plan designed to result in scheduled progress toward, and achievement of, the State energy conservation goal of such State.

Makes technical and financial assistance available to States for the development and implementation of energy conservation plans.

Requires the Administrator to set an energy conservation goal for each State by 1980.

Authorizes appropriations to carry out such provisions relating to energy conservation plans; and requires annual reports to the Congress and the President on the operation of such provisions.

Directs the Administrator to establish and maintain, in consultation with the Secretary of Commerce and the Administrator of the Energy Research and Development Administration, a program to promote increased energy efficiency by American industry, and to establish voluntary energy efficiency improvement targets for at least the 10 most energy-consumptive major energy-consuming industries.

Requires the President to establish or coordinate Federal agency actions to develop mandatory standards with respect to energy conservation and energy efficiency to govern the procurement policies and decisions of the Federal Government and all Federal agencies, and to develop and implement a 10-year plan for energy conservation with respect to buildings owned or leased by an agency of the United States.

Directs the Civil Aeronautics Board, the Interstate Commerce Commission, the Federal Maritime Commission, the Federal Power Commission, and the Federal Aviation Administration to each conduct a study and report to the Congress within 60 days after the date of enactment of this Act with respect to energy conservation policies and practices which such agencies have instituted subsequent to October 1973.

Requires the Federal Trade Commission to prescribe: (1) test procedures for the determination of substantial equivalency of re-refined or otherwise processed used oil or blend of oil; and (2) labeling standards applicable to containers of recycled oil.

[In addition there are other titles that do not address energy efficiency]

National Energy Conservation Policy Act of 1977

H.R.5037

Latest Title: National Energy Conservation Policy Act

Sponsor: [Rep Kemp, Jack](#) [NY-38] (introduced 3/14/1977) Cosponsors (None)

Latest Major Action: 11/9/1978 Public Law 95-619.

Link: <http://thomas.loc.gov/cgi-bin/bdquery/z?d095:H.R.5037>:

SUMMARY AS OF:

10/10/1978--Conference report filed in House

(Conference report filed in House, H. Rept. 95-1751)

National Energy Conservation Policy Act—Title I: General Provisions—Declares that the purposes of this Act are to provide for the regulation of interstate commerce, to reduce the growth in demand for energy, and to conserve non-renewable energy resources without inhibiting beneficial economic growth.

Title IV: Energy Efficiency of Certain Products and Processes—Amends the Motor Vehicle Information and Cost Savings Act to increase the maximum amount of civil penalties for violations of the fuel economy standards imposed by such Act.

Requires fuel efficiency disclosure on vehicles of 8,500 pounds or less. Requires an Environmental Protection Agency (EPA) report on the accuracy of fuel economy estimates for new automobiles. Requires that the fuel economy label required by the Motor Vehicle Information and Cost Savings Act include a disclosure of the tax upon fuel inefficient automobiles upon enactment of such tax legislation.

Directs the Secretary of Energy to establish energy efficiency standards for specified household appliances. Stipulates that such standards shall reflect the maximum improvement in energy efficiency which is technologically feasible and economically justified.

Amends the Energy Policy and Conservation Act to prescribe procedures for the assessment of civil penalties for violations of energy efficiency standards.

Preempts all State energy efficiency standards prescribed after January 1, 1978. Permits a State to petition the Secretary requesting a rule that such State regulation is not to be superseded pursuant to this Act, and authorizes the Secretary to make such a rule only if he finds: (1) there is a significant State or local interest to justify such State regulation; (2) such State regulation is more stringent than the corresponding Federal standard; and (3) such State regulation would not unduly burden interstate commerce. Permits a person subject to a State energy efficiency regulation prescribed on or before the establishment of corresponding Federal Standards to petition the Secretary to prescribe a rule under this Act which supersedes such State regulation.

Makes technical and conforming amendments to the Energy Policy and Conservation Act.

Authorizes additional appropriations for fiscal year 1979 to carry out the purposes of this program.

Amends the Energy Policy and Conservation Act to direct the Secretary to prescribe energy efficiency standards for classes of industrial equipment after making an evaluation and determination of standard classifications of specified industrial equipment. Requires the Secretary to submit a report of such evaluation and classifications to the Congress no later than 18 months after the date of enactment of this Act.

Requires mandatory labeling of industrial equipment subject to the Federal standards. Imposes civil penalties for violation of such requirements. Authorizes appropriations for fiscal years 1978 and 1979 to carry out such program.

Requires the Secretary to establish targets for the increased utilization of energy-saving recovered materials for four industries: metals and metal products, paper and allied products, textile mill products, and rubber.

Title VI: Additional Energy-Related Measures—Expands the existing industrial energy reporting systems to cover industries identified by the Secretary as major energy-consuming industries or industries which use at least one trillion BTU's of energy per year. Requires all individual plants of corporations which comprise such industries to (periodically) file with their corporate headquarters plant reporting forms detailing their energy-efficiency progress.

Amends the Energy Policy and Conservation Act to authorize additional appropriations for State energy conservation programs for fiscal year 1979.

Requires the Secretary to report to the Congress, within six months of enactment of this Act, on the coordination of Federal energy conservation programs involving State and local governments.

Establishes, within the Department of Energy, an Office of Minority Economic Impact, to advise the Secretary on the effect of energy-related actions on minorities and minority business enterprises and on methods to insure that minorities have an opportunity to participate in the Federal energy programs of the Department. Authorizes the Secretary to make loans to minority businesses to assist them in participating in such programs. Authorizes appropriations to carry out this program.

Repeals the authority granted to the Governor of a State, under the Clean Air Act, as amended, which allowed him to prohibit major fuel-burning stationary sources from using fuels other than regional or local coal or coal derivatives. Allows the Governor of a State to petition the President to exercise his presidential authority under such Act where it can be shown that significant local or regional economic disruption or unemployment would result from use by such sources of fuels other than local or regional coal.

Requires the Secretary of Transportation to conduct a study: (1) on the energy-conserving potential of recreational motor vehicles; and (2) on the energy-conserving potential of increased bicycle transportation, and on the development of a comprehensive program to achieve increased bicycle use.

Requires the Secretary of Energy to conduct a study on the relevance to energy conservation programs of the use of the concept of the second law of thermodynamics.

Makes necessary technical and conforming amendments to the Energy Policy and Conservation Act.

National Appliance Energy Conservation Act of 1987

S.83

Latest Title: National Appliance Energy Conservation Act of 1987

Sponsor: [Sen Johnston, J. Bennett](#) [LA] (introduced 1/6/1987) [Cosponsors](#) (68)

Related Bills: [H.R.87](#)

Latest Major Action: 3/17/1987 Became Public Law No: 100-12.

Link: <http://thomas.loc.gov/cgi-bin/bdquery/z?d100:S83>:

SUMMARY AS OF:

2/17/1987--Passed Senate amended. (Measure passed Senate, amended, roll call #28 (89-6))

National Appliance Energy Conservation Act of 1987—Amends the Energy Policy and Conservation Act to add to the list of products covered under the Act: (1) freezers which can be operated by alternating current electricity (with specified exceptions); (2) central air conditioning heat pumps; (3) direct heating equipment; and (4) pool heaters. Deletes from specific coverage: (1) humidifiers; and (2) dehumidifiers. Excludes from such coverage consumer products designed solely for use in recreational vehicles and other mobile equipment.

Authorizes the Secretary of Energy (the Secretary) to amend Federal energy efficiency test procedures for appliances under specified guidelines.

Prohibits manufacturers from making any representations regarding the energy efficiency of appliances covered by this Act unless such appliances have been tested in accordance with the Federal test procedures, and the manufacturer's representations fairly disclose the results of such testing.

Sets forth specific Federal energy conservation standards for products covered by this Act and manufactured after certain dates. Establishes deadlines by which the Secretary must issue rules regarding such standards. Details the criteria to be applied if such standards are revised. Provides that after the statutory deadlines have been met, the Secretary is authorized to publish further final rules to determine whether standards for a covered product should be amended. Authorizes any person to petition the Secretary to conduct a rulemaking to determine whether the standards established in previous rulemakings should be amended. Sets forth the criteria which the Secretary must meet in order to grant such a petition.

Revises the information requirements with which manufacturers must comply to provide that the Secretary shall exercise authority in a manner designed to minimize unnecessary burdens on manufacturers of covered products.

Revises the rules under which State regulations are superseded by the Federal regulations for testing and labeling requirements and energy conservation standards.

Permits the waiver of Federal preemption if the Secretary finds that such waiver is needed to meet compelling and unusual local energy conditions. Prescribes procedural guidelines for such a waiver.

Details conditions under which State and local building code requirements regarding energy conservation standards are not superseded by the standards promulgated under this Act.

Permits the commencement of a citizen's suit against the Secretary for failure to comply with a nondiscretionary duty to issue rules according to prescribed schedules. Directs the courts to expedite the disposition of such suits.

Vests jurisdiction in the Federal district courts over actions brought by: (1) any adversely affected person to determine whether a State or local government is complying with the requirements of this Act; and (2) any person who files a petition for an amended standard which has been denied by the Secretary.

Declares that the required submission by the Secretary of an annual report regarding Federal energy efficiency standards does not constitute a defense or justification for a failure by the Secretary to comply with the nondiscretionary duty provided for in this Act.

Energy Policy Act of 1992

H.R.776

Latest Title: Energy Policy Act of 1992

Sponsor: [Rep Sharp, Philip R.](#) [IN-2] (introduced 2/4/1991) [Cosponsors](#) (54)

Latest Major Action: 10/24/1992 Became Public Law No: 102-486.

Link: <http://thomas.loc.gov/cgi-bin/bdquery/z?d102:H.R.776>:

SUMMARY AS OF:

10/5/1992--Conference report filed in House.

Energy Policy Act of 1992—**Title I: Energy Efficiency—Subtitle A: Buildings**—Amends the Energy Conservation and Production Act to set a deadline by which each State must certify to the Secretary of Energy (the Secretary) whether its energy efficiency standards with respect to residential and commercial building codes meet or exceed those of the Council of American Building Officials (CABO) Model Energy Code, 1992, and of the American Society of Heating, Refrigerating, and Air-Conditioning Engineers, respectively.

Requires the Secretary to provide technical assistance and incentive funding to the States to promote increased use of energy efficiency codes for buildings. Authorizes appropriations.

Amends the National Energy Conservation Policy Act to direct the Secretary of Energy to: (1) issue voluntary building energy code guidelines for use by the private and public sectors to encourage the assignment of energy efficiency ratings for new residential buildings; (2) establish a technical assistance program for State and local organizations to encourage the use of residential energy efficiency rating systems consistent with such guidelines; (3) provide matching grants for the establishment of regional building energy efficiency centers in each of the regions served by a Department of Energy (DOE) regional support office; and (4) establish an advisory task force to evaluate grant activities. Authorizes appropriations.

Requires the Secretary of HUD to: (1) assess the energy performance of manufactured housing and make recommendations to the National Commission on Manufactured Housing regarding thermal insulation and energy efficiency improvements; and (2) test the performance and determine the cost effectiveness of manufactured housing constructed in compliance with certain statutory standards. Authorizes the States to establish thermal insulation and energy efficiency standards for manufactured housing if the Secretary of HUD has not issued final regulations by October 1993.

Subtitle B: Utilities—Amends the Public Utility Regulatory Policies Act of 1978 (PURPA) to mandate that: (1) each electric utility employ integrated resource planning; (2) the rates for a State regulated electric utility are such that its outlay for demand-side management measures (including energy conservation and energy efficiency resources), are at least as profitable as those for the construction of new generation, transmission, and distribution equipment; (3) the rates charged by any electric utility are such that it is encouraged to make outlays for all cost-effective improvements in energy-efficient power generation, transmission and distribution; and (4) such rates and charges are implemented in a manner that assures that utilities are not granted unfair competitive advantages over small businesses engaged in transactions regarding demand-side energy management measures.

Prescribes guidelines under which the Secretary of Energy may provide grants to State regulatory authorities to encourage demand-side management (including energy conservation, efficiency, and load management techniques), and as a means of meeting gas supply needs. Permits a State regulatory authority to provide financial assistance to nonprofit subgrantees of the DOE Weatherization Assistance Program. Authorizes appropriations.

Directs the Tennessee Valley Authority (TVA) to conduct a least-cost planning program according to prescribed guidelines. Exempts TVA from specified least-cost planning

requirements which might arise from its electric power transactions with the Southeastern Power Administration.

Amends the Hoover Power Plant Act of 1984 to establish guidelines within which the Administrator of the Western Area Power Administration shall require each customer purchasing electric energy under a long-term firm power service contract with the Western Area Power Administration to implement integrated resource planning by October 1995. Permits different regulations for certain small customers that have limited capability to conduct integrated resource planning. Authorizes the Administrator to provide customers with technical assistance to implement such resource planning. Sets forth: (1) a schedule within which each customer must submit an initial integrated resource plan and periodic revisions to the Administrator; and (2) approval criteria for integrated resource plans. Provides for enforcement of integrated resource plan requirements, including the imposition of a surcharge, and a reduction in the power allocation of a noncomplying customer. Permits customers to form integrated resource planning cooperatives.

Amends PURPA to mandate that: (1) gas utilities employ integrated resource planning for gas customers; and (2) the rates charged by a State regulated gas utility are such that its prudent outlays for demand-side measures (such as energy conservation and load shifting programs) are at least as profitable as its outlays for supplies and facilities. Requires a State regulatory authority to implement its integrated resource planning standards in a manner that assures that utilities are not provided with unfair competitive advantages over small businesses.

Subtitle C: Appliance and Equipment Energy Efficiency Standards—Directs the Secretary to provide financial assistance to support a voluntary national window rating program that will develop energy ratings and labels for windows and window systems. Requires the National Fenestration Rating Council to develop such rating program according to specified procedures. Requires the Secretary to develop specified alternative rating systems if a national voluntary window rating program consistent with this Act has not been developed.

Amends the Energy Policy and Conservation Act to: (1) detail energy conservation and labeling requirements for specified commercial and industrial equipment (including lamps and plumbing products); and (2) delineate standards for heating and air-conditioning equipment, electric motors, high intensity discharge lamps, and distribution transformers.

Directs the Secretary to provide financial and technical assistance to support a voluntary national testing and information program for widely used commercial office equipment and luminaries with potential for significant energy savings.

Requires the Secretary to report to the Congress on: (1) the potential for the development and commercialization of appliances which are substantially more efficient than required by Federal or State law; and (2) the energy savings and environmental benefits of early appliance replacement programs.

Subtitle D: Industrial—Directs the Secretary to: (1) make matching grants to industry associations for energy efficiency improvement programs; (2) establish an annual recognition award program for industrial entities that have significantly improved their energy efficiency; and (3) report to the Congress on the establishment of Federally mandated energy efficiency reporting requirements and voluntary energy efficiency improvement targets for energy intensive industries.

Directs the Secretary to make renewable grants to the States to: (1) promote the use of energy-efficient technologies in covered industries; (2) establish industry-by-industry training programs to conduct process-oriented industrial assessments; (3) assist utilities in developing energy efficiency programs and technologies for industrial customers in covered industries; (4) establish and update criteria for conducting process-oriented industrial assessments on an industry-by-industry basis energy efficiency technologies; (5) establish a nationwide directory of organizations offering industrial energy efficiency assessments, technologies, and services; (6) establish an annual recognition award program for utilities operating outstanding or innovative industrial energy efficiency technology assistance programs; and (7) convene annual meetings of parties interested in process-oriented industries. Authorizes appropriations.

Requires the Secretary to: (1) establish voluntary guidelines for energy efficiency audits and insulation in industrial facilities; and (2) conduct educational and technical assistance programs to promote their use.

Subtitle G: Miscellaneous—Amends the Department of Energy Organization Act to direct the Administrator of the Federal Energy Administration to engage in energy information data collection including: (1) electricity production from domestic renewable energy resources; (2) residential and commercial energy; and (3) demand-side management programs conducted by electric utilities.

Requires the Secretary to study and report to the Congress on specified aspects of district heating and cooling programs and vibration reduction technologies.

[In addition there are other titles that do not address energy efficiency]

Energy Policy Act of 2005

H.R.6

Latest Title: Energy Policy Act of 2005

Sponsor: [Rep Barton, Joe](#) [TX-6] (introduced 4/18/2005) [Cosponsors](#) (2)

Latest Major Action: Became Public Law No: 109-58 [GPO:]

Latest Conference Report: [109-190](#) (in Congressional Record [H6691-6836](#))

Links: <http://thomas.loc.gov/cgi-bin/bdquery/z?d109:H.R.6>:

SUMMARY AS OF:

8/8/2005--Public Law.

Energy Policy Act of 2005—Sets forth an energy research and development program covering: (1) energy efficiency; (2) renewable energy; (3) oil and gas; (4) coal; (5) Indian energy; (6) nuclear matters and security; (7) vehicles and motor fuels, including ethanol; (8) hydrogen; (9) electricity; (10) energy tax incentives; (11) hydropower and geothermal energy; and (12) climate change technology.

Title I: Energy Efficiency—Subtitle A: Federal Programs—(Sec. 101) Directs the Architect of the Capitol to develop and implement a cost-effective energy conservation and management plan for all facilities administered by Congress.

(Sec. 102) Amends the National Energy Conservation Policy Act (NECPA) to revise energy reduction goals and performance requirements for federal buildings, including: (1) a timetable for reduced energy consumption; (2) metering of energy use; (3) federal procurement guidelines for energy efficient products, including ENERGY STAR products and Federal Energy Management Program (FEMP) designated products; and (4) extension of federal agency authority to enter into energy savings performance contracts.

(Sec. 106) Authorizes the Secretary of Energy (the Secretary throughout this bill, unless otherwise named) to enter into voluntary agreements with one or more persons in industrial sectors that consume significant amounts of primary energy per unit of physical output to reduce the energy intensity of their production activities. Directs the Secretary to recognize and publicize the achievements of participants in such voluntary agreements.

(Sec. 107) Instructs the Secretary to establish an Advanced Building Efficiency Testbed demonstration program for advanced engineering systems, components, and materials to enable innovations in building technologies. Authorizes appropriations for FY2006-FY2008.

(Sec. 108) Amends the Solid Waste Disposal Act to prescribe procedural guidelines for increased use of recovered mineral component in federally funded projects involving procurement of cement or concrete.

(Sec. 109) Amends the Energy Conservation and Production Act (ECPA) to direct the Secretary to establish, by rule, revised federal building energy efficiency performance standards meeting specified requirements.

(Sec. 110) Amends the Uniform Time Act of 1966 to extend standard daylight time from March to November (currently it runs from April to October). Requires the Secretary to report to Congress on the impact of this extension upon energy consumption in the United States. Retains the right of Congress to revert Daylight Saving Time back to the 2005 time schedules.

(Sec. 111) Requires the Secretaries of the Interior, of Commerce, and of Agriculture to seek to: (1) incorporate energy efficient technologies in public and administrative buildings associated with management of the National Park System, National Wildlife Refuge System, National Forest System, National Marine Sanctuaries System, and other public lands and resources they manage; and (2) use energy efficient motor vehicles, including those equipped with biodiesel or hybrid engine technologies, in such management.

Subtitle B: Energy Assistance and State Programs—(Sec. 121) Amends the Low-Income Home Energy Assistance Act of 1981 and ECPA to extend the low-income home energy assistance and weatherization programs through FY2007 and FY2008, respectively.

Authorizes the states to purchase renewable fuels, including biomass, to implement the Low-Income Home Energy Assistance programs.

(Sec. 123) Amends ECPA to increase from 10% to 25% mandatory state energy efficiency goals in calendar year 2012 as compared to calendar year 1990.

(Sec. 124) Prescribes guidelines for: (1) a state energy efficient appliance rebate program; (2) federal grants to the states for energy efficient public buildings; (3) a low income community energy efficiency pilot program; and (4) a State Technologies Advancement Collaborative.

(Sec. 128) Amends ECPA to prescribe guidelines for state building energy efficiency codes incentives.

Subtitle C: Energy Efficient Products—(Sec. 131) Amends ECPA to: (1) establish a voluntary program at the Department of Energy (DOE) and the Environmental Protection Agency (EPA) to identify and promote energy-efficient products and buildings (ENERGY

STAR Program); (2) direct the Secretary to implement a consumer education program for homeowners and small business owners on energy efficiency benefits of air conditioning, heating, and ventilation systems; (3) direct the Secretary to convene a conference to promote a national public energy education program; and (4) direct the Secretary to implement an energy efficiency public information initiative.

(Sec. 135) Prescribes energy conservation standards for additional products, including: (1) testing requirements for ceiling fans and ceiling fan light kits, as well as (together with energy conservation standards for) refrigerated bottled or canned beverage vending machines, commercial refrigerators, freezers, and refrigerator-freezers; and (2) definitions and test procedures for the power use of battery chargers and external power supplies. Prescribes the bases for test procedures for illuminated exit signs, distribution transformers (including the low voltage dry-type), traffic signal modules, and medium base compact fluorescent lamps.

(Sec. 137) Directs the Federal Trade Commission to consider the effectiveness of the current consumer products labeling program, and changes to labeling rules.

(Sec. 138) Instructs the Administrator of General Services to study and report to Congress on the advantages and disadvantages of employing intermittent escalators in the United States.

(Sec. 139) Directs the Secretary to study and report to Congress on: (1) state and regional policies that promote cost-effective programs to reduce energy consumption by state-regulated utilities and nonregulated utilities; and (2) failure to comply with deadlines for new or revised energy conservation standards.

(Sec. 140) Directs the Secretary to establish a pilot program of financial assistance to between three and seven states to implement energy efficiency pilot projects.

Title XIII: Energy Policy Tax Incentives—Energy Tax Incentives Act of 2005

Subtitle C: Conservation and Energy Efficiency Provisions—(Sec. 1331) Allows a tax deduction for energy efficient commercial building property placed in service before 2008. Sets forth standards, special rules, and certification requirements for such property.

(Sec. 1332) Allows certain home contractors a business tax credit for the construction of new energy efficient homes acquired before 2008. Sets forth energy savings and certification requirements for such homes.

(Sec. 1333) Allows individual taxpayers a tax credit for certain residential energy efficiency improvements made before 2008. Imposes a lifetime limitation of \$500 on such credit, less aggregate credit amounts for all prior taxable years.

(Sec. 1334) Allows a business tax credit for the production of certain household appliances (clothes washers, dishwashers, and refrigerators) with a specified energy efficiency rating.

(Sec. 1335) Allows individuals a tax credit for 30% of expenditures made for certain residential energy efficient property, including photovoltaic property, solar water heating property, and fuel cell property placed in service before 2008.

(Sec. 1336) Allows an investment tax credit for the installation of qualified fuel cell property or qualified microturbine property. Terminates such credit after 2007.

(Sec. 1337) Increases the energy tax credit from 10 to 30% for qualified fuel cell property and for solar and geothermal energy property. Makes hybrid solar lighting systems eligible for the energy tax credit until 2008. Disqualifies solar energy property used to heat swimming pools from the energy tax credit.

[In addition there are other titles and subtitles that do not address energy efficiency]

Energy Independence and Security Act of 2007

H.R.6

Latest Title: Energy Independence and Security Act of 2007

Sponsor: [Rep Rahall, Nick J., II](#) [WV-3] (introduced 1/12/2007) [Cosponsors](#) (198)

Latest Major Action: Became Public Law No: 110-140 [GPO: [Text](#), [PDF](#)]

Note: Omnibus energy legislation.

Link: <http://thomas.loc.gov/cgi-bin/bdquery/z?d110:H.R.6>

SUMMARY AS OF:

12/19/2007--Public Law.

Energy Independence and Security Act of 2007—

Title III: Energy Savings Through Improved Standards for Appliance and Lighting—

Subtitle A: Appliance Energy Efficiency—(Sec. 301) Amends EPCA to set forth amended efficiency standards and updated test procedures for class A external power supplies and appliances, including residential boilers.

(Sec. 305) Revises requirements for the amendment of standards. Prescribes requirements for the analysis of potential energy savings for certain industrial equipment (including air conditioning, heating, and related equipment), and subsequent mandatory establishment of uniform national product standards.

(Sec. 306) Sets forth requirements for regional and base national standards for furnaces (except boilers), central air conditioners, and heat pumps.

(Sec. 308) Prescribes requirements for expedited rulemaking to establish an energy or water conservation standard.

(Sec. 309) Prescribes requirements for final rules prescribing energy conservation standards for battery chargers, or a determination that no energy conservation standard is technically feasible and economically justified.

(Sec. 310) Requires test procedures and standards for all covered consumer products (other than automobiles) to include standby mode and off mode energy consumption.

(Sec. 311) Revises Energy Factors for home appliances, including dehumidifiers, residential clothes washers and dishwashers, and refrigerators and freezers.

(Sec. 312) Establishes energy standards for walk-in coolers and freezers.

(Sec. 313) Revises the definition of electric motor, dividing it into subtypes I and II, and prescribes new energy efficiency standards for such motors.

(Sec. 314) Prescribes energy efficiency standards for single package vertical air conditioners and heat pumps.

(Sec. 315) Amends the Energy Policy Act of 2005 to: (1) expand R&D programs to include technologies to improve the energy efficiency of appliances and mechanical systems for buildings in cold climates, including combined heat and power units and increased use of renewable resources, including fuel; and (2) make eligible for special allocations any state whose energy efficient appliance rebate program provides rebates to residential consumers for the purchase of products with improved energy efficiency in a cold climate.

Subtitle B: Lighting Energy Efficiency—(Sec. 321) Amends EPCA to prescribe energy efficiency standards for general service incandescent lamps, rough service lamps, and other designated lamps.

Directs the Secretary of Energy to: (1) conduct and report to the FTC on an annual assessment of the market for general service lamps and compact fluorescent lamps; and (2) carry out a proactive national program of consumer awareness, information, and education about lamp labels and energy-efficient lighting choices. Authorizes appropriations for FY2009-FY2012.

Prohibits a manufacturer, distributor, retailer, or private labeler from distributing in commerce specified adapters for incandescent lamps.

Authorizes the Secretary to carry out a lighting technology research and development program. Authorizes appropriations for FY2008-FY2013.

Instructs the Secretary of Energy to report to Congress on: (1) federal measures to reduce or prevent release of mercury during the manufacture, transportation, storage, or disposal of light bulbs; (2) whether specified rulemaking deadlines will be met; (3) an NAS review of advanced solid state lighting R&D and the impact upon the types of lighting available to consumers of an energy conservation standard requiring a minimum of 45 lumens per watt for general service lighting; and (4) the time frame for commercialization of lighting to replace incandescent and halogen incandescent lamp technology.

(Sec. 322) Sets forth minimum energy efficiency standards for incandescent reflector lamps.

(Sec. 323) Amends federal law governing congressional approval of proposed public buildings projects to require the Administrator of General Services (GSA) to: (1) transmit to Congress an estimate of the future energy performance of the building or space and a specific description of the use of energy efficient and renewable energy systems, including photovoltaic systems; and (2) include, with respect to space to be leased, the minimum performance requirements for energy efficiency and renewable energy.

Sets forth requirements for the use of energy efficient lighting fixtures and bulbs in public building construction, alteration, and acquisition.

(Sec. 324) Amends EPCA to include within its regulatory oversight: (1) metal halide lamp fixtures; and (2) energy efficiency labeling for designated consumer electronic products.

Title IV: Energy Savings in Buildings and Industry

Subtitle B: High-Performance Commercial Buildings—(Sec. 421) Requires the Secretary of Energy to appoint a Director of Commercial High-Performance Green Buildings (Commercial Director) to: (1) establish and manage the Office of Commercial High-Performance Green Buildings; (2) coordinate activities with the Office of Federal High-Performance Green Buildings; (3) promote research and development of high-performance green buildings; (4) jointly establish with the Federal Director a national high-performance green building clearinghouse to provide high-performance green building information and disseminate research results; and (5) work with GSA and relevant federal agencies to ensure full coordination of high-performance green building information and activities.

Requires the Commercial Director to: (1) formally recognize groups that qualify as a high-performance green building partnership consortium; and (2) report to Congress on the status of high-performance green building initiatives and development of such initiatives at the state and local level.

(Sec. 422) Requires the Commercial Director to establish the Zero-Net-Energy Commercial Buildings Initiative to: (1) reduce the quantity of energy consumed by commercial buildings and achieve zero net energy commercial buildings in the United States; and (2) competitively select a consortium to develop and implement the initiative.

Authorizes appropriations for FY2008-FY2018.

Requires the Commercial Director and the Federal Director, in coordination with the Consortium, to implement public outreach to tell individuals and entities about the information and services available government-wide.

Subtitle D: Industrial Energy Efficiency—(Sec. 451) Amends EPCA to establish an industrial energy efficiency program under which the EPA Administrator shall establish a recoverable waste energy inventory program that involves: (1) an ongoing survey of major domestic industrial and large commercial combustion sources and their locations; and (2) a review of the quantity and quality of waste energy produced at such sources.

Requires the EPA Administrator to: (1) establish a Registry of Recoverable Waste Energy Sources, and sites on which the sources are located; and (2) publish a rule for establishing criteria for site inclusion.

Instructs the EPA Administrator to: (1) calculate the total quantities of potentially recoverable waste energy from sources at the sites, nationally and by state; and (2) make such quantities public, including greenhouse gas emissions savings that might be achieved with recovery of the waste energy from all sources and sites listed on the Registry.

Requires the EPA Administrator to notify owners or operators of recoverable waste energy sources and sites listed on the Registry before publishing the listing.

Authorizes appropriations for FY2008-FY2012.

Instructs the Secretary of Energy to establish a waste energy recovery incentive grant program to provide incentive grants to: (1) owners and operators of projects that successfully produce electricity or incremental useful thermal energy from waste energy recovery; (2) utilities purchasing or distributing the electricity; and (3) states that have achieved 80% or more of recoverable waste heat recovery opportunities.

Sets forth additional incentives for recovery, use, and prevention of industrial waste energy.

Redesignates the Combined Heat and Power Application Centers of DOE as Clean Energy Application Centers.

Instructs the Secretary of Energy to: (1) relocate administration of the Clean Energy Application Centers to the Office of Energy Efficiency and Renewable Energy within DOE; and (2) award grants to universities, research centers, and other institutions to ensure continued operations and effectiveness of eight Regional Clean Energy Application Centers in specified regions.

Authorizes appropriations for FY2008-FY2012.

(Sec. 452) Instructs the Secretary of Energy to establish a program to support, research, develop, and promote, in cooperation with energy-intensive industries and national industry trade associations representing the energy-intensive industries, the use of new materials processes, technologies, and techniques to optimize energy efficiency and the economic competitiveness of domestic industrial and commercial sectors.

Requires the Secretary to establish energy efficiency partnerships with eligible entities to improve the energy efficiency of equipment and processes used by energy-intensive industries.

Authorizes competitive grants to universities, individual inventors, and small companies for innovative technology research, development, and demonstrations.

Instructs such Secretary to fund institutions of higher education-based industrial research and assessment centers.

Authorizes appropriations for FY2008-FY2012 and ensuing fiscal years.

(Sec. 453) Directs the Secretary and the EPA Administrator to: (1) initiate a voluntary national information program for widely used data centers and data center equipment and facilities for which there is a potential for significant data center energy savings; and (2) designate jointly an information technology industry (data center efficiency) organization to consult with and coordinate the program.

Subtitle H: General Provisions—(Sec. 491) Instructs the Federal Director and the Commercial Director to: (1) establish guidelines to implement a demonstration project to contribute to the research goals of the Office of Commercial High-Performance Green Buildings and the Office of Federal High-Performance Green Buildings; and (2) carry out

demonstration projects related to green features of federal buildings and other facilities and supportive of research initiatives regarding high-performance green buildings generally.

Authorizes appropriations for FY2008-FY2012.

(Sec. 492) Requires the Federal Director to develop and implement a comprehensive indoor air quality program for federal facilities to ensure the safety of federal workers and facility occupants.

(Sec. 493) Amends the Clean Air Act to direct the EPA Administrator to establish a competitive grants program to assist local governments, with respect to local government buildings, to: (1) deploy cost-effective technologies and practices; and (2) achieve operational cost savings, through application of cost-effective technologies and practices. Authorizes appropriations for FY2007-FY2012.

(Sec. 494) Instructs the Federal Director, in coordination with the Commercial Director, to establish a Green Building Advisory Committee.

(Sec. 495) Directs the Secretary of Energy to establish an Advisory Committee on Energy Efficiency Finance to provide advice and recommendations on energy efficiency finance and investment issues, and to assist the energy community in identifying practical ways of lowering costs and increasing investments in energy efficiency technologies. Authorizes appropriations.

Title V: Energy Savings in Government and Public Institutions Subtitle D: Energy Efficiency of Public Institutions—(Sec. 531) Amends EPCA to authorize appropriations for state energy programs for FY2009-FY2012.

(Sec. 532) Amends the Public Utility Regulatory Policies Act of 1978 (PURPA) to require each electric utility to: (1) integrate energy efficiency resources into utility, state, and regional plans; (2) adopt policies establishing cost-effective energy efficiency as a priority resource; and (3) implement rate design modifications to promote energy efficiency investments.

Requires a natural gas utility to: (1) integrate energy efficiency resources into its plans and planning processes; (2) adopt policies that establish energy efficiency as a priority resource in such plans and processes; and (3) implement rate design modifications to promote energy efficiency investments.

Subtitle E: Energy Efficiency and Conservation Block Grants—(Sec. 542) Instructs the Secretary of Energy to establish the Energy Efficiency and Conservation Block Grant Program to assist eligible entities in implementing strategies that: (1) reduce their fossil fuel

emissions and total energy use; and (2) improve energy efficiency in the transportation, building, and other appropriate sectors.

(Sec. 543) Sets forth: (1) fund allocation and use requirements with respect to local governmental units, states, Indian tribes and competitive grants; and (2) grant recipient requirements.

(Sec. 548) Authorizes appropriations for FY2008-FY2012.

[In addition there are other titles that do not address energy efficiency]

American Recovery and Reinvestment Act of 2009

The **American Recovery and Reinvestment Act of 2009**, abbreviated **ARRA** ([Pub.L. 111-5](#)) and commonly referred to as **the Stimulus** or **The Recovery Act**, was an economic stimulus package enacted by the 111th United States Congress in February 2009 and signed into law on February 17, 2009, by President Barack Obama.

The act was passed in response to the rapid economic downturn in 2008 and was intended to retard the economic slide by replacing the missing private sector activity with government spending. It was hoped that it would save and create jobs quickly. A secondary goal was to provide temporary relief programs for those most impacted by the recession and invest in infrastructure, education, health, and 'green' energy.

The approximate cost of the economic stimulus package was estimated to be \$787 billion at the time of passage, later revised to \$831 billion between 2009 and 2019. The Act included spending on many energy infrastructure projects as well as allocations for energy efficiency, renewable energy facilities, renewable energy product manufacturing, and federal tax incentives related to energy investments, and expansion of accelerated depreciation. The Act also included many items not directly related to immediate economic recovery such as long-term research and development, and other spending projects included by Congress.

A summary of all sections is provided below. Additional details for sections addressing industrial energy efficiency is included.

SECTION 1. SHORT TITLE.

This Act may be cited as the ``**American Recovery and Reinvestment Act of 2009**''.

SECTION 2. TABLE OF CONTENTS.

The table of contents for this Act is as follows:

DIVISION A—APPROPRIATIONS PROVISIONS

- Title I: Agriculture, Rural Development, Food and Drug Administration, and Related Agencies
- Title II: Commerce, Justice, Science, and Related Agencies
- Title III: Department of Defense
- Title IV: Energy and Water Development
- Title V: Financial Services and General Government
- Title VI: Department of Homeland Security
- Title VII: Interior, Environment, and Related Agencies
- Title VIII: Departments of Labor, Health and Human Services, and Education, and Related Agencies
- Title IX: Legislative Branch
- Title X: Military Construction, Veterans' Affairs, and Related Agencies
- Title XI: State, Foreign Operations, and Related Programs
- Title XII: Transportation, Housing and Urban Development, and Related Agencies
- Title XIII: Health Information Technology
- Title XIV: State Fiscal Stabilization Fund
- Title XV: Accountability and Transparency
- Title XVI: General Provisions—This Act

DIVISION B—TAX, UNEMPLOYMENT, HEALTH, STATE FISCAL RELIEF, AND OTHER PROVISIONS

- Title I: Tax Provisions
- Title II: Assistance for Unemployed Workers and Struggling Families
- Title III: Premium Assistance for Cobra Benefits
- Title IV: Medicare and Medicaid Health Information Technology; Miscellaneous Medicare Provisions
- Title V: State Fiscal Relief
- Title VI: Broadband Technology Opportunities Program
- Title VII: Limits on Executive Compensation

SECTION 3. PURPOSES AND PRINCIPLES.

(a) STATEMENT OF PURPOSES.—

The purposes of this Act include the following:

- (1) To preserve and create jobs and promote economic recovery.
- (2) To assist those most impacted by the recession.
- (3) To provide investments needed to increase economic efficiency by spurring technological advances in science and health.
- (4) To invest in transportation, environmental protection, and other infrastructure that will provide long-term economic benefits.

(5) To stabilize State and local government budgets, in order to minimize and avoid reductions in essential services and counterproductive state and local tax increases.

(b) GENERAL PRINCIPLES CONCERNING USE OF FUNDS.—

The President and the heads of Federal departments and agencies shall manage and expend the funds made available in this Act so as to achieve the purposes specified in subsection (a), including commencing expenditures and activities as quickly as possible consistent with prudent management.

SECTION 4. REFERENCES.

Except as expressly provided otherwise, any reference to "this Act" contained in any division of this Act shall be treated as referring only to the provisions of that division.

SECTION 5. EMERGENCY DESIGNATIONS.

(a) IN GENERAL.—

Each amount in this Act is designated as an emergency requirement and necessary to meet emergency needs pursuant to section 204(a) of [S.Con.Res. 21](#) (110th Congress) and section 301(b)(2) of [S.Con.Res. 70](#) (110th Congress), the concurrent resolutions on the budget for fiscal years 2008 and 2009.

(b) PAY-AS-YOU-GO.—

All applicable provisions in this Act are designated as an emergency for purposes of pay-as-you-go principles.

The ARRA Act was approved February 17, 2009.

Title 3 contains a description of the intent of the act in a Statement of Purpose which includes the following:

1. To preserve and create jobs and promote economic recovery.
2. To assist those most impacted by the recession.
3. To provide investments needed to increase economic efficiency by spurring technological advances in science and health.
4. To invest in transportation, environmental protection, and other infrastructure that will provide long-term economic benefits.
5. To stabilize State and local government budgets, in order to minimize and avoid reductions in essential services and counterproductive state and local tax increases.

The Act specifies that 37% of the package is to be devoted to tax incentives equaling \$288 billion and \$144 billion, or 18%, is allocated to state and local fiscal relief (more than 90% of the state aid is going to Medicaid and education). The remaining 45%, or \$357 billion, is allocated to federal spending programs such as transportation, communication, waste water and sewer infrastructure improvements; energy efficiency upgrades in private and federal buildings; extension of federal unemployment benefits; and scientific research programs.

- Tax incentives: Total: \$288 billion
- Tax incentives for individuals: Total: \$237 billion
- Tax incentives for companies: Total: \$51 billion
 - \$5 billion: Bonus depreciation, which extends a provision allowing businesses buying equipment such as computers to speed up its depreciation through 2009.
- Healthcare: Total: \$155.1 billion
- Education: Total: \$100 billion
- Aid to low income workers, unemployed and retirees (including job training): Total: \$82.2 billion
 - \$500 million for research on emerging skill requirements and development of training programs, development of labor exchanges, and job training. Authorized by Section 171e (1)(B)(ii) of the Workforce Investment Act.
 - Up to \$37.5 million for Job Corps Centers to provide training, some of which to be targeted at energy efficiency.
- Infrastructure Investment: Total: \$105.3 billion
- Transportation: Total: \$48.1 billion,
- Water, sewage, environment, and public lands: Total: \$18 billion
- Government buildings and facilities: Total: \$7.2 billion
- Communications, information, and security technologies: Total: \$10.5 billion
- Energy Infrastructure: Total: \$21.5 billion
 - \$6 billion for the cleanup of radioactive waste (mostly nuclear weapons production sites)
 - \$4.5 billion for the Office of Electricity and Energy Reliability to modernize the nation's electrical grid and smart grid.
 - \$4.5 billion to increase energy efficiency in federal buildings (GSA)
 - \$3.25 billion for the Western Area Power Administration for power transmission system upgrades.
 - \$3.25 billion for the Bonneville Power Administration for power transmission system upgrades.
 - Energy efficiency and renewable energy research and investment
 - Loans and investments into green energy technology are a significant part of the final bill
- Energy Efficiency Programs: Total: \$27.2 billion
 - \$6 billion for renewable energy and electric transmission technologies loan guarantees, to support commercial use of advanced technologies with lower air pollution and greenhouse gas emissions. Authorized under Title XVII of EPAct 2005
 - \$5 billion for weatherizing modest-income homes

- \$3.4 billion for carbon capture and low emission coal research
- \$3.2 billion was made available to assist local governments implement conservation programs with Energy Efficiency and Conservation Block Grants (EECBGs). Program was originally authorized in Title V of EISA but was not funded until passage of ARRA. \$2.8 billion was awarded based on a formula and \$400 million on a competitive basis.
- \$3.1 billion for the DOE State Energy Program to help states invest in energy efficiency and renewable energy. State Energy Offices (SEO) functioned as local administrators of the funds. Each state created its own portfolio of programs. Program authorized under Part D of Title II of Energy Policy and Conservation Act.
- \$2 billion for manufacturing of advanced car battery (traction) systems and components.
- \$800 million for biofuel research, development, and demonstration projects.
- \$602 million to support the use of energy efficient technologies in building and in industry
- \$500 million for training of green-collar workers (by the Department of Labor)
- \$400 million for the Geothermal Technologies Program
- \$400 million for electric vehicle technologies
- \$300 million for energy efficient appliance rebates
- \$300 million for state and local governments to purchase energy efficient vehicles
- \$300 million to acquire electric vehicles for the federal vehicle fleet (GSA)
- \$250 million to increase energy efficiency in low-income housing
- \$204 million in funding for research and testing facilities at national laboratories
- \$190 million in funding for wind, hydro, and other renewable energy projects
- \$115 million to develop and deploy solar power technologies
- \$110 million for the development of high efficiency vehicles
- \$42 million in support of new deployments of fuel cell technologies
- Housing: Total: \$14.7 billion
- Scientific research: Total: \$7.6 billion
 - \$3 billion to the National Science Foundation
 - \$2 billion to the United States Department of Energy
 - \$400 million for ARPA-E. Authorized under Section 5012 of the America Competes Act.
- Other: Total: \$10.6 billion

References and additional resources

<http://energy.gov/recovery-act>

<http://www.cbo.gov/sites/default/files/cbofiles/attachments/02-22-ARRA.pdf>

<http://ase.org/resources/recovery-act-chart-energy-efficiency-provisions>

<http://www.recovery.gov/Transparency/fundingoverview/Pages/default.aspx>

<http://www.hhs.gov/recovery/overview/index.html>
