Environmental Matters

This appendix contains a wide range of information that relates to the environmental concerns PSE faces and seeks to address.

1. PSE Greenhouse Gas Policy

Many scientists and policymakers believe climate change may prove to be the most important business issue of the 21st century. The question for many business leaders is no longer "Is there human-caused climate change?" but (1) "How intense will the impacts be?" and (2) "What are feasible and economically viable solutions to the intensity of those impacts?"

Based on the level of federal activity surrounding climate change and the momentum the issue is gaining elsewhere, both at the local level and as an ever-increasing number of U.S. companies abandon the view that more research on climate change is needed before reducing GHGs is warranted, it is apparent that climate change legislation is moving in the direction from being almost "unthinkable" to being a "strong possibility." Additionally, as recent as December 1, 2006 the leaders of public utility commissions in California, Oregon, Washington, and New Mexico signed a pact agreeing to collaborate on strategies to fight climate change. In it, they agree that their "regulatory oversight ensures that the utilities operate in a manner that protects the environment and human health and safety, and protects ratepayers from economic risks of failure to plan for future regulation of emissions that cause climate change."

PSE realizes the importance of assuming leadership in devising new strategies to address climate change, even before such measures are mandated. As a first step, PSE has developed a climate change policy. The policy provides a guiding sense of the challenges we face, our obligation as a utility, and the solutions we see are feasible. Our climate change policy statement appears on the next page.

*Greenhouse Gas Policy State*ment

Puget Sound Energy (PSE) recognizes and concurs with the growing concern that increased atmospheric concentrations of greenhouse gases contribute to climate change and that such change can have global adverse economic and social consequences. While motor vehicles and the transportation industry emit a significant amount of all such greenhouse gases, PSE also recognizes that most of the world still relies on fossil fuels for much of its electric power and heating needs. Further, affordable electric power is essential to the long term growth and income prospects for the peoples of the world, including the PSE service territory. Accordingly, it is crucial that climate change policies balance a number of competing short-term and long-term interests to moderate the growth in greenhouse gas emissions while encouraging growth of the economy.

PSE believes that climate change is a very important issue that requires careful analysis and reasoned responses from policy makers. To that end, PSE advocates a national strategy that achieves both short-term measures designed to lessen the growth of greenhouse gas emissions and long-term strategies that will ultimately manage greenhouse gas emissions to appropriate levels in a cost-effective, scientifically sound, and sustainable fashion. In furtherance of the strategy that reduces near-term growth of greenhouse gases, PSE's policy is to take cost-effective measures to mitigate and/or offset greenhouse gas emissions from our energy activities while maintaining a dependable, cost-effective and diverse energy portfolio mix that will sustain our customers' needs now and into the future. The specific near-term strategies PSE will continue to explore and implement include the following:

1. Pursuit of a diverse energy portfolio mix of resources that includes renewable generation;
2. A Pledge to work with our partners in the utility industry, state government and national government to explore and evaluate opportunities to reduce greenhouse gas emissions;
3. Continue and develop a strong energy efficiency program;
4. Support the advancement of scientific understanding of climate change;
5. Support a market-based national system (e.g., "cap and trade" or carbon tax) or sub-national system that covers a large enough area to prove cost effective and useful;
6. A call for the removal of barriers and disincentives to the advancement of the aforementioned recommendations (e.g., governmental facilitation of transmission from renewable energy projects), and
7. Government incentives that will foster the development of renewable generation and other greenhouse gas reducing technologies.

Energy drives the economy. Sustainable energy is an essential component of sustainable development. Global and national problems ultimately require global and national solutions. However, PSE believes it is taking and will continue to take appropriate steps to meet the goal of providing cost effective and reliable energy while decreasing the impact on climate change through the implementation of these measures.

PSE's Emissions

During 2006, PSE's total electric retail load of 21,099,045 aMW was served from a supply portfolio of owned and purchased resources. Since 2002, we have voluntarily undertaken an inventory of the greenhouse gas (GHG) emissions associated with our portfolio. This inventory follows the protocol established by the World Resource Institute GHG Protocol (GHG Protocol). The most recent data indicate that PSE's total GHG emissions (direct and indirect) from its electric supply portfolio in 2005 were 12,999,051 tons (CO_2e). Approximately 54.3% of these emissions (7,058,313 tons) are associated with PSE's ownership and contractual interests in the 2200 MW Colstrip, Montana coal-fired steam electric generation facility.

PSE first acquired interest in the Colstrip, Montana coal-fired steam electric generation facility in 1975 and currently owns a percentage interest in each of the four units (PPLM is the Facility operator). Colstrip is a significant part of the diversified portfolio we own and/or operate for our customers. It has been and remains an important element of the overall generation and supply mix essential to meet the ongoing needs of our customers reliably and cost-effectively. However, our overall resource strategy demonstrates a concerted effort to meet customer needs with a diversified mix of supply options that includes significant energy efficiency efforts, increased renewable generation, and hydro and gas-fired generation.

Our Goal: Reduce Emission Intensity

With ongoing development of state and federal initiatives intended to address climate change, the challenge to develop strategic solutions is more complicated than ever. However, PSE believes that now is the time to act. Consequently, PSE is proposing to meet its own portfolio emissions goals that will adhere to the objectives stated in the Greenhouse Gas Policy Statement.

It is clear that the performance standards passed by California and proposed by Washington are very stringent compared to actions being taken elsewhere in the nation, but because PSE relies on the California interchange, we will participate directly in the impacts produced by them. For this reason and for the reasons presented in our policy, PSE is proposing a goal to meet the California standard of capping emission rates on new resources at an estimated 1100 lbs. of CO_2/MWh. Furthermore, we will adopt a carbon emission goal to not exceed that 1100 lbs. of CO_2/MWh for the entire portfolio, on a 5-year rolling average. We anticipate we will meet this standard through significant investments in energy efficiency programs, additional investments in renewables, and the use of highly efficient combined-cycle natural gas-fired plants.

2. Climate Change Overview

PSE has been active in environmental issues such as conservation and renewable resources for some time, and we believe it is the responsibility of both companies and individuals to take action now to address global warming.

In 2006, the popular media brought the issue of climate change to the forefront. Although PSE's 2005 Least Cost Plan did not explicitly discuss the impact of climate change on our Company's operations, we implicitly recognized the issue in our 2006 Current Momentum and Green World scenarios, which included carbon charges based on cap-and-trade regimes set forth by the National Commission on Energy Policy (NCEP) and the McCain-Lieberman proposal.

We explicitly recognize these concerns in our 2007 IRP. The basic reference case, called Current Trends, includes a carbon charge based on the NCEP proposal; and our Green World scenario incorporates substantial increases to emission charges. In addition to modeling possible legislative outcomes, PSE is actively engaged in forming a consensus on reasonable legislation such as that proposed by Senator Bingaman.

Discussions of climate change can be both complex and contentious. This appendix attempts to explain facts as simply as possible, describe the connections (global, regional, PSE, and customers), and present good science and reasonable public policies. Much of this explanation is based on information from the Climate Impacts Group at the University of Washington; the book *The Weather Makers* by Tim Flannery (© 2005, Atlantic Monthly Press); and the Intergovernmental Panel on Climate Change, Fourth Assessment Report of February 2007.

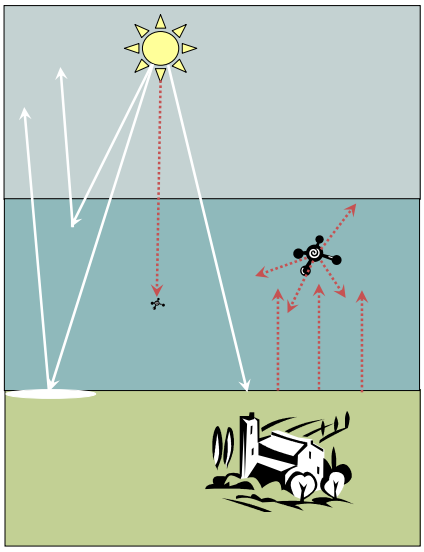
Understanding climate change can be simplified into three questions: What is the greenhouse gas effect? What do we know about CO_2 levels historically and currently? What evidence do we have that temperatures are increasing over time? We then consider possible impacts worldwide, on the Northwest, and on PSE—particularly the effect of temperature on precipitation and electric demand. We conclude with measures PSE currently supports to make a difference.

I. What is the Greenhouse Effect?

Solar radiation hits Earth in waves of different lengths. The smaller ones are x-rays and ultraviolet rays. Next are the most common wavelengths, visible light. Larger waves include infrared and various radio waves. Solar radiation can be reflected back into space by the atmosphere and by Earth—particularly when it hits the white icecaps. Molecules in the atmosphere absorb some radiation, but most is absorbed by Earth (Figure C-1).

The greenhouse effect focuses on visible light waves that pass through the atmosphere, are absorbed by the planet, and are then re-emitted as infrared radiation (heat). A common example is the south side of a house—light absorbed during the day is emitted as warm infrared radiation when the sun goes down. Its longer wavelength allows it to be captured by greenhouse gases (CO_2 and methane are the most common) and emitted again into the atmosphere.

Figure C-1
The Greenhouse Effect



- Radiation from Sun – mostly visible light, plus IR, UV, others.
  - Reflected by atmosphere
  - Reflected by earth (ice)
  - Absorbed by atmosphere
  - Absorbed by earth (most)
- IR Radiation (heat) Emitted from Earth
  - GHGs absorb IR in atmosphere, then re-emit back to Earth
- Higher Temps result from greater levels of GHGs

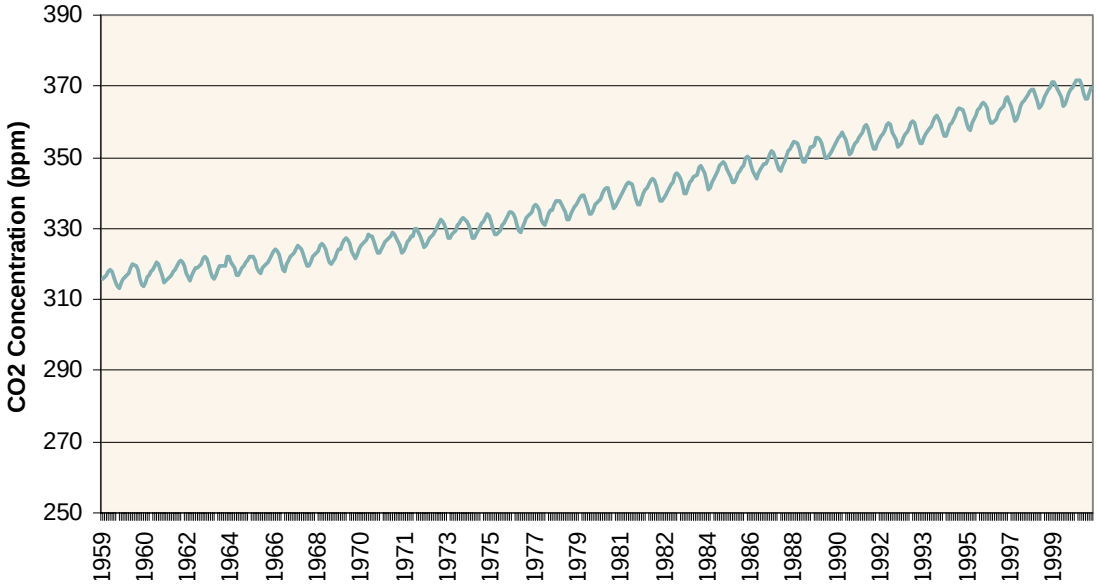
More CO_2 in the atmosphere means more infrared radiation stays in the Earth's atmosphere and less escapes back into space. This leads to higher atmospheric temperatures—also known as global warming.

II. What do we know about CO_2 levels?

There are two sources of historical CO_2 measurements. The first uses ancient evidence such as air bubbles trapped in icecaps up to thousands of years old. These indicate that CO_2 concentrations have fluctuated, dropping down to 160 parts per million (ppm) during the coldest periods and rising as high as 280 ppm during warm periods. Just before the industrial revolution (c. 1800),[1] the level of atmospheric CO_2 was at the 280 ppm level.

The other source, direct measurement, has only been possible for a few decades. A well-known set of data was collected near Hawaii, far from any large sources of CO_2 emissions. Figure C-2 shows two effects. First, the sinusoidal wave is the earth's annual cycle: Atmospheric CO_2 rises in fall/winter when grasses decompose and trees shed their leaves, releasing CO_2; it declines in spring/summer as plants grow and absorb CO_2. In addition to these semiannual variations, the graph clearly shows increasing CO_2 over time. In 1958 the CO_2 level was up to 315 ppm, and it is currently close to 370 ppm.

Figure C-2
Atmospheric CO_2 Concentration 1959 - 1999



[1] *The Weather Makers*, page 29.

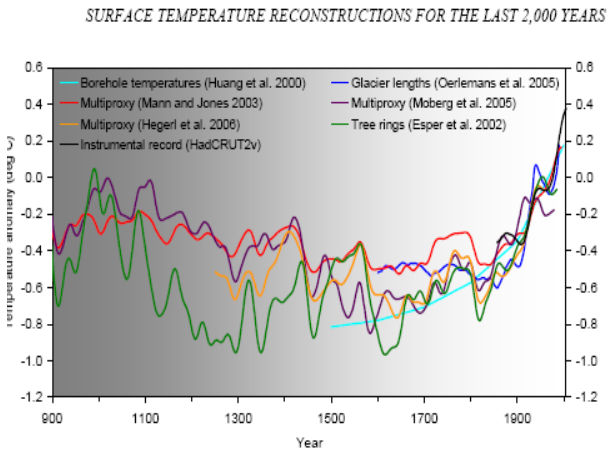
III. What evidence do we have that atmospheric temperatures are increasing?

Determining temperatures during ancient times is not an exact science. Many studies have looked back hundreds of years and a few have looked back 2,000 years. Without direct measurements, scientists use proxy indicators such as documentary and historical evidence, tree rings, marine proxies, ice cores, etc. One study in particular (Mann, 2003) has become a captive of politics, used as key evidence by former Vice President Al Gore and attacked in 2006 by former House Energy Committee Chair Joe Barton (R-TX).

In an effort to rise above partisan politics, The House Committee on Science asked the National Academy of Sciences (NAS) to review available studies to determine both variations of and certainty about Earth's temperature over the last 2,000 years. The NAS study concluded that the older the time period considered, the less certain the results. "Very little confidence" can be assigned (at this time) to results older than 900 years. However, it can be said with a "high level of confidence" that temperatures over the last 20 years are higher than during any period over the last 400 years.

The latter conclusion is based on the fact that results from many different studies, using different and unrelated methodologies, converge over time. These scientific analyses create a compelling body of evidence that global warming is occurring.

Figure C-3
Consensus on Warming, June 2006



"I think this report shows the value of Congress handling scientific disputes by asking scientists to give us guidance. The report clearly lays out a scientific consensus position on the historic temperature record. One element of that consensus is that the past few decades have been the hottest in at least 400 years."

Science Committee Chairman Sherwood Boehlert (R-NY)

IV. Global Scientific View

In February 2007, the Intergovernmental Panel on Climate Change (IPCC) published its *Fourth Assessment Report* based on the results of earlier studies and six years of research. Its Working Group I, composed of scientists from around the world, made the following conclusions in the section "The Physical Science Basis"[2]:

- Global atmospheric concentrations of carbon dioxide, methane and nitrous oxide have increased markedly as a result of human activities since 1750, and now far exceed pre-industrial values determined from ice cores spanning many thousands of years (see Figure C-4).
- Global increases in carbon dioxide concentration are due primarily to fossil fuel use and land-use change, while those of methane and nitrous oxide are primarily due to agriculture.
- Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global mean sea level (see Figure C-5).
- Most of the observed increase in globally averaged temperatures since the mid-20th century is *very likely* due to the observed increase in anthropogenic greenhouse gas concentrations. This is an advance since the 2001 conclusion that "most of the observed warming over the last 50 years is *likely* to have been due to the increase in greenhouse gas concentrations."
- Discernible human influences now extend to other aspects of climate, including ocean warming, continental-average temperatures, temperature extremes, and wind patterns.

[2] "Climate Change 2007: The Physical Science Basis," Intergovernmental Panel on Climate Change, February 2007; http://www.ipcc.ch.

Figure C-4
Changes in Carbon Dioxide and Methane from Ice Cores

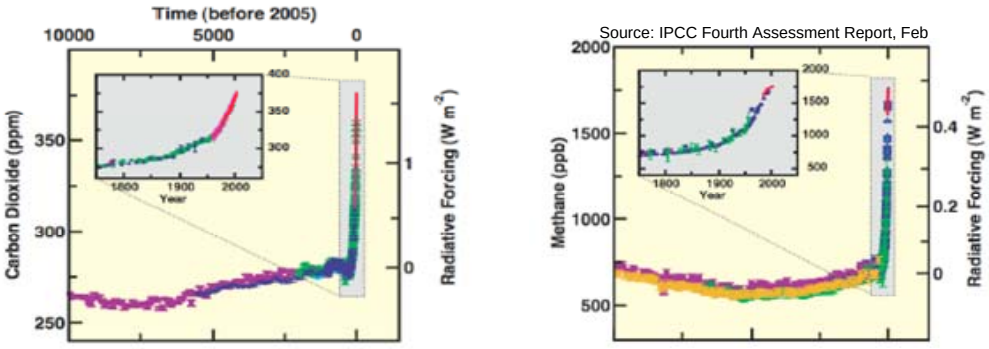
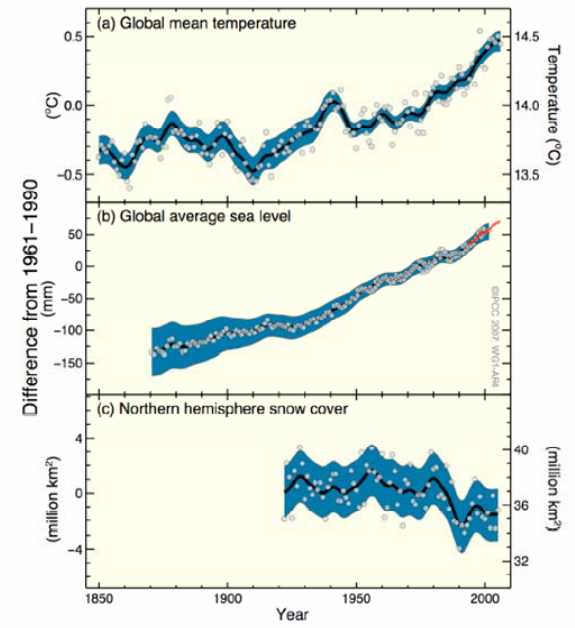


Figure C-5
Changes in Temperature, Sea Level and Snow Cover



Higher Temperature

Higher Sea Level

Less Snow Cover

Source: IPCC, Fourth Assessment Report, Feb 2007

V. Long-term Impact on the Northwest

Scientists are studying recent trends and using various models to consider the impact of climate change on the Northwest. Two particular areas interest utilities: changes in temperature, which affect energy loads; and changes in stream flows, which affect the seasonality and availability of hydro-generated electricity. Other issues—such as irrigation, water flows for fish, and flood control—are also factors since they may take priority over power generation.

A. Temperature

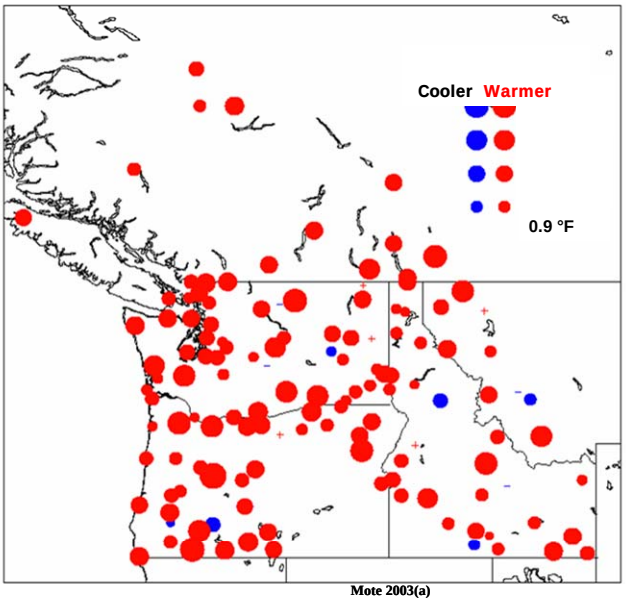
According to the Climate Impacts Group at the University of Washington,[3] "At nearly all stations in the Northwest, the temperature trends have been positive over the 1930 to 2005 period of record." The Climate Impacts Group formulated a number of conclusions:

- Minimum temperatures rose faster than maximum temperatures.
- Most temperature trends showed increases of 0.1 to 0.4 degrees Fahrenheit per decade.
- Trends for urban areas were very similar to trends for rural areas.
- The warming trend is much higher since 1960, compared to the 1930–1960 period.
- The single warmest year was 1934.
- The warmest 5-year period was 2001-2005.
- The warmest 10-year period was 1996-2005.
- The warmest 20-year period was 1986-2005.
- The regional warming trend is about the same as the global land average.

Figure C-6 shows the trends for numerous data stations throughout the Northwest. Red circles indicate warming trends; blue circles indicate cooling trends; the size of the circle represents the magnitude of the change observed. The map graphically demonstrates the overall increase in temperatures in our region.

[3] "Energy-relevant Impacts of Climate Change in the Pacific Northwest," Philip Mote, Eric Salathe, and Cynthia Peacock, July 2006.

Figure C-6
Temperature Trends Since 1920



- Over 100 meteorlogical stations in the Pacific Northwest
- Covering all climates
- Nearly all show increased temperatures

Source: CIG, UW, July 2006

B. Precipitation

Precipitation trends are not as clear as temperature trends. Known meteorological phenomena such as El Nino and the Pacific Decadal Oscillation can be large enough to be the primary cause of variability. As recently as 2004-2005, scientists have not been able to link any change in precipitation to human activities.[4]

C. Stream Flows

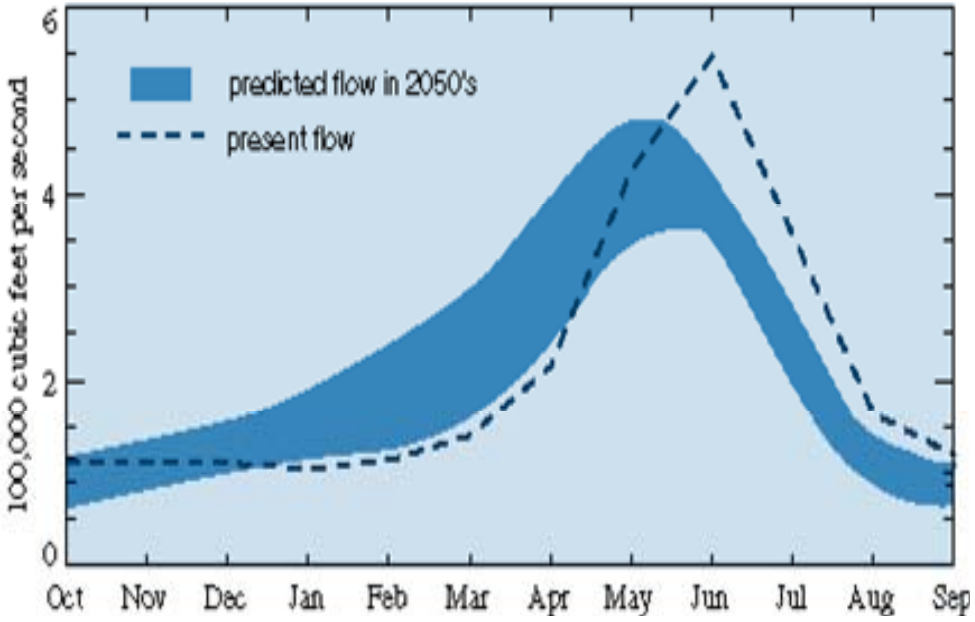
Even though precipitation may be constant on an annual basis, the warming trend will reduce snowpack and hence alter runoff timing. In general, lower snowpack means higher winter stream flows, since less precipitation stays frozen. This leads to reduced stream flows in late spring and summer.[5]

[4] Ibid, page 3.
[5] Ibid, page 4.

Seasonal shifts in stream flow can have a direct effect on hydro generation—depending on storage capacity and other priorities including flood control, fish spawning support, and irrigation. Changes in stream flow will not affect all uses equally, as various state and regional policies (legislative, executive, and judicial) have set specific water use priorities.

Figure C-7 depicts simulated stream flow for the Columbia River at The Dalles, Oregon using predictions for the climate in 2050. Flows increase in December through April, and decrease in May through September.

Figure C-7
Hydro: Winter Increase, Summer Decrease



Naturalized Columbia River flow - the Dalles, OR. Source: CIG, UW, July 2006

D. Wind

Wind along the Columbia Gorge is primarily caused by a temperature difference between the hot inland area and the cool coastal area. Under some climate change scenarios, the temperature difference between the two areas decreases, which would reduce wind speed. The Climate Impacts Group models currently do not show this reduction.[6]

[6] Ibid, page 10.

VI. Climate Change Impact on Puget Sound Energy

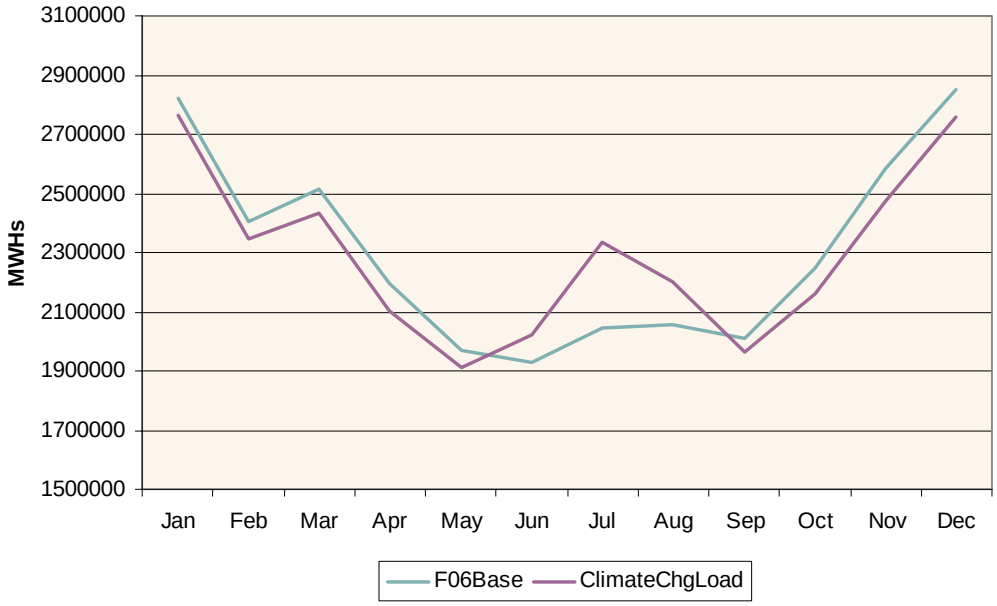
The 2007 IRP covers a 20-year period, while climate change scientists consider much longer periods (50 or 100 years). The discussion below compares the monthly load/resource balance for 2020 under current conditions and under climate change conditions.

A. Demand for Electricity

Consumption of energy is highly dependent on weather. Electric loads rise with drops in temperatures, primarily due to home heating demands. Electric loads also increase with higher summer temperatures, due to air conditioning demand. The Climate Impacts Group's latest projections of the impact of climate change for the Pacific Northwest showed an average temperature increase of about 2 degrees Fahrenheit by 2020 from current normal weather (this varies by month). From these data we developed heating and cooling degree days by month, and input them as normal weather for 2020 to 2027. We also assumed a slow change to these new averages, and thus extrapolated current values to the warmer values between 2007 and 2020.

Figure C-8 shows the impact on forecasted loads by 2020. Overall annual loads with climate change are lower—by 0.5% to 1%—compared to base case loads. Winter loads are lower by 2% to 4%, and summer loads are higher by 10% to 15%. However, PSE will continue to be a winter-peaking utility; winter loads will still be higher than summer loads.

Figure C-8
Climate Change Impact on Forecasted PSE Loads (2020)



B. Supply of Hydro Power

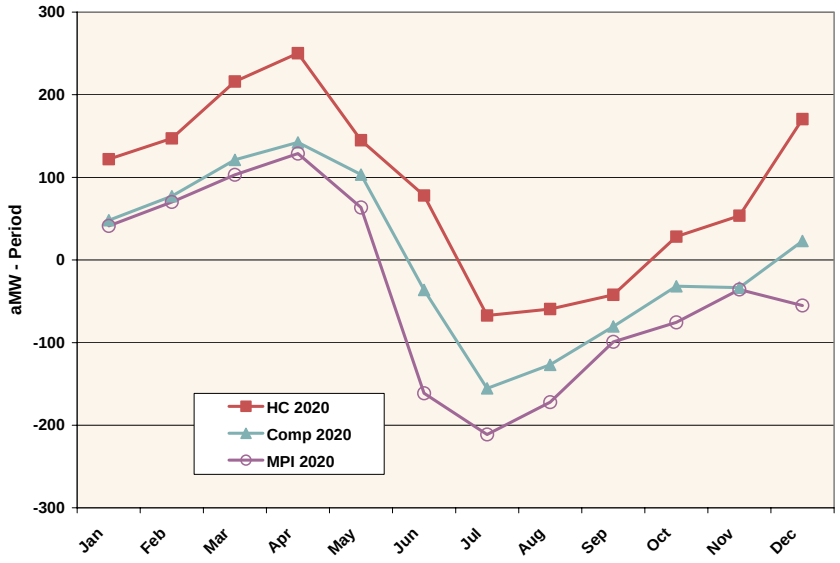
To estimate the change in hydro availability from our Mid-Columbia and Westside hydro resources, we analyzed generation data for specific resources provided by the Northwest Power and Conservation Council, which used a number of national models.[7] Downscaled hydrologic and temperature data for the Northwest was obtained from the Joint Institute for the Study of Atmosphere and Ocean Climate Impacts Group at the University of Washington. The data was derived primarily from two general circulation models, the Hadley Centre model (HC) and the Max Planck Institute model (MPI). Three sets of hydrological data were produced for operating years 2020 and 2040. Each is a downscaled and bias-adjusted set of water conditions generated using output from a

[7] A complete description of the NPCC analyses can be found in appendix N of the May 2005 Power Plan: http://www.nwcouncil.org/energy/powerplan/plan/Appendix%20N%20(Effects%20of%20Climate%20Change).pdf

particular global model. The first two sets of water conditions were derived from the HC and MPI models, and the third set was derived from a combination of model runs.

In Figure C-9, the results for PSE's hydro generation using the three model results shows little annual change in total generation, but more generation in winter months and less generation in summer and fall. These results indicate a slightly better load/resource balance in winter, as warmer temperatures decrease load and less snow increases winter stream flow. However, summer load rises and available hydro power decreases.

Figure C-9
Climate Change Impact on PSE Hydro Generation (2020)



C. Solutions and Actions Supported by Puget Sound Energy

There is no single or simple solution to climate change. Atmospheric CO_2 levels are already much higher than just a few decades ago, and the expected economic growth of developing countries will accelerate near-term increases. Nevertheless, the United States can provide leadership over the next 50 years by adopting a number of low-cost strategies for all aspects of the economy that produce CO_2.

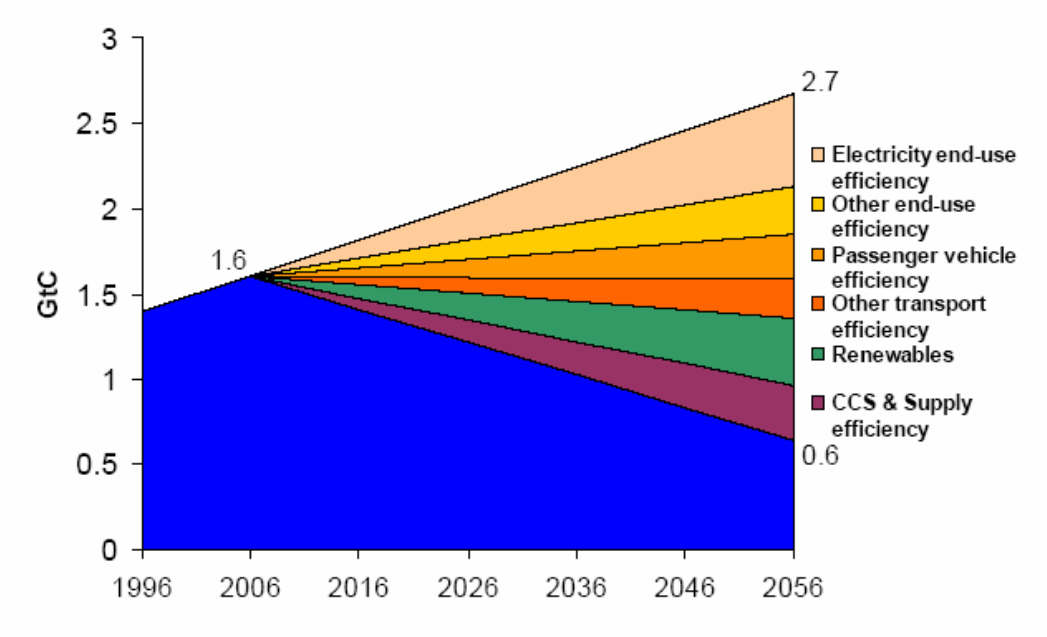
In December 2004, the National Commission on Energy Policy (NCEP) published a report entitled "Ending the Energy Stalemate—A Bipartisan Strategy to Meet America's Energy Challenges." NCEP developed a set of recommendations that "offers a balanced and comprehensive approach to the economic, national security, and environmental challenges that the energy issues present to our nation." Climate change and the resulting CO_2 charge are only part of one section out of six sections: Enhancing Oil Security; Reducing Risks from Climate Change; Improving Energy Efficiency; Expanding Energy Supplies; Strengthening Energy-Supply Infrastructure; and Developing Better Energy Technologies for the Future. The comprehensive policy indicates that since "energy" permeates all aspects of American life, national policies should as well.

Focusing on CO_2 reduction, Robert Socolow and Stephen Pacala[8] developed a framework of multiple strategies to stabilize atmospheric CO_2.[9] Their "stabilization wedges" for various energy programs would provide equal impact from reduced emissions, thereby creating a common unit to compare different strategies. This framework then allows policy makers and planners to fairly compare different options such as increasing automobile fuel efficiency and increasing the development of wind resources.

The Natural Resources Defense Council (NRDC) adapted the strategy to the U.S. situation and developed the scenario illustrated in Figure C-10. The United States currently produces about 1.6 gigatons of carbon per year; under the status quo, the level will increase to 2.67 gigatons per year. Under multiple strategies, it would be possible to lower the annual output to 0.6 gigatons per year.[10]

[8] Carbon Mitigation Initiative, www.princeton.edu/~cmi.
[9] "A Plan to Keep Carbon in Check," Robert Socolow and Stephen Pacala, Scientific American, September 2006.
[10] "An Action Plan to Reduce U.S. Global Warming Pollution," Daniel Lashof and David Hawkins, National Resources Defense Council, July 27, 2006.

Figure C-10
NRDC Strategic Framework for Stabilizing Atmospheric CO_2



The NRDC came to several conclusions relating to the framework:

- Stabilizing atmospheric CO_2 is a realizable goal.
- The solution will require a mix of strategies from different sectors of the economy.
- The tools are available today.
- Success requires both political acceptability and technological reasonableness.

PSE is contributing to the solution through a number of ongoing efforts discussed in this 2007 IRP. They include a leading energy efficiency services program that currently saves about 20 average megawatts per year, or enough electricity to serve over 15,000 homes. In December 2006 we completed our second large wind farm, giving us wind-generated capacity equal to about 5% of PSE's annual electric load. Our number of solar net metered customers rose from 60 to 110 in 2006 alone.

On the federal policy side, we continue to support policies and legislation that help move America to solve the climate change problem. Even though we own part of a coal plant

in Montana, and face continued load growth that may have to be met with fossil fuels, we are always seeking ways to mitigate our carbon footprint.

D. Carbon Sequestration

We are tracking and using technologies such as integrated gasification combined cycle plants, which use coal and other fuels yet can capture and sequester carbon. We are part of the Big Sky Carbon Sequestration Partnership based in Bozeman, Montana, which is investigating numerous sequestration technologies for effectiveness and cost.[11] Carbon sequestration can be terrestrial or geologic.

Terrestrial carbon sequestration uses natural methods for returning carbon to the soil and plants at the surface level. Soil contains CO_2 sequestered by plants, but overgrazing reduces the ability of plants to perform this function; improved pasture management can increase soil CO_2. Crops also sequester carbon in the soil, but the tilling process releases it back into the atmosphere. Agricultural practices that reduce tilling have led to an increased level of carbon in the soil. Afforestation projects—growing trees to capture and hold carbon until the wood decomposes or is combusted—require long-term management to ensure that the carbon stays sequestered. Overall, while agriculture is responsible for a small portion of America's contribution to climate change, it can also be part of the solution.

Geologic sequestration involves pumping CO_2 deep into the ground, where it reacts with rocks to form an inert compound. There are numerous opportunities for carbon capture and sequestration (CCS). For example, oil companies have practiced "enhanced oil recovery" for 30 years—pumping CO_2 produced by the refining process into their wells to improve oil recovery. Companies in the Northwest are currently testing wells drilled deep into the saline aquifer. Pumped CO_2, in an aqueous state, reacts with basalt to form inert calcite. Costs for this type of geologic sequestration have not yet been determined; however, large-scale CCS will require significant infrastructure investments.

[11] Big Sky Carbon Partnership, Montana State University, Bozeman, MT; http://www.bigskyco2.org.

3. Fossil Fuel Emissions

The electric industry, due to its combustion of coal and natural gas, is implicated in certain adverse environmental impacts. Currently, there is no requirement nor is there a mechanism to measure and account for the social, environmental and public health costs of producing electricity from coal or natural gas resources that affect the environment in these manners—what economists call "external costs." Some studies even suggest that if the market accurately reflected these costs, certain plants, particularly old coal burners, would be shut down because the price of power they generated would be too high for the market to bear. This section briefly describes the atmospheric emissions produced by coal and natural gas combustion.

Coal

Combustion of coal by electric utilities is a major source of regional sulfur dioxide (SO_2), nitrogen oxides (NOx), and carbon dioxide (CO_2) emissions. It also produces carbon monoxide (CO), particulate matter (PM), and hazardous air pollutants (HAPs).

Carbon dioxide is the principal greenhouse gas (GHG) created when coal is combusted. Although methane is a much more potent GHG than CO_2, it is released in far smaller quantities. Nationwide, it is currently estimated that utilities are responsible for approximately 40% of all GHG emissions, with the majority of those emissions coming from coal-fired generation. On average, a modern coal plant with a capacity of 500 MW emits approximately 3.7 MM tons of CO_2 per year.

Mercury emissions from power plants are also an important issue, both nationally and regionally. Presently, coal-fired power plants are the largest source of mercury emissions in the United States, emitting approximately 48 tons of mercury per year[12].

[12] Source: EPA 1999 Utility Mercury Survey

Natural Gas

Relatively, natural gas burns much cleaner than coal and has less overall environmental issues. Its combustion generates virtually no SO_2, about half the CO_2 per Btu produced by coal, and much lower PM and HAPs. Further, combustion technologies today permit the extraction of a much larger fraction of the heat energy than even 15 years ago. However, natural gas combustion may generate NOx and CO in quantities comparable to or greater than coal burning.

4. Regulatory and Policy Activity

Limits on emissions of greenhouse gas (GHG) in the United States have gained significant political momentum in 2006. While the federal government thus far has failed to address the issue, states, local governments and corporations have been taking action. As a result, a patchwork of GHG policies and regulations are adding significant challenges to long-term resource planning for utilities. This section outlines regulations and policies that may have future impacts on our operations.

I. Federal Policies

The United States has not ratified the Kyoto Protocol and has yet to enact GHG regulation, but Congress has moved closer to establish national regulation. In June 2005, the Senate passed a "Sense of the Senate" resolution (SA 866) supporting a "national program of mandatory, market-based limits on emissions of greenhouse gases." In 2006, the Senate Energy Committee conducted extensive hearings on the design of such a program, leading the chairman of the committee, Sen. Pete Domenici, and the ranking Democratic member of the committee, Sen. Jeff Bingaman, to publish a white paper on the subject entitled "Design Elements of a Mandatory Market-Based Greenhouse Gas Regulatory System." In the House of Representatives, the House Appropriations Committee voted to accept an amendment to the Interior and Environment Appropriations bill calling for a "Sense of the Congress" resolution on climate change. That resolution calls for "mandatory market-based limits and incentives to slow, stop and reverse the growth of GHG emissions in a manner that will not significantly harm the United States economy."

On January 3, 2007 Sen. Harry Reid (Senate Majority Leader) sent a memo to Senate Democrats outlining the chamber's legislative agenda in ten specific areas, including global warming. Based on the schedule outlined by Senator Reid it appears that Senate Democrats are targeting to have global warming/energy independence legislation on the floor in the spring 2007. Because PSE anticipates an aggressive year in the federal legislature on climate, many of the federal proposals and related climate change activities from the last two years are summarized below.

A. Design Elements of a Mandatory Market-Based Greenhouse Gas Regulatory System

In February 2006, Senators Domenici and Bingaman introduced this climate change white paper to frame key questions and components for creating a national mandatory market-based greenhouse gas program. The paper sets the stage for legislation that will be introduced in 2007. A draft bill has been circulated to key stakeholders. The bill favors economy-wide emissions; "upstream," rather than "downstream" allowance requirements; and the sale, rather than the grant, of emissions allowances. An upstream regulatory approach means that fossil fuel suppliers would be required to own emission allowances commensurate with the CO_2 content of the fuels they sell. This would capture almost all sources of emissions and would stimulate a wider range of emissions reduction responses. Emission reduction targets may thus be achieved at a lower cost than would be the case under a program such as the McCain-Lieberman proposal described below.

In April, more than 70 industry groups, nongovernmental organizations, and labor unions responded to Representatives John Dingell and Rick Boucher with diverse ideas on how to craft legislation to mandate caps on carbon dioxide emissions. Dingell, who chairs the House Energy and Commerce Committee, and Boucher, who heads its Subcommittee on Energy and Air Quality, sought input as part of an effort to develop climate change legislation. To support this effort, the committee has conducted 11 hearings featuring testimony from more than 50 witnesses, including former Vice President Al Gore. In a February letter written by Dingell and Boucher, the energy panel sought input on how a bill might affect the economy, which industry sectors should be covered, and a suggested timetable for congressional action.

B. Climate Stewardship and Innovation Act of 2005 (S. 280)

The bill is modeled on previous proposals by Senators John McCain and Joseph Lieberman to cap GHG emissions as part of an emissions trading program that was defeated on the Senate floor in 2003 and 2005. However, the Senators have modified the latest legislation, the Climate Stewardship and Innovation Act, to include more flexibility for industry to comply with the mandated reductions by allowing them to seek offsets earned from other green projects and by allowing emissions trading in international carbon markets. The new proposal also calls for deeper, sustained cuts in U.S. emissions than previous ones. Total greenhouse gas emissions would be gradually reduced 2% per year after 2012 until they are brought about one-third below current levels in 2050. The bill measure would put in place a U.S. cap-and-trade program for emissions beginning in

2012 that would cover key industry sectors including the power industry, petroleum refiners and importers, and chemical manufacturers that generate greenhouse gases such as carbon dioxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride.

C. Global Warming Pollution Reduction Act (S. 309)

Senator Bernie Sanders introduced a bill in January that calls for cutting U.S. GHG emissions 80% below 1990 levels, by 2050. The bill, co-sponsored by Senate Environment and Public Works Committee Chairwoman Barbara Boxer, calls for a gradual reduction in U.S. GHG emissions, first by reducing emissions to 1990 levels, by 2020. Cuts would be further reduced by 80% of those 1990 levels over the successive three decades. The measure also would provide the Environmental Protection Agency with the authority to take additional regulatory action to further reduce U.S. emissions if the legislation, along with international efforts, fail to hold global greenhouse gas emissions at 450 parts per million. That is the level that many scientists view as the tipping point for severe global climate changes.

D. Electric Utility Cap-and-Trade Act (S. 317)

Senators Dianne Feinstein and Thomas Carper introduced a bill in January that would cap GHG emissions from power plants at 2001 levels in 2015, and require an additional 1% reduction each year through 2020. The Electric Utility Cap-and-Trade Act, which would allow for emissions trading, would also require further emissions cuts of 1.5% each year after 2020. Initially, the bill would allocate 85% of emissions credits directly to utilities. By 2016, 30% of the credits would be auctioned, and by 2036, 100% of the credits would be auctioned, with 80% of the auction proceeds going to developing low-emissions technology. The bill also would allow power companies to comply with emissions reduction targets by offsetting emissions reductions outside the power industry.

E. Kerry-Snowe Global Warming Reduction Act (S. 485)

Senators John Kerry and Olympia Snowe introduced a bill in February that would cut U.S. GHG emissions 65% from 2000 levels by 2050, an approach they said represents a middle ground between other proposals calling for deeper or more modest emissions cuts. The Kerry-Snowe Global Warming Reduction Act calls for freezing emissions of carbon dioxide and other U.S. GHG in 2010. The United States would then begin gradual, steady cuts of 1.5% per year over the following decade, a 2.5% annual cut each year beginning in 2020, and a 3.5% annual cut between 2030 and 2050 to reach the 65% target.

F. Climate Stewardship Act (HR. 620)

Representatives John Olver and Wayne Gilchrest introduced the first House legislation in the 110th Congress in January that calls for capping and reducing U.S. GHG emissions through an emissions trading scheme. The legislation calls for establishing a U.S. cap-and-trade program for emissions beginning in 2012. The House bill is the companion measure to the Senate climate proposal (S. 280) introduced January 12 by Senators McCain and Lieberman. The Olver-Gilchrest Climate Stewardship Act would cover the electric power, transportation, industrial, and commercial sectors and would set up a "feasible and effective" emissions trading scheme to reduce carbon dioxide and other greenhouse gas emissions over multiple decades. The targets for reducing GHG emissions in the Olver-Gilchrest proposal are modeled after those in the McCain-Leiberman bill, which calls for cutting emissions back to 2004 levels by 2012 and deeper cuts by mid-century.

II. State & Local Initiatives to Limit GHG Emissions

While federal policy has yet to be set, state and local initiatives to limit GHG emissions date back to June 2002, when Massachusetts adopted a 10% reduction of CO_2 limits for the state's coal-fired plants. These limits took effect on January 1, 2006. New Hampshire followed suit soon thereafter.

A. In the Northeast

The Regional Greenhouse Gas Initiative (RGGI), a cooperative effort between seven northeastern states, mandates that electric utilities reduce their emissions. This interstate agreement caps GHG emissions from power plants in the participating states at 2005 levels from 2009 through 2014, then cuts allowed GHG emissions by 10% by 2019. In April 2006, Maryland's governor signed legislation requiring the state to join RGGI in 2007. All together, the 8 states in RGGI account for one-eighth of the US population and approximately 8% of the country's power generation.

B. In the West

State initiatives to limit GHG emission have also gained momentum in the West. Washington, Oregon, and California have proposed a number of emission reduction projects under the umbrella known as the West Coast Governor's Global Warming Initiative. Currently, both Oregon and Washington require that new power plants offset a certain portion of their anticipated CO_2 emissions. Similarly, the California Public Utility Commission (CPUC) requires that a "carbon adder," an estimate of the cost of complying with future carbon emission limits, be used by the states' utilities in their resource planning process when comparing the costs of alternative generation.

California was the first state to move beyond the focus on the power sector as a source of GHG emissions. In July 2002, California enacted legislation to reduce GHG emissions from motor vehicles. In 2005, Gov. Arnold Schwarzenegger signed an executive order committing the state to a program of GHG emission limits that will reach 2000 emission levels by 2010 and 1990 levels by 2020. Most notably, however, is the passage by the California legislation of AB 32 in August 2006. With the passage of AB 32, California became the first state in the nation to adopt an economy-wide cap on CO_2. The bill commits California to cutting statewide greenhouse gas emissions to 1990 levels by

2020. Although AB 32 does not mandate specific measures to reduce greenhouse gas emissions, the bill directs the California Air Resources Board to develop regulations to achieve the required emissions reductions. With the passage of AB 32 in California and the limits set forth in the RGGI states, approximately one-quarter of the U.S. population is now subject to state GHG emission limits.

In December 2006, members of the California, Oregon and Washington public utility commissions committed their agencies to exploring the development and implementation of greenhouse gas emissions standards for new long-term power supplies. President Michael R. Peevey of the California Public Utilities Commission; Mark Sidran, chairman of the Washington Utilities and Transportation Commission; Lee Beyer, chairman of the Oregon Public Utility Commission; and Chairman Ben R. Lujan of the New Mexico Public Regulation Commission signed a special document in the presence of more than 200 witnesses at the Joint West Coast Public Utilities Commissions Workshop on Energy Efficiency. This agreement states that the four commissions recognize the need to "mitigate the adverse impacts of climate change resulting from continued reliance on fossil fuels." The regulators also agree that they have the obligation to ensure that utilities protect the environment and human health and safety, and to protect ratepayers from the economic risks of failing to plan for future regulation of emissions that cause climate change. The agencies are to direct their staffs to provide annual work plans and summaries of progress starting in 2007. The California PUC is already working on a CO_2 emissions standard and will issue a final decision in early 2007 in compliance with the new law passed as Senate Bill 1368. This bill forbids long-term investments in power plants with greenhouse gas emissions in excess of those produced by a combined-cycle natural gas power plant.

C. In the Northwest

On November 7, 2006, Washington voters narrowly approved a ballot measure that mandates an increase in the investment in and production of renewable energy resources. Initiative 937, the Clean Energy Initiative (I-937), requires that by 2020, large public and private utilities obtain 15% of their electricity from renewable resources such as wind, solar, and biomass. The first requirement will be 3% in 2012, increasing to 9% by 2016 and reaching its final target of 15% by 2020. With the acquisition of Hopkins Ridge and Wild Horse, PSE comfortably meets the first Renewables Portfolio Standard (RPS) target in 2012 and would likely meet the 2016 target based on its internal goal of meeting 10% of its load with renewable energy by 2013. PSE will need to continue to

acquire renewable resources to meet the 2020 target. The Oregon legislature is also considering a Renewables Portfolio Standard. Under Oregon Senate Bill 838 (SB 838), 25% of Oregon's electricity would come from clean renewable energy sources by 2025. Given the ambitious targets, it is anticipated that further amendments to the bill and the RPS policy will be made as it makes its way through the legislative process.

Washington state Gov. Christine Gregoire signed an executive order on February 7, 2007 that outlines her administration's goals for addressing climate change. The executive order (EO) establishes a series of measurable targets and goals that are intended, according to the EO, to reduce Washington's contribution to global climate pollution, grow Washington's clean energy economy, and move Washington towards energy independence.

In April the Washington State Legislature approved S.B. 6001 to establish state goals to reduce greenhouse gas emissions. The governor signed the legislation on May 3. This legislation calls for statewide reductions of GHG emissions to 1990 levels by 2020 and to 50% below 1990 levels by 2050. Beginning July 1, 2008, public and private utilities are required to comply with a greenhouse gas emissions performance standard. The standard would be the lower of 1,100 pounds of greenhouse gas per megawatt-hour, or an amount determined by the Washington Department of Community, Trade, and Development, which would measure greenhouse gas emissions for all industrial sectors. The governor is also required to report to the Legislature by December 31, 2007, on the costs of providing tax incentives to encourage utilities to upgrade equipment to reduce carbon dioxide emissions. The legislation also allows use of ratepayer funds to reduce or mitigate the effects of greenhouse gases and requires the governor to provide a report to legislators on the possible benefits of providing tax breaks for utilities to encourage greenhouse gas emissions reduction.

Local jurisdictions in the Pacific Northwest have also been developing their own climate policies. In 2005, Seattle Mayor Greg Nickels launched the U.S. Mayors Climate Protection Agreement, which has enlisted over 330 municipalities that have agreed to reduce GHG emissions from their community by 7% from 1990 baseline levels by 2012. Mayor Nickels also created the "Green Ribbon Commission on Climate Protection," which recommended ways for Seattle to achieve the 7% goal. Seattle has been one of the leading cities behind this effort, and has since developed a list of recommendations for achieving that goal. Similarly, King County announced this year that it joined the Chicago Climate Exchange (CCX).

III. Mercury

On May 18, 2005, the Environmental Protection Agency (EPA) enacted the Clean Air Mercury Rule (CAMR) which will permanently cap and reduce mercury emissions from coal-fired power plants. State and environmental group lawsuits are seeking to overturn the CAMR program in favor of stricter control requirements and limits on trading emissions, a mechanism that gives utilities a certain level of flexibility to comply with the cap. States, however, are moving beyond the EPA in regulating mercury emissions from power plants. So far, 16 states have enacted or are working to enact programs more stringent than EPA.

In Idaho, coal-fired power plants will effectively be banned from the state under a mandate announced August 9 by Gov. Risch. Risch signed an executive order directing the state's Department of Environmental Quality (DEQ) to initiate rulemaking with an eye toward opting out of EPA's Clean Air Mercury Rule (CAMR). If approved by at least one house of the 2007 Legislature, the DEQ rule would preclude any developer of coal-fired power plants from buying mercury emission credits from elsewhere and using them to operate in Idaho. With no coal-burning power plants currently in the state, Idaho's mercury emission budget is zero.

Oregon has also adopted a rule more stringent than CAMR. In December 2006, the Oregon Environmental Quality Commission (DEQ) adopted a rule to limit mercury from new coal-fired power plants and mandate installation of mercury control technology by the state's only existing coal-fired plant. The existing Boardman plant, in eastern Oregon, is expected to reduce mercury emissions by 90% by July 1, 2012.

In October 2006, the Montana Board of Environmental Review approved a regulation to limit mercury emissions from coal-fired power plants that is also more stringent than CAMR. Adopted on a 5-1 vote, the administrative rule (ARM 17.8.771) takes a two-tiered approach to reducing mercury emissions, allowing power plants burning lower-quality lignite coal to release more emissions than plants burning cleaner sub-bituminous coal. The new rule will cut mercury emissions by about 80%, and includes a cap-and-trade provision to help power plants meet their emissions-reductions targets, as well as alternative emissions limits for plants that have tried to meet the new standards but have demonstrated that they cannot.

In Washington, the Department of Ecology (Ecology) is also drafting a mercury rule that is far more stringent than CAMR. If Ecology's proposed rules are adopted, the development of new clean-coal power plants in Washington may also be curtailed. The proposed state standards would prohibit coal-based generators from participating in the national mercury emissions cap-and-trade program after 2012. The preliminary proposal would allow the continued operation of Transalta's existing pulverized coal facility in Centralia and might allow development of another 600 MW integrated gasification combined cycle (IGCC) facility, but would prohibit additional coal generation in Washington. Ecology isn't sure if opting out of the cap-and-trade program is the best solution, but the agency is concerned about the program creating mercury hotspots. Ecology has not been able to provide any information regarding studies from mercury sources in the state and their impacts to the local and regional environment, but is steadfast on this rulemaking.