Energy Efficiency Industry Trends and Workforce Development in Washington State

Study Report, Phase 1

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About the WSU Extension Energy Program

The Washington State University Extension Energy Program (WSU Extension Energy Program) is a recognized leader in energy research, development and technology transfer. The WSU Extension Energy Program works with government agencies, power marketers, utility consortiums, educational institutions, private businesses and industries on projects that promote energy conservation, research, development of renewable energy sources, and economic and workforce development.

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Executive Summary

This report is the first part of a planned two-phase study indentifying trends and workforce issues in the energy efficiency industry. The primary purpose of this research is to provide up-to-date information on the status of energy efficiency activities in Washington, and to identify workforce development needs and opportunities that can assist employers and public and private-sector education and training providers support continued growth in the industry. The current report, Phase 1, integrates existing research on the energy efficiency industry, analyzes recent growth trends and forecasts, and discusses the major drivers of change, employment impacts and identifies existing energy efficiency-related training opportunities.

The energy efficiency industry is seeing unprecedented growth globally, nationally and regionally. Increasingly volatile energy prices, energy supply concerns, technology advances, climate change and a desire for greater energy independence are all driving up demand for additional energy efficiency efforts, and these pressures are likely to result in sustained long-term growth in the energy efficiency industry and related employment.

Many policies and incentives are in place nationally, regionally and at the state level which provide support to the energy efficiency industry. The federal government has recently targeted the energy efficiency industry for $30 billion in economic stimulus investments. Regionally, the Bonneville Power Administration and the Northwest Power and Conservation Council guide a significant amount of the electric utility conservation program activity in the Northwest. Washington State is a recognized leader in energy efficiency, and federal investments combined with state policies will usher in an expansion of energy conservation beyond what currently exists. Utility programs are affected by all of these activities as well the unique situation faced by each utility.

Growth in energy efficiency implementation is constrained by the lack of data and measurements that could be used to support coordinated efficiency efforts at all levels of the economy, from international to local. More comprehensive data would assist in raising public awareness about the benefits and opportunities for energy and cost savings, and help inform business and consumer decisions.

Employment projections suggest that the workforce will need to expand rapidly to meet the increasing demand for energy efficiency products and services. Energy services companies, government and utility efficiency programs, and weatherization programs could grow substantially in the coming years. In the short term, federal stimulus investments will boost demand for skilled workers and new trainees, while investments in research and development and efficiency-related technologies will create new employment and business opportunities.

One recent national study estimates the number of employees in the industry could double, and perhaps quadruple, by 2020. Some employers are already experiencing difficulties finding employees with specific training necessary for energy efficiency occupations. Retirement projections and a shrinking population of working-age adults

suggest that meeting the growing demand for a skilled energy efficiency workforce will be a significant challenge.

Additional research and action is needed to identify the specific skills, education requirements and employment demand for the energy efficiency sector. Expansion of regional and state education and training capacity to support new growth in energy efficiency is warranted, but efforts to enhance or expand the existing education and training infrastructure should be based on systematic data and input from the industry. Regional coordination between industry and key stakeholders should be used to inform the development of a broader strategy for supporting continued growth in the state's energy efficiency industry. Some recommended actions steps and research for Washington include the following:

- Support additional research that focuses specifically on the workforce development needs and labor markets of energy efficiency employers and employees in the region and the state.
- Expand the number and scope of industry partnerships to identify employment needs, and the foundational skills and knowledge requirements, for key sectors of the energy efficiency industry.
- Create new energy efficiency courses, certificates and degree programs and enhance existing programs to boost education and training system capacity.
- Conduct and apply research on best practices, model curriculum, industry-defined skill standards, and certifications for current and future training programs.
- Raise the visibility of energy efficiency careers and educational opportunities among youth and job seekers to expand the future workforce pipeline.
- Support development of an industry and labor market information system that provides high quality data for energy efficiency-related labor markets, education and training opportunities and employment.

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Introduction

This report is the first part of a planned two-phase study indentifying trends and workforce issues in the energy efficiency industry. The primary purpose of this research is to provide up-to-date information on the status of energy efficiency activities in Washington, and to identify workforce development needs and opportunities that can assist employers and public and private-sector education and training providers support continued growth in the industry.

The current report, Phase 1, integrates existing research, analyzes recent growth trends and forecasts, and discusses the major drivers of change in the energy efficiency industry. Additionally, this report begins to identify the potential impact on employment and identifies existing energy efficiency-related training opportunities.

The current report begins with a brief overview of global change underway in the energy sector as it relates to efficiency, and the political environment driving this change. Recent and forecasted trends in the energy efficiency sectors in the U.S., the Pacific Northwest region, Washington State, and in the Pacific Mountain region are also discussed. Globally and nationally, the focus is on efficiency across the broad energy economy, but in the Northwest region and Washington State, the primary focus is on electricity-specific efficiency. The report concludes with an initial look at workforce trends relating to the energy efficiency industry, and offers recommendations for future research.

Phase 2, which is proposed, will look more deeply into workforce issues by identifying the key workforce factors that employers, labor and other industry experts believe need to be addressed to ensure that the current and future workforce is prepared to meet this growth.

Defining Efficiency and the Energy Efficiency Industry

It is not an exaggeration to say that energy is a ubiquitous resource; it is in use at any given moment of the day, and it is a cornerstone of our economy and any modern society. Energy is the resource that powers transportation, cooking, heating and cooling buildings, manufacturing, lighting, water-use and entertainment, and many other sectors of society. Rather than increasing energy *supply* by constructing new power plants or expanding oil production, energy efficiency initiatives focus on reducing energy *demand* through a broader use of energy efficient technologies and by changing behavior patterns. In general terms, energy efficiency can be described as the decrease in energy (input) needed to do the same amount of work (output), or maximizing the output per unit of energy input.

However, because energy efficiency refers to a resource that spans so many possible economic sectors and applications, there exists no commonly-accepted definition of energy efficiency, much less its scope. Differences in stated policy objectives and goals influence the methods and metrics used for measuring efficiency, which in turn can result in different operational definitions of efficiency. Paradoxically, efficiency is also difficult to measure due to its invisibility, since tracking efficiency means measuring the energy that is *not* used. This invisibility is inhibiting development of educated policy, planning and investment in energy efficiency—a low-risk, high-value resource.

Measuring Efficiency – A Difficult Task

In addition to the lack of a common definition, terms that incorporate some aspects of energy efficiency are often used interchangeably, or as proxies for energy efficiency. For example, energy conservation is the term generally used to describe a short-term energy reduction, while energy efficiency implies a long-term reduction in energy consumption with no corresponding decrease in the amount of work. Yet these two terms are often assumed to mean the same thing. As another example, energy efficiency and demand-side management (DSM) programs are sometimes referred to interchangeably, but there are important differences between the two terms. DSM programs are usually sponsored and financed by utilities and energy distribution companies in order to reduce peak load requirements (times during which energy demand is at its highest and costliest for the utilities). In contrast, efficiency programs typically are directed at energy consumption in all residences and businesses, at all hours of the day and seasons of the year. Utilities and energy companies may or may not see any significant benefits from efficiency programs. In fact, some utilities view efficiency programs as spending money on activities which reduce their revenue stream.

Finally, energy intensity indicators, which are often used to measure the change in energy efficiency over time, frequently oversimplify energy efficiency activities and create misleading interpretations. Unknown influences such as changes in market conditions or consumer behavior can be the real, underlying causes of change in energy intensity measures that are intended to reflect efficiency improvements. For example, a measure of the energy use per dollar of manufactured goods in the U.S. that shows a decline might lead to the conclusion that the manufacturing sector is becoming more efficient. But this energy-intensity indicator doesn't reveal if the decline is actually due to efficiency improvements or because many of the most energy-intensive industries have relocated outside the U.S. Energy efficiency indicators generally need additional context to be correctly interpreted, yet frequently surface-level data is all that is available.

It is important to note that the success of any energy efficiency initiative or program, however it is defined, is heavily dependent on consumer behavior. For instance, there exists a whole host of technologies and products that can be used to achieve energy efficiency goals: compact fluorescent light bulbs, high-efficiency furnaces, or a programmable thermostat, for example. But the ability of these technologies to generate energy efficiency gains rests entirely on how willing consumers are to acquire and use these technologies. Thus, a utility may boost funding for energy efficiency programs to provide an incentive to consumers to purchase products or tools that maximize efficiency, but the utility may not see any savings until a customer decides to take action.

The Energy Efficiency Industry

Just as there is no common definition of energy efficiency, there are also varying definitions of the energy efficiency industry as a whole. As noted earlier, energy efficiency can include a broad set of activities, policies and activities, and studies of energy efficiency as an industry sector often describe the industry in different ways. Often, the descriptions used by industry leaders provide very broad definitions of the industry rather than specifying all component parts. One useful example comes from the Northwest Energy Efficiency Council (NEEC), which describes the energy efficiency industry as follows:

> The 'Energy Efficiency Industry' is made up of companies and organizations that employ people and apply resources in an effort to reduce energy consumption. Changes on the systemic or policy level are led by people working in the government, at non-profits or at utilities; these people help to coordinate and facilitate the work of energy efficiency businesses.[1]

NEEC defines an energy efficiency business as "a company that makes a profit through employing people and applying resources towards reducing the amount of energy needed to maintain a level of use or to provide a service (like heating or lighting)" (p. 4).

In other cases, the energy efficiency industry described by researchers depends on the goals and focus of the research, including the research methods and metrics used. For example, a major national study sponsored by the U.S. Department of Energy conducted by researchers at the Lawrence Berkeley National Laboratory (LBNL) describes the energy efficiency industry as:

> A multi-disciplinary industry, including engineers, economists, marketers, designers, and tradespeople. In many ways, it does not constitute an independent industry, since the activities of the industry, rather than being new efforts, often consist of a shift from standard practice to a more energy-efficient approach to design, building construction, and building operations.[2]

Because LBNL's study examines the effects of forecasted growth in the energy efficiency industry on employment and occupational structure, the study also recognizes the emergence of many new skill-sets and new professional job categories, including program administrators and program management contractors who design and manage government-supported energy efficiency programs (described later in this report). Hence the definition, scope of the research and level of detail related to the energy efficiency industry is intentionally limited and refined so that the analyses and interpretation of efficiency-related business activities is directly tied to the goals of the research.

The LBNL and NEEC definitions highlight one of the inherent difficulties of describing the energy efficiency industry, which may include myriad levels and participants. There are companies who make energy efficiency their primary business, and may therefore constitute the first-tier of the energy efficiency industry. This is typically the focus of many analyses of the energy efficiency industry and policy initiatives. First-tier companies have the potential for fundamentally and directly altering energy markets through the introduction of innovative technologies, products or services that boost the potential for energy efficiency activities.

There are additional, second-tier businesses that are also major contributors to achieving energy efficiency goals, even though energy efficiency may not be part of their core business: engineering firms, building industry contractors, or appliance manufacturers who build or install some of the new technologies that then become available to consumers, including other businesses that have a sizable yet indirect effect on the pursuit of energy efficiency goals.

Finally, there are many more companies – perhaps a majority of all businesses—that could be classified as third-tier companies, those that implement some level of energy efficiency activities. These businesses are typically the target markets for the producers of energy efficiency technologies and tools. As noted above, since the success of energy efficiency activities depends on both the technology tools and supportive consumer behaviors, the three general tiers of the energy efficiency industry are truly interdependent and essential to achieving broader economic and environmental goals.

In summary, the diverse nature of energy efficiency activities and the interdependency among industry players makes it extremely difficult to clearly distinguish between these businesses. Many energy efficiency studies use definitions, methods and measurements that are constructed to support analyses of specific components of the energy efficiency industry. The choice of components and the focus of the inquiry can vary greatly depending on the goals and purposes of the research. Taken together, these factors make direct comparisons of research results difficult and pose challenges to defining and understanding energy efficiency as a dynamic industry sector.

Global and National Energy Efficiency Trends

The section reviews the structure of the global and national energy efficiency industry, including trends, achievements and potential. A review of recent studies conducted on efficiency within the U.S., drivers of change, and recent national policy developments are also presented.

Global Energy Efficiency Organizational Infrastructure

Much of the world's fossil-based energy resources (coal, petroleum, and natural gas) are transported across vast distances in a highly organized market system. The management of these resources is consolidated into relatively few organizations, such as large multinational corporations and governments. There are many organizations with long histories, established rules and deep economic and political connections whose primary objectives are the delivery of fossil-fuel resources.

In contrast, energy efficiency is overwhelmingly local and diffused across every sector of the world economy, and it has a very small presence in global governance, regulation, business or cooperation. There are a large number of international energy initiatives; however only a few actively promote energy efficiency.[3] Additionally, the main contribution of those initiatives is not to actually implement efficiency technologies, but rather to create standards and regulations, share information, facilitate research, and/or allow funding of efficiency projects for economies in transition.

There are signs that this dynamic is changing. Improved energy efficiency is increasingly recognized as an economical and readily available means of improving energy security and reducing greenhouse gas emissions. Indeed, a number of influential studies suggest that energy efficiency options should account for an estimated 40-45 percent of the actions required to curb greenhouse gas emissions enough to stabilize the climate by 2050.[4] This has led to a growing recognition of the importance of energy efficiency initiatives for achieving global and national climate, energy security and economic goals.

Global Energy Efficiency Data and Trends

Surprisingly little data is readily available about global energy efficiency. The International Energy Agency (IEA), in cooperation with the Organization for Economic Cooperation and Development, has only recently begun collecting and analyzing efficiency data, most of which comes only from their member countries. One analysis conducted by IEA shows that in 2006, the global energy cost savings from energy efficiency was $1.1 trillion.[5] But, the rate of energy efficiency improvements since 1990 has been much slower than in the previous two decades. The IEA report also reveals that total energy consumption in developing and transition countries is growing less quickly than the gross domestic product of these countries, due partly to energy efficiency improvements. Yet, the energy intensities of developing and transition countries remain higher on average than for more developed countries.

Globally, the potential for further energy savings through energy efficiency policies and activities is substantial and opportunities exist across all industry sectors. The IEA analysis of the industrial sector suggests that the application of proven technologies and best practices on a global scale could save between 18 and 26 percent of industrial sector energy use. The largest savings potential is in the iron and steel, cement, and chemical and petrochemical sectors.

While some older power plants convert only 25% of the fuel they consume into electricity, the most modern natural gas generators are more than 50% efficient. In the electricity generation sector, if all countries produced electricity at current "best practice" levels of efficiency, then fossil fuel consumption could be reduced by 23 to 32 percent. Electricity production accounts for 32% of total global fossil fuel use and around 41% of total energy related CO_2 emissions. Improving the efficiency with which electricity is produced is therefore one of the most important ways of reducing the world's dependence on fossil fuels, helping both to combat climate change and improve energy security. Additional fuel efficiency gains can be made by linking electricity generation to heating and cooling demands through high efficiency combined heat and power (CHP) systems (e.g., for industrial use and for district heating). Because about half of electricity comes from coal, and because most of the oldest fossil fuel power plants are coal-fired, the largest energy-saving potential in electricity production comes from coal-fired plants, and just over half of the savings comes from developing and transition countries.[6]

In short, the available data on global energy are limited, but what does exist suggests that efforts to implement related policies and actions have generated significant improvements in energy savings, and there are many more opportunities to achieve additional savings through energy efficiency initiatives. But, the rate of energy efficiency improvements has slowed compared to the past, and this rate will need to be increased substantially in order to help ensure that we achieve a more secure and sustainable global energy future.

Global Household Energy Use

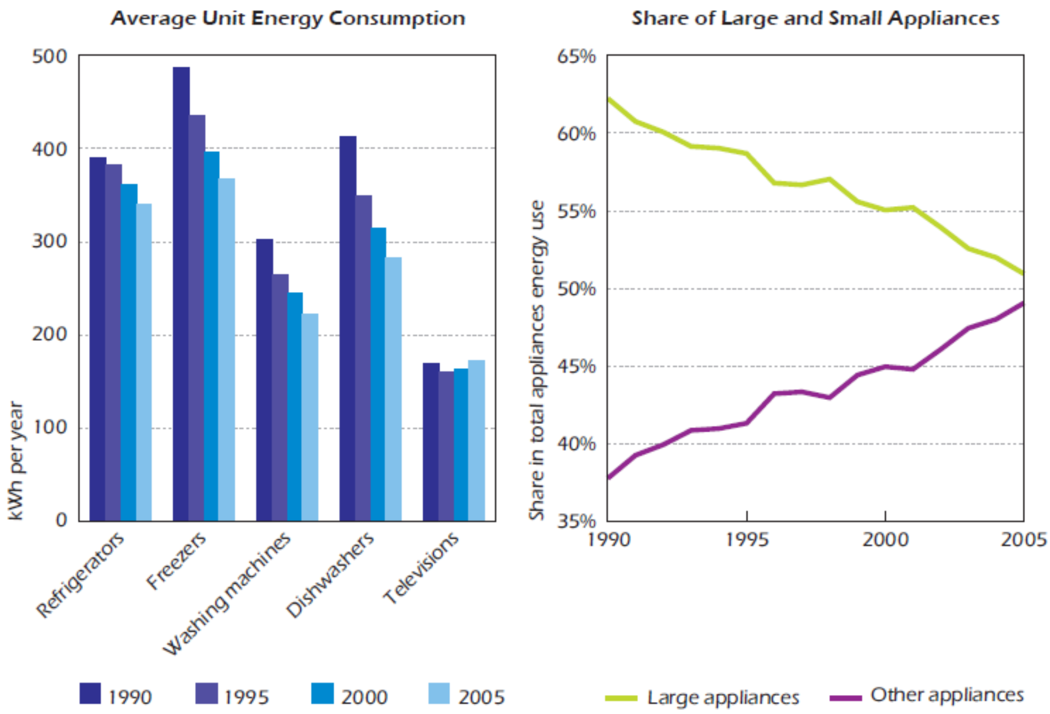
The amount of energy used in households is affected by many social and structural factors including income, age of homeowners, size of home, population, age of home and equipment. Other major impacts on energy use come from weather, appliance energy standards, and the availability of energy-saving programs. In the U.S., the most important factor affecting specifically electricity demand is household income, followed by weather.[7] Rising incomes cause a shift from multi-family to single family homes, from smaller homes to larger homes and an increase in people living alone. Also, as incomes rise, households purchase more energy-consuming goods such as appliances, air conditioners and other consumer electronics. That some of those goods have become more efficient has not offset the overall growth in ownership of these goods. (A more detailed discussion on economic drivers of residential electricity demand in the Northwest can be found in Appendix A).

Global energy use in the residential sector increased 19 percent between 1990 and 2005.[8] For developed countries, electricity and natural gas are primary energy commodities, accounting for 72 percent of household energy use. In transitional economies, renewable energy sources (most of which are traditional sources of biomass) are the primary energy commodity, but that share is decreasing, while electricity use has grown dramatically, increasing 140 percent between 1990 and 2005.

The IEA recently conducted a detailed analysis of household energy efficiency for 19 IEA-member countries.[9] This study found that space heating energy use is growing slowly and remains the most important energy user, responsible for 53% of household final energy consumption. In contrast, household appliance energy use (mostly electricity) is growing very rapidly and has overtaken water heating as the second most important household energy demand. For space heating, efficiency gains are being offset by increased demand of larger homes and lower occupancy rates, mostly in developed countries.

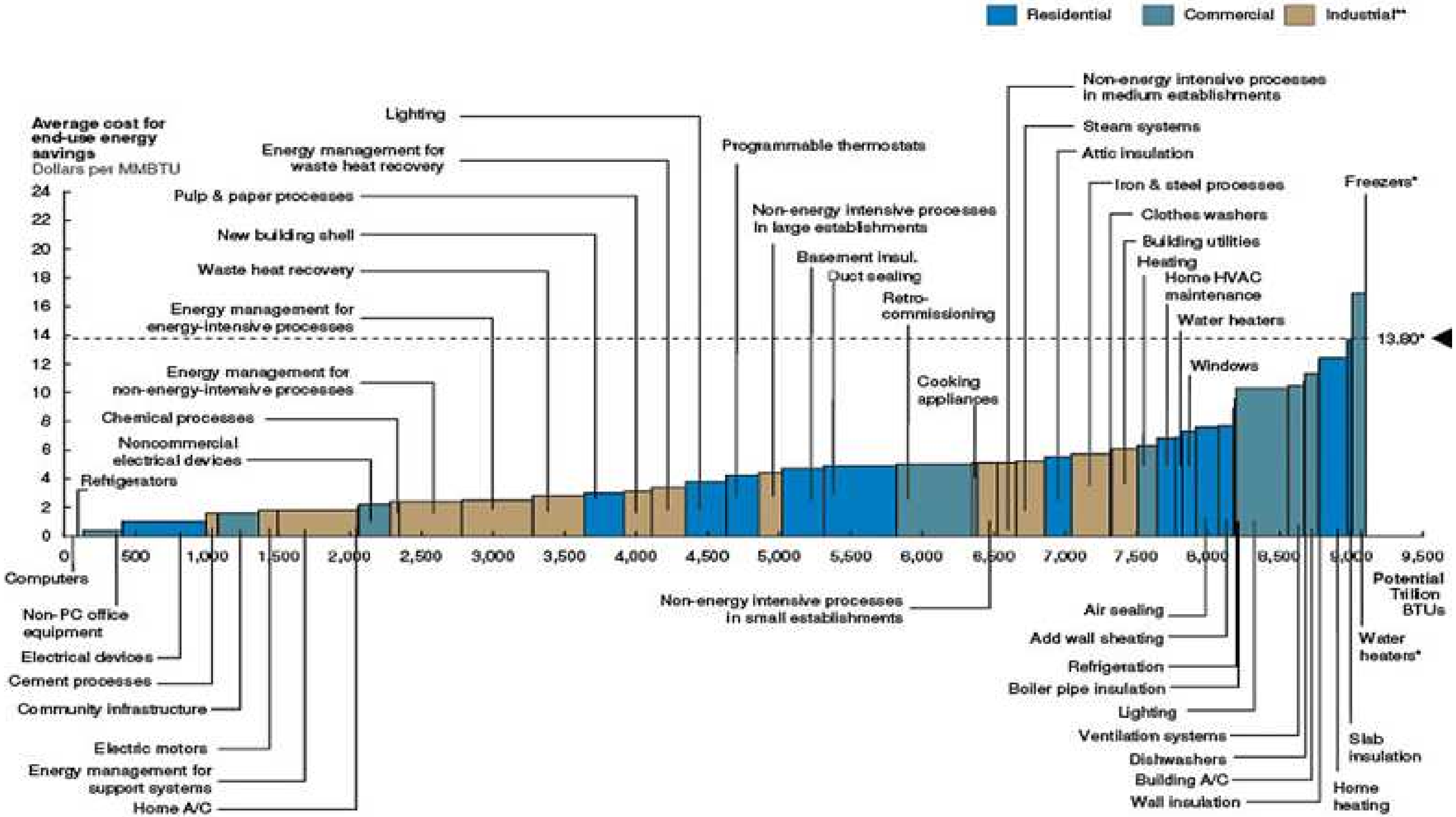
Much of the energy and CO_2 emissions increases are being driven by small appliances and air conditioning rather than large appliances, which now represent only 51 percent of total appliance energy consumption, and this share is falling. Figure 1 shows the average unit of energy consumption for large and small appliances in a group of 15 European countries. With the exception of televisions, all these appliances have shown a significant decrease in average unit energy consumption since 1990. In the case of refrigerators and freezers, the average unit energy consumption has declined, even though the appliances themselves have become larger. For televisions, energy efficiency gains have been outstripped by the consumer trend towards larger screens, which use more energy. However, total household appliance energy consumption in these 15 countries fell only in the case of refrigerators and washing machines. For other, mostly small appliances, improved energy consumption per unit has been more than offset by higher levels of ownership and use.

Figure 1. Energy Usage of Household Appliances



Source: ODYSSEE.
Note: Large appliances include refrigerators, freezers, washing machines, dishwashers and televisions.

Figure 2. U.S. Energy Efficiency Supply, 2020



* Average price of avoided energy consumption at the industrial price; $35.60/MMBTU represents the highest regional electricity price used; new build cost based on AEO 2008 future construction costs

** Our 49th source of savings, refining processes, offers no NPV-positive savings

Source: EIA AEO 2008, McKinsey analysis

Energy Efficiency in the U.S.

Currently there is very little comprehensive data available measuring the energy efficiency of the U.S economy. Although there is a great deal of data available through multiple government and private resources on the cost of energy supply resources, there is less definitive data available on the cost or potential of energy efficiency resources.

A 2009 study by McKinsey and Co. called *Unlocking Energy Efficiency in the U.S. Economy* shows that the U.S. economy has the potential to reduce annual non-transportation energy consumption by roughly 23 percent by 2020, eliminating more than $1.2 trillion in waste – well beyond the $520 billion upfront investment (not including program costs) that would be required. The reduction in energy use would also result in the abatement of 1.1 gigatons of greenhouse gas emissions annually – the equivalent of taking the entire U.S. fleet of passenger vehicles and light trucks off the roads. The residential sector accounts for about 35 percent of the savings, the industrial sector about 40 percent and the commercial sector 25 percent.[10]

Figure 2 shows the variety of sources for energy savings found in the McKinsey study. In the graph, bar height represents cost (low bars are less expensive to implement) and bar width represents energy savings potential. The report only looked at cases where the economic payback of the improvements would ultimately outweigh the initial investment.

The American Council for an Energy Efficient Economy (ACEEE) recently published a different study revealing that in 2004, $300 billion was invested in energy efficiency technologies and infrastructure in the U.S.[11] This investment is about three times the size of those made in conventional energy supply infrastructure, such as construction of new power plants. And while $300 billion is a sizeable amount, it represents less than one-third of the nation’s annual energy expenditures.

The ACEEE study noted that energy savings resulting from these investments in efficiency technology are roughly equivalent to the output of 40 mid-sized coal plants. ACEEE estimated that by the end of 2008 the savings due to investments in energy efficiency will total around $77.4 billion. As depicted in Table 1, about 60% ($178 billion) of the energy efficiency investments were made in the buildings sector. Of that total, nearly half (49%) were in energy efficient appliances and electronics, 29% were in commercial building structures, and 22% were investments in residential building structures. Table 1 also shows that at $75 billion, investments in the industrial sector were about 25% of total efficiency investments. Transportation investments were about $33 billion (11%).

Table 1. Summary of Existing U.S. Energy Efficiency Investments (2004)

	Buildings	Industrial	Transportation	Utility Power Generation	Total
Total Energy Use (quads)	38.9 (39%)	33.6 (33%)	27.9 (28%)		100.4 (100%)
Total Efficiency-related Investments ($billion)	178	75	33	15.7	300
Investment-related employment (thousands of employees)	900	351	151	139	1,630
Energy Savings (quads)	0.72	0.66	0.08	0.19	1.7
Energy Savings ($billion)	12.2	5.6	1.1	0.5	19.5

The McKinsey report also estimated energy efficiency investments. In their findings, of the 2008 nationwide investments in energy efficiency activities, 14% were from utility-sponsored programs, 19% from energy services companies (ESCOs), 22% for incremental (above-code) investments in insulation and energy devices and the remaining 44% was spent on meeting existing building codes and standards.

Driving Energy Efficiency Industry Growth

The ACEEE study noted that "in an environment of accelerated market transformation and rapid growth in efficiency investments, total investments in more energy efficiency technologies could increase the annual energy efficiency market by nearly $400 billion by 2030, resulting in an annual efficiency market of more than $700 billion in 2030."[12] The study proposes that the U.S. can cost-effectively reduce energy consumption by 25-30% or more over the next 20-25 years.

The focus on developing new markets and generating savings for consumers has levied considerable attention on the need to grow the energy efficiency sector even more. Yet there are other significant pressures as well: energy prices have become increasingly volatile, and there have been very few additions to energy supplies such as new power plants or new fossil fuel supplies. Constraints in energy supply markets are far-reaching and can provide motivation to pursue efficiency initiatives. Scientific evidence and political pressure to address climate change has become stronger, and calls for action to reduce greenhouse gas emissions are becoming increasingly urgent. Additionally, consumers are raising concerns about energy industry environmental impacts and there are growing international pressures to manage these impacts in countries such as India and China, which are expanding generation capacity rapidly. Finally, energy and energy efficiency technologies are rapidly changing, providing many new opportunities to implement technology solutions that greatly enhance efforts to improve energy efficiency.

Electricity and natural gas utilities have a long history as the coordinators and promoters of energy efficiency for their customers, and utility-based investment incentives have been the most widely used efficiency policy tool in the U.S. States and utilities spend about $2.6 billion annually on efficiency programs.[13] Sixteen states, including Washington, have implemented energy efficiency resource standards, which set efficiency goals similar to renewable energy targets (Washington's efficiency target is part of voter Initiative 937, discussed later).[14] There is considerable pressure to create a federal efficiency standard as well. A national standard for energy efficiency, combined with existing state energy efficiency standards, could drive future investments in efficiency to new heights.

American Recovery and Reinvestment Act

The national recession has also helped to boost the visibility of energy efficiency, as part of a strategy to support economic recovery. Even prior to the recession, the idea of growing a clean energy-based economy was viewed as a key strategy for addressing the growing concern about climate change and the structural changes that will be needed to reduce the nation's carbon footprint. At the same time, a clean-energy economy was promoted as a way to usher in a new foundation for national economic growth and employment that will generate thousands of new, good-paying "green" jobs that could also provide new employment opportunities for disadvantaged populations to enhance social equity. Many policy papers, studies and reports from industry groups, labor unions and advocacy groups emphasize the importance of shifting to a clean energy economy to accomplish these goals.[15]

In February of 2009 President Obama signed into law the American Recovery and Reinvestment Act (ARRA) which provides nearly $800 billion for economic stimulus activities. The Act has a major focus on energy efficiency, renewable energy and education and training related to these activities. Energy efficiency actions alone are earmarked to receive $30 billion in new investments. The Act intends to double the renewable energy capacity of the U.S and undertake the largest weatherization program in history by modernizing 75% of federal buildings and more than a million homes. Through the U.S. Department of Labor, $500 million is available on a competitive basis and a primary focus of these funds is to prepare workers for careers in energy efficiency and renewable industries.[16] The U.S. Department of Energy is sponsoring up to $40 million for developing and enhancing workforce training programs for the electric power sector and up to $65 million for smart grid workforce training. The U.S. Department of Education is expected to announce funding opportunities that support additional foundational academic and career and technical education programs that can support energy-related workforce development.

For its share of the overall stimulus act expenditures, Washington State will receive $4.1 billion in dedicated funds, $60 million of which is dedicated specifically to energy efficiency weatherization programs (of which $10 million is dedicated to training). The state and public agencies are eligible for additional competitive funds, including those available for energy-related education and training.[17] This influx of new money presents many challenges and opportunities for an expanded infrastructure and action to support energy efficiency initiatives nationally, across the Pacific Northwest, and in Washington State.

Regional Legislation and Policy

This section reviews the roles and activities of the Northwest Power and Conservation Council and the Bonneville Power Administration. It also discusses the region's conservation achievements, drivers of growth, remaining efficiency potential and efficiency targets for the region and utilities. A sample of state utility conservation program activities is also described.

Northwest Power Act and Bonneville Power Administration

For the past thirty years, the most significant force guiding energy development and energy efficiency activities in the Northwest has been the Northwest Power Act (the Power Act), enacted by Congress in 1980.[18] The Power Act required Bonneville Power Administration (BPA), the wholesale power marketer of the federal hydro system, to pursue energy efficiency initiatives (in addition to new power) to meet the region's growing electricity needs. Congress intended that BPA would constantly reduce its power demand by increasing the efficiency of its customers' energy use, which would also lower electricity costs for regional consumers.

The Regional Power Plan

The Northwest Power Act also authorized the states in the region to establish the Northwest Power and Conservation Council (NWPCC), which in turn was directed to produce the Northwest Electric Power and Conservation Plan which spells out strategies for meeting the electrical power needs of the region at the lowest possible cost.[19] The Regional Power Plan, as this report will refer to it, must give highest priority to cost-effective energy efficiencies (also called "conservation") to meet future demand for electricity. Renewable resources were given the next-highest priority. To the extent renewables are cost effective, they are ranked ahead of thermal generating resources such as natural gas. Among the thermal options, fuel-efficient methods of producing energy, such as cogeneration, must be given priority.[20]

The Regional Power Plan is updated every five years. The *Draft Sixth Northwest Power Plan* is currently available and it is due to be approved in the fall of 2009. This report incorporates early-released data from the *Draft Sixth Northwest Power Plan* to the extent that it is available.[21]

Because the Regional Power Plan adopted by the NWPCC directs BPA to be responsive to the power needs of its customers, BPA must seek to invest in and provide new power based on these priorities, beginning with providing cost-effective conservation and renewable resources. BPA may purchase power from new thermal projects, but only after determining that cost-effective conservation and renewables cannot be achieved or developed in time. The Regional Power Plan is also the basis for utility investment decisions in the region, and individual utilities are tasked with meeting individual goals that support achieving this regional goal. BPA credits utilities with a rate discount for their individual actions to implement conservation and develop renewables, though the actions utilities take must be approved by BPA.

Regional Conservation Achievement

The Power Act has resulted in the acquisition of over 3,600 average megawatts of energy efficiency between 1980 and 2007.[22] This is equivalent to the annual power needs of three cities the size of Seattle, the output of 6 or 7 coal plants, or all of the power needs of Idaho and Western Montana in 2008.[23] BPA and the utilities in the region acquired 1,941 average megawatts of that amount, over half of which was in the service territories of publicly owned utilities and under half was in the service territories of the investor owned utilities. The remaining efficiency – nearly 1,900 megawatts – was acquired as a result of state building codes, energy efficiency standards, and market-transformation efforts led by the Northwest Energy Efficiency Alliance (NEEA).[24]

Figure 3 shows the annual energy savings from conservation activities and related programs in the region between 1991 and 2007. The savings shown are a result of programs sponsored by BPA or NEEA or are a result of state energy codes or federal appliance standards. On an aggregate level, energy savings have been variable: programs ramped up quickly in the early 1990s, then tapered off, followed by another boom in 2001 and subsequent bust. Since 2004, energy savings have increased substantially to their highest levels yet seen in the Northwest.

Figure 3. Annual NW Regional Conservation Savings[25]

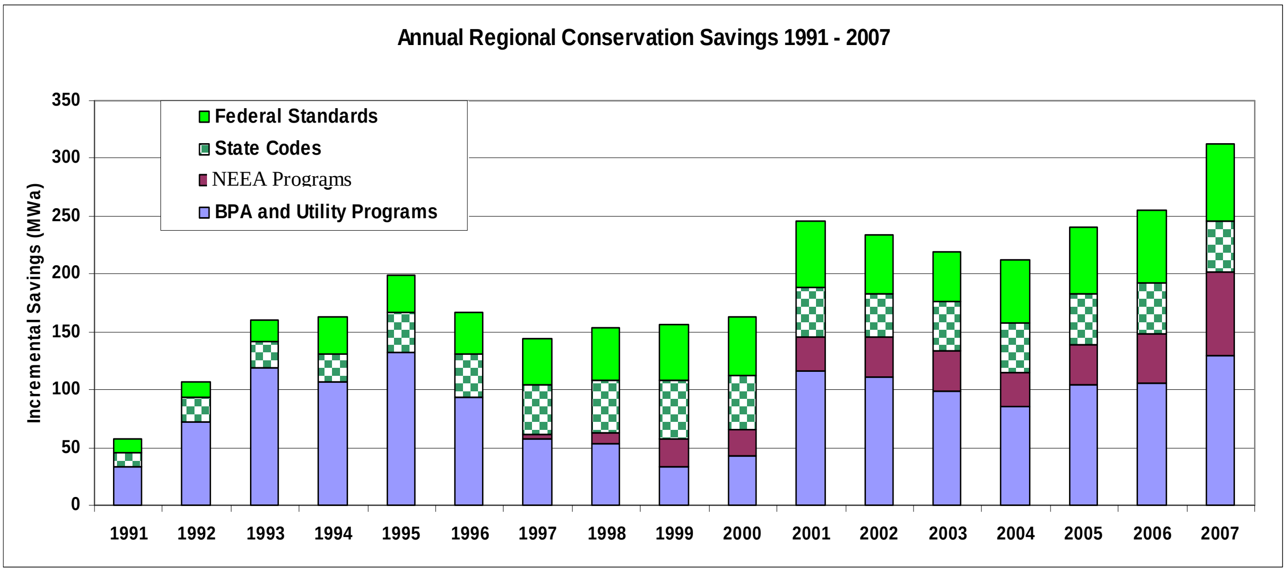
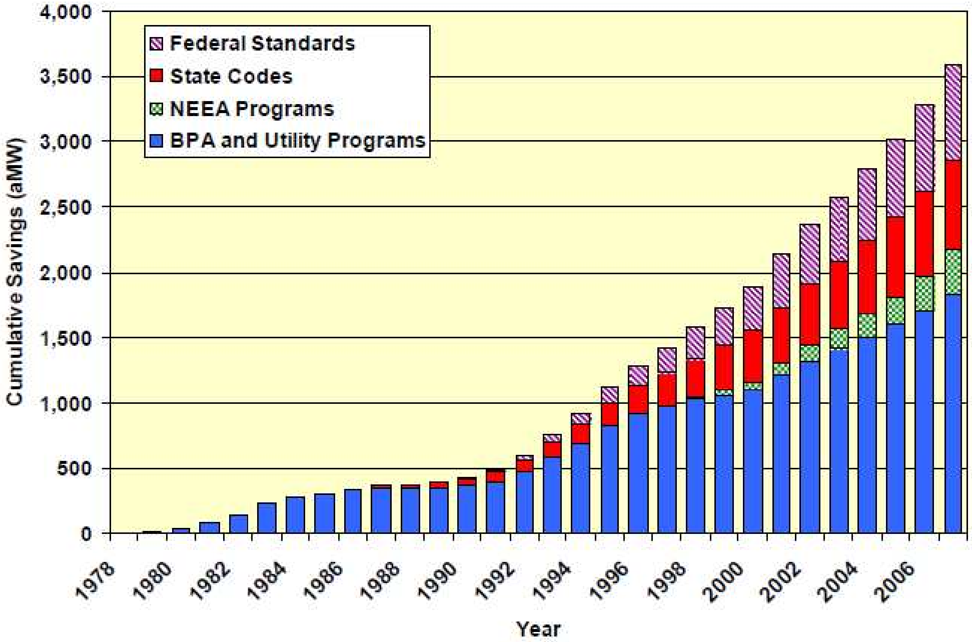


Figure 4 shows cumulative energy savings as a result of the same programs across the Northwest between 1978 and 2007. Since 2001, BPA and utility programs have accounted for the largest proportion of conservation savings in the region. The Washington and Oregon state energy codes are responsible for at least 30 percent of these regional energy savings. Additional savings have resulted from federal minimum efficiency standards for appliances and efficiency labels for products which exceed the standard, such as the ENERGY STAR® label, and from NEEA market transformation programs.

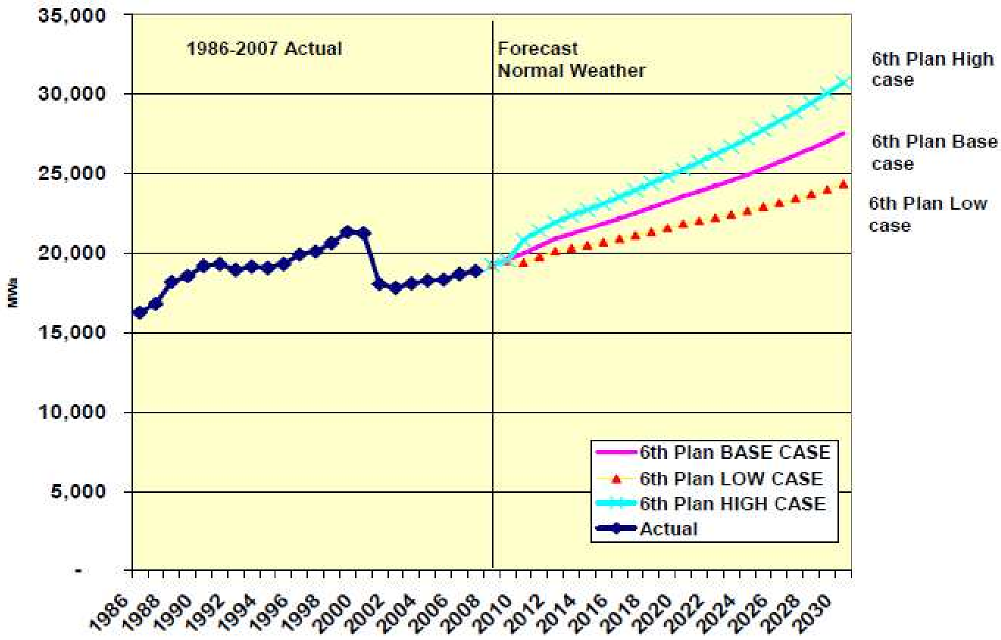
Figure 4. Cumulative NW Regional Conservation Achievement 1978-2007 (aMW)[26]



Connecting Demand, Power Prices and Cost-effective Conservation

Expanded energy efficiency initiatives are also central to our ability to address strong anticipated demand growth for electric power in the region. The NWPCC's *Draft Sixth Northwest Power Plan* estimates electricity demand through 2030 as depicted in Figure 5.[27] The figure shows that under any of the three forecast scenarios, without changes in efficiency investments, the overall demand for electric power in the region will grow over the next 20 years.

Figure 5. NWPCC Electricity Demand Forecast – *Draft Sixth Northwest Power Plan*

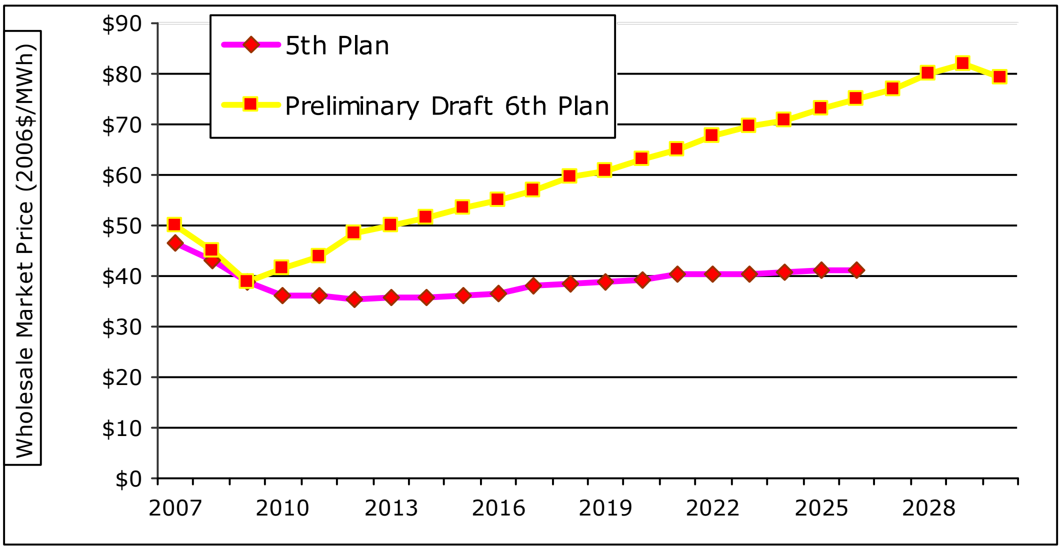


In the *Draft Sixth Northwest Power Plan*, the NWPCC estimated that over the next 20 years nearly 7,000 aMW of energy efficiency is technically achievable across the Northwest.[28] Of that amount, 5,800 aMW is considered cost-effective and over 4,000 aMW is achievable for under $40 per megawatt-hour (in the range of current average wholesale power prices). The energy savings available for under $40 per megawatt-hour is equal to more than 6 coal plants.[29] This is about double the quantity of cost-effective conservation potential found in *The Fifth Northwest Electric Power and Conservation Plan* (the Fifth Plan).

The primary reason for the major increase in cost-effective conservation is that "avoided cost" – or the price the utility avoids paying for new power supply resources by investing in conservation – has doubled since the Fifth Plan. Power prices in the current planning period have increased much more rapidly than was anticipated during the prior planning period. Figure 6 shows the forecast wholesale power price (per megawatt hour) for the *Draft Sixth Northwest Power Plan* relative to the Fifth Plan. The costs of generating power have increased substantially.

As wholesale power prices rise, the value of avoiding that cost by implementing conservation increases.[30] Thus, with both demand and prices rising, the case for boosting energy conservation grows even stronger, confirming energy efficiency as the lowest-cost strategy for meeting future energy needs.

Figure 6. NWPCC Power Price Forecast - Fifth Plan and Draft Sixth Plan



Forecasted Regional Load Growth by Sector

Table 2 breaks out the electric load growth by sector as forecasted in the *Draft Sixth Northwest Power Plan*.[31] The residential sector, in particular, shows a rapid growth rate; it is expected to grow by 2.2 percent per year until 2030. This growth rate is much higher than was anticipated in the Fifth Plan, which estimated growth in the residential sector to be 1.36 percent.

Table 2. NW Electricity Load Growth Forecast by Sector – *Draft Sixth Northwest Power Plan* (aMW)

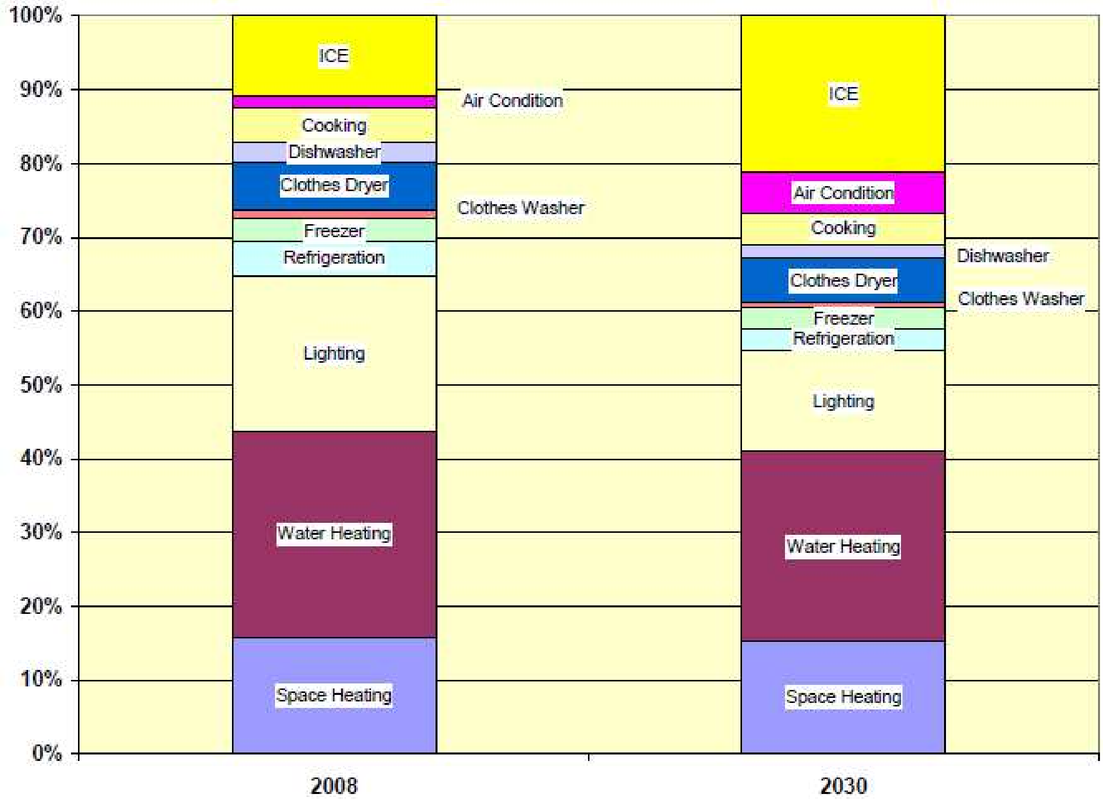
	2007 Actual	2010	2020	2030	Growth Rate 2010-2020	Growth Rate 2010-2030
Residential	7,431	7,723	9,446	11,896	2.0%	2.2%
Commercial	6,081	6,740	8,317	9,318	2.1%	1.6%
Industrial Non-DSI	3,793	4,044	4,261	4,675	0.5%	0.7%
DSI	764	693	818	818	1.7%	0.8%
Irrigation	736	705	675	774	-0.4%	0.5%
Transportation	63	63	62	64	-0.1%	0.1%
Total	18,868	19,967	23,578	27,545	1.7%	1.6%

DSI – Direct Service Industry (wholesale industrial customers of BPA)

As shown below in Figure 7, the primary driver of this change is projected demand for residential information, communication and entertainment (ICE) appliances. The *Draft Sixth Northwest Power Plan* also predicts significant growth in residential air conditioner use. Lighting, refrigeration and water heating represent declining shares of residential energy use, which is a direct result of successful efficiency standards and programs.

The forecast rapid growth in electricity consumption, combined with increasing wholesale power prices and increasing costs for new generating resources, is creating a situation very favorable to new conservation initiatives.

Figure 7. Residential Electricity Demand Forecast by Appliance – *Draft Sixth Northwest Power Plan*



Regional and Utility Energy Efficiency Targets

The *Draft Sixth Northwest Power Plan* reveals significantly higher energy efficiency targets set for the Northwest. The Regional Plan calls for acquiring 1200 aMW of conservation savings by 2014, which represents 58 percent of the new regional demand for electricity over the next five years. The Regional Plan also calls for acquiring about 5800 aMW of conservation savings by 2029, which represents 85 percent of the new demand for power in the region.[32]

In coordination with the *Draft Sixth Northwest Power Plan*, BPA will begin in 2011 pursuing all regionally cost-effective electricity savings within the entire service territories of its public utility customers, not just the share of their load supplied by BPA. This change, combined with BPA's new rate structure designed to promote efficiency, should contribute significantly to energy savings across the region.

BPA, the NWPCC and the region's utilities have been significant players in implementing conservation measures in the Northwest. Some of the Northwest's largest utilities have exceeded their 2007 NWPCC targets by as much as 25%.[33] But many others have relied exclusively on BPA's programs, and fallen short of these targets. Many of these utilities have very inexpensive power rates and therefore there is little economic incentive to spend money on implementing conservation measures. In spite of the variable levels of activity, more energy efficiency was acquired in the region during 2007 than in any previous year (see Figure 3, presented earlier).[34]

Some utilities in Washington State have been strong national leaders for promoting energy efficiency. However, it is important to note that while utility programs are an important component of the energy efficiency industry, the federal government and states also are very active in the industry through their large investments in weatherization programs, implementation of building codes, appliance standards and other government-initiated activities. Indeed, the majority of the energy efficiency programs offered by public utilities are reviewed, approved and jointly paid for by BPA.

Utility Conservation Activities

Utilities have shown varying levels of activity in their conservation programs. Generally speaking, those utilities which are responsible for meeting some or all their own load growth (rather than relying on BPA) and are closer to the limits of their existing generation resources offer more ambitious conservation programs. Some utilities that own their own generation and have large surpluses have found that conservation frees up additional power to sell elsewhere at a higher price.

BPA provides utility incentives for nearly all of the consumer efficiency programs offered by utilities, including rebates for ENERGY STAR appliances, heat pumps, insulation and lighting. The utilities reviewed during this research revealed a strong preference for efficiency measures focused on lighting, specifically installing compact fluorescent lighting (CFL). CFL measures result in energy savings at relatively little expense to the utilities and have resulted in significant energy savings. From the utility's perspective, CFL programs require fewer staff and there is strong regional and national marketing support for CFL programs. The utility's effort and expense is leveraged by these coordinated efforts, which influence their choice of program offerings. Very few of the programs were targeting energy efficiency activities that would result in substantial growth in direct employment, even though these programs probably stimulate new demand for energy efficiency products.

Following CFL measures, utilities tend to offer rebates for energy efficient appliances and heating and ventilating equipment. Some utilities offer programs targeted at home weatherization, or at commercial building design and operations, but these activities represent significantly smaller portions of the investments made by the utilities included in this review. Many utilities offer low-interest loans or loan guarantees for commercial and industrial sector energy efficiency investments.

The information listed below summarizes conservation activities among a sample of Washington utilities. This is not a comprehensive list of all programs offered by these utilities. If data was available, energy savings as a result of efficiency measures are shown below. Utilities offering low-interest loans usually require that energy audits be performed prior to work being done. For more details, see individual utility websites.

Public Utilities

Clark County Public Utility District
Clark PUD's conservation program provides loans and grants for weatherization, heat pump and market transformation activities. During 2008, $1.4 million dollars in loans were provided through the program. Energy savings were not available.[35]

Chelan County Public Utility District
Chelan County PUD offers residential customers low-interest loans for efficiency upgrades on their homes. Commercial and industrial customers are provided assistance in selecting energy efficient heating and cooling systems. Since 2000 the commercial and industrial program energy savings is 4.2 aMW. The program was curtailed during 2009 but is expected to resume in 2010.[36]

Grant County Public Utility District
Grant County PUD offers residential customers low-interest loans for efficiency upgrades on their homes. The utility also offers rebates for energy efficient lighting, appliances and ENERGY STAR manufactured homes. Commercial, farm and industrial customers may qualify for lighting rebates, irrigation and cold storage assistance. No energy savings data was available.[37]

Grays Harbor Public Utility District
Grays Harbor PUD offers low-interest loans to residential and non-residential customers for weatherization and efficiency upgrades. The utility offers rebates for heat pumps and appliances. Utilization rates and expected energy savings of specific measures were not available.[38]

Lewis County Public Utility District
Lewis County PUD does not have an active conservation program. It is passing through rebates for energy efficient appliances and water heaters through BPA's conservation rate credit program.[39]

Mason County Public Utility District #1
Mason PUD #1 offers rebates on appliances, heat pumps, lighting, new ENERGY STAR homes, manufactured homes and insulation.[40]

Mason County Public Utility District #3
Mason PUD #3 offers energy audits and rebates on insulation, duct-sealing, heat pumps, compact fluorescent lighting and appliances. Commercial sector rebates are available for lighting and motors.[41]

Pacific County Public Utility District #2
Pacific County PUD offers rebates for residential weatherization, heat pumps, commercial lighting, appliances, ENERGY STAR rated manufactured homes and solar water heaters. Utilization rates and expected energy savings of specific measures were not available.[42]

Seattle City Light

Seattle City Light developed a five year conservation plan in 2008 which calls for doubling the amount of energy savings from the previous plan, exceeding the Northwest Power and Conservation Council's target for Seattle. Seattle's goal is to save 65.5 aMW of electricity, meeting most of the city's projected load growth through 2012.[43]

Seattle's drivers for expanding efficiency targets include climate initiatives, the city's strategic plan (which calls for environmental protection, cost-efficient portfolio of power resources and enhanced financial resiliency), and a host of policy, regulatory, social and economic development initiatives, including the Seattle Jobs Initiative, which is working with local energy efficiency employers and workforce training and education providers within the City to create linkages to living-wage jobs.[44]

Seattle's plan for achieving their goal expects 52% of the energy savings to come from commercial sector programs, 9.8% to come from industrial programs and 38.2% from residential and mixed-use programs. The commercial sector programs focus primarily on commercial retrofit and lighting measures. The industrial program provides financial and technical assistance to new and existing industrial facilities. The residential program expects to find most of its savings in retail lighting measures.

Snohomish County Public Utility District

In 2008, Snohomish County PUD saved more than 60 million kWh of electricity through its conservation programs, enough to power 5,000 homes. Their programs offered rebates for efficient appliances, loans and cash incentives for home weatherization projects, recycling of energy-wasting refrigerators and freezers, and discounts on compact fluorescent light bulbs. Utilization rates and expected energy savings of specific measures were not available.[45]

Tacoma Power

Tacoma Power has a conservation plan which calls for 54 aMW over the next ten years, thus delaying the need for additional supply-side resources for many years. The drivers for the plan are Initiative 937 and the recognition that energy efficiency will help consumers manage costs. The goal of the conservation programs is to save 5.4 aMW every year for the next ten years.

Tacoma Power staff will deliver some of the programs (like weatherization), while contractors will deliver some regional programs (like lighting). Some programs target the residential sector, including ENERGY STAR lighting and appliance rebates, heat-pump rebates, single-family and multi-family weatherization, new manufactured home incentives and refrigerator/freezer recycling. The utility offers customized efficiency programs for commercial and industrial customers. The utility is also developing several new programs.[46]

Investor-Owned Utilities

Avista

Avista's conservation programs are funded through a rate surcharge which collects about $10 million annually from electricity customers. In 2008, over 49 million kWh of electricity savings was attributed to Avista's conservation programs. The largest savings came from measures focused on lighting (40%), heating/ventilating/air conditioning (28%) and buildings (10%) though there are several additional small projects.[47]

PacifiCorp

PacifiCorp collects about $5.6 million annually from Washington ratepayers on a conservation surcharge on utility bills. PacifiCorp's program activity has resulted in about 35 million kWh in annual electricity savings.[48] No details were available for the utilization rates or sector-specific savings.

Puget Sound Energy

Puget Sound Energy (PSE) ratepayers contributed $53 million annually in 2008 for measures which have captured about 273 million kWh (31.2 average megawatts or enough to power over 35,000 homes) in electricity savings. PSE increased its 2009 efficiency goal by over 18% compared to 2008.

PSE's current measures are focused primarily on lighting, and to a lesser extent retrofits to existing buildings, new building design, appliances, heating ventilating and air conditioning improvements, and building operator training and services. Over the next two decades, PSE expects to save another 440 average-megawatts of electricity and 70 million therms of natural gas.[49]

Washington State Policy and Legislation

Washington State has a long list of policies and legislation which supports the energy efficiency industry, and the emphasis on this sector has grown significantly in recent years. There are a few policies which particularly stand out as being major drivers for change. The first is the Washington State Energy Code which was established in 1977 and has been enhanced many times since then. It sets the minimum standard for energy efficiency for newly constructed buildings.[50] The energy code has been a proven success at boosting energy conservation and is responsible for at least 30% of the total energy savings achieved in the state since it was first enacted.[51] Currently, the Washington State Energy Code exceeds the very high standards of the International Energy Conservation Code.

More recently, Washington voters passed Initiative 937 (I-937), which requires utilities to develop all conservation that is cost-effective, reliable and feasible using methodologies consistent with those used by the NWPCC.[52] Utilities will be completing their plans for achieving I-937 targets in January of 2010. At that time, more specific details on the activities the utilities will be pursuing will become available. Washington's I-937 was the first state renewable energy standard in the nation to require utilities to also meet energy efficiency standards.

A more subtle yet important action was the enactment of House Bill 1010 in 2007. This legislation requires utilities to prepare resource plans to demonstrate that they have adequate resources to meet their load-serving obligations.[53] It makes the utilities' efficiency targets public, puts them into context with other resource acquisition goals, and tracks progress towards meeting the targets.

The state has legislated greenhouse gas emission reduction targets, which rely on success of energy efficiency measures. The state has also created requirements for publicly-owned buildings to reduce their energy use by 10% and become ENERGY STAR certified.[54]

Table 3 is a summary of state-level energy efficiency policies.[55]

Table 3. Overview of Washington State Energy Efficiency Policies

Electric Utility Sector	– Customer energy efficiency programs – Energy efficiency program funding – Energy efficiency resource standards – Recognition of energy efficiency as a resource
Vehicle Policies	– Tailpipe emissions standards – State tax incentives for high efficiency and alternative fuels vehicles
State Grant Program	– Manufacturing efficiency program
Building Codes	– Washington State Energy Code
Appliance and Equipment Standard	– Minimum efficiency standard
Clean Distributed Generation	– Interconnection standards – Output-based emissions regulations – Combined heat and power included in Initiative 937 – Standby rates
Smart Growth Policies	– Growth Management Act – Adopted goal to reduce vehicle miles traveled
Climate Change Mitigation	– Climate Action Team – Western Climate Initiative – West Coast Governor's Global Warming Initiative – Western Governor's Association Clean and Diversified Energy Initiative
Lead by Example Initiatives	– New and existing state buildings requirements – Energy efficient product procurement – Efficient fleets – Energy savings performance contracting

Washington's policymakers have shown strong support and leadership for advancing efficiency. The American Council for an Energy Efficient Economy (ACEEE) ranks Washington State as sixth in the nation for implementing strong energy efficiency policies, which is especially meaningful when considering that Washington has some of the cheapest electricity rates in the nation.[56] In particular, an increasingly stringent state building energy code and the landmark efficiency performance standard have laid a foundation for significant growth in the state's efficiency sector.

The Energy Efficiency Workforce

This section provides a review of existing research on the energy efficiency workforce, and discusses occupations that comprise the workforce and forecasts for growth. The impact of federal spending on the national, state and regional efficiency workforce and other overarching energy efficiency industry workforce issues are presented.

Existing research on the energy workforce points to the central role that energy efficiency plays in employment, and as an economic sector that is important as a job creation strategy now and into the future. As shown previously in Table 1, efficiency-related investments generated an estimated 1.63 million jobs in the U.S. in 2004. This is roughly twice the number of jobs in the energy supply sector. This finding is consistent with a growing body of research on energy-related investments and job creation showing that energy efficiency employment is likely to provide a large share of new employment in an emerging clean energy economy.[57]

The findings among existing studies on energy efficiency employment and occupations vary considerably, depending on the focus of the research, what is defined as efficiency employment, and the economic models used to generate forecasts for future employment. Some studies consider only direct jobs, which are those associated directly with a specific product or service, such as an energy-efficient building design or construction work. Other studies include indirect job growth, also known as a "multiplier" that estimates second-order job growth associated with increased demand for generic parts or tools provided by a supplier, for instance. In general, however, most research confirms that energy efficiency employment is already an economic driver.[58]

According to the ACEEE study (described earlier), the largest number of jobs in the U.S. in 2004 was in the buildings sector (900,000), which represents 55 percent of all efficiency-related jobs.[59] Within that sector, investments in the appliance and electronics sector generated the most jobs (more than 370,000), followed by residential construction and renovation (316,000 jobs) and commercial construction and renovation (301,000.) In addition to the buildings sector, the industrial sector supported 161,000 jobs and utility sector power generation efficiency improvements supported employment for 139,000 workers in 2004.

Understanding the Energy Efficiency Workforce

As noted earlier, the diverse nature of energy efficiency activities and the interdependency among industry players makes it extremely difficult to clearly distinguish between these businesses on many energy efficiency measures. Similarly, defining and measuring industry employment, occupational composition, and skill requirements of energy efficiency employers is complicated, and there are relatively few systematic studies available that focus on energy efficiency workforce issues. The shortage of reliable research on the energy efficiency workforce has also meant that our understanding of the workforce education and training needs of the energy efficiency industry is limited.

A recent study of energy efficiency workforce issues by the Lawrence Berkeley National Laboratory (LBNL) provides some useful foundational distinctions for the industry.[60] In designing their study, LBNL researchers developed models that identify the composition of the energy efficiency industry, which is most directly impacted by increased program activity. Increases in energy efficiency activities are also a function of greater interaction between customers and private-sector businesses, who offer related products and services through utilities, but also directly, outside of established efficiency programs. Thus, both the growth in utility programs and an increasing number of direct transactions between consumers and private-sector businesses will augment energy efficiency activity and employment.

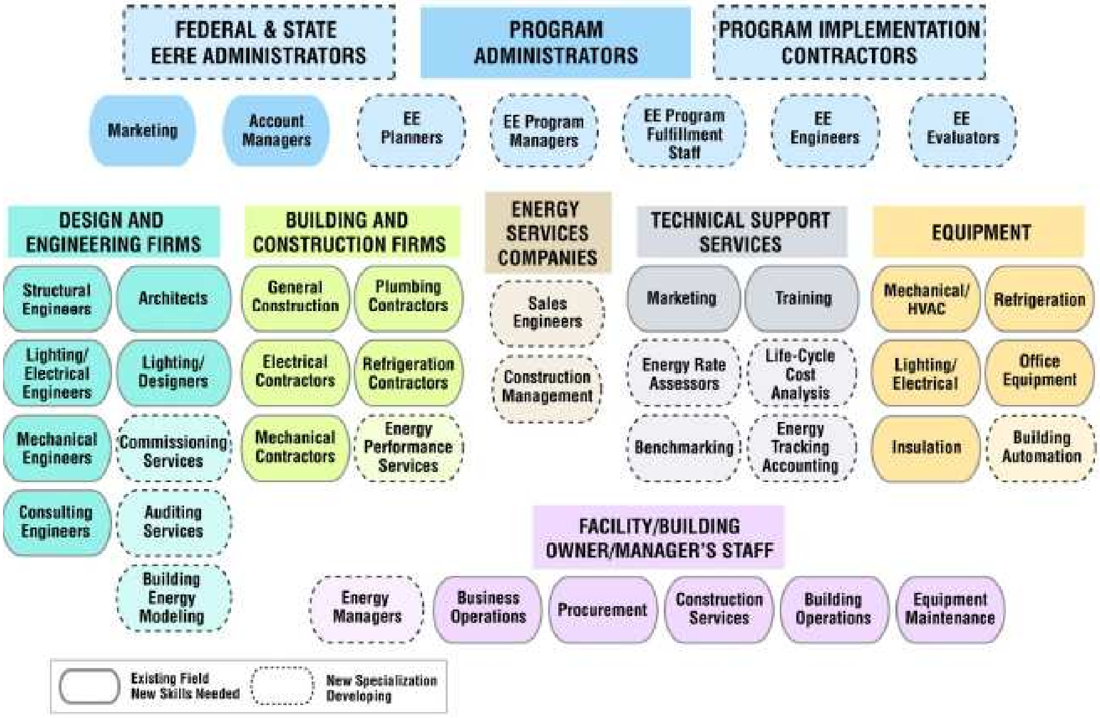
The LBNL models provide a useful starting point for identifying some of the common key sectors, businesses and occupations that comprise the energy efficiency industry. Additionally, they show how energy efficiency program activities can translate into changes in specific job categories.

As shown in Figures 8 and 9, LBNL's models highlight the various levels of occupations that exist in different functional areas that support energy efficiency program goals and activities. The top of Figures 8 and 9 depict the highest level of job categories employed in energy efficiency programs—largely program administrators and implementation contractors, where efficiency programs typically begin. Below that level are jobs which support program administration and implementation, such as marketers, program managers and evaluators. The next level shows the major employment sectors involved in the final installment or implementation of the energy efficiency activity, followed by the relevant occupations within that sector.

These charts are useful in showing the connection between efficiency programs and the specific occupations impacted by efficiency program activity. Many of the occupations shown, for example electrical contractors or mechanical engineers, have traditionally been employed in activities that are not exclusively efficiency related. However these jobs are impacted by changes in the efficiency industry.

The models highlight the existing occupations where new job skills are needed, and identify new occupations or specialization areas that are emerging, based on research reviews and interviews with employers and energy efficiency experts. The occupations at the top tier of both Figures 8 and 9 could be federal, state, local, utility, business or industrial sector energy efficiency program administrators; in fact, those occupations could be present in nearly any entity which originates an efficiency program

Figure 8. Commercial and Industrial Providers of Energy Efficiency Services



Definitions:
EE - Energy efficiency, EERE – Energy efficiency and renewable energy

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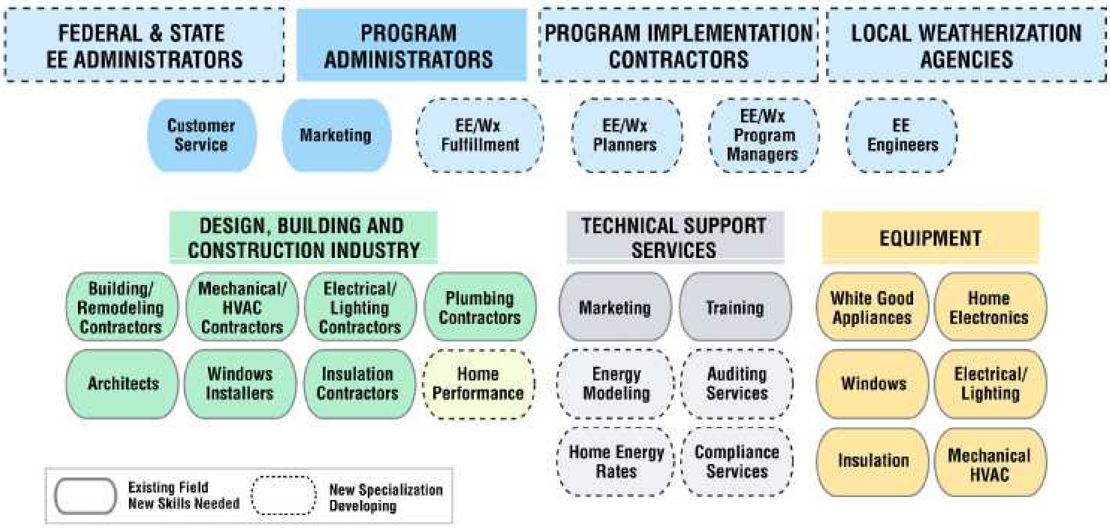
Figure 9. Residential Sector Providers of Energy Efficiency Services



Definitions:
EE - Energy efficiency, Wx – Weatherization

Figure 8 depicts job categories for commercial and industrial providers of energy efficiency services. Figure 9 shows similar categories and information for residential providers of energy efficiency services. Compared to the commercial and industrial sectors, the residential sector relies less on engineering services, facilities management and energy services companies.

Figure 10. Sample Job Descriptions from Seattle City Light's Five Year Conservation Plan

What does a Utility Energy Efficiency Planner Do?

Planning is the merger of technical analysis, market research and utility planning. The planning group must understand how customers use City Light's product (electricity) and how that use is growing, both by individual customers and in the overall system. Once planners understand this, they must identify how to reduce consumption through pricing signals (rate design), technology or by altering customers' behavior.

Planners rely on market intelligence; technology assessment; experience with previous program successes and failures; utility requirements and costs; and regional commitments/standards/laws/regulations available for the optimization of program design.

Planners must use the data to identify specific goals, such as —reducing energy consumption or peak use, and changing time of use. For example, if the goal is to reduce the energy used for residential lighting by convincing customers to convert to compact fluorescent lighting, planners might provide incentives to reduce the products' price. That seems straight forward. Yet implementing such a "simple" idea requires the coordination of thousands of retailers, all with unique delivery channels and in-store processes.

What Does a Utility Program Implementer Do?

Program implementers base implementation plans on planners' program design requirements. Implementation plans must address several questions:

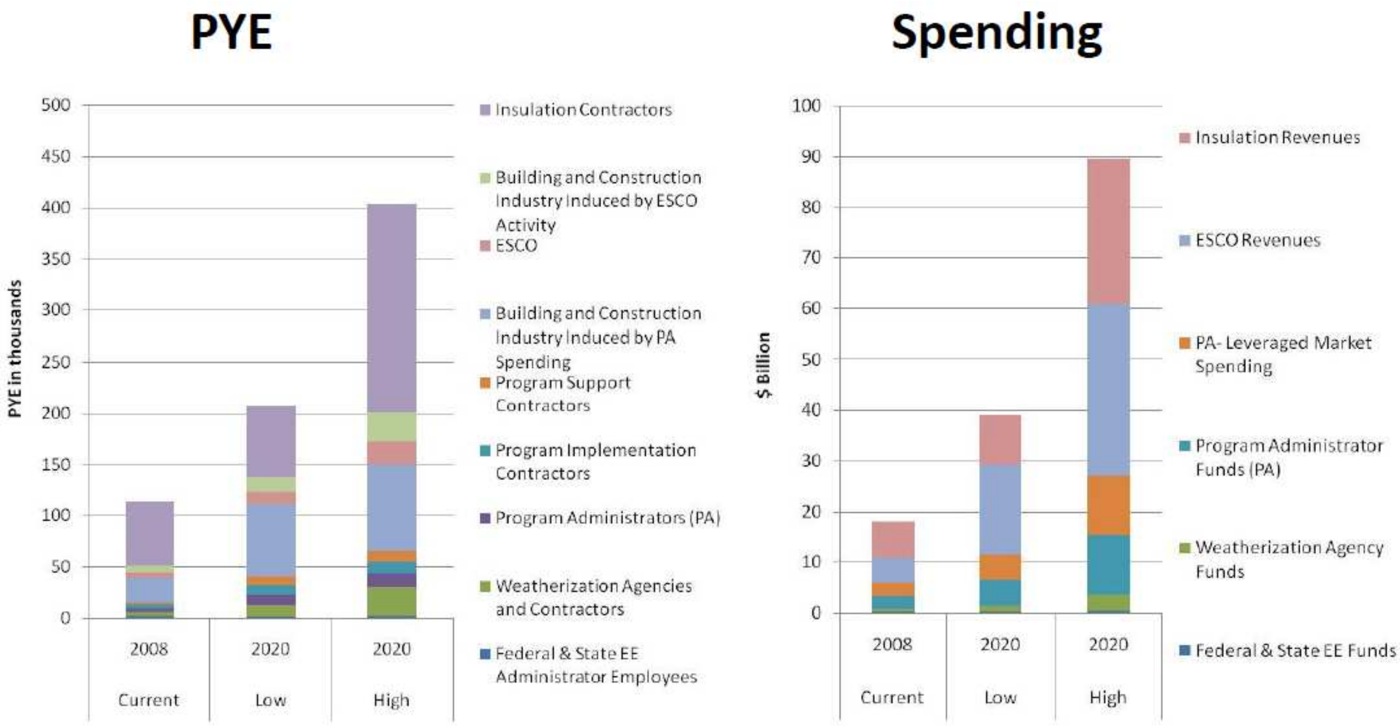
- *Which set of customers is the program designed to serve with available resources?*
- *How many customers can be influenced in a specific period of time?*
- *Which is the best way to access those customers: individually or through mass marketing?*
- *How can City Light influence those customers most effectively: by —providing incentives to reduce the measure cost, providing point-of-sale rebates, educating customers about their options, or other approaches?*

Once implementers determine how to influence the targeted customers to participate, they must develop successful sales strategies. They also must quantify outcomes, including the number of participants and the amount of energy savings, through evaluation, measurement and verification.

Forecasts for Growth in Energy Efficiency Occupations

LBNL researchers also generated forecasts for job growth in energy efficiency based on estimates of future investments in energy efficiency (Figure 10). Preliminary results suggest there will be large growth in employment resulting from expected increases in spending in energy efficiency activities: employment in energy efficiency jobs could quadruple from just over 100,000 person-year equivalents in 2008 to over 400,000 by 2020. The greatest increase in number of jobs would be for insulation-related contracting (perhaps as many as 200,000 jobs by 2020). Energy services companies, government and utility efficiency programs and weatherization programs all could grow substantially. Even the low-spending scenario, which was described by researchers as extremely conservative, shows the energy efficiency workforce doubling by 2020. The high-spending scenario does not include full regulation of greenhouse gas emissions, which would further expand the energy efficiency workforce.

Figure 11. LBNL Estimate of Energy Efficiency Workforce Size – Current and Projected, High and Low Spending Scenarios



Definitions:
PYE – Person-year equivalents
ESCO – Energy services companies
PA – Program administrators

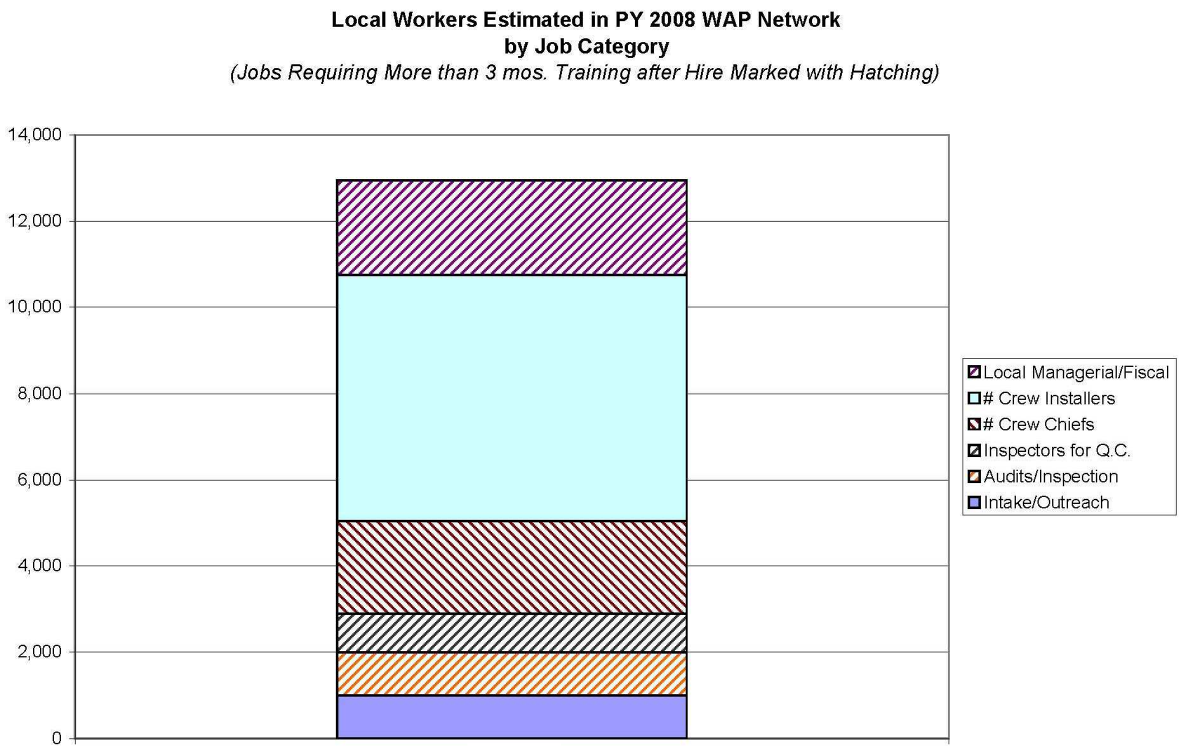
Growth in Federal Spending on Energy Efficiency

Rapid growth in employment will certainly come as a result of federal economic stimulus spending. The federal Weatherization Assistance Program (WAP) alone has received

$60 billion from the American Recovery and Reinvestment Act, and stimulus funding for job creation and education and training programs to support growth of energy efficiency initiatives is available through several federal agencies. In the course of ramping up the Weatherization Assistance Program, estimates were created to identify the type of occupations and number of expected jobs.[61] These estimates, shown in Figures 11 and 12, show a quadrupling of jobs needed to implement the program; the current number of jobs is approximately 13,000 and is expected to grow to 56,000. Crew installers, representing the largest proportion of occupations, are forecast to increase from approximately 6,000 jobs in 2008 to over 35,000 jobs in 2020.

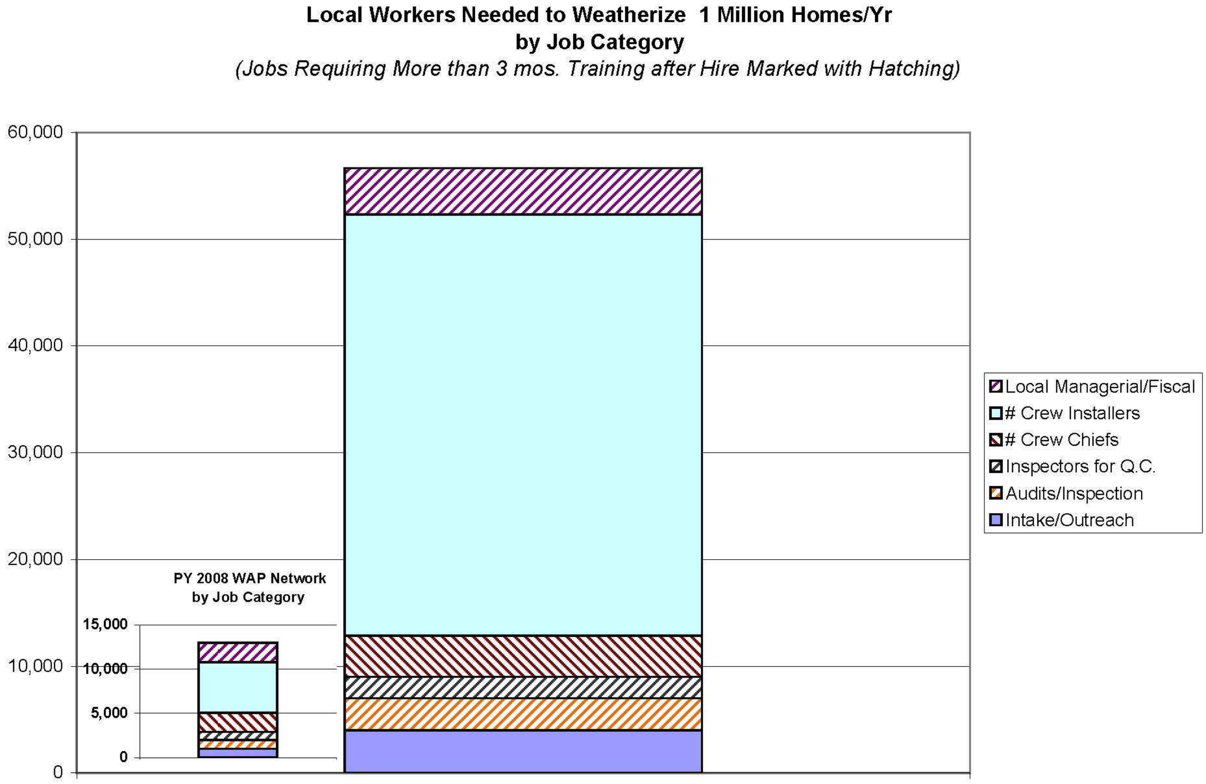
Nearly all low-income weatherization programs in Washington are contracted to local agencies that carry out the work. These agencies receive state and federal funding through the Washington State Department of Commerce. Utility funds may also be used for energy efficiency measures that are eligible for incentives.

Figure 12. 2008 Weatherization Program Jobs and Job Type



Definitions: PY – Person years. WAP – Weatherization Assistance Program.

Figure 13. 2020 Expected Weatherization Program Jobs and Job Type



Definitions: PY – Person years. WAP – Weatherization Assistance Program.

Washington State Energy Efficiency Employment

Washington State recently completed two reports on workforce and job training needs for the green economy that provide some support for the national studies and findings noted above: *2008 Washington State Green Economy Jobs* (referred to below as Green Economy Jobs Study) and *Washington State's Green Economy: A Strategic Framework* (referred to below as Strategic Framework Study).[62] Although these reports did not specifically target energy efficiency, employment or job growth, both reports provide some insights into quantifying the number of jobs and types of occupations, and they begin to identify some specific workforce needs for the energy efficiency sector. The Green Economy Jobs Study also established a statistical foundation for measuring job growth over time, and recently-passed legislation (HB 2227) calls for additional research and a follow-up survey that will examine changes in energy efficiency employment.

The Green Economy Jobs Study research was based on a random sample of all Washington state employers who responded to a survey about business activities and employees who have direct employment in specific green industries. The study identified the green economy as rooted in the development and use of products and services that promote environmental protection and energy security. The study included industries and businesses engaged in:

- Energy efficiency
- Renewable energy
- Preventing and reducing pollution
- Mitigating or cleaning up pollution

"Green jobs" were generally defined as jobs that promote environmental protection and energy security. Over 9,500 private-sector employers responded to the survey, and only jobs directly related to products or services provided by companies were included.

Within those conservative parameters, the study found that green employment represented 47,194 jobs, or about 1.6 percent of total state employment in 2008. As shown in Table 4, energy efficiency jobs make up the most significant portion of green jobs, representing over half of all green jobs in the state. Construction-related industries and occupations account for 70 percent of employment in the energy efficiency sector, followed by professional and technical services such as architecture and engineering.

Table 4. Full and Part Time Employment by Core Green Sector (2008)

Total Full Time and Part Time Green Jobs by Core Area										
	Energy Efficiency		Renewable Energy		Reducing Pollution		Pollution Cleanup or Mitigation		Total by Part Time and Full Time	
	#	%	#	%	#	%	#	%	#	%
Full Time by Core Area	23,241	93%	1,523	75%	12,472	80%	3,815	85%	41,052	87%
Part Time by Core Area	1,735	7%	503	25%	3,204	20%	668	15%	6,110	13%
Total Full Time and Part Time by Core Areas*	24,976	100%	2,027	100%	15,676	100%	4,483	100%	47,194	100%
Percent of All Green Jobs	**52.9%**		**4.3%**		**33.2%**		**9.5%**		**100.0%**	

*****The total for all green jobs is greater than the row and column total by 32 jobs because some respondents did not report green jobs by any core area.

The study concluded that the large proportion of employment in the energy efficiency core area stems in part from the fact that energy efficiency products and services are found in a wide variety of industries and occupations; and that these products and services have strong markets and historical connections with residential, commercial, and industrial construction, which is a significant player in the state's overall economy. The study also noted that the prominence of energy efficiency may also represent the current and future market expectations of construction-related employers, who are positioning themselves to pursue retrofit or renovation-related projects until the market for new building construction rebounds.

The Strategic Framework Study reports that our higher education system has not been sufficiently responsive to the labor market. This is reflected by the demand for jobs in fields which require two and four year degrees relative to the number of students entering those fields. At the same time, it has been difficult to attract and retain younger workers for many energy efficiency occupations.

Pacific Mountain WDA Energy Efficiency Employment

The Green Economy Jobs Study also examined employment within the state's various workforce development areas (WDAs). The Pacific Mountain WDA encompasses Mason, Grays Harbor, Thurston, Lewis and Pacific Counties. The study found that nearly two-thirds of all green economy jobs in the Pacific Mountain WDA were in the energy efficiency sector. As shown in Table 5, while energy efficiency employment represents less than one percent of all employment in the region, the proportion of energy efficiency jobs within the Pacific Mountain WDA was more than 11 percent higher than the state average.

Table 5. Energy Efficiency Employment for Washington and the Pacific Mountain WDA (2008)

	Washington State	Pacific Mountain WDA
Total Employment	2,974,524	172,262
Core Green Jobs	47,194	1,740
Energy efficiency jobs	24,976	1,122
Energy efficiency as % of all employment	0.8%	0.7%
Energy efficiency as % of core green jobs	52.9%	64.5%

Within this region, the fourteen energy efficiency sector occupations with the greatest number of employees identified by the study are listed in Table 6. The remaining 25 occupations mentioned by employers (not shown) all represent one percent or less of the energy efficiency sector.

Table 6. Energy Efficiency (EE) Occupations within the Pacific Mountain WDA (2008)

Occupation	# of Jobs*	% of EE Jobs in Pacific Mountain WDA*	% of EE Jobs in WA
Heating, Air Conditioning, and Refrigeration Mechanics and Installers	240	21.0%	9.4%
Carpenters	187	16.3%	9.6%
Electricians	154	13.4%	14.6%
Roofers	104	9.1%	2.6%
Forest and Conservation Workers	56	4.9%	.2%
Glaziers	52	4.5%	3.3%
Plumbers, Pipefitters, and Steamfitters	47	4.1%	6.7%
Machine Feeders and Offbearers	31	2.7%	0.1%
Architects, Except Landscape and Naval	30	2.6%	5.7%
Farmworkers, Farm and Ranch Animals	27	2.4%	.1%
Loan Officers	26	2.3%	1.4%
Construction Laborers	25	2.2%	8.2%
Maintenance and Repair Workers, General	19	1.7%	.5%
Construction Managers	18	1.6%	2%

*Figures are rounded to the nearest whole number

These data reveal some interesting trends. Energy efficiency jobs clearly cross a wide variety of occupations. Consistent with the overall study findings, the largest proportion of jobs is related to the construction industry. In the Pacific Mountain WDA, the number of jobs in heating/ventilating and air conditioning is more the double the state average. A similar trend exists for carpentry jobs, which account for 9.6 percent of all state energy efficiency jobs identified by a Washington State Employment Security Department survey. A few of these jobs may appear at first glance to have little relationship to the core energy efficiency industry. However, jobs such as loan officers are key to implementing low-interest loans for energy efficiency improvements, a popular energy efficiency initiative offered by many utilities in the region.

Energy Efficiency Industry Structure and Employment

In a recent study analyzing the impact of energy efficiency activities on jobs in California, efficiency activities were found to have compounding economic benefits. The first 1.4 percent of annual efficiency gain produced about 181,000 jobs in California, while an additional 1 percent yielded 222,000 additional jobs. The study recognized that the marginal efficiency gains would be more expensive, but would also have more intensive economic growth benefits.[63]

The predominance of building industry employment in the energy efficiency sector is consistent in the findings of the state's green jobs survey, the LBNL study, the McKinsey report and other studies of the energy-efficiency sector. The findings also suggest differences in employment trends across the industry. Government-funded programs appear to be focused on longer-term, more labor-intensive structural changes in how society uses energy, such as implementing building codes and weatherization programs, which may generate many new jobs.

In contrast, utility-sponsored programs appear to have little overlap with the building industry; they have found their niche in shorter-term technology-based programs, which likely affects employment in the manufacturing sector more than the building sector. Although increased demand for energy efficiency products and new smart grid technologies may stimulate new job growth, it seems unlikely that the number of jobs in manufacturing would increase significantly when production is shifted from traditional appliances or technologies to those that are more energy efficient; these new manufacturing jobs may also not be local, as employment in this sector relies on many national or global suppliers.

Utilities provide important leadership on energy efficiency and related employment. They also offer a unique relationship and outreach opportunity with consumers. However, they are first and foremost energy service providers; some utilities may have limited interest or capacity for providing economic benefits beyond delivering low-cost power to their customers. Municipal utilities are in the unique position of being embedded within organizations serving community goals, and their structure may lend them to be more aware of their role in local economic development and their ability to help achieve broader social and economic objectives. For example, while Seattle's primary energy efficiency activity emphasizes efficient lighting programs, the city and public utility are also exploring ways to link conservation goals and clean energy investments with economic and workforce development efforts, including supporting programs (like Seattle Jobs Initiative) that link low-income, low-skill Seattle residents with associated training and job opportunities.

Energy Efficiency Workforce Issues

Concerns about shortages of energy efficiency workers have generated much discussion both in terms of current and future labor shortages. A recent survey of eight energy efficiency occupations in the San Francisco area determined that these occupations are projected to increase substantially in the next three years, creating thousands of jobs in that region.[64] Employers reported existing difficulty hiring qualified workers in all eight occupations. Community colleges in that area are currently exceeding capacity in energy efficiency-related classes, and they are rapidly expanding courses, certificates and programs to support growth in the industry.

In the Pacific Northwest, the NWPCC, in partnership with regional stakeholders, created the Northwest Energy Efficiency Task Force (NEET) to identify infrastructure elements needed to advance energy efficiency achievement in the region. One of the working groups within the Task Force (Work Group 5) focused on workforce issues and two of the ten final NEET recommendations were related to labor training, education and the labor market. One recommendation calls for defining energy efficiency jobs, establishing skill standards, identifying job classifications and establishing a clearinghouse for jobs. The work group also recommended that the Center of Excellence for Energy Technology at Centralia College should be expanded to provide a strategic coordinating body to partner with other entities and advise on training program expertise and regional needs for workforce development.

Washington and the Pacific-Mountain region are likely to face some serious challenges to meeting the increased demand for a skilled energy workforce. Washington's workforce in general is growing more slowly than in the past; the aging baby-boom population is fast approaching retirement and will be replaced by a smaller cohort of working-age individuals through 2030.[65] Simultaneously, the population is becoming more diverse, increasing the need for basic language and skill development for populations that have traditionally been underserved by education.[66]

Recent research on the electric utility workforce reveals an imminent labor shortage in that industry: employers report an existing shortage of qualified applicants in occupations across the industry, and with nearly half of the workforce eligible for retirement in the next 10 years, those shortages will grow.[67] To the extent that energy efficiency occupations rely on utility craft and professional workers, this may negatively impact labor markets for the efficiency sector as well.

Labor shortages in the energy efficiency industry are likely to be exacerbated by growing competition for fewer qualified workers, which is a condition many employers already face. The Workforce Training and Education Coordinating Board (WTECB) 2007 survey of Washington employers found that 60 percent of all Washington employers (and 33 percent of all Pacific-Mountain WDA employers) had difficulty finding qualified applicants for job openings.[68] Eighty-two percent of employers reported difficulty finding applicants with occupation-specific skills, the most common problem reported by employers. The survey showed that the shortage of qualified workers is limiting economic growth.

Many of the specific occupations for which employers have difficulty finding qualified workers are also key occupations in the energy efficiency industry.[69] Sixty-nine percent of construction industry employers in the WTECB survey reported having difficulties finding qualified applicants. This finding may have changed significantly since the economic downturn, but the effect may be temporary; given the emphasis of the recovery efforts on this sector, it seems likely that there will be a shortage of workers with specialized training in energy efficiency techniques within the construction industry to meet short-term demand, and the industry may be forced to complete for a limited pool of skilled energy efficiency workers when the construction industry rebounds.

New jobs and new skills: Early scans of green economy jobs show there is potential for creating new jobs and that new skills will be needed in existing jobs.[70] Although the core work of many existing jobs may not change dramatically, new materials, technologies and work processes for energy efficiency-related construction workers and building operators may pose new skill requirements, demanding more of new trainees and calling for increased upgrade skills training for current workers.[71] Current levels of public and private training may not be adequate to meet the growing and changing demands on these occupations.

Early research on some of the core skills energy efficiency employers have identified include a number of technical and general employability skills.[72] They include:

- Basic math, writing, communication and analysis
- Computers and networks
- Energy technology and energy systems
- Concern for the environment and community
- Technical and plain communication
- Flexible and able to adapt to change

Training opportunities: Postsecondary education has been responding to changes in demand for energy efficiency jobs, and new programs are being developed. Community and technical colleges in Washington have been developing new programs for positions such as energy auditors and sustainable construction practices, however relatively few two-year colleges currently offer energy efficiency as a dedicated program; many programs include energy efficiency within broader subjects such as in environmental sciences, buildings sciences or engineering technology.

A gap still remains between supply and demand for two and four year degrees in occupations such as construction, engineering/architecture, and in occupations supporting research which will be crucial to the energy efficiency industry.[73] Although the number of energy efficiency-specific programs is increasing, this new capacity may still be inadequate to keep pace with industry growth and surging demand for a skilled energy efficiency workforce. Enhancing coordination between the energy efficiency industry and educational institutions would help to expand professional development opportunities and ensure that the foundational skills required by industry are integrated into education and training programs.

Appendix B contains a list of current energy efficiency education and training opportunities in Washington State.

Conclusions and Recommendations

The energy efficiency industry is experiencing rapid growth, and projections suggest that future expansion is imminent. Energy price volatility, supply concerns, technological advances, climate change and other environmental concerns are all contributing to these growth forecasts. These factors will continue to apply pressure on energy resources for the foreseeable future, and are likely to support a steady expansion of efficiency efforts.

The lack of sufficient data and awareness has held back growth in the energy efficiency industry in the past, and these gaps have created new challenges. However, the sense of urgency for using efficiency as a cost-savings and job creation tool is growing. Regardless of how we define, track or measure this industry, growth is underway and expected to continue rapidly in the near term as well as into the future. Existing public policies affecting energy efficiency initiatives are helping to solidify the role of efficiency in helping to achieve national and state energy and climate goals, and new policies are now being developed that will promote future growth in the industry.

Employment projections suggest that the workforce will need to expand rapidly to meet the increasing demand for energy efficiency products and services. Nationally, the greatest increase in number of jobs would likely be for insulation-related contracting (perhaps as many as 200,000 jobs by 2020).[74] Energy services companies, government and utility efficiency programs, and weatherization programs could grow substantially in the coming years. Some estimates show the national energy efficiency workforce doubling by 2020, and there is potential for the employment in this sector to quadruple.[75] The energy efficiency industry in Washington State is large and mature, integrating technologies, industry sectors and occupations that span the economy. In the short term, federal stimulus investments will boost demand for skilled workers and new trainees, while investments in research and development and efficiency-related technologies will create new employment and business opportunities.

The industry will face some serious challenges to developing the energy efficiency workforce of the future. The population in Washington is becoming more diverse, yet population trends show that the size of the state's labor pool is likely to shrink over the next 20 years. Initial research shows that employers are already finding it difficult to find qualified workers to fill energy efficiency-related job openings at all levels, and new types of occupations and skill requirements are emerging.[76] To meet current and projected needs, existing workers will need upgrade training to adapt to technology changes, new materials and work processes, while greater efforts will be needed to attract, train and recruit new workers to the industry.

Some research on energy efficiency occupations and training needs have identified the need for stronger federal and state roles to support future growth in the energy efficiency industry. There may be opportunities for industry leaders and sponsors to augment their support for energy efficiency employment and training to accelerate the development of energy conservation solutions that address broader social, environmental and economic goals. However, the diverse nature of energy efficiency activities and the skills required by related industry sectors has complicated efforts to determine what specific industry sectors, occupational groups and workforce education programs should be emphasized.

Systematic information about the employment and training needs of the industry at the state and regional levels is also lacking, and suggests that additional research is needed to identify specific skills and education requirements for the energy efficiency sector. Expansion of regional and state education and training capacity to support new growth in energy efficiency is needed, but efforts to adapt or expand the existing education and training infrastructure should be based on reliable data that includes input from the industry and other key stakeholders.

Future Actions and Research

In order for the state to maximize the potential of energy efficiency initiatives to address critical climate change, economic development and energy security goals, deliberate action must be taken to ensure the availability of a skilled energy efficiency workforce. This will require some immediate action steps be taken to attract, prepare and support the current and future workforce, but it is also recommended that additional research be conducted in order to fill some of the critical knowledge gaps about the labor and skill requirements of the industry.

The Northwest Energy Efficiency Taskforce provides useful recommendations and strategies for regional coordination among utility and education partners that focus on identifying solutions for workforce development and future labor needs. This regional focus can also help guide the development of a broader strategy for supporting growth in the energy efficiency industry in the state.

Some recommended actions steps and research for Washington include the following:

- Support additional research that focuses specifically on the workforce development needs and labor markets of energy efficiency employers and employees in the region and the state.
- Expand the number and scope of industry partnerships to identify employment needs, and the foundational skills and knowledge requirements, for key sectors of the energy efficiency industry.
- Create new energy efficiency courses, certificates and degree programs and enhance existing programs to boost education and training system capacity.
- Conduct and apply research on best practices, model curriculum, industry-defined skill standards, and certifications for current and future training programs.
- Raise the visibility of energy efficiency careers and educational opportunities among youth and job seekers to expand the future workforce pipeline.
- Support development of an industry and labor market information system that provides high quality data for energy efficiency-related labor markets, education and training opportunities and employment.

Definitions

Average megawatt (aMW or MWa): An average megawatt equals the average number of megawatt-hours, not megawatts, over a specified time period. For example, over the course of one year, one average megawatt is equal to 8,760 megawatt-hours, or 24 hours x 365 days x 1 megawatt. 1 aMW serves approximately 730 households. 1 average Megawatt is equal to 8,760,000 Kilowatt hours.

Avoided cost: Also called “marginal costs,” avoided costs are costs the utility avoids paying by investing in conservation rather than other generation-based resources.

British Thermal Unit (BTU): The quantity of heat required to raise the temperature of 1 pound of liquid water by 1 degree Fahrenheit at the temperature at which water has its greatest density (approximately 39 degrees Fahrenheit).

Kilowatt-hour (kWh): A kilowatt-hour is a measure of electricity defined as a unit of work or energy, measured as 1 kilowatt (1,000 watts) of power expended for 1 hour. One kWh is equivalent to 3,412 Btu. One kWh will operate a 40-watt light bulb for a full day, a 19" color television for about four hours, a personal computer for 2-1/2 hours, an electric hairdryer for 30 to 60 minutes, an electric razor for 36 hours, a clothes dryer for 15 minutes, a microfurnace heater for 40 minutes, a clock radio for up to several days, a portable stereo for as long as a week, and a telephone answering machine for as long as a month. The typical Northwest household’s annual electrical use is 12,000 kWh.

Market transformation: Market transformation is a strategy that promotes the manufacture and purchase of energy-efficient products and services in order to induce lasting structural and behavioral changes in the marketplace and increase adoption of energy-efficient technologies.

Megawatt (MW): A standard unit of electrical power equal to 1,000 kilowatts, or 1 million watts. Like watts and kilowatts, the term “megawatt” is used as a standard measure of electric power plant generating capacity, although larger in scale.

Megawatt-hour (MWh): 1 megawatt acting over a period of 1 hour. One megawatt-hour is equal to 1,000 kilowatt-hours or 1 million watt-hours. The primary difference between a megawatt and a megawatt-hour is that “megawatt” measures the capacity of an electric generator and “megawatt-hour” measures the actual amount of electricity it produces over a certain period of time.

Quad: Quadrillion BTU.

Acronyms

ACEEE: American Council for an Energy Efficient Economy
BPA: Bonneville Power Administration
EE: Energy efficiency
LBNL: Lawrence Berkeley National Laboratory
NEEA: Northwest Energy Efficiency Alliance
NEEC: Northwest Energy Efficiency Council
NWPCC: Northwest Power and Conservation Council
Pac-Mt: Pacific Mountain Workforce Development Region (Grays Harbor County, Mason County, Pacific County, Thurston County and Lewis County)
WDA: Workforce Development Area

Energy Conversion Factors

Convert from:	**Convert to:**	**Equation:**
Kilowatt-hour (kWh)	Megawatt-hours (MWh)	kWh ÷ 1000 = MWh
Megawatt hours	Average megawatt	MWh ÷ 8760 (# hours/year) = aMW

Appendix A

Economic Drivers of Residential Demand

Excerpts from "Economic Drivers of Residential Demand," ***Draft Sixth Northwest Power Plan,*** **Appendix B: Economic Forecast, page 3 and page 6, Northwest Power and Conservation Council,**
http://www.nwcouncil.org/library/2009/2009-03.htm

> The number of dwellings is a key driver of energy demand in the residential sector. Residential demand begins with the number of units, including single family, multifamily, and manufactured homes. This demand is forecast to grow at 1.7 percent annually from 2010-2030. The current (2007) stock of 5.6 million homes is expected to grow to 7.6 million by 2030, or approximately 88,000 new homes per year.
>
> Another factor affecting residential demand for electricity is life-style trends. As more homes are linked to the internet and the saturation rate for air-conditioning appliances and electronic equipment increases, demand for electricity in the residential sector increases. Over 80 percent of all new homes in the region now have central air conditioning. This compares to 7-8 percent of housing stock with central air conditioning in the 1980s. Another change is the growth rate in home electronics, which has been phenomenal at over 6 percent per year since 2000, and which is expected to continue to increase.
>
> In the residential sector, electricity demand is driven by space heating and cooling, as well as refrigeration, cooking, washing, and a new category called Information, Communication and Entertainment (ICE). This new category includes all portable devices that must be charged, such as laptop computers and cell phones, as well as larger, more energy-intensive televisions and gaming devices. As the regional population grows, and with it the number of homes, demand for these and other appliances will also increase. The energy efficiency of appliances as dictated by state and federal standards, which appliances consumers buy, and how they use them, affect energy demand, as well.
>
> …
>
> While the number of occupants per household has declined, the square footage of homes has been increasing. According to the U.S. Bureau of Census's annual survey of new homes, the average single-family house completed in 2007 had 2,521 square feet, 801 more square feet than homes in 1977. Going back to the 1950s, the average square footage of a new single-family home was about 983 square feet. Over the past five decades, the average home size has grown by more than 250 percent. In 2007, 38 percent of new single-family homes had four or more bedrooms, almost twice the number of bedrooms in most homes built 20

years ago. In addition, 90 percent of these new homes had air conditioning. These changes have meant an increased demand for space conditioning and lighting.

Appendix B
Energy Efficiency Education and Training

Washington State offers a number of postsecondary education and training opportunities focused on advancing energy efficiency knowledge and skills, however relatively few offer energy efficiency as a dedicated program. Many programs include energy efficiency within broader subjects such as in environmental sciences, buildings sciences or engineering. This list emphasizes community and technical college programs in Washington with either a primary focus in efficiency or which may have significant relevance to the energy efficiency industry.

In addition to the list of degrees, certificates and courses below, Washington State has eleven colleges that have been named “Centers of Excellence.” Each Center focuses on an industry which is strategic to the economic growth of a region or state. The Centers are Washington’s hubs for education and training, resources for industry, educators, and colleges, and for convening state and regional workforce networks. Two of these centers, the Center of Excellence for Energy Technology at Centralia Community College and the Construction Center of Excellence at Renton Technical College, have common interests with the energy efficiency industry.

Please note this list was compiled in June, 2009 and may not include all programs. Course offerings change frequently.

Energy Efficiency Industry Core Skills Programs		
Program Title	**Degree/ Certificate or Course**	**Description**
Bates Technical College (Tacoma)		
Civil Engineering	AAS Degree	Bates Technical College is a U.S. Green Building Council (USGBC) approved education provider for its online green construction and remodeling series.
HVAC+R Technician	AAS Degree	
Facilities Maintenance Engineer	AAS Degree	Bates' continuing education on-line Green Construction courses and Certificate were developed in coordination with their two-year degree construction related programs including (but not limited to) Architectural Engineering, Carpentry, Electrical Construction,
Electrical Construction	AAS Degree	
Green Construction and Remodeling	Certificate	Bates Technical College is a U.S. Green Building Council (USGBC) approved education provider for its online green construction and remodeling series.
Bellevue College (Bellevue)		
Green/Sustainable Design	Certificate	This certificate is designed to help students meet the diverse needs of businesses in the design of "green" interior environments or specialist in healthy interiors.
Bellingham Technical College (Bellingham)		
Building Construction Technology	AAS Degree	BTC is developing a Weatherization certificate to teach home energy audits and retrofits
HVAC & Refrigeration	AAS Degree	
Construction Technician	Certificate	
Residential Home Inspection	Certificate	BTC is developing a Weatherization certificate to teach home energy audits and retrofits

Energy Efficiency Industry Core Skills Programs		
Program Title	**Degree/ Certificate or Course**	**Description**
Cascadia Community College (Bothell)		
Environmental Technologies and Sustainable Practice	AAS-T Degree	This program teaches students to measure, monitor, and recommend actions to reduce energy use and applications in commercial settings. All graduates will have a business and scientific basis for choosing actions.
Energy Management	Certificate	This certificate prepares students to enter the rapidly emerging field of energy management, with an emphasis on energy auditors, energy analysts, building technician, resource conservation manager, efficiency manager, measurement and verification technician, and system technician.
Centralia Community College (and via ITV to Wenatchee, Peninsula, and Grays Harbor Colleges)		
Energy Efficiency	AAS Energy Technology Program (5 credits)	An overview study of energy efficiency concepts related to efficient and cost effective electricity use. Topics covered will be electricity terms, insulation, windows, lighting, HVAC, energy audits, and alternative energy sources. Course will also look at the societal and political influences of de-regulation and lessons learned from industry covering the generation of electricity from current existing sources and a look at alternative renewable green energy sources including solar, wind, biomass, and ocean waves.
Clover Park Technical College (Lakewood)		
Environmental Sciences and Technology	AAS Degree	Students have the opportunity to perform hands-on water quality monitoring; soil, water, and air sampling; mineral identification; wetland delineation and restoration; geographic information system mapping and simulated hazardous waste site cleanup operations. The subject of energy efficiency is an important topic throughout.
Hybrid and Alternative Fuel Technologies (pending)	AAS Degree	Students learn how to make vehicles more energy efficient.
Green Design	Certificate	This program focuses on topics such as historic preservation, sustainable environments, and energy efficient design.

Energy Efficiency Industry Core Skills Programs		
Program Title	**Degree/ Certificate or Course**	**Description**
Community Colleges of Spokane - Institute for Extended Learning		
Homeowners Environmental Stewardship Program	Non-Credit, Non-Certificate classes	
Green Building Home Owners Series	Non-Credit, Non-Certificate classes	
Online Training in Green/Renewable Energy	Non-Credit, Non-Certificate classes	These online courses will teach the skills needed to excel in the new green economy. Courses offered include: Certified Indoor Environmentalist (CIE), Certified Microbial Investigator (CMI), Certified Indoor Air Quality Manager (CIAQM), Intro to Building Energy Efficiency, Weatherization Energy Auditor, Building/Home Energy Analyst (HERS), Fundamentals of Solar Hot Water Heating, Photovoltaic System Design & Installation, Solid Waste Operations Certificate, Certified Sustainability Professional, Green Supply Chain Professional, Green Building Sales Professional , Green Building Technical Professional, LEED Certification Prep and Smart Home Technology.
National Sustainable Building Advisor Program	Certificate	This program teaches students to analyze the costs and benefits of incorporating sustainable building measures, financial incentives and technical assistance offered by governments, utilities and non-profit organizations; work with architects, designers, builders, building operators, and utilities to improve a building's performance; establish a sustainable design goal for project development; assist in the education and training of staff in sustainable building, identify the key practices of sustainable building and establish competencies in applying LEED, Built Green and other standards.

Energy Efficiency Industry Core Skills Programs		
Program Title	**Degree/ Certificate or Course**	**Description**
Edmonds Community College (Edmonds)		
Construction Management	ATA Degree	
Restoration Horticulture	ATA Degree	This program teaches students the art and science of Restoration Horticulture. Topics include native plants, green roofs, green walls, bioswales, and rain gardens. This new degree is part of the college's sustainability efforts, which include the development of curriculum to teach environmentally, economically, and socially sustainable practices.
Energy Management	ATA Degree	This degree focuses on skills needed for residential energy auditors, commercial lighting auditors, energy accounting specialists, energy efficiency technicians, and construction and weatherization. This new degree is part of the college's sustainability efforts, which include the development of curriculum to teach environmentally, economically, and socially sustainable practices.
Construction Industry Training	Certificate	
Lake Washington Technical College (Kirkland)		
Science Technician (Energy Specialty)	AAS Degree	
Bio Energy	Certificate	
Energy Technology	Certificate	

Energy Efficiency Industry Core Skills Programs		
Program Title	**Degree/ Certificate or Course**	**Description**
Olympic College (Bremerton)		
National Sustainable Building Advisor Program	Certificate	This program teaches students to analyze the costs and benefits of incorporating sustainable building measures, financial incentives and technical assistance offered by governments, utilities and non-profit organizations; work with architects, designers, builders, building operators, and utilities to improve a building's performance; establish a sustainable design goal for project development; assist in the education and training of staff in sustainable building, identify the key practices of sustainable building and establish competencies in applying LEED, Built Green and other standards.
Seattle Community College (North) (Seattle)		
HVAC Service	AAS Degree	
Green Real Estate	Certificate	The two quarter certificate includes some continuing education fulfillment and qualification as a Built Green Certified Professional. The 7 courses that make-up the program cover topics such as green building materials, energy efficient design and development, healthy buildings, indoor air quality, marketing and more.
HVAC Service	Certificate	
Seattle Central Community College (Seattle)		
National Sustainable Building Advisor Program	Certificate	This program teaches students to analyze the costs and benefits of incorporating sustainable building measures, financial incentives and technical assistance offered by governments, utilities and non-profit organizations; work with architects, designers, builders, building operators, and utilities to improve a building's performance; establish a sustainable design goal for project development; assist in the education and training of staff in sustainable building, identify the key practices of sustainable building and establish competencies in applying LEED, Built Green and other standards.

Energy Efficiency Industry Core Skills Programs		
Program Title	**Degree/ Certificate or Course**	**Description**
South Seattle Community College (Seattle)		
Weatherization and Sustainable Building Management. (Pending)	Certificate (pending)	Working on developing new certificate and degree programs in conservation, weatherization, and building sustainability management. Working on pre-apprenticeship, apprenticeship, contract, and credit-bearing options. Expanding residential energy auditing program into multi-family and commercial.
Residential Energy Auditor	Certificate	The Energy Auditor course and certificate (12 credits) for residential buildings is expanding into multi-family and eventually commercial energy auditing. The course is targeted for those in the electrical trades in coordination with the electricians, energy and utility workers, and conservation and weatherization fields. Developing the commercial and multi-family applications is underway. This course trains students for the BPI exam.

Energy Efficiency Industry Core Skills Programs		
Program Title	**Degree/ Certificate or Course**	**Description**
Shoreline Community College (Shoreline)		
Zero Energy Building Practices	Certificate of Proficiency	Program teaches sustainable building design, construction, maintenance and management. Emphasis is on residential and commercial building design with specialties in passive solar and sustainable (green) building design and photovoltaic (solar electric) system design.
Zero Energy Building Practices	Certificate (short term)	The Zero Energy Building Practices Certificate will provide students with the beginning steps in theoretical and practical knowledge and skills necessary for a career in sustainable building design, constructions, maintenance and management. Emphasis is on residential and commercial building design with specialties in passive solar and sustainable (green) building design and photovoltaic (solar electric) system design.
Energy Audit 1: Residential	Certificate (short term)	This certificate includes training in the principles of energy auditing and weatherization inspection. Students will learn the principles of energy, energy and the building shell, energy auditing, air leakage, insulation, windows and doors, heating and cooling systems, indoor air quality, lighting and appliances, and water heating. Students will be trained to conduct energy audits and work with utility customers in the field. This course is the beginning step in acquiring knowledge to pass the BPI National Certification Exam for Energy Auditors.
Energy Audit 2: Commercial	Certificate (short term)	This certificate includes training in the principles of energy auditing and weatherization inspection. Students will learn the principles of energy, energy and the building shell, energy auditing, air leakage, insulation, windows and doors, heating and cooling systems, indoor air quality, lighting and appliances, and water heating. Students will be trained to conduct energy audits and work with utility customers in the field. This course is the beginning step in acquiring knowledge to pass the BPI National Certification Exam for Energy Auditors.
Pre-Apprenticeship Training for Green Careers in the Trades	Certificate (short term)	

Energy Efficiency Industry Core Skills Programs		
Program Title	**Degree/ Certificate or Course**	**Description**
Sustainable Business Leadership	Certificate (short term)	Students will develop skills to implement sustainable business practices within their own companies. Students who successfully complete the certificate should be able to: explain the importance of sustainability in business, discuss types of sustainability initiatives, understand the role of business in society, describe various marketing practices surrounding sustainability, develop sustainability assessments, report sustainability progress, and use diagrams to create sustainability systems.
Clean Energy Technology	AAAS Degree	This program provides students with the theoretical and practical knowledge and skills necessary for a career in sustainable building design, construction, maintenance and management. Emphasis is on residential and commercial building design with specialties in passive solar and sustainable (green) building design and photovoltaic (solar electric) system design. This training will enable students to prepare for the Silicon Energy Manufacturing Solar Installation Certification and the National PV Installer Certification through the North American Board of Certified Energy Practitioners (NABCEP).

Energy Efficiency Industry Core Skills Programs		
Program Title	**Degree/ Certificate or Course**	**Description**
Walla Walla Community College (Walla Walla)		
Energy Systems Technology - Refrigeration and Air Conditioning	Certificate	Energy Systems Technology is designed to meet the emerging needs of the expanding energy industry. Students learn the principles of energy as they relate to electricity, mechanics, and refrigeration and air conditioning.
Energy Systems Technology - Electrical	Certificate	Energy Systems Technology is designed to meet the emerging needs of the expanding energy industry. Students learn the principles of energy as they relate to electricity, mechanics, and refrigeration and air conditioning.
Energy Systems Technology - Mechanical	Certificate	Energy Systems Technology is designed to meet the emerging needs of the expanding energy industry. Students learn the principles of energy as they relate to electricity, mechanics, and refrigeration and air conditioning.
Energy Systems Technology	AAAS Degree	Energy Systems Technology is designed to meet the emerging needs of the expanding energy industry. Students learn the principles of energy as they relate to electricity, mechanics, and refrigeration and air conditioning.
Wenatchee Valley College (Wenatchee)		
Environmental Systems and Refrigeration Technology	Certificate	

Energy Efficiency Industry Core Skills Programs		
Program Title	**Degree/ Certificate or Course**	**Description**
Whatcom Community College (Bellingham)		
Science, Economics, and Politics of Sustainable Resource Use		
National Sustainable Building Advisor Program	Certificate	This program teaches students to analyze the costs and benefits of incorporating sustainable building measures, financial incentives and technical assistance offered by governments, utilities and non-profit organizations; work with architects, designers, builders, building operators, and utilities to improve a building's performance; establish a sustainable design goal for project development; assist in the education and training of staff in sustainable building, identify the key practices of sustainable building and establish competencies in applying LEED, Built Green and other standards.

Additional Educational and Training Opportunities

University of Washington Lighting Design Lab

Lighting Design Program

The Lighting Design Certificate program focuses on the integration and application of light in architecture. This certificate program explores daylighting, electric lighting, and computational lighting analysis, to teach students how to design light that reveals the architecture and supports the visual environment. Its purpose is to give students a comprehensive lighting education focusing on sustainable approaches to light in architecture. The core knowledge areas that are covered include conceptual design, daylighting analysis, lighting metrics, lighting technology, computer modeling, lighting integration, site studies and applied lighting design competitions. The 30 credit certificate is designed to be completed with the Masters in Architecture degree

LEED Certification Training Calendar

http://www.cascadiagbc.org/calendar/month?currentDate=2009%2F06%2F24&xmy=0&xsub=&xsub=Washington

The Cascadia Region Green Building Council (NW Chapter of the U.S. Green Building Council) hosts a calendar of LEED (Leadership in Energy and Environmental Design) trainings offered in the northwest. LEED's Green Building Rating System is a voluntary, consensus-based national standard for developing high performance, sustainable buildings.

ENERGY STAR Existing Buildings Energy Efficiency Training

U.S. EPA's ENERGY STAR Program offers an on-line course on improving the energy efficiency of buildings and business operations. The ENERGY STAR Challenge program is a national effort to improve the efficiency of buildings across America by 10%. All government buildings in Washington State will be participating in this challenge (SB 5854).

http://www.energystar.gov/index.cfm?c=business.bus_internet_presentations

Endnotes

[1] *Workforce Development Needs of the Energy Efficiency Industry Survey Results from Washington and Oregon*, Northwest Energy Efficiency Council, (2008) pg 3: http://www.neec.net/pdf/Workforce_Dev_Needs_11-12-08.pdf

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[4] *"Wedges": Early Mitigation with Familiar Technology*, Robert Socolow, Stephen Pacala, Jeffery Greenblatt, (2004), Proceedings of the 7th International Conference on Greenhouse Gas Control Technologies (pp. 5-9).

[5] *Towards a More Energy Efficient Future*, International Energy Agency (IEA) and the Organization for Economic Cooperation and Development OECD, (2009) (Pg 5): http://www.iea.org/Papers/2009/Indicators_Brochure2009.pdf

[6] *Worldwide Trends in Energy Use and Efficiency*, International Energy Agency (IEA) and the Organization for Economic Cooperation and Development OECD, (2008) Pg 10

[7] *The Growth in Electricity Demand in U.S. Households, 1981-2001: Implications for Carbon Emissions*

Behjat Hojjati, PhD and Stephanie J. Battles, Energy Information Administration (n.d.)(Pg 5): http://www.eia.doe.gov/emeu/efficiency/2005_USAEE.pdf

[8] *Worldwide Trends in Energy Use and Efficiency*, International Energy Agency (IEA) and the Organization for Economic Cooperation and Development (OECD), (2008)

[9] The study is included in the IEA/OCED *Worldwide Trends in Energy Use and Efficiency,* (2008). The following 19 countries participated in the International Energy Agency's Household Energy Efficiency study: Australia, Austria, Canada, Denmark, Finland, France, Germany, Ireland, Italy, Japan, Republic of Korea, Netherlands, New Zealand, Norway, Spain, Sweden, Switzerland, United Kingdom and United States.

[10] *Unlocking Energy Efficiency in the U.S. Economy*, McKinsey and Co., July 2009 http://www.mckinsey.com/clientservice/electricpowernaturalgas/US_energy_efficiency/

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[12] See Page vii

[13] *Washington Electric Utility- Sector Energy Efficiency Policies*, American Council for an Energy-Efficient Economy:http://www.aceee.org/energy/state/washington/wa_utility.htm

[14] For details on Initiative 937, see Wash Dept of Commerce website: http://www.commerce.wa.gov/site/1001/default.aspx

[15] *Green Recovery: A Program to Create Good Jobs and Start Building a Low-carbon Economy,* Center for American Progress and the Political Economy Research Institute, University of Massachusetts, Amherst (September). See also: *Green-collar jobs in America's cities: Building pathways out of poverty and*

careers in the clean energy economy. Washington, DC: The Apollo Alliance and Green For All, 2008. Also: *Green Jobs: Towards decent work in a sustainable, low-carbon world.* Also see: Bournakis, A., Cuttica, J., Mueller, S. & G. Hewings (2005). Also: *The economic and environmental impacts of clean energy development in Illinois*. Chicago, IL: The Energy Resources Center, University of Illinois at Chicago, and the Regional Economics Application Laboratory, University of Illinois at Urbana-Champaign (June).

[16] Recovery.gov: http://www.recovery.gov/

[17] Recovery.wa.gov: http://www.recovery.wa.gov/

[18] The full title of the Act is: Pacific Northwest Electric Power Planning and Conservation Act (16 USC 839) [Section 1 of the Act]

[19] The full title of the Council is: Pacific Northwest Electric Power and Conservation Planning Council (16 USC839b) [Section 4(a)(2)(A) of the Act]

[20] Cogeneration, or combined heat and power, is the simultaneous production of electricity and useful heat from the same fuel or energy. Facilities with cogeneration systems use them to produce electricity, and use the waste heat for process steam, hot water heating, space heating, and other thermal needs.

[21] NWPCC's *Draft Sixth Northwest Power Plan* can be found: http://www.nwcouncil.org/energy/powerplan/6/default.htm

[22] An average megawatt equals the average number of megawatt-hours, not megawatts, over a specified time period. For example, over the course of one year, an average megawatt is equal to 8,760 megawatt-hours, or 24 hours x 365 days x 1 megawatt.

[23] Northwest Power and Conservation Council, Columbia River History, Energy Efficiency section: http://www.nwcouncil.org/history/EnergyEfficiency.asp, *The Power of Efficiency*, Northwest Energy Coalition (2009) http://www.nwenergy.org/power, NWPCC Conservation Resources Advisory Committee presentation: http://www.nwcouncil.org/energy/crac/meetings/2009/06/Default.htm

[24] Examples of the Alliance's market transformation efforts include increasing the availability of energy-efficient appliances, particularly compact fluorescent light bulbs. For general information about market transformation see: http://www.cee1.org/cee/mt-primer.php3 or the Alliance's website for specific programs: http://www.nwalliance.org/

[25] Northwest Power and Conservation Council Draft Sixth Plan (pg 4-17): http://www.nwcouncil.org/energy/powerplan/6/default.htm

[26] Northwest Power and Conservation Council Draft Sixth Plan (pg 4-16): http://www.nwcouncil.org/energy/powerplan/6/default.htm

[27] NWPCC 6th Plan Demand Forecast (pg 7): http://www.nwcouncil.org/library/2009/2009-03.htm

[28] NWPCC Draft 6th plan, Summary of Key Findings "The Council identified just under 7,000 average megawatts of technically achievable conservation potential in the medium demand forecast by the end of the forecast period, at a levelized (net) life-cycle cost of up to $200 per megawatt-hour (2006 dollars). Sources of potential savings are about 50 percent higher than in the Fifth Power Plan. The assessment is higher for two principal reasons. First, the Council identified new sources of savings in areas not addressed in the Fifth Power Plan: consumer electronics, outdoor lighting, and the utility distribution system. Second, savings potential has increased significantly in the residential sector as a result of technology improvements and in the industrial sector as a result of a more detailed conservation assessment. Not all of the 7,000 average megawatts identified will prove to be cost-effective to develop. The Council uses its portfolio model to identify the amount of conservation that can be economically developed."

[29] *Utility Conservation Achievements Report*, Northwest Power and Conservation Council: http://www.nwcouncil.org/energy/rtf/consreport/Default.asp

[30] The Northwest Power and Conservation Council has more information on the *Conservation Resource Advisory Committee* website: http://www.nwcouncil.org/energy/crac/

[31] *Preliminary Draft Demand and Economic Forecasts for the Sixth Power Plan (2009):* http://www.nwcouncil.org/library/2009/2009-03.htm

[32] Northwest Power and Conservation Council Draft Sixth Plan: http://www.nwcouncil.org/energy/powerplan/6/default.htm

[33] NWPCC Utility Conservation Achievement Reports: http://www.nwcouncil.org/energy/rtf/consreport/Current.asp

[34] NWPCC Draft Plan Proposed Regional Conservation Targets fro 2010-2014 http://www.nwcouncil.org/news/2009/06/(P-3)%20DrafPlanTargets_061009-D2.ppt#277,20, The "Big Picture"

[35] Clark County Public Utility District 2008 Annual Report, Pg 23: http://www.clarkpublicutilities.com/aboutus/annualReports

[36] Chelan County Public Utility District Efficiency page: http://www.chelanpud.org/energy-conservation.html

[37] Grant County Public Utility District conservation page: http://www.gcpud.org/conservation/index.htm

[38] Grays Harbor County Public Utility District energy services website: https://www.ghpud.org/index.php?option=com_content&task=view&id=25&Itemid=35

[39] Lewis County Public Utility District energy efficiency information: http://www.lcpud.org/energyefficiency.html

[40] Mason County Public Utility District #1conservation pages: http://www.masonpud1.org/electric_conservation.html

[41] Mason County Public Utility District #3's Energy Services website: http://www.masonpud3.org/powerSupply/energyTips.aspx

[42] Pacific County Public Utility District #2's Energy Services website: http://www.pacificpud.org/es.html

[43] Seattle City Light's Five Year Conservation Program: http://www.seattle.gov/light/conserve/

[44] Initiatives mentioned in Seattle's Conservation Plan include the National Action Plan for Energy Efficiency, I-937, the Northwest Power and Conservation Council, Bonneville Power Administration, congressional action such as the 2005 Energy Policy Act and the 2007 Energy Independence and Security Act and social justice initiatives.

[45] Snohomish County Public Utility District 2008 Annual Report: http://www.snopud.com/about/finrate/annual.ashx?p=1865#

[46] Tacoma Power Conservation page: http://www.mytpu.org/tacomapower/conserve-energy/Default.htm

[47] Avista's conservation program data can be found on the Washington Utility and Transportation website: http://www.wutc.wa.gov/webimage.nsf/8d712cfdd4796c8888256aaa007e94b4/0b2e39343c0be04a88256a3b007449fe!OpenDocument See Docket #082272, filed 04/24/2009

[48] PacifiCorp's Demand-side Management website: http://www.pacificorp.com/Article/Article75535.html

[49] Puget Sound Energy's Energy Efficiency website: http://www.pse.com/energyEnvironment/renewableenergy4/Pages/energyEfficiency.aspx

[50] Washington State Building Code Council: http://www.sbcc.wa.gov/

[51] Conversations with Gary Nordeen, WSU Extension Energy Program Building Science Specialist

[52] I-937 Rulmaking: http://www.cted.wa.gov/site/1001/default.aspx. See also: *Annual Report to Congress and Citizens of the Pacific Northwest*, Bonneville Power Administration (2007): http://www.nwcouncil.org/library/2008/2008-02.pdf

[53] *Washington State Utility Plans Report (2008):* http://www.cted.wa.gov/site/1140/default.aspx

[54] *Engrossed Second Substitute Senate Bill 5854:* http://bcap-energy.org/files/WA_SB5854_2ndEngrossed.pdf

[55] ACEEE State Energy Database contains links to specific activities: http://www.aceee.org/energy/state/washington/wa_index.htm

[56] ACEEE State Energy Efficiency Scorecard: www.**aceee**.org/pubs/e086_es.pdf

[57] *Putting renewables to work: How many jobs can the clean energy industry generate?* Kammen, D., Kapadia, K, and Fripp, M. (2004), Berkeley, CA: Goldman School of Public Policy, University of California. See also: *Green collar jobs in the U.S. and Colorado: Economic drivers for the 21st Century*, Bezdek, R. (2009), Management Information Services for the American Solar Energy Society, www.ases.org (January).

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[59] *The Size of the U.S. Energy Efficiency Market: Generating a More Complete Picture* Karen Ehrhardt-Martinez and John A. "Skip" Laitner, for the American Council for an Energy Efficient Economy (ACEEE), May 2008.

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