Industrial Energy Efficiency Programs and Supporting Policies: A White Paper

Prepared for

WESTERN GOVERNORS' ASSOCIATION

Serving the Governors of 19 States and 3 US-Flag Pacific Islands

Prepared by

Neil Kolwey, Southwest Energy Efficiency Project (SWEEP) and

Anna Chittum, American Council for an Energy-Efficient Economy (ACEEE)

March 2011

Executive Summary 3
Industrial Energy Challenges and Opportunities in the West 4
Industrial Energy Use in the West 4
Today's Challenges to Industrial Energy Efficiency 4
Opportunities – Examples of Company Successes 6
Utility and State Industrial Energy Efficiency Programs 10
Utility Programs 10
State Industrial Efficiency Programs 12
Policies to Support Industrial Programs 13
State Energy Efficiency Goals 13
Incentives for Utilities 14
Funding State Industrial Programs 15
Policies to Support Combined Heat and Power (CHP) 15
Appendix A - CHP Examples 17
Appendix B – Model Utility-Administered Industrial Energy Efficiency Programs 18
Appendix C – Federal Industrial Programs 21
Appendix D – Regional Industrial Programs 22
Appendix E – Further Reading 25
Notes 27

Executive Summary

The western states have a large potential for energy savings in the industrial sector. On average western states' industrial energy use is about 28% of total energy use. With good internal energy efficiency programs and with assistance from local utilities and other partners, industrial companies can reduce their energy intensity by 2-3% per year, or 10-15% energy savings after five years of effort. These reductions in energy use improve the companies' profits and competitiveness, and reduce emissions of greenhouse gases and other environmental impacts of energy consumption. For energy-intensive industrial sectors, reducing energy costs improves international competitiveness and helps maintain U.S. manufacturing jobs. The main obstacles for companies to achieve greater energy efficiency are capital constraints, short payback period thresholds, and limited staff resources.

Utilities and state energy offices can be important partners to industrial companies in energy efficiency efforts. Effective utility energy efficiency programs include custom and prescribed incentives, technical assistance, training, and self-direction programs. There are several state policies that can help build robust and successful utility industrial programs, including state energy efficiency goals or standards, and the adoption of policies to make effective efficiency programs a profitable enterprise for utilities.

State and regional industrial efficiency programs can complement utility programs and provide industrial companies with additional support towards developing sustainable energy management programs that achieve on-going energy savings. Effective state programs include technical assistance, training, and in some cases recognition of company achievements. Although state budgets are tight, there are several possible alternatives for funding these types of programs, such as public benefits funds or severance taxes on energy production.

Multiple examples of effective state and utility industrial efficiency programs exist around the country and in the West, and continue to develop as states and utilities identify industrial energy efficiency as a priority.

Industrial Energy Challenges and Opportunities in the West

Industrial energy consumption accounts for a significant portion of total energy use in most Western states. There are challenges to taking advantage of these opportunities, but many companies have developed successful programs that achieve on-going energy savings of 2-3% per year.

Industrial Energy Use in the West

For most western states, industrial energy consumption represents a significant opportunity to reduce total energy consumption and the associated environmental impacts, while at the same time helping companies improve their profitability and competitiveness. Some studies estimate potential industrial energy savings of up to 20%, based on readily available, cost-effective technologies.[1]

Table 1 (on p. 5) shows industrial energy consumption and total consumption (combined natural gas and electricity) in the Western states. Texas and California account for 58% of the total industrial energy consumption in all 19 western states. Some of the largest energy-consuming industries in these two states are chemicals, petroleum refining, forestry/pulp and paper, food processing, electronics, and stone/clay/glass.[2] Table 1 also shows the Western states' average industrial retail prices of energy (natural gas and electricity), which vary considerably from state to state.

Today's Challenges to Industrial Energy Efficiency

Although energy efficiency can result in significant cost savings for industrial facilities, there are several obstacles to companies achieving their full potential of energy savings. The main obstacles are capital constraints, limited staff dedicated to energy management, and lack of staff training.

Capital Constraints and Competing Priorities

Industrial firms are, first and foremost, businesses. Their primary goals – to produce and sell more products and to grow their companies – may or may not include achieving energy reductions. Industrial companies are focused on internal investment priorities and production process needs, and have a strong sense of which kinds of investments are essential to remaining competitive and profitable. Energy efficiency investments are generally not viewed as essential. For most industrial facilities (other than energy-intensive industries such as chemicals, primary metals, and paper), energy costs are typically less than 5% of total operating costs.[3] If a company chooses not to invest in energy efficiency, they can continue to pay higher energy costs and see greater wear on their equipment, but they won't necessarily go out of business or have to shut down, as they would if they ignored other business needs. Therefore, energy efficiency investments are often viewed as non-essential, discretionary investments, which are given a lower priority for funding. As a result, for many companies, energy efficiency projects are not implemented unless the payback period is very rapid – often two years or less.

Table 1 – Industrial Energy Consumption in the Western States

State	2009 IND energy use (thous MMBtu)	2009 Total energy use (thous MMBtu)	IND % of Total	2009 Ave. Industrial Retail Electricity price ($/MWh)	2009 Ave. Industrial Retail Natural Gas Price ($/MMBtu)
Texas	2,113,351	6,389,637	33.1%	70.1	3.98
California	1,193,507	4,873,035	24.5%	105.8	6.87
Oklahoma	320,389	1,120,756	28.6%	49.5	8.12
Washington	300,344	1,187,905	25.3%	44.1	9.36
Colorado	251,873	936,733	26.9%	63.3	6.75
Kansas	208,841	627,202	33.3%	61.9	5.08
Oregon	179,531	715,577	25.1%	53.0	8.39
Nebraska	176,962	439,822	40.2%	58.4	5.78
Nevada	148,334	613,071	24.2%	80.4	9.02
Wyoming	138,203	232,220	59.5%	48.6	6.37
Arizona	133,005	1,126,869	11.8%	66.7	7.54
Utah	118,148	469,637	25.2%	48.5	6.29
Idaho	108,660	305,253	35.6%	51.9	7.71
New Mexico	83,101	364,814	22.8%	58.4	6.19
Montana	79,088	220,112	35.9%	56.6	7.96
South Dakota	59,176	171,689	34.5%	56.5	5.80
North Dakota	52,016	162,533	32.0%	59.3	5.38
Hawaii	37,183	103,995	35.8%	179.6	18.55
Alaska	19,844	145,378	13.6%	133.5	3.91

Texas and California have the largest levels of industrial energy consumption, accounting for 58% of the total for all Western states. Industrial retail electricity prices vary considerably across these states, from $44/MWh - $180/MWh. Data from U.S. Energy Information Administration (EIA).

The recent global economic recession has worsened these internal capital constraints, as companies face limited budgets to invest in capital improvement projects. These constraints are also present externally, as banks and other lenders take more conservative approaches to financing major plant upgrades or retrofits. Industrial companies plan major plant upgrades and investments in capital investment cycles that can span five years or more, and plan their downtimes and major equipment upgrades years in advance.

Lack of Adequate and Trained Staff

Unless a manufacturing or industrial firm is very large, it typically does not employ a dedicated energy manager. Instead, decisions about investing in energy efficient equipment are frequently made by plant managers and technical/engineering managers, with approval from a C-level director such as a CFO. Since these people tend to prioritize day-to-day operational concerns,

they don't have the luxury of thinking strategically about new energy efficiency investments and how such investments might help the company in the long term. They also may not be monitoring the facilities' energy use with any degree of detail. It's quite common for industrial firms to lament their high energy bills, but view them simply as a cost of doing business – not as a variable cost that they can control. An in-house energy manager would be able to take a more proactive approach to the facilities' energy use.

An additional barrier to greater energy efficiency deployment in the industrial sector is a lack of technical expertise among plant or facility staff. Individuals responsible for managing particular pieces of equipment may have managed the equipment in the same way for years; they may not be aware of more sophisticated operating practices that save energy. These kinds of improved operating practices or system optimization methods often require special energy management training or support.

Obstacles to CHP

Combined heat and power (CHP) is a specific type of industrial energy efficiency opportunity. CHP produces electricity and useful thermal energy using a single fuel input, with a much greater overall efficiency than if the two had been produced separately. In the industrial sector, CHP can be cost-effective when there is a consistent need for thermal energy, such as a year-round process heating load. CHP systems can also help improve the reliability of the facility's electrical supply. Despite these advantages, there are some obstacles to installing new CHP systems. In addition to initial investment costs, the unique obstacles to CHP include high utility standby service charges and regulatory barriers to interconnection with the grid.[4]

Opportunities – Examples of Company Successes

Despite these obstacles, many companies have developed successful energy efficiency programs. What does a successful industrial program look like, and how much energy savings are possible? Companies with excellent programs achieve on-going energy efficiency improvements of at least 2-3 % per year. Successful company programs tend to have several elements in common: strong support from management including financial support, energy management teams and energy champions at major facilities, and energy efficiency goals with tracking of relevant metrics.[5] These companies also take advantage of partnerships with utilities and other organizations for support in developing their programs and for assistance with financing projects.

Management Support

A key for any successful energy efficiency program is support from the management. For most companies, this includes the corporate level managers as well as the site manager. "The boss has to expect energy efficiency to happen," according to Bill Burich, Corporate Production Manager for NORPAC Foods.[6] When upper management sets corporate goals for energy savings, then the facilities will put the systems in place to make things happen.

For newer energy efficiency programs, the challenge is to gradually build this type of management support if it does not already exist. Energy managers do this by implementing a few projects/measures and reporting the energy and dollar savings back to the management; then asking for more money or resources to devote to energy management for the next year, and repeating. This process may not always be smooth sailing, but the energy manager can succeed if he/she is persistent. Don Sturtevant, corporate energy manager of J.R. Simplot, a food products, fertilizer, and mining company, said that the energy manager has to make persuasive arguments for obtaining more resources (people and capital). Don commented, "Management and others within the company are often resistant to change. You need an energy leader who will not accept *no*."[7]

Energy Team and Champion

To create on-going energy savings, each major facility should have an energy team with an energy leader/champion. J.R. Simplot's facilities have cross-functional teams with one person designated as the energy champion. Team members represent engineering, operations, accounting, human resources, etc. J.R. Simplot's facility teams also receive strong support from the corporate level in the form of guidance in the monthly site energy team meetings, and two engineers who help the sites to identify and evaluate energy projects.

To ensure that the energy champion has enough time to devote to this mission, one option is to create a full-time position. At Amgen's Boulder and Longmont, Colorado facilities (located within 10 miles of each other), the company chose to hire a full-time energy manager. Amgen, a biotechnology company, also has ten other facilities in the U.S., but the Boulder/Longmont sites are the only ones to have a full-time energy manager so far. For these two facilities, the energy manager's goal is to save enough energy costs annually to pay for his salary. From the time the energy manager was hired in late 2007 to the end of 2010, energy consumption at the two facilities was reduced by 16.4%, resulting in enough cost savings to pay for five times the energy manager's salary.[8]

Energy Goals and Metrics

One of the first tasks of the energy team should be to assess the baseline energy consumption for the facility, and to determine the best way to measure progress. For many facilities, there is a strong link between energy consumption and the level of production, such as pounds of product, in which case the best metric for energy efficiency progress would be total energy consumption per pound of product. For some companies, the level of energy consumption is strongly influenced by weather, such as for facilities with clean rooms with specific requirements for heating and cooling.

Next, it is important to set a goal, in order to focus the efforts of the energy team. A simple approach is to use a rule of thumb such as striving for 2-3% reduction in energy intensity per year. Several programs including EPA's Energy Star for Industry and DOE's Save Energy Now Leaders have developed standard goals of 2.0-2.5% annual intensity improvements. Another approach is to set an energy savings goal based on potential or planned improvements.

Simplot has committed to the Save Energy Now Leaders goal of 25% intensity improvement over 10 years, beginning with its Food and Agribusiness groups. Amgen developed a goal for its Boulder/Longmont facilities in order to participate in the Colorado Industrial Energy Challenge program. Amgen developed its goal of 20% absolute savings over five years by projecting the savings for planned projects. It chose an absolute energy savings goal because its consumption does not vary significantly with production levels. IBM has had a 3.5-4% per year energy savings target since 1996.[9] The energy manager may have to persuade management to approve a goal, by making good business arguments about how much money the company can save through achieving the goal.

Financial Support

Having a strong champion, monthly team meetings, and setting an energy goal are important steps toward building a successful program. But a huge obstacle at many facilities is the shortage of capital to invest in new energy-saving measures. Many facility managers/energy managers complain of having to achieve 2- or even 1-year simple payback periods in order to receive funds for implementing energy savings projects.

To address this challenge, some companies create a separate fund for energy efficiency projects, which helps ensure that projects will be implemented each year to help the plant achieve its energy goal. Amgen has a small fund set aside for energy saving projects at its Boulder and Longmont facilities, and its energy projects generally need to achieve a return on investment of at least 30%. NORPAC Foods, like many companies, has a tight capital budget, but does manage to set some capital aside for energy projects for each of its five larger sites. To help energy efficiency projects compete with other capital projects, IBM includes the non-energy benefits in the evaluations. For example, more efficient data centers require less floor space, which results in additional cost savings for this type of upgrade.[10]

As mentioned above, CHP projects are a specific type of energy efficiency improvement, often with additional obstacles to overcome. Appendix A provides some examples of successful CHP projects.

Partnerships

It takes time to build management support to provide more staff support and capital for funding energy projects, but it can be done. Working with outside organizations can help, especially in the early stages of program development. These can include utility programs, state or regional energy efficiency programs, or federal programs.

Utility demand-side management (DSM) programs are important partners for many industrial companies. For both Simplot and NORPAC, the local electric utilities participate in the monthly energy team meetings at the major facilities and contribute ideas as well as incentives for projects. For many companies, utility incentives are essential for helping energy projects achieve the minimum return on investment required for project approval.

The Northwest Energy Efficiency Alliance (NEEA) Industrial program helped NORPAC Foods get started with forming its energy teams. NORPAC also worked with the Northwest Food Processors Association and NEEA to obtain benchmarking data for facility energy intensity (Btu/lb of product) and to do initial energy assessments. NEEA worked with NORPAC's corporate operations manager to further develop the energy program by assisting with energy management plans and establishing protocols for the on-going work of the site energy teams.[11]

In 2007 Simplot joined the ENERGY STAR for Industry program, a program sponsored by the U.S. EPA. According to Sturtevant, joining ENERGY STAR was helpful by providing management and the energy teams a specific cause (the recognition and ENERGY STAR logo) to rally behind. ENERGY STAR's peer-to-peer networking opportunities were also useful.

The Colorado Industrial Energy Challenge (CIEC) program helped Amgen in building management support for its goal-development process. The energy manager of the Boulder and Longmont facilities and the Executive Director of Engineering attended the program's recognition event with Colorado's Governor in July of 2010. This recognition helped encourage Amgen Colorado to set an aggressive energy goal, a 20% absolute reduction in energy consumption over a five-year period.[12]

Achievements

Table 2 highlights the energy-saving achievements of Amgen, IBM, Simplot, and NORPAC Foods.

Table 2 – Energy Saving Achievements of Four Companies

Company	Energy Savings
Amgen	From 2007-2010, Amgen's Boulder and Longmont, CO facilities reduced total energy consumption by 16.4%, reducing energy costs by over $500,000/yr.
IBM	IBM achieved an average of 5% annual energy savings from 2000-2008; from 2007-2008 the annual savings amounted to $32.3 million.
J.R. Simplot	Simplot's Food Group (8 facilities) achieved a 7.5% intensity improvement over 2 years (from 2007-2009), resulting in avoided energy costs of over $40 million/yr.
NORPAC Foods	NORPAC achieved an 8% intensity improvement over 4 years (2005-2009) at its four processing facilities, despite declines in production.

These companies, by focusing on energy efficiency, committing staff and financial resources, and through successful partnerships, have achieved energy savings of 2-5% per year.[13]

Utility and State Industrial Energy Efficiency Programs

Utilities offer a variety of programs to help their industrial customers achieve greater energy efficiency. State industrial efficiency programs can offer several additional types of services to complement utility programs, such as providing recognition from the Governor to outstanding companies, technical assistance, training and networking opportunities, and low-interest loans. In addition, state (non-utility) programs can promote more efficient use of all forms of energy (electricity, natural gas, petroleum products, and solid fuels) in an integrated manner.

Utility Programs

Electric utilities can play a very important role in the deployment of energy efficiency in the industrial sector. (Most medium-size and large industrial facilities buy their natural gas through wholesale suppliers rather than directly from their local natural gas utility. Therefore, these facilities are generally not eligible to participate in utility natural gas-related efficiency programs.) Utilities interact regularly with their industrial customers, and a wide variety of utility-based industrial energy efficiency programs have leveraged this customer service relationship to help industrial firms identify, finance, and implement energy-saving equipment and behaviors.

There are five main types of utility programs for industrial customers, and the most effective utility programs include services or incentives in all these areas:

- Prescriptive incentive programs
- Custom incentive programs
- Training/education/outreach services, including energy management training and support
- Technical assistance and energy auditing services
- Self-direction programs

Prescriptive incentives are rebates for investments in specific types of energy efficiency equipment, such as premium efficiency motors, variable speed drives, efficient compressors, etc. The list of eligible measures and rebate amounts are specified in advance, which makes it very easy for companies to plan qualifying efficiency projects, analyze cost effectiveness, and receive utility rebates. Custom incentive programs provide an important complement to prescriptive incentives, covering many types of energy efficiency investments not covered by prescriptive programs, and allowing companies to take a more system-wide approach to efficiency improvements, rather than targeting specific pieces of equipment. Good utility programs offer both prescriptive and custom incentives to their industrial customers.

Training programs help fund courses, workshops, or webinars for company employees in energy efficiency technologies, practices or behaviors. Technical assistance programs provide companies with no- or low-cost energy assessments, which help identify cost-effective energy efficiency opportunities. These programs can also help a company move through an energy efficiency upgrade process, by providing direct technical assistance and helping the company

select specific equipment, choose vendors, install the equipment, and learn how to operate and maintain the equipment. The most effective utility efficiency programs provide substantial technical assistance and continued guidance throughout the energy efficiency upgrade or investment process, and allow industrial customers to implement major energy efficiency projects over a multi-year period.

The most effective utility industrial energy efficiency programs also develop different approaches for the different types of companies they serve. They spend time getting to know their customers, and work with local trade associations and other respected stakeholders to reach out to industrial sectors that may not actively seek energy efficiency guidance. In some cases they also offer dedicated staffing and programming to meet the unique needs of each major industrial sector.

Some utility programs also help address and identify the behavioral changes that can be made to reduce energy use. The Puget Sound Energy (PSE) Resource Conservation Management Program, for example, helps to offset the cost of a salary for an individual to be an on-site Resource Conservation Manager, tasked with reducing onsite consumption and increasing general facility efficiency. This individual achieves such improvements in efficiency by addressing behavioral changes and opportunities for improved facility operation and maintenance. Xcel Energy's "Process Efficiency" program provides a suite of incentives and technical assistance, including an assessment of the company's overall energy management program, with suggestions for improvement. (See Appendix B for a description of Xcel's Process Efficiency program.)

Some utility programs also help firms understand the importance and extent of non-energy benefits that can result from energy efficiency investments. These programs highlight the production benefits, safety improvements, and any reduced operation and maintenance costs associated with energy efficiency projects. These can be difficult to quantify, but even conservative estimates of the non-energy benefits can make a big difference in getting projects approved by company management.

Several utilities in the Western states offer large industrial customers a "self-direction option." (Note that this is different than an "opt-out" option, which does nothing to encourage energy savings by the large customers that are allowed to opt-out, while reducing the funds available for all the utility's DSM programs.) Self-direction programs allow large customers to receive credits against their utility bill surcharge for DSM programs based on investments they make on their own (i.e., without any utility financial or technical assistance) to improve energy efficiency. In effect, this allows companies to self-direct part of their electricity charges into internal energy efficiency projects. The best utility self-direction programs review and evaluate these projects in the same manner as projects implemented through other DSM programs. The energy savings from projects implemented through self-direction programs are counted towards a utility's energy savings goals or requirements, and self-direction programs tend to be among the most

cost-effective industrial programs. For example, large industrial customers in Utah implemented 176 projects under the self-direction program implemented by Rocky Mountain Power during 2004-2009.[14] In 2010, an additional 13 projects were implemented through this program, and the levelized cost of the energy savings achieved was only $.023 per kilowatt-hour.[15]

A self-direction option can help to increase investment in energy efficiency by large industrial customers. For example, a large company interviewed for this paper (that prefers to remain anonymous) explained that it was able to implement 3-4 energy efficiency projects in 2010 through participation in Rocky Mountain Power's self-direct program. These projects would not have been implemented without the incentives (credits to the company's electricity bill) provided by the self-direction program. This company also noted the benefits of having the flexibility to choose between the custom incentive program or the self-direction program, since both have advantages.

Some examples of effective utility industrial efficiency programs are highlighted in Appendix B.

State Industrial Efficiency Programs

State industrial programs can also form helpful partnerships with industrial companies, and can complement the efforts of utility programs in several ways. There are several possibilities for services that state programs can provide, from simple and low-cost to more resource-intensive technical assistance programs. It is possible to develop an effective, low-budget state industrial efficiency program by focusing on recognition, training and networking opportunities, and by promoting the resources already available through federal, regional, and utility programs.

State programs can take advantage of federal and regional programs and resources. For example, the U.S. Department of Energy (DOE) will co-sponsor workshops in optimizing industrial energy systems, including compressed air, fan, pump, process heating, and steam systems. DOE also provides energy assessments to companies that join its Save Energy Now (SEN) Leaders program. State programs can leverage both of these services by working with DOE to schedule workshops and by encouraging industrial companies to join the SEN Leaders program. For example, Idaho's OER has successfully recruited four of its industrial partners to become SEN Leaders. Federal and regional industrial efficiency programs, including CHP assistance programs, are highlighted in Appendices C and D.

State recognition for companies who commit to an energy efficiency goal or achieve outstanding energy savings can encourage industrial plant managers and executives to place a higher value on energy efficiency. Ideally, this type of recognition can be a catalyst for management to elevate the status of the facility/energy manager's role and to provide more resources to support him or her. For example, in July 2010, Colorado's former Governor Bill Ritter recognized the first 13 companies that joined the Colorado Industrial Energy Challenge (CIEC) program by committing to a five-year energy savings goal. In 2011 newly elected Governor Hickenlooper is expected to hold a similar event, recognizing new participants in the program, as well as five companies with the greatest achievements in energy savings over the past two years.

In states where utilities provide minimal technical assistance or training to industrial facilities, state programs can help fill this gap. States can also fill the gap in assistance with steam or process heating systems. As mentioned above, most medium-size or large industrial customers do not receive any energy efficiency assistance from natural gas utilities since they purchase their gas from other sources. Colorado's program provides free energy assessments to the industrial companies participating in the CIEC program. Utah's Industrial Energy Efficiency Program focuses on providing workshops and training opportunities in key industrial energy end-uses (compressed air, steam, pumps, and fan systems. Idaho's Office of Energy Resources (OER) Industries of the Future (IOF) program specializes in custom approaches specific to the customer needs, intended to move energy efficiency projects toward implementation and help build industrial energy engineering expertise. Likewise, the Texas IOF Program provides energy assessments and training to industrial firms in the state.

State programs can also help educate industrial firms about what it takes to achieve on-going savings and continual improvement. Without attention to the overall energy management program, companies tend to be haphazard in their energy savings efforts, perhaps implementing a project or two after an initial assessment, and then going back to business-as-usual. A key element of achieving on-going energy savings is the development of energy teams at the company's major facilities. These teams often meet regularly to discuss possible energy saving measures, project management, and energy consumption data collected to measure progress.

The Northwest Energy Efficiency Alliance's (NEEA) Industrial Program has pioneered several efforts directed towards facilitating energy teams and helping companies to develop comprehensive, strategic energy management programs. State programs can also leverage the training and assistance in this area available through the U.S. EPA's ENERGY STAR for Industry program. Colorado's program is in the early stages of developing training and assistance programs in energy management. Texas' industrial program is encouraging plants to become certified under the new ANSI standard for energy management through participation in DOE's Superior Energy Performance pilot program. (DOE's and NEEA's programs are described in Appendices C and D.)

Policies to Support Industrial Programs

State policies can have a significant influence on the types of programs that utilities offer to industrial customers. States can establish overall energy saving goals, can require utilities to develop comprehensive programs, including industrial programs, and can provide appropriate financial incentives to utilities so that energy efficiency programs do not harm and can possibly benefit their bottom line. For state (i.e., non-utility) industrial programs, the main challenge is how to obtain program funding, but there are several options worth considering.

State Energy Efficiency Goals

Across the U.S., many states have established mandatory or voluntary goals for energy efficiency within their electric or natural gas markets. The establishment of mandatory or voluntary

targets for energy savings can lead utilities to develop comprehensive programs for their industrial customers, depending on the level of industrial activity in the state.

An Energy Efficiency Resource Standard (EERS) is a mandatory energy savings requirement set by a legislative or regulatory body that establishes savings targets for electric and/or natural gas utilities over a period of time such as ten years. In the WGA region, six states have mandatory energy savings requirements, including Texas, Hawaii, Washington, Nevada, New Mexico, and Arizona.[16] In addition Utah's legislature passed a resolution asking the State PUC to set specific energy saving requirements for the State's investor-owned utilities, but the PUC has yet to act.

Three WGA states have established voluntary energy efficiency goals for its utilities. These states are California, Oregon, and Colorado.[17] For example, the Colorado PUC has adopted electricity savings goals for the two investor-owned utilities in the state, Xcel Energy and Black Hills Energy. These are not mandatory goals, and there is no penalty for failing to meet them. However, the utility's shareholders receive a financial incentive if they meet or exceed the goals in any particular year.

Incentives for Utilities

Implementing energy efficiency programs often appears counter to a utility's basic profit-making goals. Energy efficiency programs, which aim to reduce energy consumption by stimulating greater adoption of energy efficiency projects and measures, will reduce a utility's overall energy sales. Since most utilities earn their revenue and profits from electric or gas sales, a reduction in sales can harm the utility's bottom line. To address this fundamental challenge to utility efficiency programs, some states have adopted policies intended to make effective energy efficiency programs a profitable enterprise for investor-owned utilities.

These policies come in several different varieties. *Decoupling* mechanisms separate actual utility fixed cost recovery from the amount of electricity or gas sold to customers. Utilities are allowed to recover their authorized fixed cost recovery, and no more or no less, independent of energy sales. This eliminates the disincentive that utilities traditionally have for implementing effective energy efficiency programs for their customers, but it does not reward them for superior performance. A *lost revenue adjustment* uses a rate adjustment to help a utility recover net lost revenue that results from energy efficiency program implementations. *Shareholder incentives* aim to offer utility shareholders a return on investments in energy efficiency, similar to the manner in which shareholders earn a return on investments in new forms of generation and infrastructure. The incentive is often tied to the level of energy savings and/or net economic benefits achieved, increasing the reward as program performance improves.

While there are benefits and drawbacks to all methods, recent research indicates that these policies lead to increased deployment of utility energy efficiency programs (resulting in more

energy savings), and that shareholder incentives in particular are effective in influencing utility behavior.[18]

Funding State Industrial Programs

The programs in Colorado, Idaho, Utah, and Texas were partially funded by the U.S. Department of Energy (DOE). DOE funding for new state industrial programs may not be available. However, there are other funding sources that states can consider, including use of ratepayer funds, energy development royalties, environmental fines, and emission fees.

The Energy Trust of Oregon funds industrial efficiency and other energy efficiency programs through a small additional charge to all ratepayers in Oregon. This type of charge is also referred to as a public benefits charge. The New York State Energy Research and Development Authority (NYSERDA) is also funded through this type of charge.

In energy-producing states, another option would be to levy a small additional fee or tax on production of energy resources (coal, natural gas, and oil) developed within a state. Several western states already have an existing fee of this type, called a severance tax. The benefit of using this type of fee is that it could have a minimal impact on energy bills for customers in the state, since most of the energy resources are typically exported to other states.

Another source of funds that could be potentially tapped for a state industrial efficiency program is the money collected through environmental fines and penalties. Several states such as Colorado already re-direct part of these funds towards projects with environmental benefits, called "supplemental environmental projects." Another possibility is to create a fee on greenhouse gas (GHG) emissions from large emitters in the state, as reported to the Environmental Protection Agency (EPA) through the new GHG mandatory reporting rule. A very small fee, on the order of 1 cent per metric ton of CO2 emissions, would be adequate to fund a statewide program with the elements described above.[19]

Policies to Support Combined Heat and Power (CHP)

CHP projects often face a substantial number of barriers to their deployment. While some of them are entirely market-based, others can be reduced or overcome by appropriate policies promulgated at the state level. These policies include:

- **Ensuring reasonable utility standby charges**, which are rates an electric utility charges for providing backup and standby power to a facility when the electricity load is not fully met by the CHP system;
- **Developing an effective interconnection standard**, which delineates clear costs, timelines and processes for connecting a CHP system to the local grid and helps prevent a utility from stalling the interconnection of a CHP system;
- **Identifying CHP as a portfolio resource (EERS or RPS)**, which can help provide additional monetary benefit to CHP developers since resources that count towards a state's portfolio standard are prioritized by utilities over those that do not count;

- **Offering CHP incentives**, which can help offset the often high up-front capital cost of CHP equipment;
- **Developing output-based emission standards**, which take a CHP system's increased efficiency into consideration and provide a level playing field for CHP to compete with other types of emission reduction measures.

Policies such as rate-base incentives could also be developed to reward utilities for developing and operating large CHP plants that serve industrial facilities. Idaho's Office of Energy Resources (OER) is exploring a partnership between the electric utility and an industrial facility with a large process heating load, the Amalgamated Sugar Company. A proposed large (100 MW) CHP plant is undergoing a detailed feasibility study, co-funded by the company, OER, and Idaho Power Company.

For more detailed explanations and good examples of these policies, refer to the CHP Resources section of Appendix E.

Appendix A - CHP Examples

One specific type of energy efficiency opportunity is installing a combined heat and power (CHP) system. For industrial facilities, CHP can be cost-effective when there is a consistent year-round process heating load and where electricity prices are relatively high. However, there can be special cases in which CHP is cost-effective even with low-cost electricity.

Kennecott Utah Copper sees CHP as a main component of its strategy for energy management and environmental stewardship. Since nearly all of Kennecott's activities (mining, milling, refining, smelting and ancillary operations such as railways and power stations) are energy intensive, all these operations have targets for increasing energy efficiency and reducing greenhouse gas emissions. Kennecott has recently installed or is in the process of installing new CHP systems at two of its facilities, the molybdenum processing facility and the copper refinery. Both CHP systems generate about 6 megawatts (MW) of electricity using natural gas-fired turbines, with steam generated from the waste heat. Both systems were sized to provide the amount of steam needed at the plant, with the generated electricity providing part of the plant's electricity needs. Both systems have overall efficiencies of 80-85%.

According to Kennecott, these projects were only marginally cost-effective due to its low electricity rates, but were implemented anyway for other reasons, including improved electrical reliability and lower emissions of conventional pollutants (such as nitrogen oxides and sulfur dioxide) and carbon dioxide. Another factor aiding the implementation of CHP is that Kennecott has its own generating station (175 MW) with its own distribution system. The two CHP projects do not affect the interconnections between Kennecott's system and the local utility's system, and Kennecott does not need to rely on the utility to completely back-up the CHP systems, as most industrial facilities would.[20]

New Belgium Brewing, located in Fort Collins, Colorado, also views CHP as an important part of its energy management and sustainability efforts. In 2003 it installed a new wastewater treatment plant, including anaerobic digestion. New Belgium recovers the methane generated and uses it to power a 290 kW reciprocating engine. It uses the heat recovered from the engine to heat the wastewater from the plant to optimize digester performance. Installing the new wastewater treatment plant and CHP system was cost-effective, mainly due to the elimination of New Belgium's wastewater fees to the City of Fort Collins. Other factors for implementing the system include the improved energy efficiency, reduced energy costs, and significant reductions in greenhouse gas emissions.[21]

Appendix B – Model Utility Industrial Energy Efficiency Programs

Puget Sound Energy's Resource Conservation Manager Program

Among its other industrial offerings, Puget Sound Energy administers the Resource Conservation Manager Program, which helps to fund and support an individual on-site Resource Conservation Manager at qualifying industrial, commercial and institutional facilities. The Resource Conservation is trained and supported to identify behavioral and operation and maintenance changes that can be made to improve the efficiency of energy, water and other utility usage throughout the facility or facilities. Puget Sound Energy offers a host of technical assistance for the Manager and even helps qualifying companies and organizations recruit the individual Manager.[22]

Puget Sound Energy Self-Direct Program

For large Puget Sound Energy customers interested in self-directing their public benefit funds, Puget Sound Energy offers a structured self-direct program that aggregates the funds that a company would have otherwise paid in public benefit funds into a dedicated pool that can cover up to 100% of an efficiency improvement's project cost. After two years, any funds not used are pooled together and distributed via a competitive bid process. PSE recovers a small portion for administrative costs, and companies are free to invest the funds as they best see fit, using available PSE resources when appropriate and applicable.

Xcel Energy Process Efficiency Program

The Process Efficiency program offers a three-phase, comprehensive approach to helping large industrial customers improve their energy efficiency. The programs' goal is to help customers achieve significant energy savings and to develop a 3-5 year energy management plan. An additional goal is for customers to achieve additional energy savings beyond the three-phases of support from Xcel, by helping the customers develop stronger energy management programs. Here is a summary of the three phases of the Process Efficiency program:[23]

Phase 1 – Identify opportunities**.** The company participates in a high-level, walk-through audit to identify potential energy-saving opportunities, and also participates in an assessment of its energy management program, using EnVinta's One-2-five energy model, to benchmark and identify areas for improvement.

Phase 2 – Scope energy-efficiency potential**.** The company participates in a more detailed energy assessment and develops an energy action plan. The company prioritizes opportunities for improvement, may choose to contract for additional scoping assistance at reduced costs, and applies for incentives from Xcel before implementation.

Phase 3 – Implement energy-efficiency improvements and qualify for rebates**.** The company selects projects to implement and sets a timeline for installation, and reviews and approves Xcel's proposals for rebates, bonuses, and additional support.

Rocky Mountain Power and Pacific Power: Energy FinAnswer and FinAnswer Express

Energy FinAnswer (a play on "financer") is a comprehensive energy efficiency incentive program for commercial, industrial, and agricultural customers of any size in the Rocky Mountain Power's and Pacific Power's Washington and Utah service territories. The program offers high quality technical services (at no cost to the customer) and cash incentives. Design assistance and design team incentives are available for new construction and major renovations. The program includes an energy commissioning requirement for more complex energy efficiency measures.

FinAnswer Express offers simple, prescriptive incentives for lighting, HVAC, premium efficiency motor and other common measures in retrofits and new construction or major renovation. It is attractive to customers who don't require energy engineering services to move forward with their projects.

Rocky Mountain Power and Pacific Power contract with energy engineering consulting firms for site specific work such as scoping, energy analysis, and post-installation inspections. Energy FinAnswer and FinAnswer Express complement each other in the market, providing a broad platform of services and incentives for a wide variety of energy efficiency projects from comprehensive to those involving a single measure and even a single piece of equipment.

The program results have grown rapidly in a short time; the 2006 program results are seven times greater than the results in 2001—the first program year. In 2009 the total energy savings of Energy FinAnswer program in Utah was 62.8 GWh, and FinAnswer Express for Utah achieved 41.0 GWh of savings (gross savings in both cases). Both Energy FinAnswer and FinAnswer Express have achieved significant energy savings very cost-effectively, with levelized costs in 2009 of $0.034/kWh and $0.036/kWh respectively.[24]

Rocky Mountain Power Self-Direct Program

In Utah, Rocky Mountain Power (RMP) offers its largest industrial customers a structured self-direction program. Facilities with annual consumption of over 5,000 MWh or peak consumption of over 1 MW are eligible to participate. This program enables such customers to direct a portion of the funds that would have otherwise been collected for the state's public benefits programs into custom energy efficiency improvements at their facilities. While customers are still required to pay the public benefit fund charge, customers that implement such improvement can earn up to 80% of the total project cost as a credit against their public benefit fund charge on their bills. Customers that prove that there are no cost-effective energy efficiency investments to be made can earn 50% of the public benefit fund charge back as a credit on their bill. In 2009, RMP's self-direction program achieved total energy savings of 9.4 GWh (gross savings), with a levelized cost of $0.023/kWh.[25]

The Energy Trust of Oregon Production Efficiency Program

Production Efficiency is a program administered by Energy Trust of Oregon. Production Efficiency offers energy efficiency services for industrial processes of all kinds, including manufacturing, agricultural and water/wastewater treatment. The program funds studies to

identify energy-saving opportunities and provides financial incentives to help customers implement recommended improvements targeting a broad menu of industrial end-use technologies.

The program provides participating industrial customers their own "personal program delivery contractor" (PDC). These contractors are highly skilled, industry-specific specialists with expertise on the best and most appropriate technologies that can help customers capitalize on energy-saving opportunities. The services provided by PDCs are done at no-cost to participating facilities. The PDCs examine facility operations and energy usage, and identify ways to save customers money and energy. PDCs also conduct post-installation inspections of projects and will create plans designed specifically so that facility operators understand how to properly use equipment to maximize energy savings.

The 2008 Production Efficiency program provided $7.7 million in incentives for projects resulting in net savings of nearly 52 GWh per year. End-use measures generating the most savings include compressed air, lighting, air abatement, and process measures.[26] Production Efficiency's efforts have helped numerous industries achieve higher energy efficiency, thus saving them energy costs and helping them to be more competitive. A broad range of industries have participated, including steel, paper, seafood, shipping, lumber, nurseries, machinery, wastewater treatment and buildings.[27]

PG&E Motor and HVAC Distributor Rebate Program

The PG&E Motor and HVAC Distributor Rebate Program was an upstream program that provided prescriptive rebates to Motor and HVAC distributors who stocked and sold Premium Efficiency Motors and HVAC equipment using an online application system and database to allow distributors to upload applications listing hundreds of units. PG&E then automatically verified that equipment met the eligibility requirements and that the end use customer was served by the sponsoring utility. The Program was open to distributors who installed qualifying motors and HVAC equipment at any non-residential electric customer facility in the PG&E service territory, regardless of size. The qualifying equipment had to meet a minimum efficiency standard based on Consortium for Energy Efficiency (CEE) specifications.

Moving from the downstream to the upstream delivery mechanism dramatically increased the number of units rebated in the program. This shift resulted in a 590% increase in tons of HVAC and 400% increase in motors receiving rebates. As compared to the impacts being generated via the earlier downstream mechanism, the 2004 to 2006 PG&E upstream programs saved an additional 34.65 GWh and 17.3 MW. While the program has since been discontinued, the 2004-2005 Statewide Upstream Program resulted in two year energy savings of more than 62 GWh and 29 MW, with 24.4 GWh and 13.2 MW of that achieved by PG&E. The 2006 PG&E Program energy savings improved on the previous pace by delivering one year accomplishments of 16.55 GWh and 8.79 MW.[28]

Appendix C – Federal Industrial Programs

In addition to utility efficiency programs, there are federal and regional programs available to help industrial companies throughout the western states. States and utilities can promote these programs to industrial companies with no additional cost.

DOE Save Energy Now Leaders

Launched in 2009, the U.S. Department of Energy's (DOE) Save Energy Now (SEN) Leaders program offers recognition and free technical assistance to industrial companies or facilities that commit to reduce their energy intensity by 25% over ten years. DOE offers a variety of types of technical assistance to the SEN Leader participants through its contractors, including energy assessments, benchmarking energy performance, metrics for tracking progress, and accessing financial resources. More information is available at http://www1.eere.energy.gov/industry/saveenergynow/leader.html.

Superior Energy Performance

Companies that join the Save Energy Now Leaders program are also eligible to enroll in the Superior Energy Performance pilot program. The purpose of this program is to provide training and assistance to companies to help them obtain certification of their energy management programs under the new International Standard Organization (ISO) standard, ISO 50001. In addition to this certification, companies must demonstrate progress towards the SEN Leaders goal described above. (For more information, see http://www.superiorenergyperformance.net/aboutus.html.)

EPA ENERGY STAR for Industry

The U.S. Environmental Protection Agency's (EPA) ENERGY STAR for Industry program has been serving industry in the U.S. for the past ten years. Energy Star provides guidelines and assistance on developing a good energy management program. It has convened working groups within eleven sectors (listed here) to develop useful benchmarking data for those sectors. Benchmarking data for most other industrial sectors is very difficult to find. Plants in nine of these sectors can earn Energy Star recognition by performing within the top 25% of their sector. In addition Energy Star for Industry has a challenge and recognition program called Energy Star Challenge for Industry (similar to DOE's Save Energy Now Leaders), which requires companies to achieve a 10% intensity improvement over 5 years. (For more information, see http://www.energystar.gov/index.cfm?c=industry.bus_industry,)

Appendix D – Regional Industrial Programs

NEEA Industrial Program

The Northwest Energy Efficiency Alliance (NEEA) Industrial Program serves industrial facilities in Washington, Oregon, Idaho, and Montana. NEEA's Industrial program focuses on transforming the industrial market in the Northwest. NEEA defines market transformation as "the strategic process of intervening in a market to create lasting change in market behavior by removing identified barriers or exploiting opportunities to accelerate the adoption of all cost-effective energy efficiency as a matter of standard practice." NEEA's programs aim to do this by creating greater awareness and motivation for pursuing energy efficiency from industrial companies, and also addressing the market barriers for specific technologies or products. NEEA's industrial program includes the following initiatives:[29]

25 in10sity Challenge

NEEA is mobilizing industrial executive management to lead its industry groups to set group-wide energy-intensity reduction goals of at least 25 percent in 10 years. NEEA encourages existing industry groups—including trade associations, alliances and geographic clusters—to set goals and create plans to achieve those goals. NEEA then supports the industry group by helping them implement elements of their plans and collaborating with them to form alliances with funding partners to support their implementation efforts.

Strategic Energy Management (SEM)

As industry executives become familiar with the benefits of energy management through NEEA's 25 in10sity CHALLENGE goal setting, many choose the next step of beginning an energy management program at their own industrial facilities. In 2010 NEEA will implement this initiative through two approaches: The Northwest Energy Management Demonstration Project and NEEA's facility-based program, also known by the product name, Continuous Energy Improvement (CEI).

Regional Technical Solutions

The third part of NEEA's industrial sector strategy is its Regional Technical Solutions (RTS) initiative. Through this initiative, NEEA and the region's utilities bring together industrial end-users from across the region for technical training. To date, industrial training has focused on systems that drive production: motors, pumps, compressed air and refrigeration. NEEA continues to work with industry to help define the training and education needs of its workforce, and to investigate the best format and delivery methods for that training and education. This initiative also enables NEEA to work with utilities and the marketplace to identify products and services that utilities can incorporate into their own industrial offerings.

Standards

In 2010, NEEA will work on strengthening industrial standards through its Northwest Energy Management Demonstration Project. Companies and utilities participating in the Northwest demonstration project, which is co-sponsored by the U.S. Department of Energy and NEEA, will

provide critical input for an emerging set of energy management standards and a certification scheme. Once completed, these new standards could help pave the way for all industrial facilities to achieve on-going energy efficiency improvements and cost savings.

DOE Clean Energy Application Centers

DOE's Clean Energy Application Centers, formerly called the Combined Heat and Power (CHP) Regional Application Centers (RACs), promote CHP, waste heat recovery, and other clean energy technologies and practices and offer regional assistance for specific projects. Key services of the DOE Clean Energy RACs include:

- Market Assessments – Supporting analyses of CHP market potential in diverse sectors, such as supermarkets, restaurants, health care facilities, industrial sites, hotels and motels, and new commercial and institutional buildings and facilities.
- Targeted Education and Outreach – Publicizing the benefits and applications of CHP through educational resources and case studies distributed via workshops, webinars, seminars, and training.
- Technical Assistance – Performing site assessments, producing project feasibility studies, and providing technical and financial analyses.

The WGA region is served by five regional clean energy application centers: Intermountain, Northwest, Pacific, Midwest, and Gulf Coast.[30]

WSU Energy Services Industrial Program

The Washington State University (WSU) Extension Energy Program is a self-supported department within the University's Extension Service. It receives project funding from federal and state government agencies, federal power marketing agencies, private corporations, the nonprofit Northwest Energy Efficiency Alliance, and several other sources. The Energy Program has a budget of about $24 million and a staff of approximately 110 working in Olympia, Spokane, and other satellite locations. Program customers range from industrial plants to private consulting firms, businesses, government agencies, and utilities. The WSU industrial program is comprised of professional energy engineers and energy specialists experienced in industrial process systems, as well as software developers and experienced project managers and coordinators. Support currently available through WSU includes plant assessments, industrial best practices trainings, technical assistance, policy advocacy, and project technical and financial support. These services are available for free to industrial facilities in the northwest region, and to companies outside the northwest on a fee basis,

In addition to these services, WSU develops industrial energy system optimization software (now available in five languages); helps with the identification, selection, and assessment of new and emerging technologies; performs building science research and training; promotes and supports renewable energy development; and responds to inquiries about energy efficiency from across the country—thousands of inquiries in a typical week.

For over a decade, the WSU Industrial Services program has raised awareness of industrial energy efficiency opportunities in the region. Between 2004 and 2009, WSU helped conduct 46 trainings on Industrial best practices, training a total of 1,026 students. Since 2006, WSU has obligated nearly $1.5 million dollars towards capital projects with energy savings totaling approximately 35,000 MMBtu and over 22 million kWh annually from implemented projects, with another 142.6 MW coming from CHP projects being partially financed with incentive funds.[31]

Best Person to Contact for Information about the Program:

Christine Love
Industrial Services Program Manager
Washington State University Extension Energy Program
360-956-2172
lovec@energy.wsu.edu

Industrial Assessment Centers

Funded by the U.S. DOE, there are Industrial Assessment Centers (IAC) in six western states, including Oklahoma, Kansas, Texas, Colorado, Washington, Oregon, and California (which has three). (See http://iac.rutgers.edu/database/centers/.) Industrial Assessment Centers are managed by university engineering programs in these states, and serve the dual purpose of training young engineering students, while also providing energy assessment services to medium-size manufacturing facilities (within a certain size range in terms of energy expenditures) in the respective states. The IAC programs provide industrial facilities with a one-day walk-through energy audit, followed up with a report detailing several cost-effective energy efficiency recommendations. The energy audits and reports are provided at no cost to the participating companies.[32]

Appendix E – Further Reading

CHP Resources

The Oak Ridge National Laboratory produced a useful 2008 report on CHP technologies, benefits and related policies: http://info.ornl.gov/sites/publications/files/Pub13655.pdf

ACEEE has produced several resources for those interested in learning more about CHP:

- CHP Local Technical Assistance: A Compendium of Resources: http://aceee.org/files/pdf/CHP-Local-Assistance-Resources.pdf
- State Policy Database on Distributed Generation policies: http://aceee.org/node/2958/all
- State Energy Efficiency Scorecard, including a chapter on CHP policies: http://aceee.org/sector/state-policy/scorecard
- CHP policy page: http://aceee.org/topics/chp

Industrial Projects and Programs

ACEEE has produced several reports for those interested in learning more about industrial energy efficiency programs:

- 2009 report on utility-administered industrial energy efficiency programs: http://aceee.org/research-report/ie091
- 2010 report on state-led energy efficiency programs: http://aceee.org/research-report/e106
- 2008 report on leaders in the administration of energy efficiency programs: http://aceee.org/research-report/u081
- 2010 report on energy efficiency resource standards in the U.S.: http://aceee.org/files/pdf/State%20EERS%20Summary%20Dec%202010.pdf

The Pew Center on Global Climate change produced a 2010 report on best practices in company-led energy efficiency: http://www.pewclimate.org/energy-efficiency/corporate-energy-efficiency-report

The Department of Energy's Save Energy Now program offers multiple case studies of industrial companies that have succeeded in achieving significant energy efficiency savings: http://www1.eere.energy.gov/industry/saveenergynow/leader.html

The Consortium for Energy Efficiency maintains a list of active members' industrial energy efficiency program offerings (and links to their program's websites) here: http://www.cee1.org/ind/programsummary/index.php

Utility Incentive Resources

ACEEE's 2011 report on utility incentives: http://www.aceee.org/sites/default/files/publications/researchreports/U111.pdf

Notes

[1] "California Industrial Energy Efficiency Market Characterization Study," Pacific Gas & Electric, 2001, http://www.calmac.org/publications/California%20Ind%20EE%20Mkt%20Characterization.pdf. 20% is the total estimated potential savings in this study, based on proven technologies with a payback period of 3 years or less.

[2] Texas Industrial Energy Efficiency, http://www.seco.cpa.state.tx.us/industrial_ee.htm; also "California Industrial EE Market Characterization Study," (endnote 1).

[3] 2009 Annual Survey of Manufactures, "Statistics for Industry Groups and Industries," U.S. Census Bureau, http://factfinder.census.gov/servlet/IBQTable?_bm=y&-ds_name=AM0931GS101. By calculating the total energy costs (total fuels costs plus total electricity costs) by the "total value added" from the table on this page, one can compare the energy intensity of various industrial sectors.

[4] Combined Heat and Power, ACEEE, http://aceee.org/topics/chp. This page provides an overview of barriers to CHP with links to additional CHP policy resources.

[5] Guidelines for Energy Management, ENERGY STAR, http://www.energystar.gov/index.cfm?c=guidelines.guidelines_index. The "key elements of successful programs" highlighted in the paper are a condensed version of ENERGY STAR's Guidelines.

[6] Bill Burich, personal communication (January 14, 2011), Corporate Production Manager, NORPAC Foods, email bburich@NORPAC.com.

[7] Don Sturtevant, personal communication (January 7, 2011), Corporate Energy Manager, J.R. Simplot, email don.sturtevant@simplot.com.

[8] Jim Williams, personal communication (February 1, 2011), Energy Management Engineer, Amgen, Inc., email jamesw01@amgen.com.

[9] Bill Prindle, "From Shop Floor to Top Floor: Best business practices in energy efficiency," Pew Center for Global Climate Change, p. 99.

[10] Bill Prindle, (Endnote 9), p. 103.

[11] Bill Burich, (Endnote 6).

[12] Jim Williams, (Endnote 8).

[13] Bill Burich, (Endnote 6); Don Sturtevant, (Endnote 7); Jim Williams (Endnote 8); Bill Prindle, (Endnote 9), p. 99 (for IBM). For IBM, see also Climate Leaders – Partners, U.S. Environmental Protection Agency, http://www.epa.gov/climateleaders/partners/index.html#I.

[14] H. Geller, J. Bumgarner, and D. Dent, "The Utah Story: Rapid Growth of Utility Demand-Side Management Programs in the Intermountain West," Proceedings of the 2010 ACEEE Summer Study on Energy Efficiency in Buildings, American Council for an Energy-Efficient Economy, Washington, DC.

[15] "DSM Report for 2009," Rocky Mountain Power - Utah, March 2010.

[16] State Energy Efficiency Resource Standard (EERS) Activity, American Council for an Energy-Efficient Economy (ACEEE), December 2010, http://www.aceee.org/files/pdf/State%20EERS%20Summary%20Dec%202010.pdf. Note that Nevada's requirement is a combined energy savings and renewable energy standard.

[17] ACEEE, (Endnote 16).

[18] Hayes et al, "Carrots for Utilities: Providing financial returns for utility investments in energy efficiency," ACEEE, January 2011, http://www.aceee.org/research-report/u111.

[19] Using Colorado as an example, there are about 43 million metric tons CO2 of greenhouse gas emissions from the utility sector, and another 13 million metric tons CO2 from the industrial sector. (see "Colorado Greenhouse Gas Emissions Inventory," CDHPE, http://www.cdphe.state.co.us/climate/greenhouse.pdf.) A fee of 1 cent per metric ton CO2 would generate about $500,000 per year, which is about 70% of the current budget for the Colorado Industrial Energy Challenge program.

[20] Stephen Sands, personal communication (January 18, 2011), Energy Programs Director, Kennecott Utah Copper, email sands@kennecott.com.

[21] New Belgium Brewery Project Profile, Intermountain Clean Energy Application Center, http://www.intermountaincleanenergy.org/profiles/New_Belgium-Project_Profile.pdf.

[22] Resource Conservation Manager Program, Puget Sound Energy, http://www.pse.com/solutions/forbusiness/pages/efficiencyComPrograms.aspx?tab=2&chapter=1.
[23] Process Efficiency, Xcel Energy, http://www.xcelenergy.com/SiteCollectionDocuments/docs/ProcessEfficiencyFeatureSheet.pdf.
[24] "DSM Annual Report for 2009 – Utah," Rocky Mountain Power.
[25] "DSM Annual Report for 2009 – Utah," Rocky Mountain Power.
[26] "Production Efficiency Impact Evaluation," Energy Trust of Oregon, September 2010, http://energytrust.org/library/reports/100903_PE_ImpactEval0.pdf.
[27] "Compendium of Champions, Industrial Process Efficiency Programs, ACEEE, http://www.aceee.org/sites/default/files/publications/researchreports/u081/ind-process.pdf, p. 9-17.
[28] "Compendium of Champions, Commercial/Industrial Motor and HVAC Replacement Programs, ACEEE, http://www.aceee.org/sites/default/files/publications/researchreports/u081/ci-motor-hvac.pdf, p. 3-2.
[29] Northwest Energy Efficiency Alliance, Industrial Program, http://neea.org/ourwork/industrial.aspx.
[30] Clean Energy Application Centers, http://www1.eere.energy.gov/industry/distributedenergy/racs.html.
[31] WSU Extension Energy Program: Industrial Efficiency, http://www.energy.wsu.edu/IndustrialEfficiency.aspx.
[32] Industrial Assessment Centers, U.S. DOE, http://iac.rutgers.edu/.