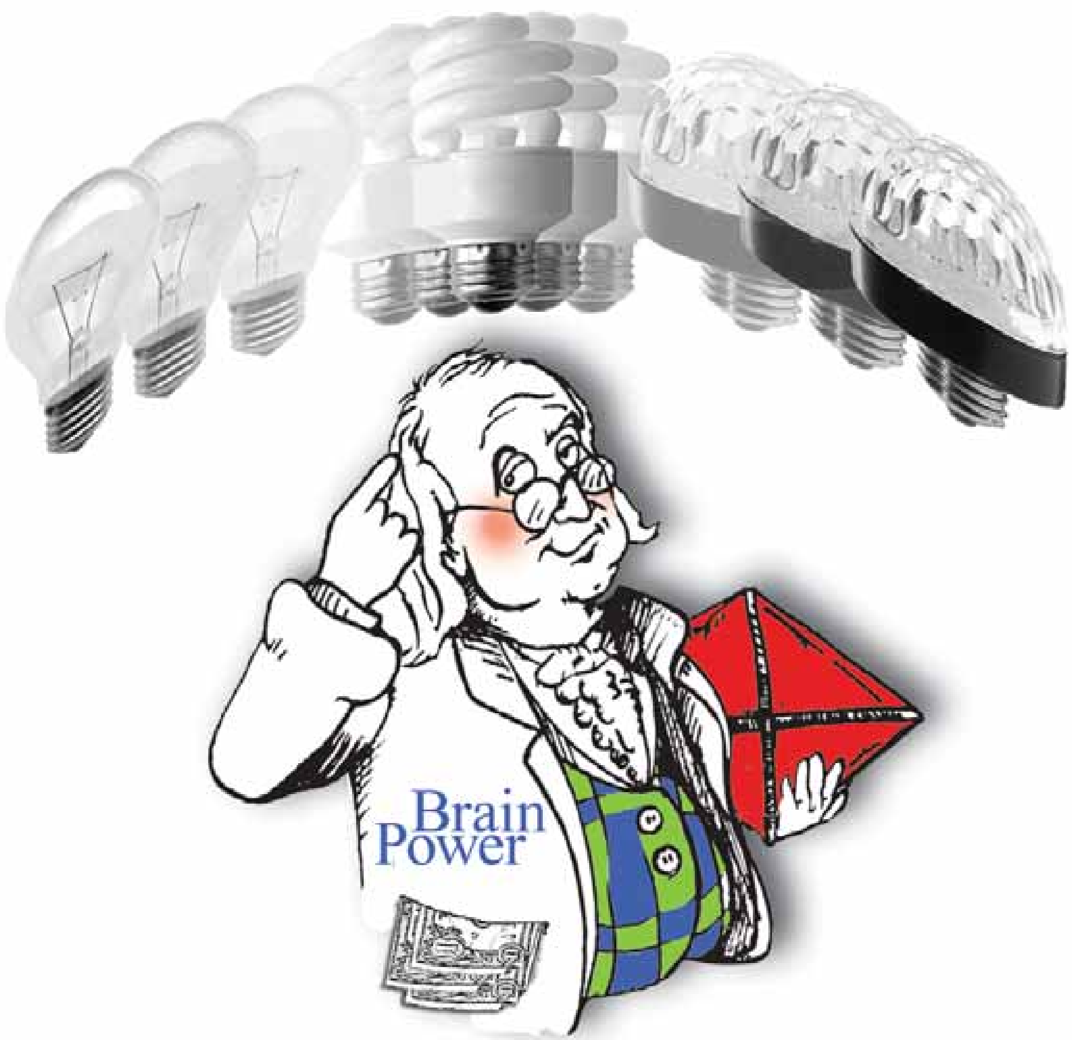
Energy Efficiency



30 Years of Smart Energy Choices

A publication of the
Northwest Power and Conservation Council

Council Document 2010-03

Energy Efficiency

Building on Success for the Next Generation

Introduction

2008 marked the twenty-fifth anniversary of the first Pacific Northwest Electric Power and Conservation Plan produced by the Northwest Power and Conservation Council. That and subsequent plans produced by the Council have been road maps to remarkable achievements in electricity resource development in the Pacific Northwest and remarkable savings for consumers who did not have to pay the higher costs of electricity from generating plants.

Most remarkable is the role that energy conservation—the more efficient use of electricity—has played in meeting the region's electricity needs. Approximately 50 percent of the growth in demand for electricity in the region since 1980 has been met through energy efficiency. That amounts to more than 3,900 average megawatts (34.2 million annual megawatt-hours) that have been supplied not through the construction and operation of new generating resources, but through increasing the efficiency with which we use electricity in our homes, offices, factories, and farms. The average cost of the efficiency has been a little over two cents per kilowatt-hour, well below the cost of power from any generating alternative. Thus, energy efficiency helps reduce the electricity bills paid by consumers.

An average megawatt, a common measure of electricity output, is a megawatt — 1 million watts — delivered continuously 24 hours a day for a period of one year.

Moreover, as the region gained more experience in energy-efficiency acquisition, the cost to utilities declined dramatically. In the process, consumers in the region saved literally billions of dollars—$2.3 billion in 2008 alone—and carbon dioxide emissions were reduced compared to generating the same amount of electricity at power plants that burn fossil fuels—a reduction of 14.9 million tons in 2008 alone. Thousands of jobs were created in the energy-efficiency industry that emerged.

2008 also was the year the Council began development of the next version of the power and conservation plan. The Council issued the Sixth Northwest Power Plan in early 2010. In creating the Sixth Plan, the Council faced a familiar challenge: How to meet the region's electricity needs at the lowest cost. Nationally, electricity generation is the largest source of carbon dioxide emissions. While this is not the case in the Northwest because of the region's large hydroelectricity base, many of the new resources that are being considered by developers and utilities in the region are fueled by natural gas and, as such, are potential sources of greenhouse gas emissions. Reducing demand for power through energy efficiency can help reduce the number of hours thermal power plants operate, thus reducing their emissions. However, the opposite is true, too: Less energy efficiency potentially means more emissions. The Council estimates that if the energy efficiency incorporated in the Sixth Plan is not accomplished, emissions of carbon dioxide will be 17 million tons per year higher by 2030. And it appears increasingly likely that the region will need to achieve even greater reductions through energy efficiency to effectively mitigate climate change. This portends an even greater role for energy efficiency in the future power supply.

'Negawatts'

Amory Lovins of the Rocky Mountain Institute calls the "energy" of energy efficiency "negawatts," as opposed to "megawatts," a common measure of electricity generation. By acquiring "negawatts" of energy efficiency, we achieve the same purposes as acquiring megawatts of generated electricity—comfortable, convenient homes; comfortable, well-lit offices; and productive factories and farms—with less electricity. But building energy efficiency is not like building a conventional power plant. Energy efficiency is incredibly diverse in terms of the technologies employed, the end-uses to which they are applied, the users of the different components, the sources of the funding, and the challenges faced. Many of the end uses to which energy efficiency needs to be applied today did not exist when the Council issued its first regional power plan in 1983. That said, many of the efficiency technologies now in use are relatively new.

In view of the increasing importance of energy efficiency, now is a good time to think about how to deploy it in the future. To that end, it is instructive to review the Northwest's efficiency achievements of the past quarter-century, how they were achieved, and by whom. What we learn will be useful to decision-makers and consumers in the Northwest and to others across the nation, as well.

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The Foundation —The Northwest Power Act

The region's energy efficiency achievements resulted from an extraordinary collaborative effort involving publicly and privately owned utilities, the Bonneville Power Administration, state and local governments, federal agencies, businesses, and ordinary citizens of the Northwest. Many factors contributed to the success. However, the foundation is the Pacific Northwest Electric Power Planning and Conservation Act of 1980—"The Power Act." While several utilities had energy-efficiency programs before 1980, energy efficiency gained real momentum and staying power because of the Power Act.

In a nutshell, the Act's directive is to treat energy efficiency as a "real" resource and acquire that efficiency that is cost-effective.

What made the Act seminal was that it codified energy efficiency, in Section 4.(e)(1), not merely as a personal or social virtue but as a real electricity resource like hydropower, coal-fired power plants, or any other conventional generating source. The Act required the region's largest supplier of electricity, the federal Bonneville Power Administration, to acquire energy efficiency that was "cost-effective." In the Act, this means less expensive from the standpoint of the total cost per unit of energy saved than the next least-expensive, available electricity resource.

To help guide Bonneville in this process, the Act authorized the formation of the Northwest Power and Conservation Council, an interstate compact of the states of Oregon, Washington, Idaho, and Montana and charged the Council with periodically producing a Northwest energy-efficiency and electric-power plan. The plan is developed with broad public involvement and must identify the electricity resource choices available to the region, ranking them in order of cost-effectiveness. Energy efficiency is the highest-priority resource—so important, in fact, that the Act provides a 10-percent cost advantage over other resources. That is, an energy-efficiency measure is considered cost-effective even if it is up to 10-percent more expensive than the next-most-expensive resource. After energy efficiency, priority resources in the Act, and therefore in the power plan, are, in order: renewable resources second, "high-efficiency" generating resources like co-generation third, and all other resources fourth. Bonneville's resource acquisitions are to be consistent with the Council's plan. And while the Council's plan applies only to the Bonneville Power Administration, the plan has become a benchmark against which the plans and resource acquisitions of utilities, both publicly owned and investor-owned, are measured.

The Act also included a requirement for "model conservation standards" applying to, among other things, new and existing structures. These standards were to be designed to capture all the power savings that were cost-effective for the region and economically feasible for consumers, taking into account any assistance made available to consumers under the Act. The Act included the possibility of surcharges on the price of power for the failure to enact these standards. While surcharges never have been enacted, the model conservation standards moved building design and construction in the Northwest to the forefront of energy efficiency.

In a nutshell, the Act's directive is to treat energy efficiency as a "real" resource and acquire that efficiency that is cost-effective. And, by including model conservation standards, the Act reached out to state and local governments as well as to utilities in the effort to implement cost-effective energy efficiency.

How We Got there

Of course, the Act and its directives did not emerge spontaneously. They were the product of approximately 20 tumultuous years of electricity resource development in the Northwest. During the 1960s and much of the 1970s, demand for electricity in the Northwest grew at a pace that approximately doubled every 10 years. This growth was driven by very inexpensive electricity, costing half or less the national average, most of which was produced by federal and publicly owned hydroelectric dams along the Columbia River and its tributaries. Per-capita electricity use in the Northwest was almost twice the national average, largely as a consequence of a very high use of electric heating and appliances and the large number of electricity-intensive industries like aluminum smelters.

However, the ability to expand major hydroelectric capacity was reaching its limit. As power planners looked forward from the vantage point of 1968, they forecast continued high rates of growth in demand and the need for a large number of thermal power plants—as many as 22 coal-fired and nuclear plants—by 1990. The most ambitious promoter of this plan was the Washington Public Power Supply System, a consortium of publicly owned utilities that undertook the construction of five nuclear power plants. Although Bonneville lacked the authority to purchase the output of new power plants, it was able to support the development of three of these plants through a mechanism known as net billing.[1]

Through the 1970s, power plant construction programs were plagued by rising interest rates and significant cost overruns. Although these costs had not yet worked their way into power rates, many could see what was coming and a vigorous debate began to emerge. Some saw demand growth as unchangeable and the options for meeting that demand as limited. For these people, pushing forward with major power plant construction programs and getting federal backing for projects beyond the three net-billed Supply System plants was of paramount importance. Federal backing, it was believed, would result in lower-cost financing. In 1976, the Bonneville administrator issued a “notice of insufficiency” indicating that Bonneville would be unable to meet its customers’ load growth in the future. As much as anything else, this statement leveraged support

Washington Nuclear Plant 3, at Satsop in Grays Harbor County, never was completed.

Energy efficiency was much less expensive than new generating plants, particularly nuclear plants, but was efficiency really a resource equal to generation?

for increasing Bonneville's authority for resource development. Others, however, thought demand would decline as the price of electricity rose, thus making it unrealistic to plan so many new power plants. These people pointed to viable alternative power sources with lower environmental risk than new coal and nuclear plants. They marshaled skillful analyses to support their view. A 1976 study carried out by the architectural firm Skidmore, Owings, and Merrill for Bonneville found that 1995 demand could be reduced by 5 to 33 percent through regional efficiency strategies at costs significantly less than the cost of new power plants. In the same year, the City of Seattle considered whether to participate in one of the later Supply System nuclear plants. The city's Energy 1990 study found that rising electricity rates would significantly dampen demand growth and that energy efficiency could meet much of the city's needs at a much lower price than new generating plants. Seattle subsequently chose not to participate in that nuclear power plant.

These two ideologies collided in Congress in the late 1970s, where an effort was under way to create legislation that would authorize Bonneville to purchase the output of new, non-federal power plants. There were perceived financial benefits from federal participation, but parties were at odds over the fundamental premise: should federal investment back the construction of new power plants or energy efficiency, which would reduce demand and mean fewer new plants would be needed? Energy efficiency was much less expensive than new generating plants, particularly nuclear plants, but was efficiency really a resource equal to generation?

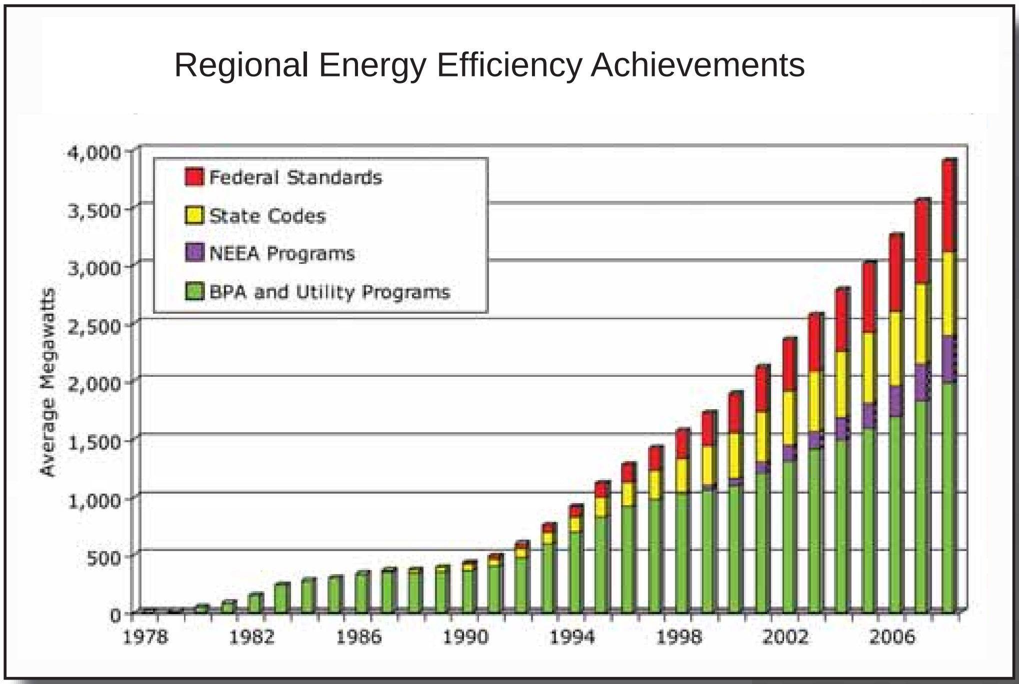
After several years of argument and effort, a compromise emerged and Congress passed the Northwest Power Act of 1980. The Act authorized Bonneville to purchase the output of non-federal power projects but also made energy efficiency Bonneville's highest-priority resource. Thus, Bonneville could meet its demand growth with electricity from new, non-federal power plants only after it first reduced its demand through investments in cost-effective energy efficiency. In fact, the Act mandated that all resources acquired by Bonneville must be cost-effective—an additional boost for efficiency. Additionally, the Council's regional energy planning must be done in public, according to the Act. Thus, energy efficiency became a resource equal to generation.

Building Energy efficiency

Overview of Northwest Energy Efficiency Development

Perhaps the best way to appreciate the scope and reach of the Northwest's energy-efficiency achievements is to look at what has been accomplished over the years. Figure One shows the cumulative energy-efficiency savings accomplished between 1978 and 2008. The savings are broken out by those attributable to Bonneville and utility programs (including, in the later years, savings accomplished through so-called system benefits programs like the Energy Trust of Oregon); activities of the Northwest Energy Efficiency Alliance, which is funded by Bonneville and utilities; state

Figure One



and local building codes; and federal efficiency standards.

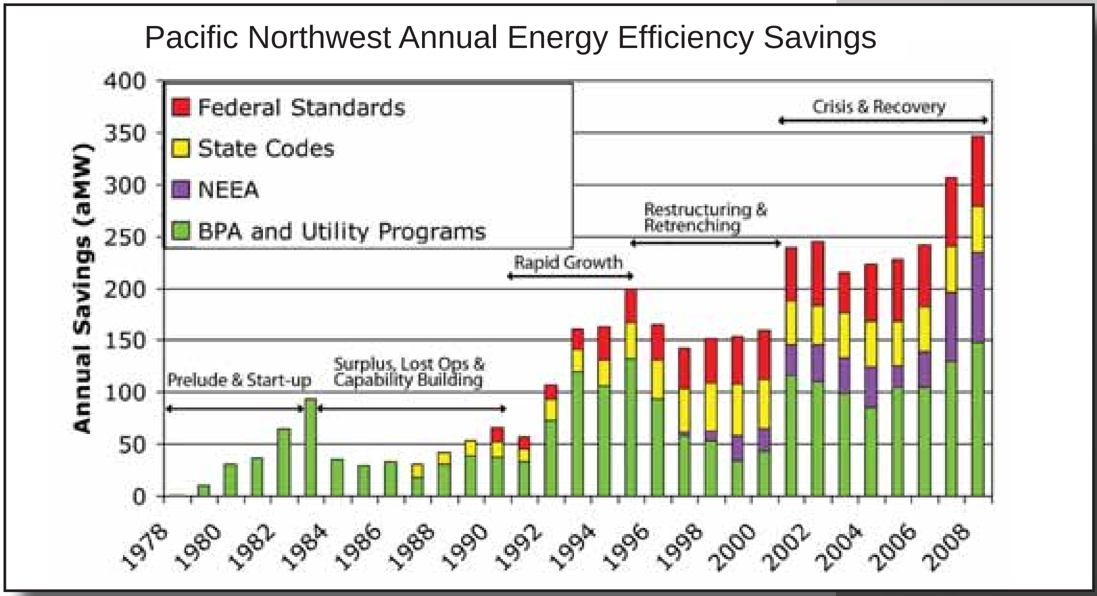
Figure One shows what appears to be relatively smooth growth in energy-efficiency development over the entire 30-year period. And while utility- and Bonneville- funded activities are the largest contributors throughout the period, state codes and federal standards for appliances and equipment contribute significantly in the later years. Overall the results are impressive: 3,900 average megawatts, with almost 2,400 from Bonneville and utility-supported programs and more than 1,500 from state and local energy codes and federal efficiency standards. Bonneville and Northwest utilities also were significant players in achieving the state and federal codes and standards. Buried within these numbers are activities in almost every sector of the Northwest economy—residential, commercial, industrial, and agricultura—and a broad and continually evolving set of approaches to implementing energy efficiency.

As impressive as the cumulative results are, it is instructive to look at the annual savings achieved and, in particular, to focus on the Bonneville- and utility-funded programs.

Figure Two shows more clearly the several stages of Northwest energy-efficiency achievement:

- An initial start-up phase
- A period of surplus power supplies and reduced energy-efficiency development, but also a focus on potential lost opportunities and improving energy-efficiency capability
- A period of rapid growth and rapidly expanding energy efficiency
- A period of retrenchment while the utility industry wrestled with the idea of competitive restructuring, and
- A period that includes the West Coast electricity crisis of 2000 and

Figure Two



When the Act passed in late 1980, the idea of energy efficiency as a resource was very much in its infancy.

2001 and its aftermath, during which energy efficiency assumed even greater importance.

Through these periods, Bonneville and utility funding of energy efficiency followed a roller coaster pattern of ups and downs. The achieved savings generally followed the funding. This largely reflected the ups and downs of the regional and national economies and the efforts of regional utilities to adapt energy efficiency to changing circumstances.

Prelude & Startup

When the Act passed in late 1980, the idea of energy efficiency as a resource was very much in its infancy. But the Northwest hadn't waited for the Act to get started on efficiency. In particular, Bonneville, some publicly owned utilities like Seattle City Light and Eugene Water and Electric Board, and some investor-owned utilities like Puget Power (now Puget Sound Energy), PacifiCorp, and Portland General Electric began offering limited energy-efficiency programs in the mid-1970s.

The thinking behind these efforts was a mix of "energy efficiency is customer service" and "energy efficiency is a resource," depending on whom one asked. Support among the region's utilities was mixed. For many, the concept of paying customers to use less of their product was, at the very least, counter-intuitive. Some believed the market would take care of energy efficiency. That is, if energy efficiency were cost-effective for consumers, they would spend money on efficiency measures in response to the price of power (market signals).

This, of course, overlooked the fact that the cost of a kilowatt-hour is the average cost of all resources in a utility's portfolio—a cost that is far less than the cost of new power generation. Thus, the market signal is seriously distorted. As well, this created an unfair price competition, pitting the cost of energy efficiency against the much lower average cost of electricity, which reflects the large, low-cost hydroelectric base.

The "market-will-take-care-of-it" approach also overlooked some of the significant market barriers energy efficiency faced and, to some degree, still faces from consumers. For example:

- Individual consumers generally are ill-equipped to assess the cost-effectiveness of energy-efficiency choices
- Renters have a disincentive because they pay the electricity bill but do not own the building where the energy-efficiency measures would be installed, and
- Individual and business investment criteria frequently have higher financial hurdles than typical utility investments

The situation was similar in government. During the late 1970s, legislatures in Oregon and Washington enacted energy codes that required some level of energy efficiency in the construction of new residential and commercial buildings. By 1980, Seattle had done the same. But the idea of energy codes to protect homeowners' pocketbooks instead of the traditional health and safety rationale for codes was a difficult concept for many state and local officials. Support for going farther was limited.

On the other hand, the early energy-efficiency efforts generally were well received by customers. In 1979, Washington voters amended the state's very restrictive constitution to permit publicly owned utilities to make energy-efficiency loans to their customers. This showed there really was public support for utility involvement in efficiency.

The passage of the Act at the end of the 1980 Congressional session did not end these arguments, but it moved them to a different plane. The Act provided a legal basis for treating energy efficiency as a resource even though the concept was not fully accepted throughout the utility community. As Bonneville and utilities began to come to grips with the realities of energy-efficiency implementation, a whole new set of questions arose, including:

- What share of energy-efficiency costs should be paid directly by consumers and how much by utilities?
- Should utility expenditures for energy efficiency be limited so that customers who could not participate would not be disadvantaged (the "no losers test")?
- How extensively did energy-efficiency savings need to be verified?
- To what degree would consumers "take back" energy-efficiency savings by raising their thermostats or taking longer showers?

The list was long. But when the Act became law, energy-efficiency activities began in earnest and have grown and evolved over time.

This was an exciting period for energy-efficiency advocates. Finally, they could practice what they had been preaching. A number of relatively young and committed people found their way into the fledgling energy-efficiency staffs of Bonneville, the utilities and state and local government energy agencies. Things began to happen. Much of the initial effort was focused on the residential sector—weatherization, water heater wraps, shower-flow restrictors. Street lighting and commercial lighting also drew attention. By 1983, the year the Council adopted its first power plan, utility energy-efficiency programs had achieved more than 90 average megawatts in efficiency savings, approximately two thirds of which was in the residential sector. This rapid growth was abetted by the fact that by 1980 power rates in the region were beginning to rise dramatically. This was the result of the construction costs of new power plants beginning to enter the rate base. Adjusted for inflation, wholesale power rates jumped 250 percent between 1980 and 1983. As these costs worked their way into retail rates, demand for energy-efficiency services grew. That demand could not have been met without the extraordinary efforts of the energy-efficiency pioneers of those early years.

SMART FACT

FLAT PANEL TVs

Plasmas are energy guzzlers. LCDs are more energy efficient. New, organic LEDs emit their own light and use 40-50% less energy than LCDs.

Surplus/Lost Opportunities, Capability Building

The Council's first Northwest power plan, issued in 1983, introduced an innovation in power-demand forecasting and planning: the so-called "range forecast." The range forecast acknowledged that it was impossible to make a single forecast that would accurately capture 20 years' load growth. Rather, a power plan should have the flexibility to adapt to a wide range of potential growth paths. So the Council produced four load-growth forecasts—high, medium high, medium low, and low. That first power plan anticipated the effect of rising power rates on demand and the potential for energy efficiency to play a major role in meeting the region's future energy needs. The 20-year energy-efficiency potential associated with these forecasts ranged from 5,000 average megawatts in the high forecast to 600 in the low, including the savings from Model Conservation Standards for new construction. The mid-range, 20-year, cost-effective energy-efficiency potential was 2,500 average megawatts.

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By 1983 it also was clear that the region was slipping into a recession, partly attributable to increases in power rates. Electricity-intensive industries were particularly hard hit. Demand growth essentially was flat, and there was a surplus of power generation in the region. Bonneville and utilities cut back on their energy-efficiency activities dramatically. Efficiency achievements dropped two thirds between 1983 and 1984. This

"flexibility" of energy efficiency was touted as a benefit—efficiency efforts, it was argued, could be ramped down and, presumably, ramped up as need dictated.

Fortunately, it also was recognized that many energy-efficiency opportunities potentially are "lost opportunities." That is, some efficiency improvements can only be accomplished cost-effectively when a structure is built or an appliance or piece of equipment is being manufactured. Unless the efficiency is built in at the time of construction, the potential savings are lost for the lifetime of the building or equipment. As a consequence, a great deal of effort went into first demonstrating the feasibility and then the effectiveness of the Model Conservation Standards (MCS) for new construction and then incorporating them into state and local building codes.

The home-building industry was opposed to the residential MCS and sued the Council, challenging its authority to adopt the MCS. The homebuilders lost. Nonetheless, it was clear that getting the MCS into codes would be a challenge. One approach was to encourage through incentives the "early adoption" of the MCS by local jurisdictions. The City of Tacoma became the first early-adopter in 1984, demonstrating it could be done on the scale of a major city. A few smaller cities in the region followed suit. Other approaches focused on building experience in the construction industry with MCS-level construction. First the Residential Standards Demonstration Program provided incentives and technical assistance for builders to build homes to the MCS. This was superseded by the Super Good Cents Program that provided incentives and marketing assistance for builders producing MCS-level homes.

As experience in building to the new codes grew, resistance lessened. In 1986 the Washington State Legislature adopted a residential code that captured approximately 60 percent of the MCS savings. Efforts to achieve the full MCS did not stop, and in 1991, the Washington Legislature adopted the full MCS. Oregon's Building Code Council is on a three-year cycle of code revisions and got up to MCS level by late 1992. By 1987 state codes were contributing significantly to regional energy-efficiency savings. Adoption of the full MCS has been more of a patchwork in the rest of the region, but the use of energy-efficient building practices improved significantly throughout the region. In 2004, Montana implemented MCS-equivalent codes. Idaho did the same in 2006.

Part of the improvement is traceable to the forcing effect that higher standards have had on building technology. A prime case in point is window technology. The MCS were cost-effective with the aluminum-framed, triple-glazed windows available at the time they were adopted. However, when it became clear that the MCS were becoming prevalent in their major market areas, window manufacturers responded with new technologies (vinyl frames, inert-gas fillings, low-emissivity coatings) that yield better performance at lower costs. The Northwest led the revolution in energy-efficient windows.

This also was a period for learning. One question that bothered energy-efficiency planners was what level of "penetration" of energy-efficiency measures actually could be achieved. For example, was it possible to weatherize 100 percent of the eligible homes or just 10 percent? The Hood River Project was conceived to answer the question. A joint project of Bonneville and Pacific Power, the project offered free installation of technically feasible weatherization measures in electrically heated houses in the community of Hood River, Oregon. Under these conditions, 83 percent of the eligible measures, representing 92 percent of the estimated savings, were installed. The actual savings also were monitored, and while they did not meet the estimated levels, some of the shortfall was attributable to the high use of wood-burning stoves in the community prior to the weatherization. The project highlighted many of the non-energy benefits of weatherization improvements such as reduced air

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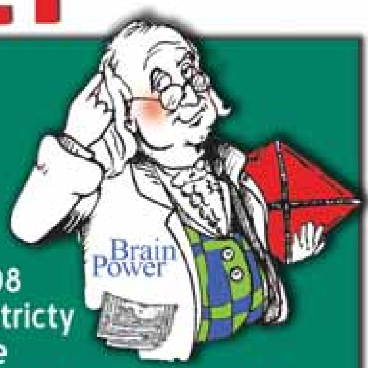

Through 2008 regional electricty savings were about 4,000 average megawatts. That's enough to annually power the entire state of Idaho and Western Montana, with enough left over to power a city the size of Eugene, Oregon.

pollution and quieter homes, and showed that high penetration of efficiency improvements could be achieved.

The efficiency of new commercial buildings also was a target for learning. The initial MCS for lighting in commercial buildings were aggressive, calling for a lighting power density of 2 watts per square foot, much less than the prevailing 5 watts per square foot. However, the structural and mechanical components of the commercial MCS were less aggressive than the residential standards, essentially incorporating the then-current ASHRAE standards. But how much farther could the commercial MCS be taken? The "Energy Edge" program was conceived to demonstrate the feasibility of commercial buildings that use 30-percent less energy than they would if built to the commercial MCS standards. The project demonstrated the feasibility of achieving these levels but also the pitfalls that would need to be addressed, leading to a greater emphasis on building commissioning and ongoing operations and maintenance actions to ensure high levels of efficiency.

Finally, this period saw the initial forays into energy efficiency in the industrial sector. The State of Oregon had established its ground-breaking Business Energy Tax Credit (BETC) as early as 1979, but utility energy-efficiency programs for industry were relatively limited until the middle to late 1980s. During that decade, the biggest industrial contribution came from Bonneville's Conservation-Modernization program for the aluminum industry. The aluminum industry, particularly aluminum smelting, was attracted to the Northwest during World War II by Bonneville's low power rates. At its peak, the industry's loads accounted for approximately 3,000 average megawatts, about 25 percent of Bonneville's total load. With rising rates, most aluminum smelters in the region increasingly were "swing" plants, operating only when aluminum prices were relatively high. Improving efficiency lowered the cost of a primary "raw material"—electricity—and made it possible for plants to operate over a wider range of aluminum prices. The program helped stabilize Bonneville's loads as well as save energy overall.

Rapid Growth

By the late 1980s and early 1990s, the economy was on the rebound and loads were growing in the region. The third iteration of the Council's Northwest power plan, completed in 1991, identified the need for 1,500 average megawatts of energy efficiency by the year 2000. Energy efficiency won a number of new converts during this period, as it was one of the quickest and most cost-effective things utilities could do in response to growing demand for power. It was “pedal to the metal” for energy-efficiency programs. Utility energy-efficiency acquisitions increased rapidly, from a little over 30 average megawatts in 1991 to almost 120 in 1993. Acquisitions totaled 130 average megawatts in 1995—a one-year record in the region to that point. During this period, commercial and non-aluminum industrial programs took off. In 1994, commercial-sector energy-efficiency savings exceeded residential savings for the first time; industrial-sector savings were 80 percent of the residential. It was during this period that Bonneville, the utilities, and their trade allies began to appreciate how to do energy-efficiency “business” in the commercial and industrial sectors, and the results were positive.

State and local codes and federal efficiency standards for appliances and equipment were also now contributing significant amounts. With prodding from the states, federal standards were established for refrigerators, freezers, and a number of other appliances. In 1993, standards were established for electric motors, commercial water heaters, heating/ventilation/air-conditioning systems, and other equipment. However, as the Northwest had learned with building codes, it is much easier to gain acceptance for regulation if the builders or manufacturers have an incentive to participate. During the early 1990s, a national effort emerged, with early support from several Northwest states, to offer an award of $30 million (called the “Golden Carrot” award, for obvious reasons) to design and market a refrigerator 25-percent more efficient than the 1993 federal standards. Bonneville, PacifiCorp, and Portland General Electric participated in funding the effort. Whirlpool won the competition, and the effort was instrumental in leading to new federal standards—enacted in 1997 and effective in 2001—that required an efficiency improvement of up to 30 percent for most refrigerators and freezers compared to the 1993 guidelines. That new standard, in turn, was predicted to save the Northwest about 100 average megawatts over 20 years. It also continued a long-term trend toward improved refrigerator efficiency, which increased more than 200 percent from 1972 to 1993 with no sacrifices in size or consumer options.

Another success was the Manufactured Housing Acquisition Program (MHAP), which was supported initially by Bonneville and all of the region’s investor-owned utilities. Factory-built homes are manufactured to standards established by the federal Department of Housing and Urban Development (HUD). Those standards

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lagged the state of the art of energy-efficient construction by a significant margin. In 1992, the MHAP program offered incentives of $2,500 per manufactured home built to the Super Good Cents/Model Conservation Standards level. The program was almost too successful. Fifty thousand Super Good Cents manufactured homes were built between 1992 and 1995, saving electricity at a cost of approximately two cents per kilowatt-hour.

HUD improved its standards in 1994, but not to the MHAP level. As a result, manufacturers had less incentive to spend the additional money to build to the MHAP standards. Support from Bonneville and utilities waned, too, over the higher cost of building to the higher standards, and the MHAP program was terminated in 1995. The market share of MHAP-level homes dropped significantly. However, a subsequent Bonneville-funded program of technical and marketing assistance to manufacturers, coordinated by state energy offices, helped MHAP-level manufactured homes regain a significant market share. This effort is now entirely supported financially by the industry, and “Energy Star” homes, which exceed the MHAP standards, now account for two-thirds of the manufactured-home market.

Restructuring/ Retrenching

By the mid-1990s, there was a growing drumbeat for restructuring the electric utility industry. At the heart of this movement was a vision of a deregulated, competitive industry marketing electricity to end-use consumers through regulated transmission and distribution utilities. Politically powerful interests supported such a change, and both Congress and the Federal Energy Regulatory Commission (FERC) paid attention. By 1995, the uncertainty engendered by efforts to restructure the electricity industry began to exact a toll on the Northwest’s energy-efficiency efforts. Bonneville and utilities, both public and investor-owned, were concerned about energy-efficiency costs increasing their rates while their potential unregulated competitors could avoid those costs. Utilities began retrenching, cutting back sharply on their energy-efficiency investments. Energy-efficiency implementation dropped by half between 1995 and 1997 and stayed at this relatively lower level through the rest of the 1990s. Bonneville’s expenditures for energy efficiency fell from more than $135 million in 1995 to less than $16 million in 2000. The fourth iteration of the Council’s Northwest power plan, completed in 1996, recommended approximately 90 average megawatts per year of energy-efficiency acquisition by utilities for the period 1997 – 2000. The actual achievements were a little over 50 per year. Savings attributable to state codes and federal standards contributed more than utility programs.

This was not all bad news, however. Energy efficiency achieved in the late 1990s cost less than efficiency achieved earlier. From 1994 to 1997, the amount of new energy efficiency dropped by half, but its cost, compared to earlier acquisitions, also dropped by half, or more.

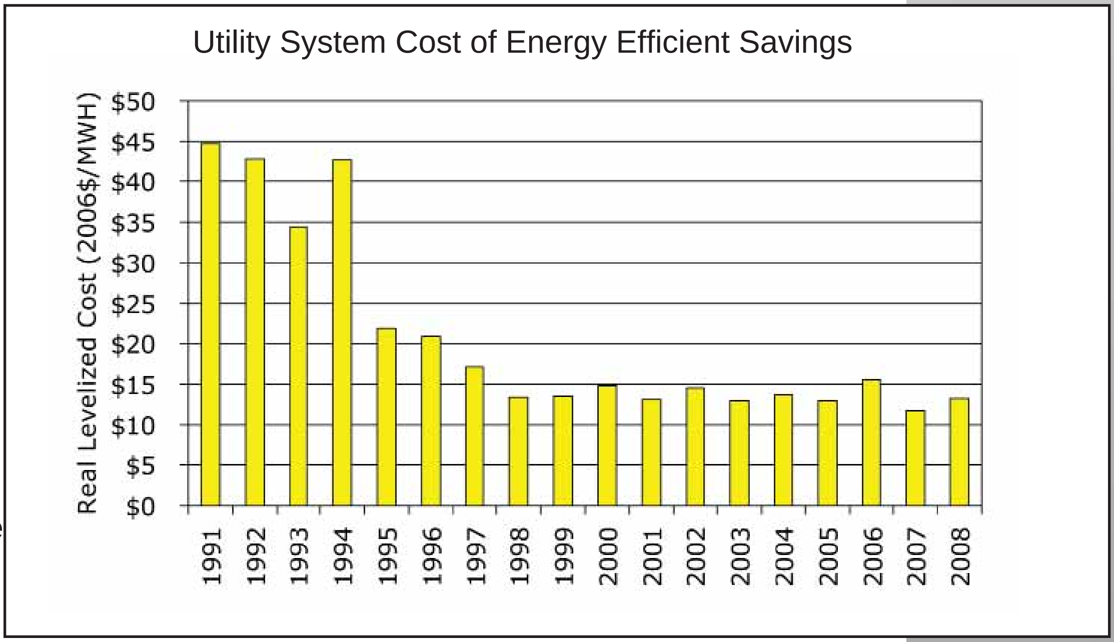
Figure Three - Some of this resulted from increased attention to cost-effective commercial and industrial energy efficiency. Some resulted from reduced expenditures for "infrastructure" activities such as research, demonstration, training, and evaluation. And some probably resulted from "cherry picking"—focusing efforts on the lower-cost energy-efficiency opportunities, a strategy that has obvious limits.

This situation focused attention on how energy efficiency could be accomplished in a restructured, competitive electricity market. One approach was to treat energy efficiency as a benefit to the entire power system and charge the entire system for its acquisition. Legislatures in Oregon and Montana enacted laws to encourage electricity industry competition and included "system-benefit charges" to pay for energy efficiency. These charges are applied at the distribution-system level and cannot be avoided even if there are alternative power suppliers.

In Oregon, the system-benefit charge is 3 percent of the retail revenues of the investor-owned utilities and is administered by the Energy Trust of Oregon, a non-profit entity that provides energy-efficiency and renewable resource services in the service territories of the investor-owned utilities. Publicly owned utilities are not included. In Montana, the charge is 2.4 percent, and the energy-efficiency and renewable activities are carried out by the utilities. In Montana, publicly owned utilities (cooperatives) also are subject to the law. In Oregon and Montana, large customers of utilities can, in effect, self-direct the energy-efficiency investments. In both states, the system-benefit charge is proving a viable way to deliver energy-efficiency services.

Another approach to acquiring energy efficiency in a competitive electricity marketplace focused on assisting the development of promising new technologies. The idea is to lower the cost of new technologies to the point that they become competitive in the marketplace or are incorporated in codes or standards. This was not just pie-in-the-sky thinking. It evolved from previous successes with the Model Conservation Standards and national appliance-efficiency standards, such as the "Golden Carrot" refrigerator

Figure Three



program. By improving standards, long-term costs to the utility system could be dramatically reduced. The same could be said for new technologies.

Fundamentally, however, this was not a task for a single utility or group of utilities. The markets for improved energy-efficiency technologies were far broader than any individual utility's service territory, even Bonneville's. A truly regional approach or, if possible, a broader approach, was necessary. As well, technologies could not be improved and made competitive unless the effort encompassed the entire supply chain—researching and developing the products, manufacturing them, selling them, installing them, and using them.

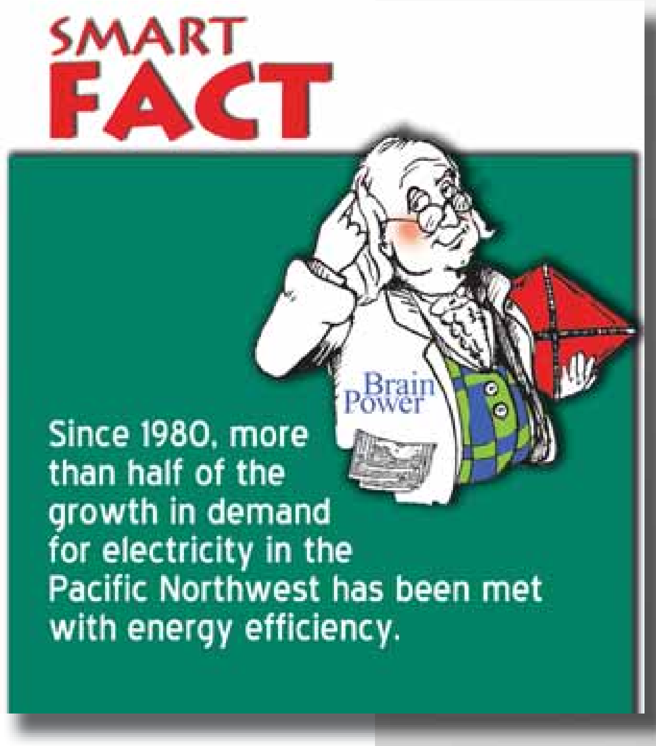
In 1996 the Council convened a series of meetings to assess how the markets for promising energy-efficiency products and services might be made self-sustaining. The result was the creation of the Northwest Energy Efficiency Alliance (NEEA), with funding from Bonneville and its customer utilities and the region's investor-owned utilities. In just a few years, NEEA and its utility partners carried out a number of effective market-transformation projects over a broad range of applications including wastewater treatment, compact fluorescent lights, industrial processes, energy- and water-efficient washing machines, computers, and so on. Where possible, NEEA joined with entities elsewhere in the country that also were emerging to address market transformation.

Electricity Crisis & Recovery

Serious movement toward electricity industry restructuring effectively came to a crashing halt with the West Coast electricity crisis of 2000-2001. The crisis was the result of a "perfect storm" of circumstances, including an extraordinarily poor Northwest water year with below-normal hydropower generation, the failure of a competitive generation market to develop new resources, and market manipulation by unscrupulous participants. Huge increases in the wholesale price of power wreaked havoc on those Northwest utilities that had decided to serve significant portions of their loads with power purchases on the open market. Energy efficiency resurged as a way of reducing these purchases and addressing the power-cost concerns of customers. Energy-efficiency achievements during and after the crisis were remarkable. Utility-funded achievements doubled in the span of a year—without an increase in the cost of each average-megawatt conserved.

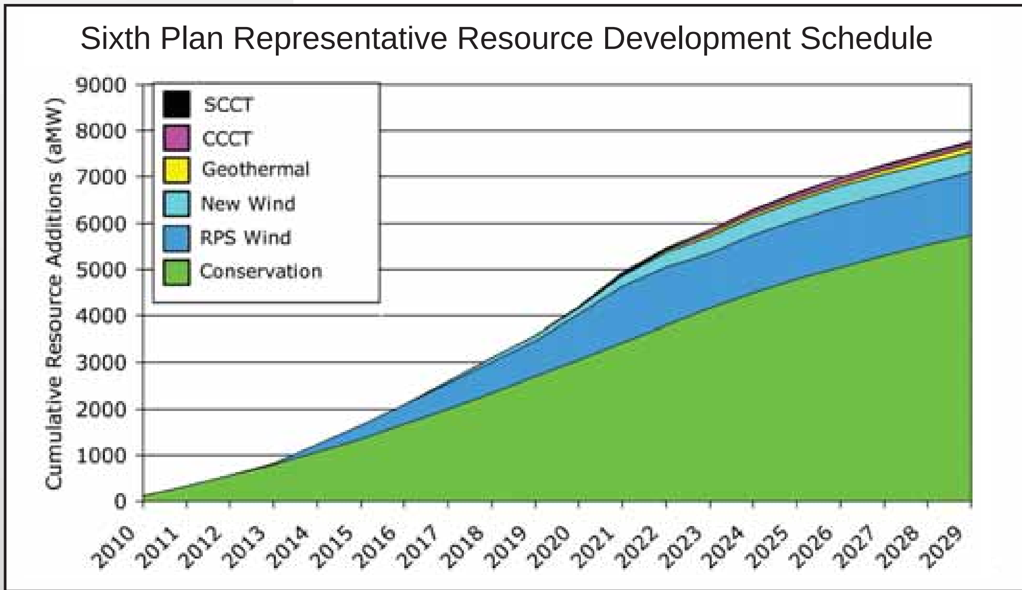
The fact that energy-efficiency achievement doubled without a cost increase can be explained partly by the fact that the cost of electricity increased as much as 50 percent during and after the crisis because of intense competition for a limited amount of power. The cost of electricity rose; the cost of energy efficiency did not. But another reason for the impressive energy-efficiency achievements following the electricity crisis is that a solid foundation to support energy efficiency was in place, thanks to the work of utilities and others, particularly NEEA, in the late 1990s.

A prime example in terms of market impacts and megawatts saved is the penetration of compact fluorescent lights (CFLs) in the Northwest lighting market. By 2001, NEEA had been working for several years to increase awareness of CFL technology and the Energy Star brand in the Northwest. Relationships with bulb manufacturers and bulb retailers were established and, when the electricity crisis hit, NEEA worked with Bonneville and the utilities to provide bill-stuffer coupons for the purchase of a CFL. This was a key contributing factor to the overall increase in CFL sales in the region in 2001-02, as 8.3 million lights were sold regionwide in 2001 alone. In 2005, the Northwest, with only 4 percent of national households, purchased 7 million CFLs, or 16 percent of all purchases nationwide. In 2007, Northwest sales of CFLs reached almost 19 million—an average of nearly two lights per person or 4.5 lights per household. Largely because of the CFL sales, in 2007, energy-efficiency achievement, not counting codes and standards, surpassed 200 average megawatts for the first time.



Many lessons can be learned in hindsight from the experiences of the late 1990s, when energy-efficiency investments waned in response to low market prices, and the first few years of the 21st century, when high market prices caused energy-efficiency investments to surge. We learned, for example, that it is a mistake to ramp energy-efficiency investments up and down in response to the ups and downs of the wholesale market price of power. If energy efficiency had been acquired through the late 1990s at the rate recommended in the Council's power plan, 80 percent of its costs would have been recovered in one 12-month period—June 2000 through May 2001—because of high market prices during the energy crisis. And that efficiency still would have many more years of useful life. As well, many utilities would have been in a better position facing the high-priced market because their demand for power would have been lower. When the average wholesale market price topped \$200 per megawatt-hour in early 2001 and stayed there for weeks, the price of energy efficiency remained unchanged—about 100 times less expensive. Regular annual

Figure Four



investments in energy efficiency might have made the energy crisis less of a crisis for both utilities and consumers.

Looking Forward

The question of adequate and stable support of energy efficiency was addressed directly in the Council's Fifth and Sixth Northwest Power Plans. These analyses subjected alternative energy-efficiency deployment strategies to hundreds of scenarios incorporating key future variables such as wholesale fuel and power prices, hydropower-generating conditions, demand levels, carbon costs, and so on. The analysis looked not only at the average or "expected" cost associated with different strategies but also at the degree of risk—essentially the costs incurred under the most expensive scenarios. The key finding was that the lowest cost and lowest-risk strategy was steady funding for energy-efficiency implementation at the highest practical rate of development.

Figure Four shows a representative resource development schedule from the Sixth Power Plan. Energy efficiency accounts for 85 percent of the expected load growth under medium-load and market-price conditions. And while the planned resource development amounts and schedule for other resources vary for different future scenarios of demand, fuel price, carbon-control costs, and so on, the amount of planned energy efficiency remains essentially the same—sustained investment at the highest feasible levels. This strategy results in the lowest costs and risks.

The composition of the energy efficiency included in the Sixth Power Plan is shown in Figure Five.

Figure Five - Buried in each of these categories are a number of different end-uses and energy-efficiency technologies. However, it is quite possible, even likely, that when we look back from the perspective of 2030, how the efficiency actually is achieved will look somewhat different. Looking back today at the recommendations in the Council's first power plan, in 1983, it is clear that the amount of energy efficiency achieved over the first 20 years was essentially the amount called for in that plan. However, the composition of that efficiency was significantly different than what made up the first plan's portfolio. This is because the end-use targets were constantly evolving over that 20-year period, as were the energy-efficiency technologies to address them. Changes in the economy and changes in technology are inevitable, and we can expect the same in the next 20 years. For example, increased penetration of compact fluorescent lights (CFLs) accounts for much of the forecasted improved efficiency in residential lighting. But already we are seeing advances in light-emitting-diode lighting technologies that could supplant CFLs and extend the projected savings in this sector. Energy savings from irrigation efficiency and scheduling measures might be supplanted by the use of drought-resistant crops that require less water. Developments like these might result from luck or chance, but more likely they result from targeted research, development, and demonstration.

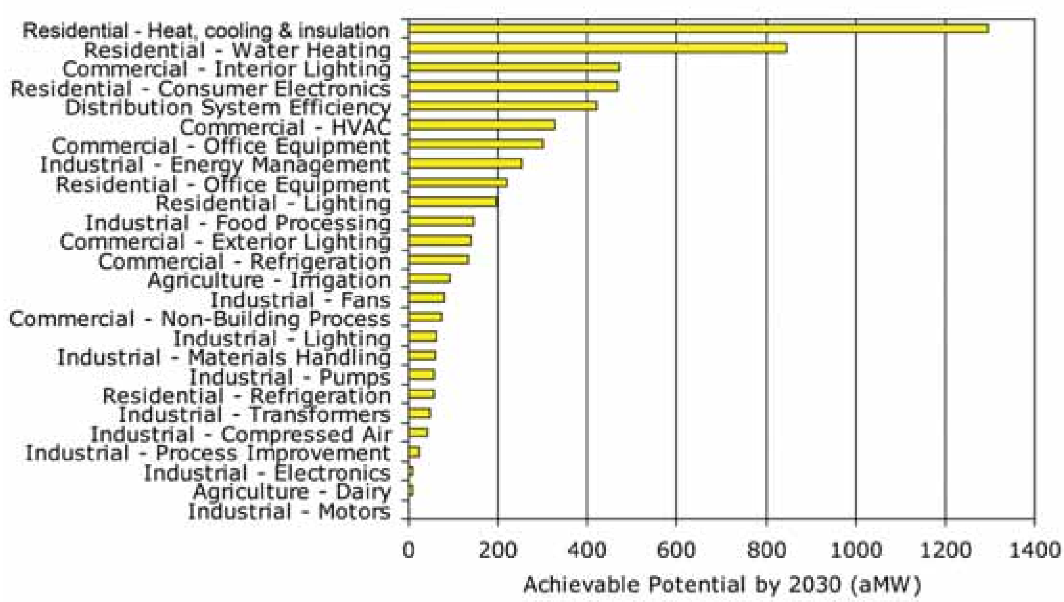
A Large Potential

In focusing on energy efficiency 28 years ago, Congress was quite far-sighted. In 2008, gasoline prices ranged wildly from $4 per gallon early in the year to $2 in the fall, and with increasing public concern about greenhouse-gas emissions, global climate change, and the monetary and environmental cost of energy, it is more important than ever to improve the efficiency of our energy use. Energy efficiency is unlike any other electricity resource. There is no fuel, and therefore no ongoing fuel costs or associated risk of volatile prices. Energy efficiency requires no backup resource to shape its output to meet demand, as does wind power, for example. Energy efficiency is not a fuel we import from a foreign country so there is no risk of supply shortages or curtailments. There are no emissions, and therefore no risks to the climate. There is no ongoing cost after the resource is installed—except, for example, when a compact fluorescent light burns out and needs to be replaced. Importantly in the Northwest, by reducing demand for power, energy efficiency reduces pressure on the hydropower supply and therefore increases its potential to serve as a backup for renewable energy, particularly wind power.

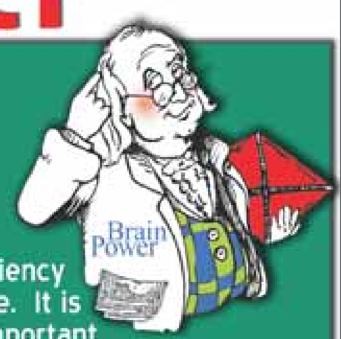
Western states are national leaders in energy efficiency as the result of impressive efficiency improvements in California and the Northwest states. In the Northwest between 1978 and 2008, demand for electricity was reduced by 3,900 average megawatts. Fifty-six percent of that amount—2,180

Figure Five

Composition of Sixth Plan Energy Efficiency Resources



SMART FACT



Energy efficiency is a resource. It is a proven, important component of an adequate, efficient, economical, and reliable power supply and a resource that reduces environmental risks and impacts of electricity production.

average megawatts—has been achieved since 2000. The average cost of this efficiency was between 2 cents and 3 cents per kilowatt-hour ($2-$3 per megawatt-hour). That is less than half the cost of power generated by wind or natural gas.

Expressed as electricity generation, 3,900 average megawatts is enough power to supply the entire state of Idaho and all of Western Montana today, with 600 average megawatts left over. Put another way, 3,900 average megawatts approximates the average output of eight large coal-fired power plants that did not have to be built; 15 million tons of carbon dioxide that were not emitted into the atmosphere in 2008; and a savings to consumers, compared to the cost of electricity from the wholesale market, of nearly $1.8 billion in 2008 alone. Looking to the future, the Council has identified nearly 6,000 average megawatts of new efficiency that is available, also at a cost of about 3 cents per kilowatt-hour.

Next Steps

As we anticipate the next steps in acquiring energy efficiency in the region, it is instructional to review our accomplishments to date for lessons that will help future decision-making. Here are some of the key lessons:

It's a Resource

Energy efficiency is a resource. It is a proven, important component of an adequate, efficient, economical, and reliable power supply and a resource that reduces environmental risks and impacts of electricity production. As such, it needs to be part of every utility's resource portfolio. Utility acquisition of energy efficiency is a business proposition and needs to be approached that way. It is something we pay for and that provides us value in return. The business proposition is complicated by the fact that cost and value streams are frequently split between the power system and the end user. But that is just a complication. Energy-efficiency acquisition is a viable business proposition for both the utility and its customers.

It's an Under-Valued Resource

Energy efficiency is an under-valued resource in that its contribution to reducing greenhouse gas emissions and other pollutants is currently not reflected in the price of power. While the Northwest Power Act includes a 10-percent credit for energy efficiency compared to other resources, it is really only a tie-breaker and its result in terms of additional energy efficiency has been small. Many believe this situation will change in the future with the imposition of a cap-and-trade-system for carbon dioxide emissions or the equivalent. This will improve the business proposition for energy efficiency significantly.

Get the Incentives Right

We have relied on the utility system as the primary vehicle for implementing energy efficiency. Utilities depend on revenue from the sale of electricity to pay their costs. Energy efficiency has a cost, albeit less than the alternative of paying for new generating resources or power from the wholesale market, and it reduces utilities' revenue streams.

There are regulatory approaches to addressing this problem, such as lost-revenue adjustments and "decoupling" revenues from sales (this means basing revenue on something other than power sales, thus eliminating the disincentive to reduce sales). The pros and cons of these approaches are complicated. A number of regulatory jurisdictions around the country and here in the Northwest have taken steps in these directions or are considering doing so. If energy efficiency is to play an even more important role in the future, it is important to get the incentives for utilities right. This means addressing these issues in the regulatory framework, or through state law such as Washington's requirement that utilities acquire all cost-effective energy efficiency, or through a system-benefit charge that utilities cannot avoid, as in Oregon and Montana.

Codes, Standards, and State Laws Yield Savings

Codes and standards ensure a basic level of energy efficiency in new construction, both residential and commercial, and in appliances and electricity-using equipment. Codes and standards ensure that very cost-effective energy-saving measures are captured and do not become lost opportunities. Codes and standards are set to be cost-effective to consumers and, as such, form a floor for additional savings. They do not require additional incentives from the power system. They are implemented at the time when the costs are most easily financed by consumers -- at the time of purchase of a major appliance, for example, or at the time a new home is built. However effective implementation requires active attention to and participation in the federal, state, and local regulatory processes for adopting codes and standards, and attention to their implementation. Good codes poorly enforced are not much better than poor codes.

New state laws also will yield energy savings and reduced emissions from power plants over time. In Washington, voters approved Initiative 937 in 2006. The law requires the state's largest electric utilities, publicly owned and investor-owned, to gradually increase the amount of new renewable resources in their electricity supply to 15 percent by 2020. Utilities also must acquire all cost-effective energy conservation in their service territories beginning in 2010. In addition, the law specifically directs the utilities to use a methodology consistent with the methodology used by the Council in its most recent power plan to determine the amount of conservation to acquire.

In Oregon, investor-owned electric utilities collect from their customers a 3-percent surcharge on monthly electricity bills dedicated to a "public purposes charge." The money goes to state agencies and an organization called the Energy Trust of Oregon, which uses the money for efficiency and renewable energy projects. About 57 percent of the collected

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One of the great energy efficiency success stories is market transformation. For proof, look no farther than the fact that in 2006 Northwesterners purchased 10.7 million compact fluorescent lights, four times the national average per-household sales.

funds is dedicated to conservation projects, 17 percent to renewable resources development, 12 percent to low-income household weatherization, 10 percent for school energy conservation assessments, and about 4 percent for low-income housing. The state's consumer-owned utilities are responsible for designing public-purposes programs and directing customer money to those programs.

The Montana Legislature established the Universal System Benefits program (USB) in 1997, which requires electric utilities to fund USB programs at 2.4 percent of retail sales. The USB law applies to all utilities in the state, and oversight of investor-owned utilities is provided by the Montana Public Service Commission (oversight of public-utility programs is provided by the Montana Department of Revenue). USB funds are directed by the utilities and must be spent on the following: 1) low-income energy assistance and weatherization (not less than 17 percent); 2) cost-effective conservation, including research and development; 3) market transformation activities; and 4) renewable energy. In 2005, the Legislature enacted a renewable-energy portfolio standard that requires public utilities and competitive electricity suppliers to obtain an increasing percentage of their retail electricity sales from eligible renewable resources over time.

In Idaho, the Public Utilities Commission directs the three regulated, investor-owned electric utilities operating in the state to pursue all available cost-effective demand-side management and conservation. The Commission evaluates cost-effectiveness on the basis of total resource cost, ensuring that the cost of a measure, including administrative costs, is less than the quantifiable benefits of the measure. The three utilities have riders in their rates to recover the costs of demand-side management, conservation and energy efficiency. The utilities also participate in the Northwest Energy Efficiency Alliance.

Transforming Markets Works

One of the great energy efficiency success stories is market transformation. For proof, look no farther than the fact that in 2006 Northwesterners purchased 10.7 million compact fluorescent lights, four times the national average per-household sales. In the late 1990s, CFLs were hard to find and expensive—$14 to $24 per bulb. CFLs from that era were large and awkward, they fit in few lamps or lighting fixtures, and they had poor light quality. Today, they are widely available, their cost is reasonable—particularly considering they last several times longer than an incandescent—they have been "down-sized" to fit in most lamps, and the quality of the light is much improved. This was largely the result of a market-transformation effort of the utility-funded Northwest Energy Efficiency Alliance and its allies elsewhere in the country. They worked with the lighting industry to improve quality, increase production, and reduce prices; they worked with retailers to improve availability and merchandising; and they worked with utilities to provide incentive coupons to utility customers. We have reached the point where the market for CFLs is self-sustaining without incentives.

While this is the most dramatic example, it is not the only one. The key is engaging the entire market from manufacture to retail. And it requires working across utility service territories. Sometimes utilities are reluctant to support efforts like these because it is not clear there is a one-to-one correlation between monetary contributions and subsequent benefits. But it only takes a few big winners like CFLs to answer this concern. We need to keep a focus on market transformation.

Efficiency Research, Development and Demonstration is Important

Many improvements in energy efficiency technology resulted from research, development, and demonstration (RD&D), some of it regional, some national, and some international. Many of today's electricity end-uses did not exist 25 years ago. With the possibility that the costs of controlling carbon-dioxide emissions will be reflected in the price of electricity, the incentives for private-sector investment in energy-efficiency RD&D are improving. But RD&D activities have high risks. For that reason, federal investment in RD&D is important. Studies of the costs and benefits of federal support of RD&D have shown it to yield significant benefits. Among the successes are advanced refrigerator compressors, low-emissivity glass, and electronic ballasts for fluorescent lights. In recent years, federal support waned but then began a revival. More support is needed. Energy-use efficiency cannot play its intended role in the future without a significant commitment to RD&D.

Steady and Aggressive Wins the Race

While energy-efficiency expenditures can be ramped up and down, doing so will result in lower savings than a sustained and significant level of investment. That was the key finding of the Council's Fifth Power Plan, issued in 2005, and it is reaffirmed in the Council's Sixth Power Plan. It is relatively easy to cut programs. It is more difficult to build them back up. The result is that some energy efficiency may not be in place when it is most needed. The lesson of the first 25 years of energy-efficiency experience through the Council's power plan is to set aggressive, long-term goals and steadily work to achieve them.

This report was written by Dick Watson, who retired in 2007 as the Council's Director of Power Planning, and Mark Ohrenschall, an energy writer based in Seattle.

For more information: www.nwcouncil.org/energy

(Footnote)
[1] The development of these plants was financed by tax-exempt bonds issued by the Supply System. The participating utilities pledged to repay their shares of the bonds. Under the net-billing agreement, Supply System participants who were Bonneville customers assigned their shares of the plants' planned output to Bonneville. The participants made payments to the Supply System for their shares of the cost of the net-billed bonds, and Bonneville in return deducted each participant's share from the participant's bill for power from Bonneville. Bonneville's rates to all customers were increased to reflect these costs. This was a way of "regionalizing" the costs of the Supply System plants and, in effect, provided an implicit federal guarantee for the bonds. However, a 1972 Internal Revenue Service ruling prohibited tax-exempt status for additional bonds, effectively ending Bonneville's participation in the development of additional new power plants under the laws in effect at that time.

The lesson of the first 25 years of energy-efficiency experience through the Council's power plan is to set aggressive, long-term goals and steadily work to achieve them.

On The Cover: The Evolution of the Common Light Bulb

In recent years we have witnessed a dramatic change in the light bulb. From incandescent bulbs, we have moved to the more energy-efficient compact fluorescent version. Now we have the even more efficient LED (light emitting diode) bulbs that consume even less electricity to produce the same amount of light.

A publication of the
Northwest Power and Conservation Council

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