

An Introduction to U.S. Policies to Improve Industrial Energy Efficiency

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Acknowledgments

This paper was inspired by staff at the China Sustainable Energy Program at the Energy Foundation who wanted more information about U.S. energy policies for their colleagues in China. We expanded upon their initial concept to also write this report for Americans who are new to energy efficiency policies and could use an introduction. This report is on programs and policies for the industrial sector. A companion report on programs and policies for the buildings sector was published in 2012.

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 to be filled in after external review 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 though many of them have only recently been implemented. These programs are operated by the federal government as well as states, utilities, municipalities and non-profit organizations. Some of these programs are decades old, though most are more recent.

The federal government has created obligatory minimum performance standards as well as voluntary standards both of which result in improved energy efficiency. Though not covered 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 tax payer's income or property tax liability.

This report summarizes many of the major efforts, but also including summaries of other 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 policy-makers 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 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 this objective, both English and Chinese Mandarin versions of this report are available.

Background

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, and the facilities are more energy-intensive, and energy is a more significant fraction of the cost of operation. 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 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 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 a greater challenge meeting the needs of a heterogeneous mix of customers. 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, utilities, public benefit funds, and non-profit 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 require common industrial products such as motors, fans, pumps, and compressors, are required to meet or exceed minimum performance standards. In addition to legislated performance requirements, many trade, technical and professional organizations establish voluntary test and performance 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 and pollution control systems. Though the net benefit to people and the environment is greater, energy 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 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 source of the program or policy. It is important to keep in mind that although the more locally focused programs and policies are limited in geographic scope, that collectively they contribute the majority of the nation’s industrial energy efficiency efforts.

This study was commissioned by the Energy Foundation China Sustainable Energy Program to provide Chinese policy-makers and industrial energy efficiency practitioners information about U.S. industrial energy efficiency programs and policies. We hope that this information will allow them to learn from what the U.S. has and is doing, helping to inform discussions about appropriate programs and policies for China. To serve this objective, both English and Chinese Mandarin versions of this report are available. This report is also designed to serve as an “Industrial Energy Efficiency Policy 101” introduction for Americans who are new to the industrial energy efficiency field and could benefit from a quick tutorial on many of the major programs.

Introduction

The body of this report is divided into three sections: national; regional, state and local; and market actors. The first two focus on programs and policies, while the third focuses on organizations that exist outside of 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 are better able to 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, labyrinth of policies, all combine to 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 programs types covered in this report and lists the organizations or types of organizations likely to provide them. The reader 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	Technical 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			
National Air & Space Agency		X						X	X			
State Government		X	X	X	X							
Local Government			X									
Utilities	X	X	X	X			X					
Public Benefit EE Programs	X	X	X	X	X	X	X	X	X	X	X	X
Regional Networks				X	X	X	X	X	X	X	X	X

This matrix is not intended to be a comprehensive list of all possible combinations, only to provide the reader with a point of reference to gain a better understanding of the connection between programs, policies, and supporting entities. 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.

Section I: Federal programs and policies

The federal government plays a number of roles in promoting industrial energy efficiency. These roles include: providing information and education; technical assistance; financial assistance; and new technologies and processes resulting from research.

Many federal agencies are involved with elements of promoting energy efficiency in the industrial sector. While it might be intuitive that the Department of Energy would be the lead agency energy efficiency, we see agencies without a clear energy connection including the Department of Labor or the Department of Commerce providing programs that drive energy efficiency. Some of these programs are focused on research and development in 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.

In addition the government is involved in creating regulations and standards to aid interstate commerce. The Nation Bureau of Standards was created in 1901 to undertake this task, a mission continued by its successor body the National Institute of Standards and Technology (NIST), which resides within the Department of Commerce. Since the 1980s, it has supported the development of performance standards, both mandatory and labeling, that reduce the energy needed to run common industrial systems. More recently, it has supported the development of management systems that encourage organizations to take a systematic approach to managing quality, environmental compliance and now energy. Other agencies including the U.S. Environmental Protection Agency and Department of Energy also play a role in regulations and standards that affect industrial energy use.

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 chapter will look into federal RD&D programs and the benefits they have provided to the energy efficiency sector. ([Vaidyanathan 2012](#)).

SMALL BUSINESS TECHNOLOGY TRANSFER (STTR) PROGRAM

STTR is an R&D focused program with the goal of expanding public/private sector partnerships between small businesses and research institutions. STTR assistance is provided through competitive solicitations. In addition to the funding, recipients receive technical assistance and guidance from federal agencies. The Small Business Administration (SBA) coordinates the STTR program, collecting information from all the participating agencies and publishing it in a pre-solicitation announcement (PSA).

The program is funded by five federal departments and agencies: 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). 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:

Phase I: Startup phase: an award of up to \$100,000 for a term of approximately one year is used to fund exploration of scientific, technical and commercial feasibility of an idea or technology

Phase II: An award of up to \$750,000 for a term of up to two years 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 STTR funds can be used to support this phase. The business must find funding in the private sector or other non STTR federal agency funding.

SMALL BUSINESS INNOVATION RESEARCH PROGRAM (SBIR)

SBIR program is essentially the same program as STTR targeted at small business. The program is managed by SBA and supports the development of emerging technology with a three-phase engagement protocol. The major difference is that eleven federal agencies fund the program. In addition to DOD, DOE, DHHA, NASA and NSF, SBIR is also funded by USDA, Department of Commerce (DOC), Department of Education (DOEd), Department of Homeland Security (DHS), Department of Transportation (DOT), and the Environmental Protection Agency (EPA).

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 2012). A company in the private sector performing basic research should partner with an academic institution when seeking NSF funding.

DEFENSE (DARPA)

The Defense Advanced Research Projects Agency (DARPA) was established in 1958 “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.”(www.DARPA.mil)

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. Funding in 2012 for research and development exceeded \$2.8 billion.

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

(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 transformational and disruptive 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 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). [\(Vaidyanathan 2012 to be published\)](#)

References and Resources

- ARPA-E:

- **DARPA:** www.darpa.mil
- **NSF:** www.nsf.gov
- **SBIR:** www.sba.gov/content/small-business-innovation-research-program-sbir-0
- **STTR:** www.sba.gov/content/small-business-technology-transfer-program-sttr-0#

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 manufacturers 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. There is at least one MEP Center in each state and territory, 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, ISO9001 and Six Sigma. Through adopting a systematic approach to improving production processes and product quality, the energy intensity of these companies is lowered. 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 manufacturing-focused federal government initiatives where companies.

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.

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.

References and Resources:

- http://www.nist.gov/public_affairs/general_information.cfm)
- <http://www.manufacturing.gov/welcome.html>
- <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 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 heavy 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. More recently it has funded the development and deployment of the *Superior Energy Performance* (SEP) energy performance standard. These two management systems are often thought of as two parts of the same standard but are in fact separate standards.

Dozens of companies have participated in a demonstration of the ISO50001 and SEP standards over the past few years having much of the cost of training absorbed by AMO in exchange for participating in the *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 *CHP Regional Application Centers* or RACs) that are described in more detail later in this report. 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 program partner agrees to reduce energy intensity by 25% over a ten-year period and in exchange get access to a Technical Account Manager (TAM) who will work with them to analyze energy use and develop performance metrics. He or she will also teach company staff how to use AMO's portfolio of on-line tools. Partners are listed in a national registry.

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

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.

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

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.

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

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.

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

Budget

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

- Industrial Assessment Center (IAC) program (\$6 million)
- Deployment (\$12 million)
- Next Generation Materials (\$34 million)
- Next Generation Manufacturing Processes (\$64 million)

Results

Technology R&D

From 1990 to 2010, AMO awardees have commercialized 229 new technologies, received 54 R&D awards, obtained 251 patents,

Deployment

On-line tools have been used to identify over \$1.6 billion in annual energy savings

IACs have trained over 3000 students and performed over 15,000 audits since 1980

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) of installed or developing capacity

References and Resources

- C.K. Lyn Griffith, “*An Overview of U.S. Federal Government Industrial Energy Efficiency Programs 2005-2011*”, Rockville, MD., Energy Pathways LLC June 20, 2012
- Daniel Trombley, *ACEEE & AMMEX Respond to DOE's Industrial Program FY2013 Budget Request*, Washington, D.C.: American Council for an Energy-Efficient Economy, March 16, 2012.
- Daniel Trombley, *Restoring Funding for the Industrial Assessment Center Program at DOE*, Washington, D.C.: American Council for an Energy-Efficient Economy, September, 2011.
- AMO Home Page: <http://www1.eere.energy.gov/manufacturing/about/index.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.

EnergyStar™ Program

The EnergyStar™ 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. These mandatory and voluntary standards are covered in more detail in the companion report *Introduction to U.S. Policies to Improve Building Efficiency* and later in this report in the Standards section.

The EnergyStar™ program 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. Companies can work with EPA to produce products that earn the EnergyStar™ label and upgrade the efficiency of their manufacturing facilities to become EnergyStar™ Certified Plants. This facility certification program is a voluntary program covered in the next section. .

Energy Star for Industry

To assist its manufacturing partners, EPA offers training and marketing resources to aid their sales efforts. 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.

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:

- 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 Road head: 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.
- www.energystar.gov/industrybenchmarkingtools

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

- 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

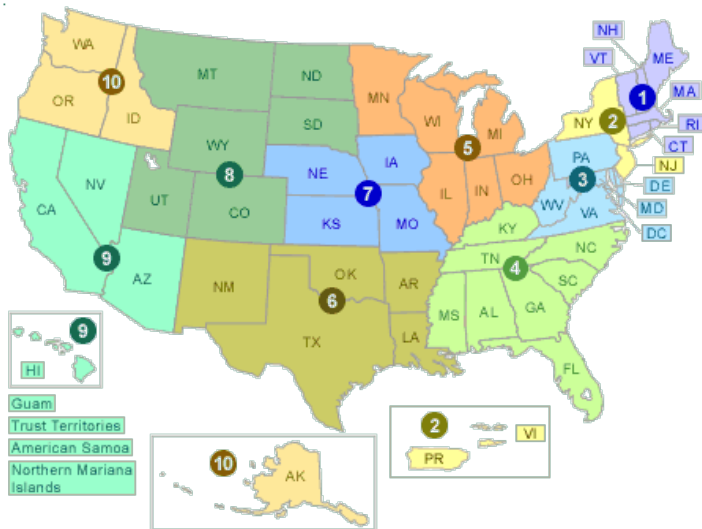
- Energy Star Challenge for Industry: recognizes sites that reduce energy intensity by 10%

Performance of Energy Star Program

For the Focus Industry initiative, it 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. One hundred and ten plants from thirteen 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.

Pollution Prevention

Within OCSPP is the Office of Pollution Prevention and Toxics. OPPT 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. This structure allows programs and financial assistance to be structured to regional needs and characteristics.



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

OPPTA 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

Pollution prevention (P2) often overlaps with energy efficiency (E2). 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 and the Department of Commerce Manufacturing Extension Partnership (MEP) 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 works with large original equipment manufacturers (OEMs) to target and engage key suppliers with on-site training and P2 opportunity identification and analysis. GSN services are often delivered by state MEP centers with P2 technical guidance provided by state environmental protection agency staff.

The goal of the GSN program is 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 Suppliers 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



E3: ECONOMY - ENERGY - ENVIRONMENT
SUPPORTING MANUFACTURING LEADERSHIP THROUGH SUSTAINABILITY

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.

Programs are managed on the state level and each of the ___ 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.

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.

Reference and Resource

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

DEPARTMENT OF LABOR (DOL)

DOL has focused on increasing the number of workers with skills to meet the needs of the renewable and energy efficiency sectors. Often referred to as "green jobs", 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. 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.

References and Resources

- DOL training grants: www.dol.gov/media/webcast/grants/htm
- Environmental Justice: <http://www.dol.gov/asp/ej/>
- Weatherization:
- Bureau of Labor Statistics green jobs: <http://www.bls.gov/green/>

DEPARTMENT OF AGRICULTURE (USDA) -

The United States Department of Agriculture (USDA) offers grants to help rural small businesses and agricultural producers to install renewable energy 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.

Rural Economic Assistance Program (REAP) Financial Assistance

The REAP Energy Efficiency Improvement Grant provides grant of \$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 REAP)

The United States Department of Agriculture (USDA) offers grants to help rural small businesses and agricultural producers to install renewable energy systems, and conduct energy audits and feasibility studies. The REAP program has many components, only one of which are 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.

- 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

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.

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.

References and Resources

- USDA REAP website, Accessed 7/13/12: http://www.rurdev.usda.gov/BCP_Reap.html
- <http://www.rurdev.usda.gov/Business.html>
- 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, price 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 mandatory and some are voluntary. The latter tend to be 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 to which other organizations must adhere when developing and administering standards.

When a standard is incorporated into legislation, it becomes a mandatory standard. Otherwise, it is voluntary, though in many instances for a product to be accepted in the market it must comply with a commonly accepted standard. For example, many people will not purchase an electrical product unless it has a Underwriters Laboratories Inc. certification mark (UL ref needed).

Mandatory standards set a baseline of performance and stipulate an input such as energy or an output such as pollution. A manufacturer can be affected by regulatory standards in a couple of ways. The products they manufacture may be required to meet certain performance standards. The equipment it purchases and uses in its processes may be required to meet certain performance standards. In both instances, the regulated variable may be tied to an input or an output.

ENERGY PERFORMANCE STANDARDS

Manufacturers may be affected by performance standards in two fashions: the products they make, and the products they buy. The EnergyStar™ program was created as a partnership between DOE and EPA to establish energy performance for common consumer products. As described in detail below, DOE has gone on to establish standards for many more product categories, chief among them is industrial motors. Some of the standards are required by law and others are voluntary. Descriptions of major examples of both are included in this section.

Companies manufacturing these products had to make design changes and possibly even redesign parts of their manufacturing processes. There is certainly an energy cost to these investments. However, companies and consumers purchasing these products ultimately save considerable sums of money through reduced utility expenditures. Collectively, less energy is consumed and overall costs are lowered.

EnergyStar™ 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, buildings, industrial plants, and organizations. The energy star logo has become a symbol for energy efficiency in the U.S. and around the world.

In this report, we will cover 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* report.

The first section will describe how a manufacturer can register its products with the Energy Star program. The second section will deal with how an organization registers its facilities and processes.

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.

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 allow 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.

Qualify: new products that meet Energy Star specifications must be certified by EPA recognized certification body before the product can be labeled with the EnergyStar™ 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 ES 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.

For additional information on third-party certification requirements, including a list of EPA-recognized CBs by product category, visit: www.energystar.gov/3rdpartycert.

Industrial Equipment and System Minimum Efficiency Performance Standards

Collectively, motors consume more electricity than any other end use in the United States. Motors are the default mechanism in every sector of the economy except for transportation at tuning energy into motion. They 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. Because as much as 60% of all electricity flows through them, even modest improvements in their design and operation can yield tremendous energy and energy cost savings.

To realize this potential energy savings, the Department of Energy developed minimum performance standards for industrial motors. DOE's standards are supported by National Institute of Standards and Technology (NIST) and American National Standards Institute (ANSI) established test procedures. All industrial motors sold in the U.S. must be compliant with these standards.

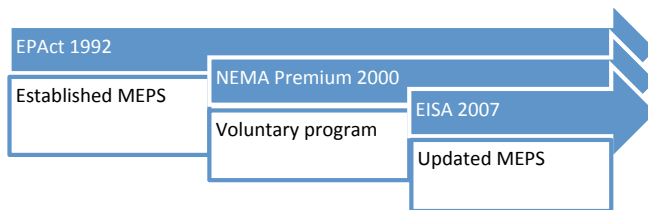
They may also be compliant with even more stringent standards set by trade organizations such as National Electrical Manufacturers Association (NEMA), but are not legally required to do so. Products that do meet the higher voluntary standards are able to display the respective labeling for those standards.

Legislated Standards

The Energy Policy Act of 1992 (EPAct) sought to comprehensively address national energy needs including energy efficiency. Included in the Act was authorization for DOE to create minimum performance standards of industrial equipment. In 2007, Congress passed the Energy Independence and Security Act of 2007 (EISA) which emphasizes energy efficiency as a top priority and continued existing provisions and established new ones targeting commercial, institutional, manufacturing, and transportation energy use.

Voluntary Standard

In June 2003, NEMA released General Specification for Consultants, Industrial and Municipal: NEMA Premium® Efficiency Electric Motors establishing the requirements a motor would need to meet to receive the NEMA Premium® designation. This voluntary program established a new standard for motor performance that has become the industry norm.



History

The Department of Energy has worked with industry to establish performance standards for common industrial systems such as motors, pumps, fans and compressors. One fourth of the electricity used in the U.S. is consumed by electric motors in the industrial sector (DOE 1998). It is for this reason that in the 1990s, the U.S. Department of Energy launched the Motor Challenge program to better understand the characteristics of the installed population of motors systems in the manufacturing sector. In parallel with this work, under the direction of the Energy Policy Act of 1992 (EPAct), the DOE worked with industry to create a definition of electric motors and enact Minimum Energy Performance Standards (MEPS). Standards were developed and instituted for certain electric motors between 1 and 200 horsepower (hp) in size, and were based on the "energy efficiency" level specified in NEMA's MG-1 standard (equivalent to the current levels in Table 12-11). In the Energy Independence and Security Act of 2007, Congress directed DOE to enhance those standards. Most of

the motors covered by EAct were required to meet higher standards, defined by NEMA MG-1 Table 12-12. Additionally, certain larger motors from 200-500 HP were brought up to the Table 12-11 level. For more on history of motor MEPS, see ACEEE's 2007 report (Trombley 2010).

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.

Results

Due to the replacement of a majority of motors in the industrial sector since the passage of the ***Energy Policy Act of 1992 (EAct)***, ACEEE estimated that these provisions have saved about 2.6 Quads of energy per year between 2000 and 2010. It is also estimated that 15 to 25% of U.S. electricity usage could be eliminated through optimizing the performance of electric motors driven systems (www.aceee.org/topics/motors).

References and Resources

US DOE Motors program:

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

<http://energy.gov/savings/energy-goals-and-standards-federal-government>

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

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

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

ASAP website: <http://www.appliance-standards.org/>

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

Elliott 2007 (IE073) Impact of Proposed Increases to Motor Efficiency Performance Standards, Proposed Federal Motor Tax Incentives, and Suggested New Directions Forward”

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

Trombley 10/21/10: ACEEE Delivers statement to DOE on electric motors efficiency standards. <http://www.aceee.org/blog/2010/10/aceee-delivers-statement-doe-electric-motors-efficiency>

United States Industrial Electric Motor Systems Market Opportunities Assessment, U.S. Department of Energy, https://www1.eere.energy.gov/manufacturing/tech_deployment/pdfs/mtrmkt.pdf

ENERGY MANAGEMENT SYSTEMS

Energy efficiency can be achieved through 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

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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 systematically investing in energy efficiency. The three covered in this report are:

- U.S. EPA EnergyStar for Industry
- ISO 50001 Energy Management System
- ANSI Management System for Energy (MSE) / 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 EnergyStar Plant Certification however is only a labeling program and not a standard. By contrast, ISO50001 is and is the international standard for measuring and documenting energy use. The ANSI Management System for Energy (MSE 2000-2008) is also a standard and is the basis for the U.S. Department of Energy's Superior Energy Performance (SEP) program that provides a company with a systematic method setting an energy-intensity target and measuring progress towards that goal.

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

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 programs. Staff and technical assistance were provided to these companies as they learned and implemented the new systems. Support of ISO 50001 and SEP systems is now a fundamental component of DOE's Advanced Manufacturing Office (AMO) programmatic offering. 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.

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.

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

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 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.

ANSI/MSE 2000:2008

The ISO 50001 does not require a company to improve its energy performance, only to track its performance. Setting a goal and measuring progress against it requires an additional protocol. In 2000, Georgia Institute of Technology (GIT) developed the first comprehensive, American National Standards Institute (ANSI)-compatible energy management standard (MSE 2000) for industry. This standard was revised in 2008 ([ANSI/MSE 2000:2008](#)) and is now the most recognized standardized approach to manage energy supply, demand, reliability, purchase, storage, use, and disposal. It captures 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).

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 to the private sector. Once complete, companies will contact the certifying body and go through a registration process similar to that for ISO 9001 and ISO 14001.

References and Resources

- ISO 50001 was published as an International Standard in June 2011 and is available from the American National Standards Institute (ANSI).
- <http://www.iso.org/iso/home/standards/management-standards/iso50001.htm>
- <http://www.superiorenergyperformance.net/ems.html>

ENVIRONMENTAL

Environmental regulations can affect energy consumption in the industrial sector in a number of ways. Many pollution control devices require energy to operate. For example, thermal oxidizers are often used to destroy volatile organic compounds (VOCs) and require natural gas as a combustion fuel.

Other regulations encourage energy efficiency by setting limits on the amount of a given pollutant that can be emitted. Since the volume of pollution usually varies directly with the amount of fuel consumed, the more efficient a process the less pollution per unit of production. This means more product can be produced under an existing permit (foot note all the needed qualifiers for this broad brush statement).

Air, Land and Water Regulations

Regulations dictating the amount of a pollutant that can be released into the atmosphere, a waterway, or the ground all impart a compliance cost to a company. Part of that compliance cost is the energy needed to run any treatment, measurement, or control equipment. Therefore regulatory compliance has the potential to increase energy use.

However, in some instances, reducing emissions through combustion efficiency has the potential to reduce compliance costs. An excellent example of this, and one that is explained in greater detail in the section describing the Clean Energy Application Center (CEACs) funded by the Department of Energy, is the costs involved in complying with the U.S. Environmental Protection Agency (EPA) Clean Air Act pollution standards for Hazardous Air Pollutants (HAPs) from Major Sources such as industrial, commercial, and institutional boilers and process heaters. This regulation is often referred to as the Boiler MACT rule.

Under the new rule, efficiency of combustion is treated the same as a control technology. Therefore a company may choose to install a highly efficiency CHP system which will reduce its energy inputs or a control technology that will likely increase its energy inputs.

SAFETY

Regulations affecting worker safety can also have a profound impact on energy consumption. In the food products and pharmaceutical industries, the Food & Drug Administration (FDA) has established good manufacturing practices (GMP) that must be followed. Cleanliness standards require frequent and thorough cleaning of manufacturing facilities. All aspects from water temperature to reclamation of discharge water are stipulated. Each of these requirements has an energy component and affects overall energy consumption. Just as with environmental compliance, there is a compliance cost part of which is energy. In general, the more energy efficient a process is, the less it costs to operate.

Section II: Regional, state and local programs and policies

Although some energy efficiency activities can be directed at the national level, local programs and policies are critical to driving industrial energy efficiency implementation because of regional diversity in the industrial sector. Many state agencies, such as state energy offices (SEOs) and public service 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. Some programs

work as a technical resource providing information and guidance to policy makers with the goal of changing legislation to favor energy efficiency.

Many state and local governments have expanded their economic development efforts to include energy efficiency. In addition to encouraging manufacturers of 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 those funded to increase investments in energy efficiency as a matter of public benefit. In terms of funding, this is the largest segment of the energy efficiency sector having invested \$XXX in industrial energy efficiency in 2010 (Chittum 2012: Money well spent). We'll summarize the extensive program offering of these programs and provide several examples.

Then we'll transition to 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.

Then we will 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 programs provided by state agencies. There is some continuity to these across the country as many are funded in part by their federal counterparts.

The role some organizations play in the energy efficiency sector is hard to categorize as they may have many responsibilities in a state's effort to address energy issues, or although they may be a state organization, they have a national presence and impact. We've titled these Centers of Excellence and describe three well known 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.

Utility Customer Energy Efficiency Programs

Many 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 a supply side plan that only uses utility revenues to cover the cost of generation, transmission, and distribution assets and associated operating costs, demand side planning recognizes and provides 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 as the name implies that 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 investments. A few programs cover the salaries of engineering professionals who identify and solve energy efficiency opportunities at customer sites. (IE121, 1)

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 tip-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 since 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” 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 efficient 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.

Custom Incentive Program

These programs offer a rebate when a customer retrofits, replaces, or renovates a production line or part of its production process. These incentives are generally 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.

Self-Direct Program

Similar to a custom program, these programs provide incentives to larger, more energy-intensive customers for projects with the potential to reduce energy use or energy intensity. The amount of the financial assistance may be related to the amount of energy saved or be a percentage of the overall

project cost. Customers may have the option to not participate (Opt Out) in these programs, or may have to choose to participate in them (Opt-In).

One type of opt-in program requires 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 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 would likely be very competitive and be selected for funding by the program administrator. By contrast a project with minimal energy savings and a significant funding request would not be competitive. By using a common market mechanism, such a program structure has the advantage of maximizing energy savings, minimizing free riders.

Energy Manager / Energy Management Programs

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. (IE091, Appendix A)

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.

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.

New Construction and Renovation Incentives

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

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 efficiency commercial and industrial (C&I) programs saved over 124,000 GWh of electricity and 1.3 billion therms 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.

A survey of by the Southwest Energy Efficiency Project (SWEET) of the seven major utilities in the six states it serves, the 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.

Hundreds of millions spent. Each utility or program has its own budget. 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.

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).

REFERENCES AND RESOURCES

For more information, please visit the following links

- 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, Nowak, 2012).

REFERENCES

Chittum, Anna and Seth Nowak, *Money Well Spent: 2010 Industrial Energy Efficiency Program Spending*. Washington, D.C.: 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 (SWEET). 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

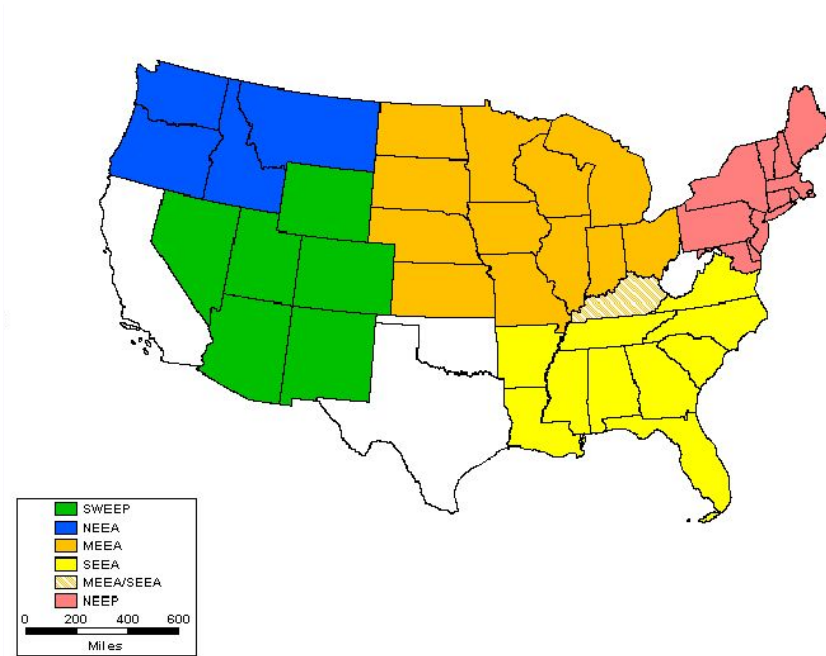
Most individual energy-intensive industries are concentrated in one or two regions of the country. Because of this and other geographic effects, a regional approach to engaging industry has proven effective since the mix varies by region. ACEEE has been working with the regional energy efficiency organizations (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 ([SWEET](#))
- 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)

The major industrial states of California, Texas and Oklahoma are not covered by an established REEO, though EF is exploring developing a TX and OK REEO. West Virginia and Kentucky are covered by both SEEA and MEEA. California is a leader in energy efficiency and is not viewed as being in great need of inclusion in a regional organization.

Figure 1. Regional Energy Efficiency Organizations and the State They Serve



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Comment [2]: Update with new figure including SPEER

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.

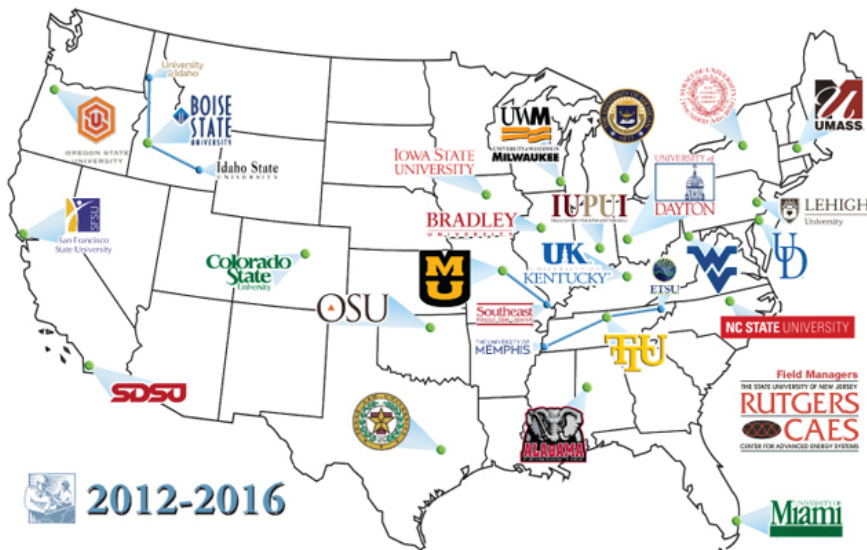
INDUSTRIAL ASSESSMENT CENTERS (IACs)

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.

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 \$1001,000 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.



FigureX: 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 engineers 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).
- (Source: IAC website)

DOE funds 24 schools on a five year cycle. The current centers are identified in Figure X. DOE as 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 and ask to be put on the audit schedule.

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), 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.

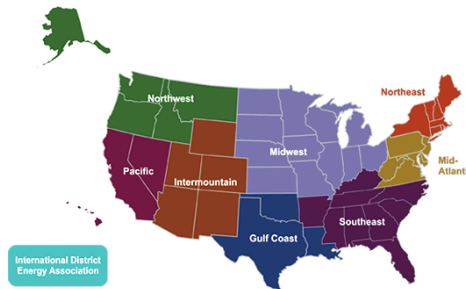
Technical Assistance – Providing technical information to energy end-users and others to help them consider if CHP, waste heat recovery or district energy makes sense for them. This includes performing site assessments, producing project feasibility studies, and providing technical and financial analyses.

In 2013, the CEACs will offer [technical assistance](#) to the more than 650 major source facilities impacted by the Boiler MACT regulation.

The U.S. Environmental Protection Agency (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 Heaters (known as Boiler MACT), in late 2012. 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

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

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



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.

References and Resources

- <http://www.nist.gov/mep/>
- <http://www.nist.gov/mep/find-your-local-center.cfm>
- <http://www.nist.gov/mep/e3.cfm>

COOPERATIVE EXTENSION PROGRAM

The USDA provides funding to at least one university in each state so that it can engage in agricultural extension services. 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)

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.

References and Resources

- www.csrees.usda.gov/qlink/extension.html

State Implementation 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) (<http://www.naseo.org/members/states/default.aspx>). 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 a 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 that government funding is never completely free or guaranteed. 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. ([EAR FinGuide](#))

A number of state energy offices have emerged as leaders including:

- New York State Energy Research and Development Authority (NYSERDA)
- California Energy Commission (CEC)
- Oregon Department of Energy
- West Virginia State Energy Office

All of these organizations actively participate in NASEO and ASERTTL.

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 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>

Centers of Excellence

Several institutions have developed a level 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.

The structure of these centers is as varied as they are numerous. Three different models are described below.

NYSERDA

Is one of the nation's largest and most accomplished state energy offices. It benefits from being the sole organization in the state of New York with responsibilities for energy related issues: utility regulation, energy efficiency and renewable energy research and development, 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.

Funding

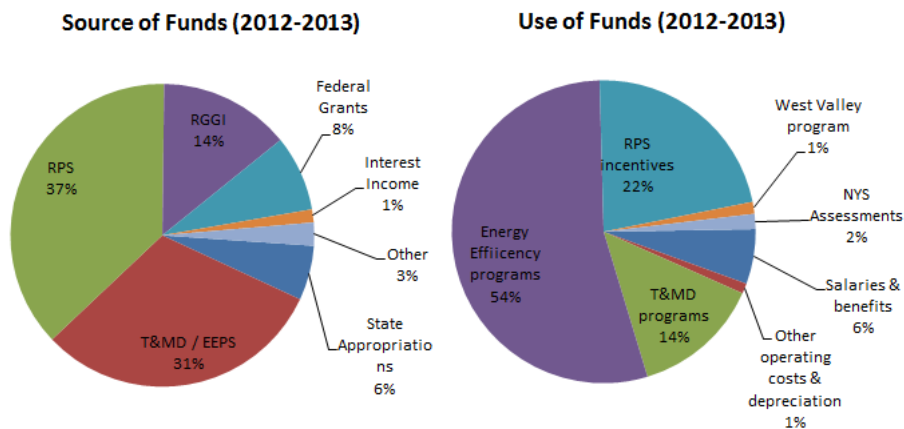
New York funds much of their energy efficiency programs through system benefits charges (SBC) authorized by the New York State Public Service Commission (PSC). An SBC, sometimes referred to as a public benefit charge, is a common way to pay for energy efficiency or renewable energy activities. It is 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 style program to reduce greenhouse gas emissions in the 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 r

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



(Source: NYSERDA. “Fiscal Year 2012-13 Budget and Financial Plan.” 2012)

References and Resources

- Tombley 2012
- <http://www.dps.ny.gov>
- www.rggi.org
-

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 design plant layouts, quality systems, and information 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 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. (https://development.ohio.gov/bs_thirdfrontier/etc.htm)

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

NC 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 resource providing financial incentives and policies (www.DSIREUSA.org). The Center offers companies the following energy efficiency and renewable energy related services.

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.

References and Resources

- <http://ncsc.ncsu.edu/index.php/about-ncsc/>

Local Financing

These state and local programs seek to grow local 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.

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 of projects financed with QECB and Internal Revenue Code 179D explains how savings realized by all aspects of a building's performance. 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” as increased to \$32 billion. As of July 23, 2012, at least \$673 million of QECBs have been issued (Bellis 2012).

COMMUNITY DEVELOPMENT FINANCE INSTITUTIONS (CDFI)

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 the 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 is an entire alphabet soup 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.

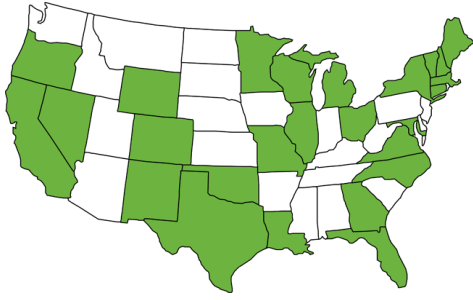
It is not important that the incentive seeker understand all the details of these financial instruments, only that they may be available in their locality. Most of them will not specifically single out energy efficiency, but so long as they are designed to encourage capital investment or facility improvement,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

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

ON-BILL FINANCING

Several utilities have experimented with on-bill financing of capital projects for different customer classes. For companies who are not able to finance large capital projects internally, this is a viable substitute to traditional lending. A requirement is that the project generates sufficient energy cost savings to offset the monthly payments of the loan. The utility acts as the lender, financing the project, and collects the fees through a monthly rider on the customer’s bill. Figure 2 below identifies all the states that have or have had PACE programs.



States with PACE Programs (ASE 2012)

References and Resources

CDFA 2012: Primer on Development Finance, Toby Rittner

<http://www.naseo.org/resources/financing/qecb/index.html>

Tip Sheet on PACE: http://ase.org/sites/default/files/PACE_factsheet_0.pdf

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

Section III: Non-Governmental Market Actors

NON-GOVERNMENTAL ORGANIZATIONS (NGOs)

There are many Non-Governmental Organizations (NGOs) engaged in promoting and brining awareness to energy efficiency practices, technologies and demonstration projects. b 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.

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:

1. Building Technologies
2. Energy Storage
3. Renewable Energy
4. 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 and as a result have brought coordination in accessing 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.

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

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

Consortium for Energy Efficiency (CEE)

The CEE is a non-profit public benefits corporation that develops initiatives that promote the manufacture and purchase of energy-efficient products and services. Its membership include utilities, statewide and regional market transformation organizations, environmental groups, research institutions, and state energy offices in the U.S. and Canada. It coordinate events, develops advocacy campaigns, and sponsors research. It also serves as a forum for its members to exchange information and ideas. (<http://www.cce1.org/cee/about.php3>)

Electric Power Research Institute (EPRI)

EPRI is an independent, non-profit 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.

<http://www.epri.com/About-Us/Pages/Our-Business.aspx>

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.

There are dozens of organizations involved in energy efficiency 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 either 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)
- Institute Industrial Energy Consumers of America (IIECA)
- 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. ([Shruti TBP](#))

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)
- Association of Energy Engineers (AEE)
- 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)
- Institute of Electrical and Electronics Engineers (IEEE)
- 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)

Summary

This report has attempted to identify the resources most widely available and most commonly used 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.

OTHER READING RECOMMENDATIONS

Griffith, *An Overview of U.S. Federal Government Industrial Energy Efficiency Programs 2005-2011*, Rockville, MD. Energy Pathways LLC, June 2012

Kolwey, *Utility Financing Programs for Industrial Customers*, Boulder CO. SWEEP, September 2012

Steven Nadel, Jennifer Amann, Sara Hayes, Shui Bin, Rachel Young, and Eric Mackres, *Introduction to U.S. Policies to Improve Building Efficiency*, Washington, DC. American Council for an Energy-Efficient Economy, August 2012

References

Bellis, Elizabeth 2012. *Internal Revenue Service Issues Guidance on Qualified Energy Conservation Bonds*, Washington, DC: State & Local Energy Report, Volume 5.3- Summer 2012.

Shreve, Chris 2012. *Internal Revenue Service Issues Guidance on Qualified Energy Conservation Bonds*, Washington, DC: State & Local Energy Report, Volume 5.3- Summer 2012.

motor MEPS, see ACEEE's 2007 report (Trombley 2010).

NEMA's MG-1 standard

(www.aceee.org/topics/motors)