IDAHO ENERGY PRIMER

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IDAHO STRATEGIC ENERGY ALLIANCE

Preface

The Idaho Strategic Energy Alliance (ISEA) is pleased to present this update of the Idaho Energy Primer (Primer), a resource to help the citizens of Idaho better understand the contemporary energy landscape in our state and to make informed decisions about our state's energy future.

The Primer provides information about energy resources, production, distribution, and use in the state. The availability of reliable, affordable, and sustainable energy for individuals, families, and businesses while protecting the environment is critical to achieving sustainable economic growth and maintaining our quality of life.

The U.S. Energy Information Administration (EIA) is the primary source used for the Primer. The EIA collects, analyzes, and disseminates independent and impartial energy information to promote sound policymaking, efficient markets, and public understanding of energy and its interaction with the economy and the environment.[1] The EIA provides regular information updates and therefore the reader may find the information contained in the Primer has changed.

Disclaimer

The Primer is not printed at taxpayer expense.

The Primer is prepared by the ISEA and the Idaho Office of Energy Resources (OER). Costs associated with publication are maintained by the Idaho Office of Energy Resources in accordance with Section 60-202, Idaho Code, OER-01-2016-250. The views and opinions of authors expressed herein do not necessarily state or reflect those of the State of Idaho or its agencies.

[1] www.eia.gov/about/

Contents

Idaho Energy Snapshot

Like their peers across the country, Idahoans power their homes, businesses, and various means of transportation with a diverse mix of energy sources.

Despite Idaho's heavy reliance on imported energy, its overall energy prices remain among the lowest in the nation.

- Idahoans used 530 trillion British thermal units (BTUs) of energy in 2013.[2] This is the equivalent of roughly 91 million barrels of oil per year. About 74 percent of the total energy used in Idaho comes from outside the state.
- On a per capita basis, Idaho's consumption ranks 22nd in the nation as of 2013.[3]
- The residential, commercial, industrial, and transportation sectors in Idaho spent $6.9 billion on energy in 2013.[4]
- Over the last five years, about 70 percent of the electricity produced in Idaho is from hydroelectric generation, about 13 percent from natural gas, and the remaining 17 percent from wind, wood fuels, and other sources.
- The Hells Canyon Complex on the Snake River is the largest privately owned hydroelectric power complex in the nation.[5]
- In 2013, Idaho's in-state net electricity generation equaled 62 percent of the state's total electric industry retail sales. The remainder is imported, primarily from coal fired power plants in neighboring states.[6]
- There are no coal mines in Idaho; however in 2015, Idaho became a natural gas producer, with six natural gas wells in Payette County coming on-line.
- In 2013, 78 percent of Idaho's net electricity generation came from renewable energy sources, including hydroelectric power, and Idaho had the fourth-lowest average electricity prices in the United States.[7]
- Idaho has the fifth lowest carbon dioxide output of any state due in large part to its renewable energy generation, including hydroelectric energy.[8]

[2] www.eia.gov/state/seds/data.cfm?incfile=/state/seds/sep_fuel/html/fuel_te.html&sid=US&sid=ID
[3] www.eia.gov/state/
[4] www.eia.gov/state/data.cfm?sid=ID#ConsumptionExpenditures
[5] www.eia.gov/state/print.cfm?sid=ID
[6] www.eia.gov/state/?sid=ID#tabs-2
[7] www.eia.gov/state/state-energy-profiles.cfm?sid=ID
[8] www.eia.gov/state/rankings/?sid=ID#series/226

- Petroleum, the large majority of which is used for transportation fuels, constituted 30 percent of Idaho's end-use energy consumption in2013.
- Idaho's wind generation increased by 35 percent in 2013, providing 16 percent of net electricity generation.[9]

Idaho Energy Usage and Generation Sources

Idaho Energy Use

Idaho is a net importer of energy. About 74 percent of Idaho's total energy, including transportation fuel, comes from sources outside the state. Idaho has very few fossil fuel resources, and as a result the state must import fossil fuels to be consumed in Idaho.

Idaho used about 530 trillion BTUs of energy in 2013. Generation of 1 kilowatt-hour (kWh) of electricity from fossil or nuclear sources requires about 10,000 BTUs of thermal energy; 1 gallon of gasoline contains about 125,000 BTUs. Idaho's per capita energy consumption is above the national average. Idahoans use a little more than 328 million BTUs per person each year, which ranks the state 22nd in terms of per capita energy use. The energy consumed in Idaho can be divided into four sectors as shown below:[10]

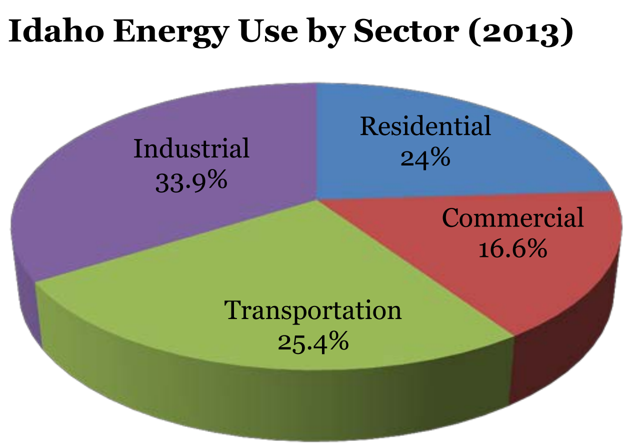


Figure 1. Idaho Energy Use by Sector (2013)

[9] www.eia.gov/state/state-energy-profiles.cfm?sid=ID
[10] www.eia.gov/state/?sid=ID#tabs-2

Electricity Consumption

Although electricity consumption overall has typically increased, consumption per capita in Idaho has declined since 1997. Overall consumption in Idaho has increased by 17 percent from 2002 to 2013 due to load growth, with a slight decrease in 2009 coinciding with the economic recession. Since 2010, electricity consumption has resumed annual growth, and looking into the future, growth is expected to average between 1-1.5 percent per year. Contributing to the decline in consumption was a substantial increase in energy efficiency and demand-side reduction programs by all of Idaho's major utilities. While Idaho's electricity consumers are using energy more efficiently, there is no doubt that additional energy will be required to power Idaho's future.

Energy Sources

Transportation Fuel

Petroleum, the large majority of which is used for transportation fuels, constitutes 30 percent of end-use energy consumption in Idaho.[11] Although liquid fuels (ethanol and biodiesel) are produced in Idaho for transportation use, 100 percent of petroleum utilized in Idaho comes from out of the state.

Average gasoline prices in Idaho were the 46th highest among U.S. states in October of 2015. However, each state has a different state fuel tax and gasoline price rankings can change rapidly and significantly.[12] In 2015, the Idaho legislature approved an increase in the state's gasoline tax rate, from 25 cents per gallon to 32 cents per gallon.[13] Idaho's state gasoline taxes are 11 cents higher than the recent national average of 21 cents. [14] Additionally, the cost of shipping transportation fuels into Idaho, which has no refineries, are included in gasoline prices.

Heating Fuel

There are several different sources of heating fuel in Idaho, the most common of which are natural gas, propane, electricity, geothermal, and biomass.

Idaho is located between two major natural gas supply basins and benefits from natural gas prices that are below the national average. Historically, all of Idaho's natural gas supplies were imported from out of state. However, in 2015 Idaho began producing natural gas from with six wells in Payette County. Idaho also has several geothermal district heating systems that provide inexpensive and efficient heating, although they are available only in localized geographic areas.

[11] www.eia.gov/state/seds/sep_sum/html/pdf/sum_use_tx.pdf
[12] www.fuelgaugereport.aaa.com/todays-gas-prices/
[13] www.tax.idaho.gov/i-1119.cfm#sub4
[14] www.api.org/oil-and-natural-gas-overview/industry-economics/fuel-taxes

Fuel Sources for Electricity

Power plants generate electricity using a fuel or energy source such as coal, natural gas, flowing water, wind, biomass, or uranium. Power plants are grouped by the type of fuel or energy source they use: fossil fuel, renewable, and nuclear.

Coal, natural gas, and refined oil products are classified as fossil fuels. Fossil fuels supply about 67 percent of the nation's electrical generation needs.

Renewable sources of electricity include hydropower, wind, solar, geothermal, and biomass (such as wood, wood waste, and landfill gases). The image below shows the national mix of energy sources for electricity.[15]

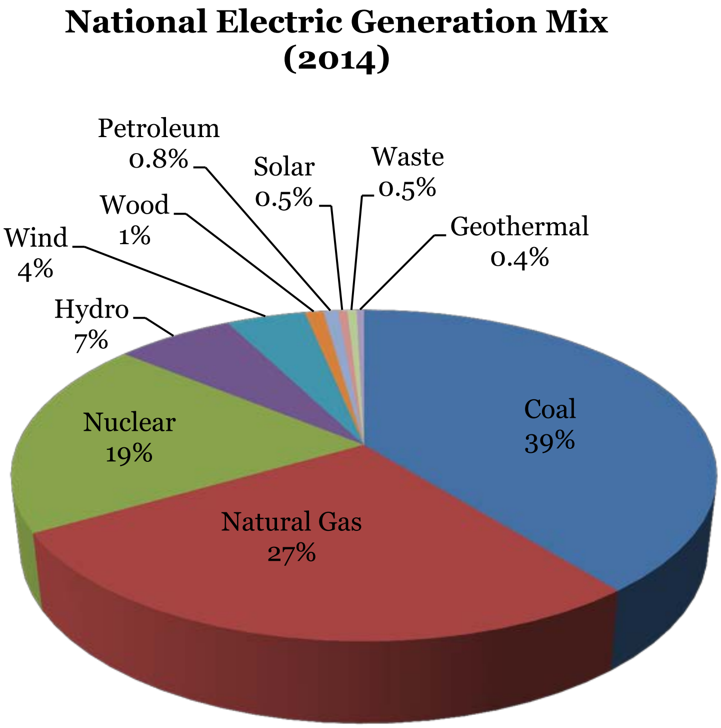


Figure 2. National Electric Generation Mix (2014)

[15] www.eia.gov/electricity/monthly/epm_table_grapher.cfm?t=epmt_1_1

Electricity in Idaho

Though Idaho is in the early stages of fossil fuel production from natural gas, it is rich in renewable resources. In a year with average hydroelectric generation, about 65 percent of Idaho's electricity is generated in-state. The other 35 percent comes primarily from coal fired power plants located in neighboring states. As shown in the chart below, the majority of electricity generated in Idaho is through hydroelectric dams. The use of this clean and renewable source of energy in the state results in lower prices for ratepayers. On the national level, hydroelectricity is used as a source for approximately 7 percent of electricity generation. Idaho is well above the average in its use of this efficient, reliable, and renewable energy.[16] [17]

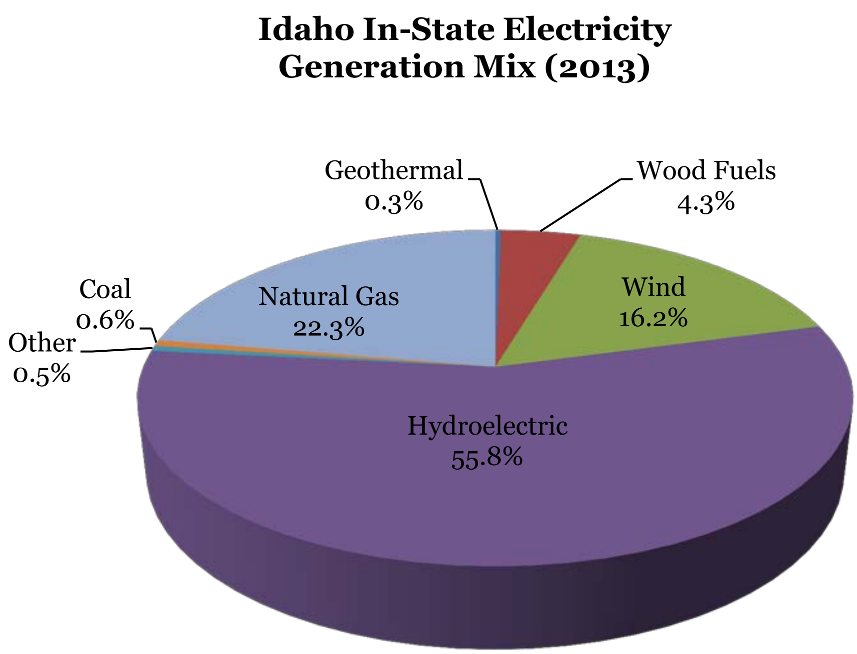


Figure 3. Idaho In-State Electricity Generation Mix (2013)

[16] www.eia.gov/electricity/data.cfm#generation
[17] www.eia.gov/state/state-energy-profiles-print.cfm?sid=ID

Forecasting and Planning

As shown in the graph below, electricity use in Idaho is expected to continue to increase.[18] Potential resources available in Idaho to meet our growing electricity needs include wind, geothermal, solar, small hydropower, biomass energy, and in-state production of natural gas, coupled with increased imports of natural gas for electricity generation, imported electricity, and potentially nuclear energy.

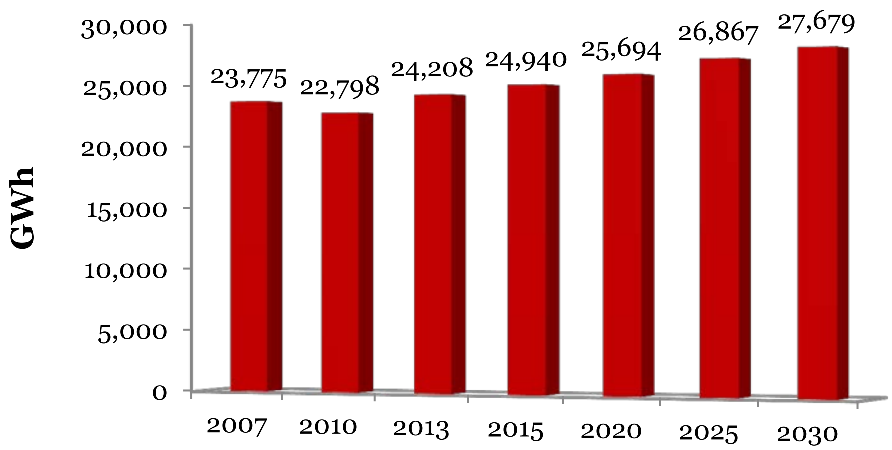


Figure 4. Electricity Use in Idaho

The investor-owned utilities develop 20-year Integrated Resource Plans (IRPs) to identify sufficient resources to reliably serve the growing demand for energy from their customers. Various stakeholders including customers, regulators, governmental officials, and the environmental community participate in the process.

Planning goals include:

- Identifying sufficient resources to meet growing energy demand
- Selecting resource portfolios that balance risk, costs, and environmental concerns
- Consideration of supply-side (generation) and demand-side (conservation and energy efficiency) resources

Planning begins with a forecast of customer demand, which is compared with existing resources, demand-side management (energy conservation) performance, and transmission capability. A financial analysis is performed for various potential resource portfolios, along with their accompanying risks, that can provide both energy and capacity future requirements. Ultimately a preferred portfolio is selected, along with actionable steps to begin implementing the plan.

[18] EIA 861 Average Retail sales forecasted at 1.5% annual increase.

ELECTRICITY PROVIDERS IN IDAHO

Eighty-six percent of Idaho's electric consumers are served by three investor-owned utilities ("IOUs"), whose operations are regulated by the Idaho Public Utilities Commission. The remaining 14 percent is served by 11 municipal utilities and 17 rural electric cooperatives/mutuals.

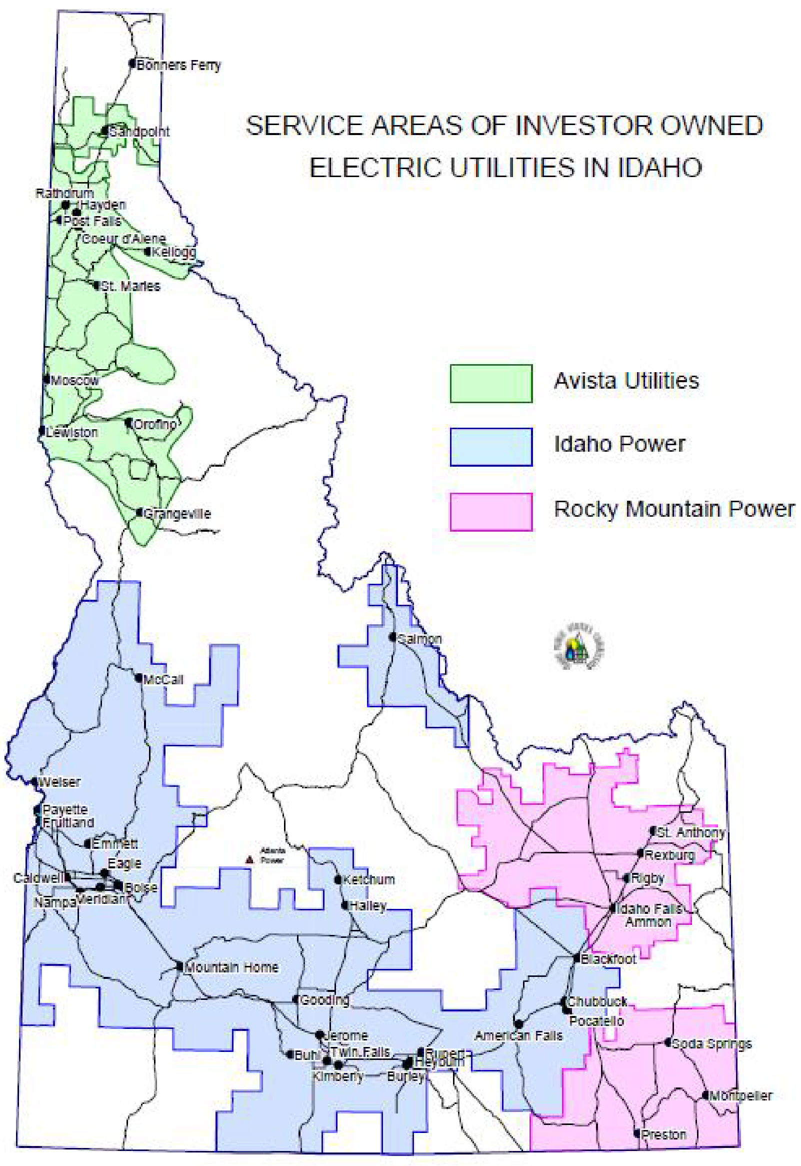


Figure 5. Service Areas of Investor Owned Electric Utilities in Idaho[19]

[19] www.puc.idaho.gov

Idaho Power Company

Founded in 1916, Idaho Power Company serves approximately 523,000 customers across a 24,000 square mile service area in southern Idaho and eastern Oregon. Headquartered in Boise, Idaho Power Company is the largest provider of electricity in the state. Idaho Power Company is one of the nation's few investor-owned utilities with a hydroelectric generating base; it has 17 low-cost, emission free hydroelectric projects at the core of its generation portfolio. Other resources include baseload coal facilities in Wyoming, Oregon, and Nevada, as well as two natural gas-fired combustion turbines and a natural gas-fired combined cycle project located in Idaho. In addition to its company-owned resources, Idaho Power Company's supply-side portfolio includes several long-term power purchase contracts with wind and geothermal facilities and it has power purchase contracts with 140 projects covered by the Public Utility Regulatory Policies Act. As of the beginning of November 2015, Idaho Power has approximately 728 megawatts (MW) of wind generation and 389 MW of PV solar generation either on-line or under contract.

Idaho Power Company obtains energy from a diverse set of generation resources, long-term power purchase agreements, and short-term market purchases. The estimated fuel mix for Idaho Power Company's resource portfolio in 2014 is shown here.[20] [21]

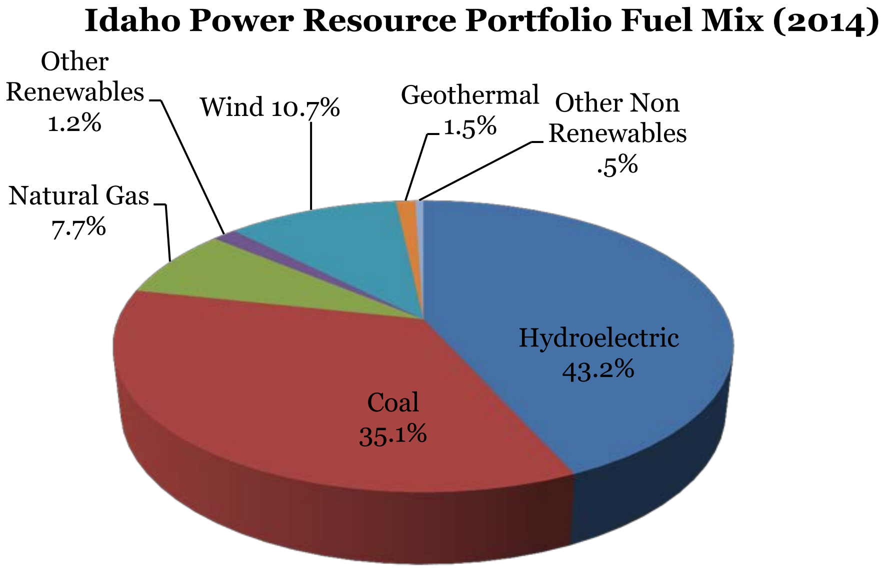


Figure 6. Idaho Power Fuel Mix (2015 IRP)

Learn more at: www.idahopower.com

[20] www.idahopower.com/AboutUs/EnergySources/FuelMix/resourcePortfolio_2014.cfm; this is an estimate of the fuel mix of Idaho Power's portfolio of generation supply, including market purchases.
[21] Current loads and resources at: www.idahopower.com/generationdemand

Avista Corporation

Avista is an investor-owned electric and natural gas utility headquartered in Spokane, Washington. Founded as Washington Water Power Company in 1889, it changed its name to Avista Corporation in 1999. Currently, Avista serves more than 127,000 electric customers in northern Idaho, Washington and Oregon, and is the second largest electricity provider in Idaho. Customers receive electricity from a mix of hydroelectric, natural gas, coal, biomass, and wind sources delivered through 2,200 miles of transmission line and 18,000 miles of distribution line. A substantial portion of Avista's electricity comes from hydropower resources which provide a significant price benefit for its customers. Avista has hydroelectric resources located in western Montana, eastern Washington, and northern Idaho; an ownership share of a Montana coal plant; and natural gas fired baseload and capacity resources in Idaho, Oregon, and Washington.

Avista Power Fuel Mix (2015 IRP)

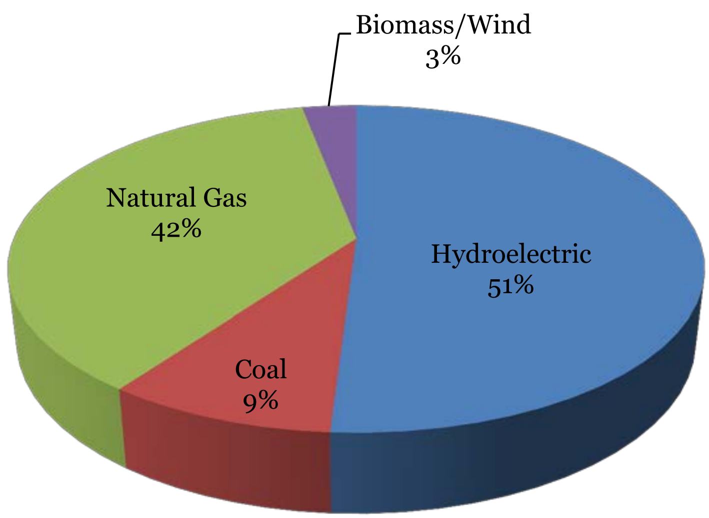


Figure 7. Avista Power Fuel Mix (2015 IPR)

Learn more at: www.avistautilities.com

PacifiCorp/Rocky Mountain Power

PacifiCorp serves retail customers in six Western States- California, Idaho, Oregon, Utah, Washington, and Wyoming-and serves more than 1.8 million customers across its 136,000 square mile service territory. The utility was founded in 1910 as Pacific Power & Light, and changed its name to PacifiCorp in 1984. PacifiCorp began operating in Idaho in 1989 through its merger with the Utah Power & Light Company, which began serving customers in Idaho in 1912. The company was purchased by Mid-American Energy Holdings Company in 2006, which changed its name to Berkshire Hathaway Energy. PacifiCorp changed the name of its eastside retail operating division to Rocky Mountain Power, which serves 73,871 customers in south-eastern Idaho (approximately four percent of PacifiCorp's total customer base). PacifiCorp owns 75 generating plants capable of 10,904 MW of net generation capacity, including coal, hydroelectric, natural gas, and wind resources. As a stand-alone utility, PacifiCorp is second only to Berkshire Hathaway Energy in the ownership of wind generation. Wind, hydro, geothermal, and other non-carbon-emitting resources currently make up more than 27 percent of PacifiCorp's owned and contracted generating capacity, accounting for about 20 percent of total energy output.

As of September 2015, PacifiCorp had 1,031 megawatts of owned wind generation capacity and long-term purchase agreements for more than 915 megawatts from wind projects owned by others.

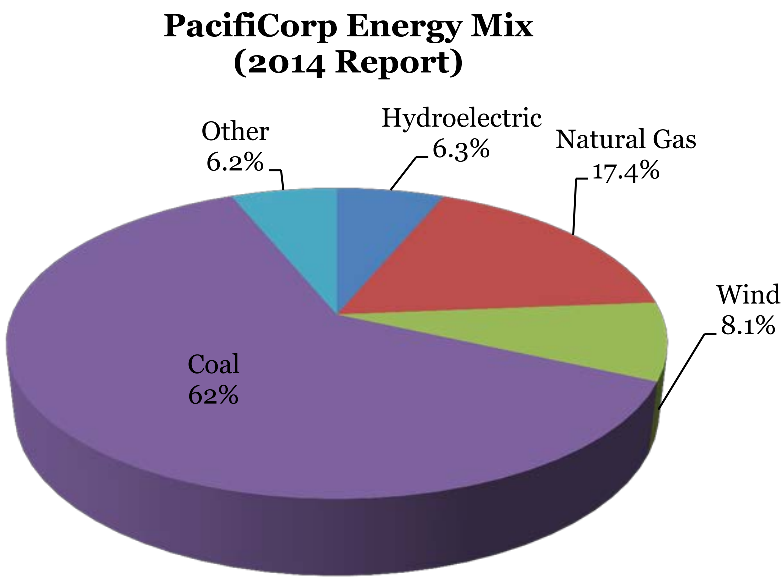


Figure 8. PacifiCorp Energy Mix (2014 Report)

Learn more at: www.rockymountainpower.net

Electric Cooperative, Mutual and Municipal Utilities in Idaho

There are 28 rural electric cooperatives, mutuals, and municipalities providing electric service in Idaho. These are public power systems that operate with a not-for-profit business model, setting their rates to cover their costs with no profit motive.

These utilities serve more than 130,000 customers in Idaho, accounting for 16 percent of Idaho's load. Ninety-six percent of the power distributed is purchased through the Bonneville Power Administration. Most of these utilities collaborate under the Idaho Consumer Owned Utilities Association. The mission of the Idaho Consumer-Owned Utilities Association is to advocate for Idaho's public power interests through the collective action of its members at the state, regional, and federal levels. Policies including resource planning and electric rates for these utilities are set by their individual boards of City Councils.

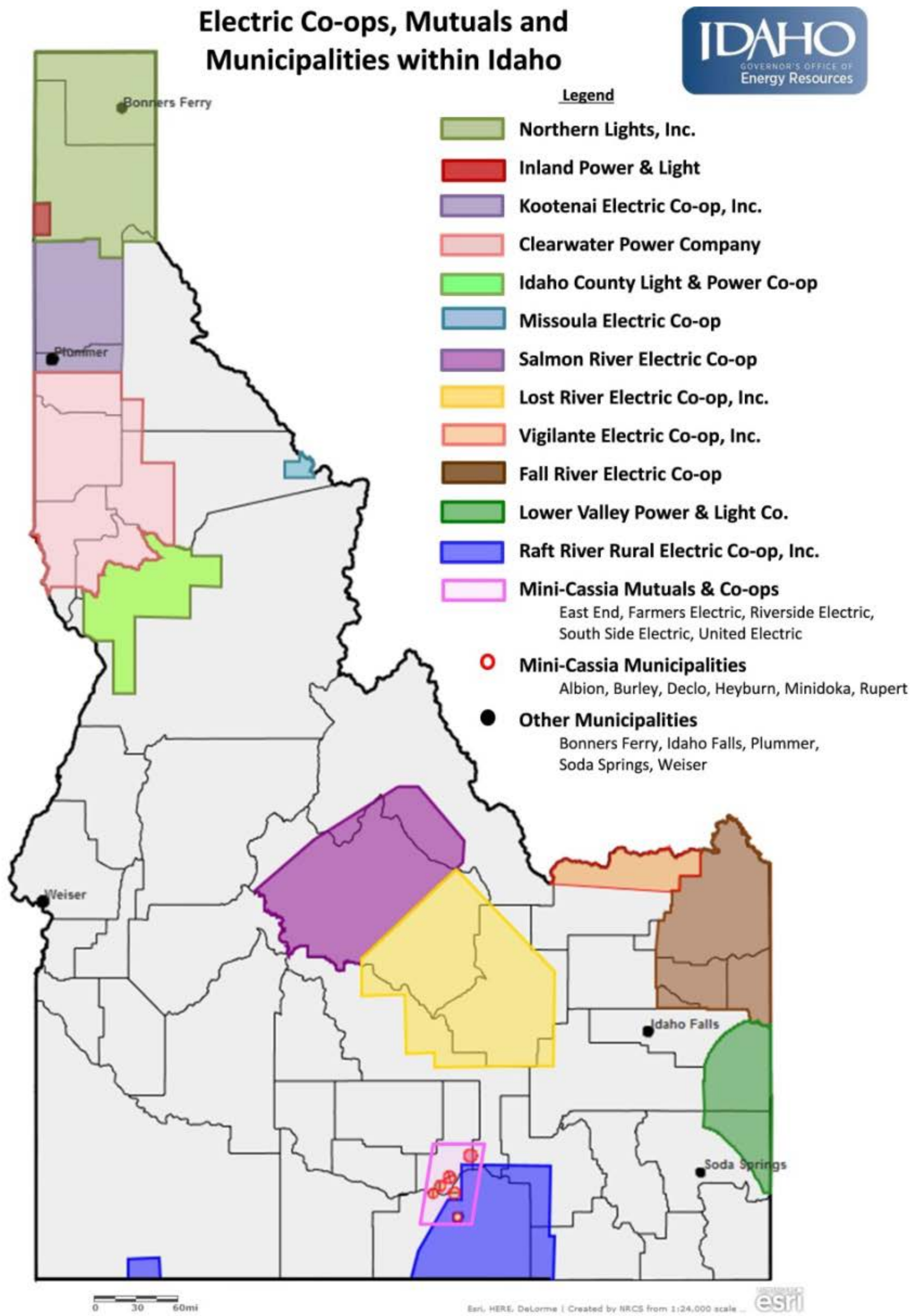


Figure 9. Electric Co-ops, Mutuals, and Municipalities within Idaho

Bonneville Power Administration

Bonneville Power Administration (BPA) is a federal power marketing agency housed in the United States Department of Energy. BPA markets the power from 31 federal hydroelectric dams on the Columbia River and its tributaries, as well as from the 1,200 MW Columbia Generating Station nuclear power plant in Richland, Washington. These resources comprise the majority of the Federal Columbia River Power System ("FCRPS"), whose output is reserved by statute for the public power utilities (PUDs, municipals, cooperatives) in the Pacific Northwest. BPA markets about 30 percent of the electric power used in the Northwest, and supplies over 96 percent of the wholesale electric power that Idaho's municipal and cooperative utilities deliver to their customers. BPA provides Residential Exchange Program benefits to residential and small farm customers of investor owned utilities in the Northwest, and provides limited energy service to one industrial customer known as a "Direct Service Industry".

In addition to electric power, BPA operates and maintains about three-fourths of the high-voltage transmission lines in Idaho, Oregon, Washington, western Montana, and small parts of eastern Montana, California, Nevada, Utah, and Wyoming. Capacity on this transmission system is marketed to all Northwest utilities including, Cooperatives, Municipalities, Public Utility Districts, Federal Agencies, Investor Owned Utilities, Direct Service Industries, Port Districts, Tribal Utilities, and independent power producers, including some California and Canadian companies.

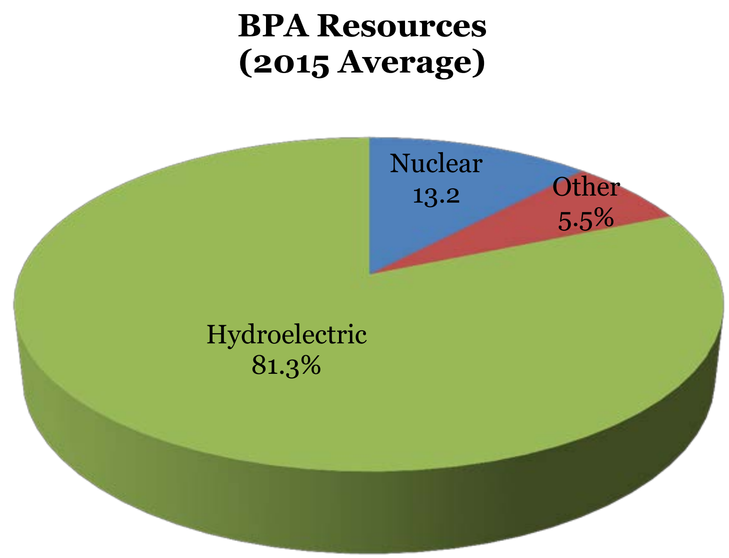


Figure 10. BPA Resources (2015 Average)

Learn more at: www.bpa.gov

The Northwest Power and Conservation Council

The Northwest Power and Conservation Council (Council) was created by Congress in 1980 when it passed the Pacific Northwest Electric Power Planning and Conservation Act (Act), giving the states of Idaho, Montana, Oregon, and Washington a greater voice in how they plan their energy future and protect their fish and wildlife resources.

Congress concluded that an independent agency, controlled by the states and without a vested interest in selling electricity, should be responsible for forecasting the region's electricity load growth and helping determine which resources should be built.

The Northwest Power Act gives the Council three distinct responsibilities: 1) to assure the region an adequate, efficient, economical and reliable electric power supply; 2) to prepare a program to protect, mitigate and enhance fish and wildlife of the Columbia River Basin that have been affected by the construction and operation of hydropower dams; and 3) to inform the Pacific Northwest public about energy issues and give the public the opportunity to be involved in the Council's decision-making process.

The Council is to write a 20-year, least-cost power plan for the Pacific Northwest and update it at least every 5 years. The plan includes several key provisions, including an electricity demand forecast, electricity and natural gas price forecasts, an assessment of the amount of cost-effective energy efficiency that can be acquired over the life of the plan, and a least-cost generating resources portfolio. The plan guides the Bonneville Power Administration's decision-making to meet its customers' electricity load requirements.

In a decision that was ahead of its time, Congress concluded in 1980 that energy efficiency should be the priority energy resource for meeting the region's future load growth. The Northwest Power Act includes a provision that directs the Council to give priority to cost-effective energy efficiency, followed by cost-effective renewable resources. In effect, for the first time in history, energy efficiency was deemed to be a legitimate source of energy, on par with generating resources. The rest is history. Since the release of the Council's first Northwest Power Plan in 1983, the region's utilities have acquired the equivalent of more than 5,900 average megawatts of electricity, enough savings to power five cities the size of Seattle.

The Council also is to update the Columbia River Basin Fish and Wildlife Program every 5 years. The latest Fish and Wildlife Program was adopted by the Council October, 2014. The full Fish and Wildlife Program will be incorporated into, and is to be a part of the 7th Power Plan which is expected to be finalized February 2016.

Learn more at: www.nwcouncil.org

Natural Gas Providers in Idaho

Thousands of Idaho households and businesses have natural gas service for space and water heating and for industrial process needs. More than one-half of households in Idaho use natural gas as their primary energy source for home heating.[22]

In the early 2000s, the Western energy crisis drove huge increases in natural gas prices and reduced the long-term availability of natural gas contracts. However, more recently, the unprecedented availability of shale-derived natural gas has resulted in a significant and relatively stable drop in gas prices.

While the long-term price of natural gas is expected to rise from current levels, it is also expected to remain well below that of gasoline and diesel for the foreseeable future. Whether natural gas might be adopted as an alternative transportation fuel will likely depend on the confidence of markets in the long-term price of natural gas, the risks associated with developing natural gas compatible vehicles, and an adequate fueling infrastructure.

Avista Corporation

Avista, an investor-owned electric and natural gas utility headquartered in Spokane, Washington, provides natural gas service to more than 78,000 customers in north and central Idaho. Avista delivers gas over 7,600 miles of natural gas distribution mains in the state. As with electricity, natural gas prices for Avista's Idaho customers are regulated by the Idaho Public Utilities Commission.

Similar to the integrated planning performed by the investor-owned utilities for electricity, Avista also prepares an integrated resource plan for natural gas, on a two-year cycle, which identifies a strategic natural gas portfolio that meets future customer demand requirements for a twenty year horizon. With the involvement and contribution of its Technical Advisory Committee (composed of Idaho Public Utilities Commission staff, peer utilities, Avista customers, and other stakeholders), Avista develops a portfolio that is sufficient to meet forecast needs while balancing cost and risk.

Learn more at: www.avistautilities.com

[22] www.eia.gov/state/state-energy-profiles-analysis.cfm?sid=ID

Intermountain Gas Company

Intermountain Gas Company is a natural gas distribution company serving approximately 336,000 residential, commercial, and industrial customers in 75 communities in southern Idaho. Intermountain Gas is a subsidiary of MDU Resources Group, Inc., a multi-dimensional natural resources enterprise (more at www.mdu.com).

Industrial customers account for 46 percent of Intermountain Gas Company's sales. The company's industrial customers include potato processors, chemical producers, fertilizer plants, and electronic factories. Commercial customers account for 18 percent of sales and residential about 36 percent.

Learn more at: www.intgas.com

Questar Gas

Questar Gas, a natural gas utility based in Salt Lake City, provides retail natural gas-distribution service to almost 900,000 customers in Utah, southwestern Wyoming, and a portion of Franklin County in southern Idaho. Questar has three lines of business: retail gas distribution, interstate gas transportation and storage, and gas development and production.

Learn more at: www.questargas.com

Transmission of Energy

Idaho is an energy transmission crossroad, linking critical conventional energy centers and substantial renewable energy generation resources in the western energy corridor with urban economic hubs in the west. This makes Idaho a critical link in the nation's economic and national security chain. However, as energy demands increase in Idaho, the need for modern infrastructure to transport the energy supply will also increase. The state of Idaho does not have conventional fossil energy resources like coal and oil, and has recently begun to produce natural gas. As a result, a substantial percentage of the energy consumed in Idaho (approximately 70 percent) is produced outside of Idaho's borders. Idaho's homes and businesses therefore depend greatly on the ability of energy suppliers to import energy from outside the state. The energy delivered to Idaho by oil and gas pipelines, tanker trucks and transmission lines is essential for Idaho's economy to function. Though new sources of energy are being sought, it is likely that much of the most affordable electricity supplies will continue to come from outside the state. These imports from neighboring states will continue to play a significant role in Idaho's energy future.

Major Electric Transmission Lines

Electrical transmission in Idaho is operating at near-full capacity during periods of peak electricity demand.[23] As a result, Idaho will require additional transmission capacity to keep up with growth, reduce congestion, and enhance reliability of the western grid. More than a half-dozen new electric transmission line projects have been proposed that would stretch into or through the state of Idaho, though several of these projects have been canceled or put on hold due to permitting delays, the nationwide drop in electricity demand, and other factors. If constructed, new lines would help relieve congestion, improve reliability, and provide access to secure, affordable energy supplies.

Major Natural Gas Pipelines

Idaho is served by two interstate natural gas transmission pipelines and three natural gas distribution utilities. These pipelines provide natural gas from Canada, although the smaller Williams Gas Pipeline West has bi-directional capabilities and can provide natural gas from Wyoming if necessary.

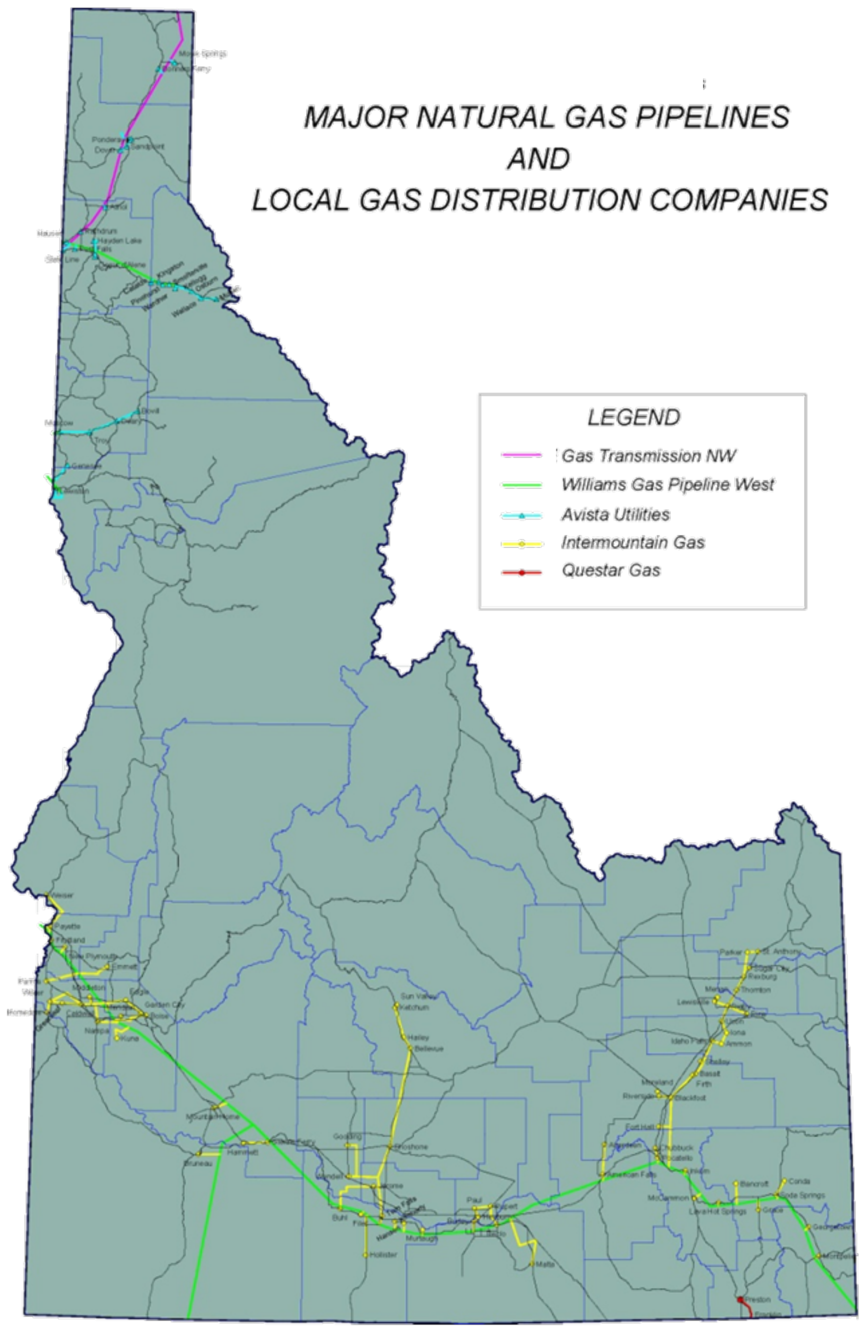


Figure 11. Major Natural Gas Pipelines and Local Gas Distribution Companies

[23] www.wecc.biz

Transportation Fuel Distribution Companies in Idaho

Idaho has a relatively small transportation fuel market, and has no refineries and limited pipeline infrastructure. All gasoline and diesel fuel used in Idaho is imported by truck, rail, or pipeline. Most Idaho markets receive petroleum-based fuels from refineries in Montana and Utah via two pipelines, one owned by ExxonMobil and ConocoPhillips (Yellowstone Pipeline) and the other by Tesoro Logistics LP (Northwest Products Pipeline). The Northwest Products Pipeline connects Salt Lake City with Spokane, Washington, and it has refined products terminals at Pocatello and Boise, Idaho, as well as Pasco, Washington. Additional supplies originate at three refineries in the Billings, Montana area and are transported to Spokane via the Yellowstone Pipeline. These pipelines generally operate at capacity on at least a seasonal basis, during the late spring and summer months when the demand for gasoline and diesel is at its highest.

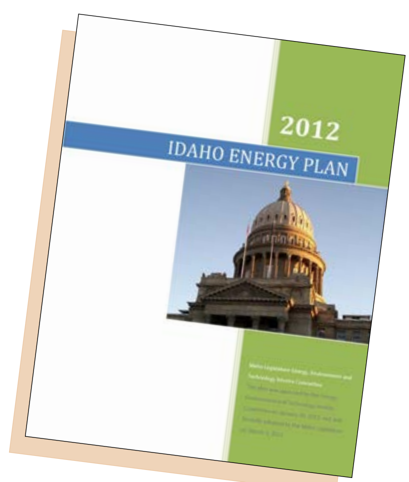
A small portion of Idaho's supply originates at refineries in northwestern Washington. This fuel is transported to Portland via the Olympic Pipeline, where it is loaded onto barges and transported up the Columbia River-Snake River System to Lewiston, Idaho.

Policy and Pricing

Idaho Energy Policy

The Idaho Governor's Office of Energy Resources was established to help maintain Idaho's energy advantages and implement a pragmatic, common-sense approach to meeting the energy challenges of the future.

During its 2006 session the Idaho Legislature passed House Concurrent Resolution No. 62, which directed the Legislative Council Interim Committee on Energy, Environment and Technology to "develop an integrated state energy plan that provides for the state's power generation needs and protects the health and safety of the citizens of Idaho and to report back to the Governor and the Legislature its findings and recommendations." The products of this effort have been the 2007 and 2012 Idaho Energy Plans that considered all of Idaho's energy systems and developed energy plan policies and identified actions to help achieve the committee's objectives of ensuring a reliable, low-cost energy supply while protecting the environment, and promoting economic growth.



The 2012 Idaho Energy Plan can be accessed online at: www.energy.idaho.gov/energyalliance/d/2012_idaho_energy_plan_final_2.pdf.

Idaho's Public Utilities Commission

Under state law, the Public Utilities Commission (IPUC) regulates Idaho's investor-owned utilities to ensure that customers receive adequate service at just and reasonable rates. The Legislature has granted the IPUC quasi-legislative and quasi-judicial authority in Titles 61 and 62 of the Idaho Code. In its quasi-legislative capacity, the IPUC sets rates and makes rules governing utility operations.

The three commissioners are statutory officers appointed by the Governor and confirmed by the State Senate. No more than two commissioners may be of the same political party. The commissioners serve staggered six-year terms. The IPUC's operations are funded by fees assessed on the utilities and railroads it regulates. The Legislature sets the IPUC's annual budget and then the IPUC collects proportional assessments from each utility and railroad within limits set by law. The IPUC employs a professional staff of approximately fifty persons: engineers, rate analysts, accountants, investigators, economists, policy analysts, safety inspectors, and other support personnel.

When a utility requests a rate increase, the IPUC staff examines the revenues, expenses, and investments of the utility to determine the amount needed for the utility to reasonably recover its costs and earn a fair return on its investment. In other cases, the staff audits the utility's books, determines the cost-effectiveness of energy efficiency, conservation, and cogeneration programs, evaluates the adequacy of utility services, and frequently helps resolve individual customer complaints. The staff also develops computer models of utility operations and reviews utility forecasts of energy usage and the need for new facilities.

Energy Prices

The average residential monthly electric bill in Idaho (2014) was 13 percent less than the national average (see map below, U.S. Energy Information Administration, for average cents per kilowatt hour by state) while residential natural gas prices are about 72 percent of the national average.[24] [25]

Average Residential Price of Electricity (2014)

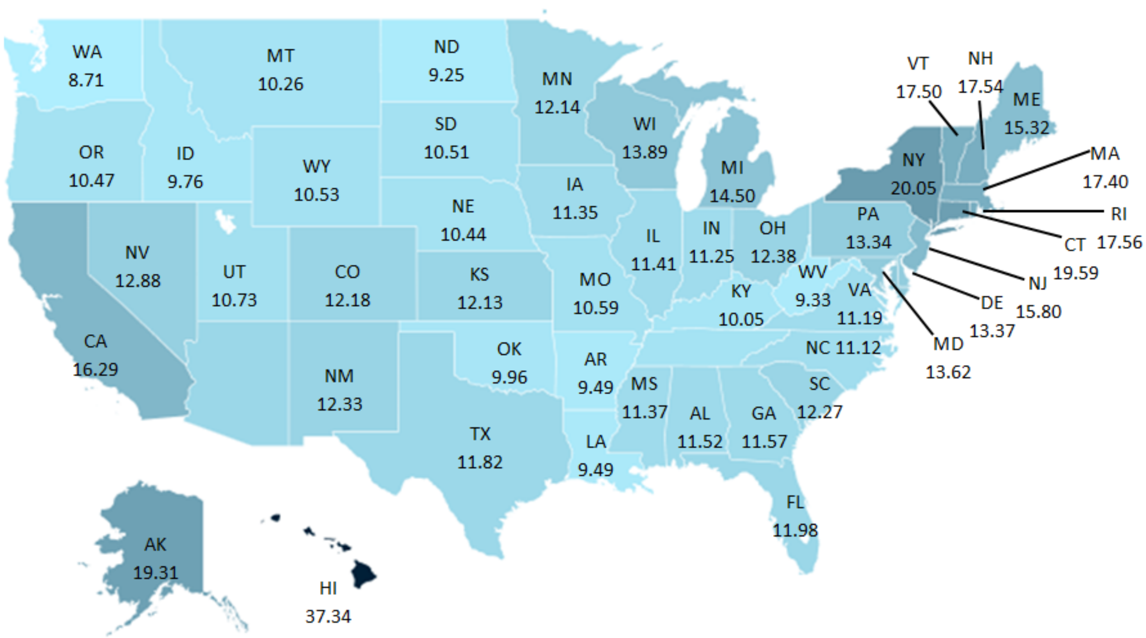


Figure 12. Average Residential Price of Electricity (2014)[26]

The affordability of energy in Idaho is a foundation for economic competitiveness and a significant factor in affordable living.

While costs associated with generation are the largest component of the cost of electricity, there are also significant costs associated with transmission, distribution, and customer service. Similar considerations apply to natural gas utilities. There are also significant pipeline transmission costs and distribution costs associated with transportation fuels. Idaho's low-cost, reliable energy represents a competitive advantage for the state and provides enormous benefit to Idaho's industrial, commercial, and residential customers.

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[24] www.eia.gov/electricity/sales_revenue_price/pdf/table5_a.pdf
[25] www.eia.gov/dnav/ng/ng_pri_sum_dcu_nus_a.htm
[26] www.eia.gov/electricity/data/browser

Cost Factors and Considerations

Below are some facts about Idaho's regulatory environment that affect the cost of energy or the cost of using energy.

- More than 16 percent of Idaho's electricity demand is met by municipal and cooperative utilities that operate as not-for-profit entities.
- Counties in Idaho are responsible for siting energy facilities.
- Idaho does not have a renewable portfolio standard. However, the large amount of in-state hydropower and wind energy means Idaho's electricity mix has among the lowest carbon emissions in the nation.
- The Idaho Public Utilities Commission has reduced the maximum size of a "qualifying facility" that can receive the "avoided-cost" rate contract under the Public Utility Regulatory Policies Act (PURPA) from 10 average MW to 100 kW for wind and solar projects in response to concerns that the rapid growth of wind and solar generation in Idaho will raise consumer rates and decrease system reliability.
- Idaho does not have a renewable fuel standard for transportation.
- Idaho requires new residential and commercial buildings to meet the energy efficiency standards. Outlined in the International Energy Conservation Code (IECC) for the year that has been adopted by the Idaho legislature. The IECC, developed by the International Code Council, is a model code that mandates energy efficiency standards.
- Electric utilities may "decouple" revenue from the sale of electricity, but Idaho does not allow natural gas utilities to decouple. Some states decouple revenue from actual sales, allowing utilities to increase their revenue by selling less electricity and natural gas to encourage energy efficiency investment. Idaho Power has effectively decoupled residential and small-commercial customers, but Avista and Rocky Mountain Power currently remain under traditional ratemaking.

Energy Resources: Renewable Energy

Geothermal

Idaho has some of the best potential in the country for geothermal energy production. The state uses geothermally-heated water for generating electricity, heating buildings, producing fish, alligators, and plants, and also for recreation. Idaho is a prime candidate for additional geothermal energy development in the future because the state has vast, untapped, and underused geothermal resources. Idaho has the first utility-scale geothermal power plant in the Pacific Northwest, U.S. Geothermal's Raft River Facility, approximately 200 miles southeast of Boise, which started providing baseload generation in January 2008. The power is being purchased by Idaho Power through a 25 year power purchase agreement.

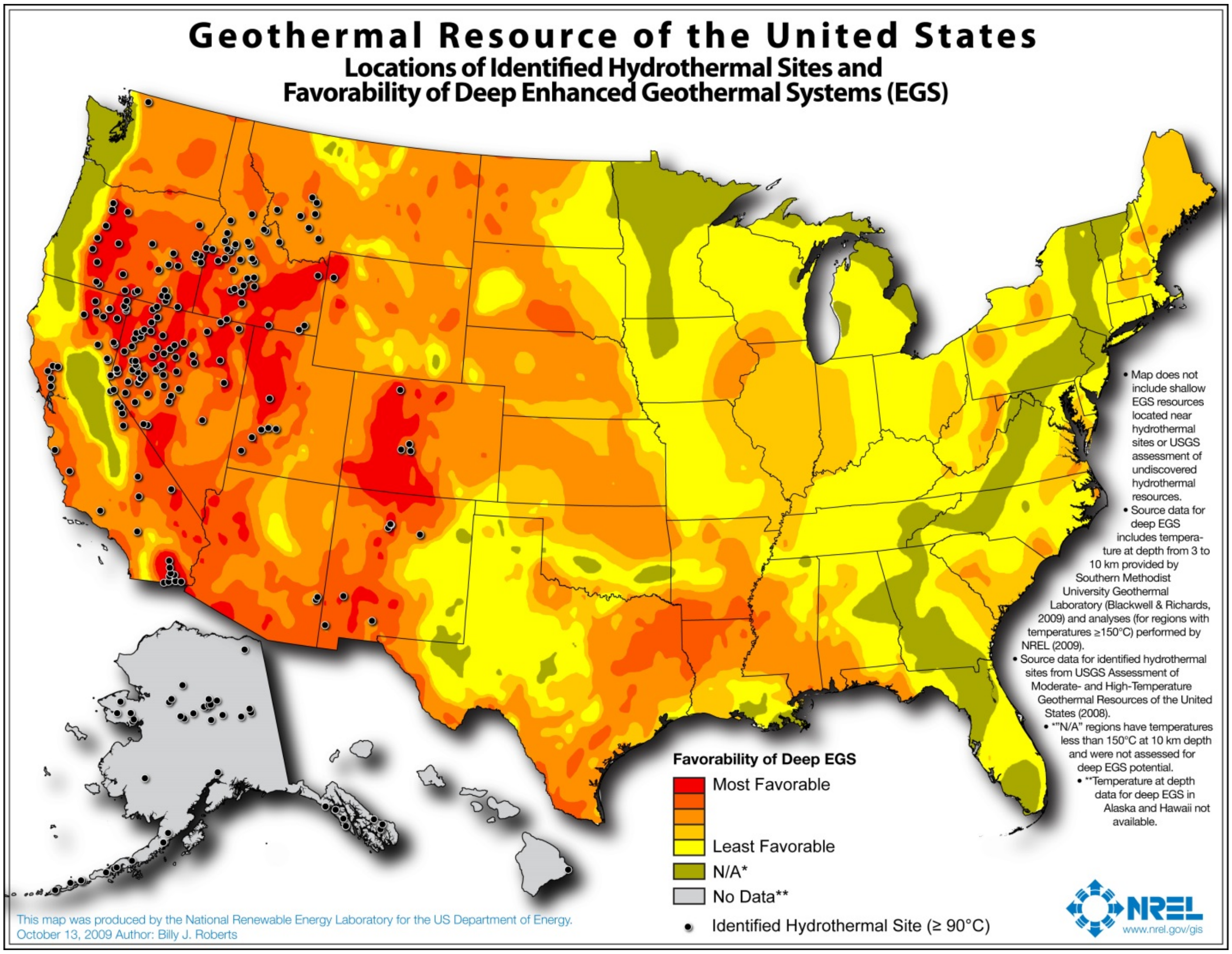

Figure 13. Geothermal Resource of the United States

Heating

Geothermal water heats buildings throughout Idaho, ranging from the Idaho State Capitol to residences. A geothermal well can supply heat for an individual home or multiple buildings connected to a system of distribution lines resulting in a district heating system. Several district heating systems are in operation in the state, including the Boise Warm Springs Water District, the oldest system in the United States.

Open- or closed-loop methods are employed to extract heat from geothermal water. In an open-loop system, water is withdrawn from a well, circulated through a building's heating system, and discharged away from the residence or reinjected into the aquifer at a different site. The closed-loop system works by installing a metal piping system in the well which transfers heat to water inside the piping. The water circulates continually in a closed-loop.

Electricity

Geothermal power generation uses a technology in which turbines are driven directly by steam (dry steam), by steam that is produced by "flashing" very hot geothermal water, or through the use of a secondary "working" fluid that is heated by the primary geothermal water to the flash point (binary plant).

In December 2007, construction of the Raft River geothermal power plant was finished and commercial sale of electricity began in January 2008. Raft River is the first commercial size binary-cycle plant in the world and uses 300°F water from underground to produce electricity. The Raft River plant has a nameplate production capacity of 15.8 MW, while present net electrical power output from the plant is approximately 11.5 MW. Geothermal plants provide less than 1 percent of the electric energy consumed in Idaho. Developers are considering additional geothermal plants in Idaho.[27]

Solar

Solar cells, also called photovoltaic (PV) cells, convert sunlight directly into electricity. PV gets its name from the process of converting light (photons) to electricity (voltage), which is called the PV effect.

Some utility companies are also using PV technology for large power stations. Solar energy is an intermittent resource, producing energy only when the sun is shining. Because it is intermittent, solar energy cannot be dispatched to meet load or counted on to produce at any particular capacity during times of high energy demand. Solar panels can also be used to power homes and businesses and are typically made from solar cells combined into modules that hold about 40 cells. A typical home will use about 10 to 20 solar panels. The panels are mounted at a fixed angle facing the sun, or they can be mounted on a tracking device that follows the sun, allowing them to maximize exposure to sunlight. Many solar panels combined together to create one

[27] Geothermal Energy Association

system is called a solar array. For large electric utility or industrial applications, hundreds of solar arrays are interconnected to form a large utility-scale PV system.

Traditional solar cells are made from silicon, are usually flat-plate, and are generally the most efficient. Second-generation solar cells are called thin-film solar cells because they are made from amorphous silicon or non-silicon materials such as cadmium telluride, a stable crystalline compound formed from cadmium and tellurium. Thin-film solar cells use layers of semiconductor materials only a few micrometers thick. Because of their flexibility, thin-film solar cells can double as rooftop shingles and tiles, building facades, or the glazing for skylights.

Third-generation solar cells are being made from a variety of new materials besides silicon, including solar inks using conventional printing press technologies, solar dyes, and conductive plastics. Some new solar cells use plastic lenses or mirrors to concentrate sunlight onto a very small piece of high efficiency PV material. This PV material is more expensive, but because so little is needed, these systems are becoming cost-effective for use by utilities and industry. The lenses must be pointed at the sun so the use of concentrating collectors is limited to the sunniest parts of the country.

Concentrating solar power (CSP) technologies use mirrors to reflect and concentrate sunlight onto receivers that collect the solar energy and convert it to heat. This thermal energy can then be used to produce electricity via a steam turbine or heat an engine that drives a generator.

Solar energy is currently used in the state for specific applications such as water pumping, thermal heating, and electricity production in remote locations that would be difficult to serve with energy from the electricity grid. Increasingly, solar is used in Idaho for grid inter-tied applications, offsetting facility energy use. Southwest Idaho's solar potential is very similar to that of the desert southwest, which has the highest solar potential in the United States.[28]

Currently there are no utility-scale PVs or CSP installations in the state, however, the Idaho Public Utilities Commission has approved Idaho Power Company agreements for 260 MW of solar power as of October 1, 2015. Idaho Power also recently signed contracts for 60 MW of solar generation in its Oregon service territory.[29]

It is estimated that a total of approximately 3 MW of solar PV is currently installed in Idaho. The U.S. installed 6,200 megawatts (MW) of solar photovoltaics (PV) in 2014 to total over 20 gigawatts (GW) installed PV capacity, enough to power 4 million homes.[30] At present, solar facilities produce less than 0.0001 percent of the electric energy consumed in Idaho.

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[28] For example, see Oak Ridge National Laboratory's report *Application of Spatial Data Modeling and Geographical Information Systems for Identification of Potential Siting Options for Various Electrical Generation Services;* http://info.ornl.gov/mwg-internal/de5fs23hu73ds/progress?id=jb3iSBl8saKqhefK0FfeuEER7M-_hEFuNSGsjamP9pU
[29] www.puc.idaho.gov/press/150108_IPCsixsolarprojects.pdf
[30] www.seia.org/research-resources/us-solar-market-insight

Wind

People have been harnessing the wind's energy to pump water or grind grain for hundreds of years. Today's modern windmills, or wind turbines, use the wind's energy primarily to generate electricity.

Wind turbines are mounted on a tower to take advantage of the stronger and less-turbulent wind overhead. Turbines harness the wind's energy using highly-efficient blades that are mounted on a shaft connected to the turbine's generator.

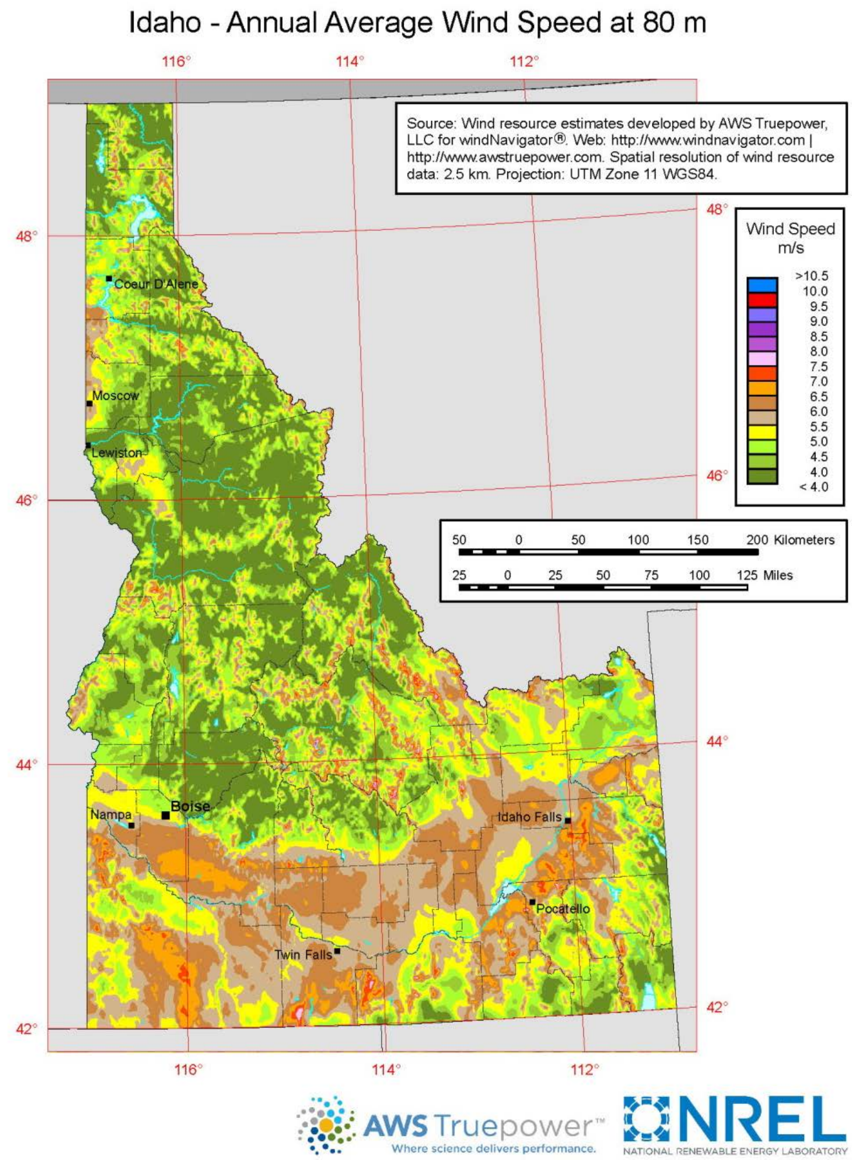

Figure 14. Idaho-Annual Average Wind Speed at 80 m

Source: www.windpoweringamerica.gov

Wind turbines can be used in stand-alone, small-scale systems that provide electricity to individual users, or large scale developments that supply electricity directly to the grid.

Electricity from U.S. wind power generation has increased from 4.1% to 4.4% of total electricity generation in 2014. Idaho is one of the states with more than twice the national share of wind power.[31] Over 67,000 MW of nameplate wind was in operation in the U.S. through the second quarter of 2015, with another 13,000 MW (nameplate) under construction. Idaho's wind generation increased by 13% in 2014 and provided 18% of net electricity generation.[32] Idaho has experienced a wind construction boom, growing from 75 MW at the end of 2008 to a total nameplate capacity of more than 900 MW in 2014.

Recent wind mapping studies estimate that Idaho has approximately 25,000 MW of wind generation potential, the 13th highest potential in the U.S. The most readily available wind resources in Idaho are located in the Snake River Plain and the surrounding hills and ridges. There has been high interest for wind development on the eastern end of the Snake River Plain.

Electricity produced from wind does not emit carbon dioxide or other emissions and can reduce the demand for fossil fuels. However, since wind generation is an intermittent resource and produces energy only when the wind blows, wind generators cannot be dispatched to meet load, and cannot be counted on to produce electricity at any particular capacity during times of high energy demand, or any other particular time for that matter. The consequence is that dispatchable resources (often natural gas-fired plants) must be ready to meet actual customer loads at times when wind generation is not available.

Wind generation in Idaho is currently providing 16 percent of net electricity generation and approximately 10 percent of the electric energy consumed in Idaho.[33]

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31 www.eia.gov/electricity/data.cfm#summary
32 www.eia.gov/state/?sid=ID
33 www.eia.gov/state/?sid=ID

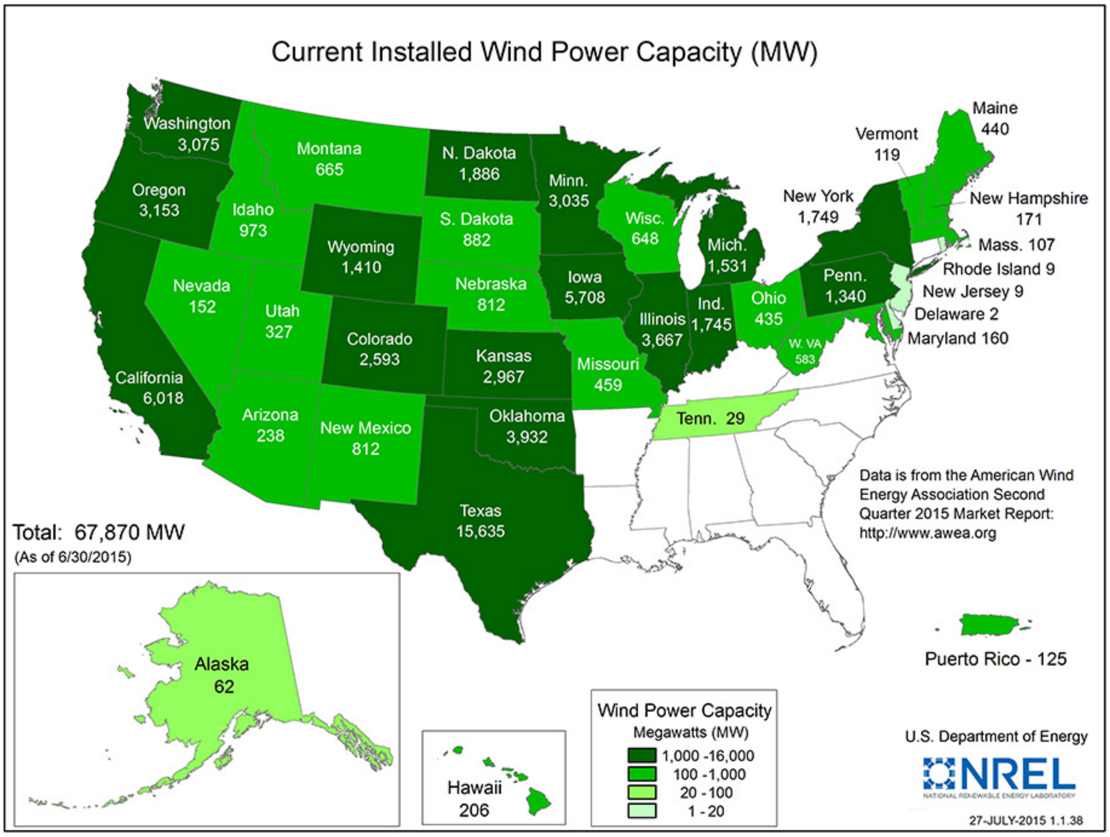
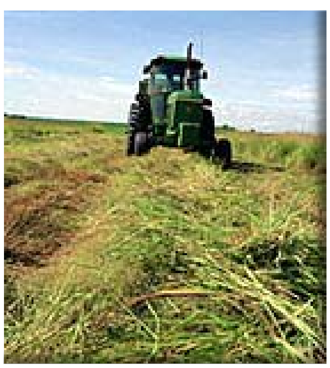


Figure 15. Current Installed Wind Power Capacity (MW)

Biomass



People have used biomass energy, or "bioenergy," the energy from plants and plant-derived materials, since they began burning wood to cook food and keep warm. Wood is still the largest biomass energy resource used today, but other sources of biomass can also be used. These include food crops, grassy and woody plants, residues from agriculture or forestry, oil-rich algae, and the organic component of municipal and industrial waste. Even the fumes from landfills, which contain methane or natural gas, can be used as a biomass energy source.

Biomass has historically supplied approximately less than ten percent of the total energy used in Idaho. However, there is sufficient biomass waste available (from forest and logging residue, municipal solid waste, agricultural residues, animal waste, and agricultural processing residue) to meet a larger share of Idaho’s energy needs.[34]

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34 www.energy.idaho.gov/renewableenergy/bioenergy.htm

Biomass can be used for fuels, power production, and products that would otherwise be made from fossil fuels. In such scenarios, biomass can provide an array of benefits. Around the state, there is ongoing research to develop and advance technologies for the following biomass energy applications:

- Biofuels - Converting biomass into liquid fuels for transportation.
- Biopower - Burning biomass directly or converting it into gaseous or liquid fuels that burn more efficiently, to generate electricity.
- Bioproducts - Converting biomass into chemicals for making plastics and other products that typically are made from petroleum.

In 2014, there was 87 MW of installed capacity for biomass electricity that produced 650,000 MWh or 4.3 percent of Idaho's electricity production for that year.[35] In 2014 Idaho has one operating ethanol plant capable of producing 63 million gallons per year.[36]

Hydroelectricity

Idaho's many rivers provide a tremendous source of renewable electricity. With more than 140 existing hydro plants having a combined generating capacity of approximately 2,700 MW, Idaho has some of the most valuable hydroelectric power resources in the country. Hydroelectricity is a unique renewable energy resource. It is a clean, inexpensive, dispatchable resource, and has greater flexibility than any other form of renewable electric generation for matching the always-fluctuating demands on the electric grid as well as accommodating the highly-variable and intermittent contribution of wind and solar generation.

Idaho's largest hydroelectric projects are the 1,167 MW Hells Canyon Complex (consisting of the Hells Canyon, Oxbow and Brownlee dams) owned by Idaho Power Company, the 400 MW Dworshak dam operated by the U.S. Army Corps of Engineers, and the 260 MW Cabinet Gorge Project owned by Avista Corporation. Idaho dams produce approximately 1,300 MW of electricity in an average water year, approximately half of Idaho's electricity consumption.[37] In 2010 hydroelectric generation was 8,473,000 MWh, providing about 55 percent of in-state electrical generation.[38]

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35 www.eia.gov/electricity/data.cfm#generation
36 www.neo.ne.gov/statshtml/122.htm
37 Idaho Strategic Energy Alliance Hydropower Task Force Report, May 2009, Appendix F, Idaho Strategic Energy Alliance Hydropower Task Force Report, May 2009, Appendix F
38 www.eia.gov/electricity/data.cfm#generation

In order to generate electricity in a hydropower dam, water from the reservoir is released into a massive pipe called a penstock, where it enters the powerhouse deep within the dam. The force of this water pushing against the turbine blades causes them to rotate. The turbine is connected to the generator that produces the electricity. All of the water entering the turbine returns to the river downstream in the tailrace of the dam. At times when more water is available in the river than can be used by the dam, the additional flow passes through the dam's spill gates.[39]

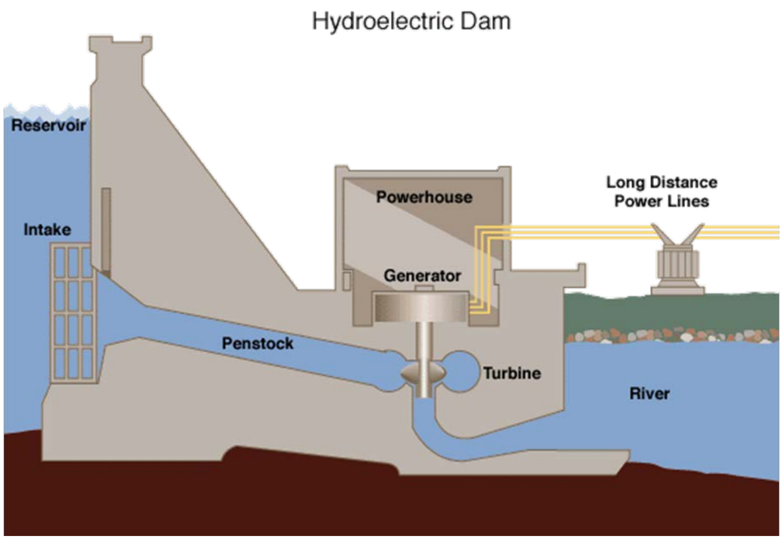

Figure 16. Hydroelectric Dam

Cybersecurity

From the 2015 Energy Sector Cybersecurity Framework Implementation Guidance by the U.S. Department of Energy:

> The National Institute of Standards and Technology (NIST) released the voluntary Framework for Improving Critical Infrastructure Cybersecurity (NIST, 2014; hereafter called the "Framework") in February 2014 to provide a common language organizations can use to assess and manage cybersecurity risk. Developed in response to Executive Order (EO) 13636 "Improving Critical Infrastructure Cybersecurity" of February 2013, the Framework recommends risk management processes that enable organizations to inform and prioritize decisions regarding cybersecurity based on business needs, without additional regulatory requirements. It enables organizations—regardless of sector, size, degree of cybersecurity risk, or cybersecurity sophistication—to apply the principles and effective practices of risk management to improve the security and resilience of critical infrastructure. The Framework is designed to complement, and not replace or limit, an organization's risk management

[39] The USGS Water Science School; http://water.usgs.gov/edu/hyhowworks.html

process and cybersecurity program. Each sector and individual organization can use the Framework in a tailored manner to address its cybersecurity objectives.

> Energy sector organizations have a strong track record of working together to develop cybersecurity standards, tools, and processes that ensure uninterrupted service. The U.S. Department of Energy (DOE), as the Energy Sector-Specific Agency, worked with the Electricity Subsector and Oil & Natural Gas Subsector Coordinating Councils along with other Sector-Specific Agencies to develop this Framework Implementation Guidance specifically for energy sector owners and operators. It is tailored to the energy sector's risk environment and existing cybersecurity and risk management tools and processes that organizations can use to implement the Framework.[40]

The Federal Energy Regulatory Commission issued Order 706 in January, 2008. This administrative mandate requires the electric utility sector to comply with reliability standards to protect critical infrastructure. These standards require users, owners, and operators of what is the bulk-power system to comply with specific requirements to safeguard critical cyber assets. Currently there are ten standards with over sixty requirements addressing; personnel, controls, physical security, electronic security, incident response, incident reporting, recovery plans, and security management. Given the ephemeral nature of cyber threats, so too are the standards evolving as most are now in their sixth iteration with seven filed pending regulatory approval. Non-compliance with the requirements of the standards can result in penalties to the offending utility reaching $1 million per day.

Energy Resources: Fossil Fuels

In 2014, fossil fuels, primarily natural gas, coal, and petroleum, provided about two-thirds of the nation's electricity (and about 80 percent of the nation's total energy demand).[41] In Idaho, fossil fuels provide approximately 45 percent of the electricity used within the state. While utility scale coal-fueled generation does not take place in Idaho, a substantial amount of the electricity used in the state is imported from coal-fired plants in neighboring states.[42] Natural gas is used to produce an increasing share of the electricity generated in Idaho (about 22 percent in 2013) and is also a significant fuel source for space heating and industrial process heat; and a small amount of coal is burned in Idaho for space heating and process heat.[43] Fossil energy, in the form of gasoline and diesel, provides the bulk of transportation fuel. Idaho's neighboring states, of Montana, Wyoming, and Utah are among the most fossil-energy rich areas in the country.

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40 www.energy.gov/sites/prod/files/2015/01/f19/Energy%20Sector%20Cybersecurity%20Framework%20Implementation%20Guidance_FINAL_01-05-15.pdf

41 www.eia.gov/beta/MER/?tbl=T01.01#/?f=A&start=1949&end=2014&charted=4-6-7-14

42 A small amount – less than one percent – of the electricity generated within Idaho comes from the burning of coal by non-utility companies in plants that produce both heat and electricity.

43 www.eia.gov/electricity/state/idaho/, Table 5: Electric Power Industry Generation by Primary Energy Source, 1990 Through 2010

Natural Gas

Natural gas is burned to generate electricity by passing hot pressurized gases through either a combined-cycle combustion turbine (CCCT) or simple-cycle combustion turbine (SCCT) connected to an electric generator. CCCT plants have a gas turbine and generator combined with a heat recovery steam generator that captures the exhaust heat from the turbine to produce additional electricity. CCCTs are typically used for baseload generation due to their higher efficiency. SCCTs do not harness the exhaust from the turbine, making them more expensive to operate. However, since they can be placed in and out of service more rapidly than a CCCT, they are normally dispatched to meet periods of peak electrical demand. CCCT plants have a low initial capital cost compared to other baseload technologies, are highly reliable, offer considerable operating flexibility, and have lower emissions than coal plants. The cost of the natural gas fuel and its price volatility is a major consideration in the operation of combustion turbines.

In 2013, natural gas was used for almost 3,400,000 MWh of electricity in Idaho, 22 percent of the state's total electricity production.[44] In 2015, Idaho became a petroleum-producer, with six natural gas wells in Payette County coming on-line. Some of the natural gas from the Little Willow gathering system goes into Idaho Power's Langley Gulch gas power plant, the rest goes to the Northwest Pipeline.[45]Despite this recent success, Idaho is still an oil and gas frontier region. By definition, frontier regions are generally far from most markets and established infrastructure, and places that little, if any, drilling has occurred.[46] In an oil and gas region, drilling density usually indicates how intensively an area has been explored.[47] For example, Texas has had about 1.5 million wells drilled[48] and is an extensively-explored region. In contrast, Idaho has had about 180 wells drilled, with about 110 of these within the two known geologically-distinct frontier regions, the Idaho-Wyoming fold and thrust belt of easternmost Idaho, and the Western Snake River Plain.

The Western Snake River Plain had shallow wells drilled in the early 1900's, with some indicating the presence of natural gas.[49] By the 1950's, about 50 wells had been drilled.[50] Since

[44] www.eia.gov/electricity/data.cfm#generation
[45] www.idahostatesman.com/news/local/environment/article41905926.html
[46] Daly, M.C., 2013, Future Trends in Global Oil and Gas Exploration, Lecture given at Oil Technology Conference, Imperial College, London on September 13, 2013. Last accessed July 8, 2015 at http://www.bp.com/content/dam/bp/pdf/speeches/2013/Future_Trends_in_Global_Oil_and_Gas_Exploration_.pdf
[47] Magoon, L. B., 1995. The play that complements the petroleum system—a new exploration equation: Oil & Gas Journal, vol. 93, no. 40, p. 85–87.
[48] http://www.drillingedge.com
[49] Newton, V. C., and R. E. Corcoran, 1963, Petroleum geology of the western Snake River basin, Oregon-Idaho: Oregon Department of Geology and Mineral Industries Oil and Gas Investigation 1, 67 p.

2010, 18 exploration wells were drilled in the Western Snake River Plain. Of these recently-drilled wells, operator Alta Mesa Services LLC has placed into production six natural gas wells in Payette County. One well produces a small volume of pipeline-quality natural gas that is delivered to the Intermountain Gas Pipeline for use by the city of New Plymouth. The five other wells produce commercially-significant volumes of "raw" natural gas that is collected in a gathering line system and transported in a pipeline to Northwest Gas Processing's Highway 30 natural gas processing plant. At the plant, the raw natural gas is processed into pipeline-quality natural gas, natural gas liquids, and stabilized condensate. The pipeline-quality natural gas is delivered from the plant to the Williams Pipeline, which then transports the product to the consuming public. The natural gas liquids and stabilized condensate are shipped by rail or truck to a refinery. Production information is still held confidential because natural gas production has just started.

Coal

Coal-fired generation has been the primary source of commercial power production in the United States for many decades. Pulverized coal plants provide a significant portion of electricity used in Idaho, but these plants are located in neighboring states. Idaho Power Company partially owns 1,118 MW of coal-fired generation capacity in Wyoming, Nevada, and Oregon.[51] Avista Corporation owns 222 MW of coal-fired capacity located in Eastern Montana, and PacifiCorp owns 6,728MW of coal-fired capacity. All of these plants use coal pulverized to a dust-like consistency that is burned to heat water producing steam to drive the turbine and generator.

While coal power plants require significant capital expenditures, they take advantage of low-cost coal fuel and provide reliable baseload electricity. Air quality and other environmental concerns have recently driven regulations that are aimed at reducing emissions and particulates. Coal-fired plants emit more carbon dioxide per kilowatt-hour (kWh) produced than natural gas-fired plants.[52]

50 ibid
51 www.idahopower.com/pdfs/printPDF.cfm
52 www.epa.gov/cleanenergy/energy-and-you/affect/natural-gas.html

Petroleum

Petroleum products are used for transportation fuels, electricity production, and heating fuels. The primary use of petroleum for energy generation is in the transportation sector with 92 percent of the transportation energy in the United States provided by petroleum products (gasoline and diesel fuel).[53] In 2013, Idaho consumed 30.8 million barrels of petroleum products.[54] About 1 percent of the electricity generated in the United States uses petroleum as the fuel source, mainly in Hawaii where petroleum is the primary fuel source for electricity generation.[55] In this application, petroleum is combusted in a boiler to produce steam that turns a steam turbine connected to a generator. Petroleum, primarily as distillate fuel oil and liquefied petroleum gas, is used for space heating, largely in the northeastern United States. It is also used for industrial process heat. In these applications, petroleum fuels are combusted in boilers to produce hot water or steam, burned directly to heat the air or used as material being processed.

Energy Resources: Nuclear Power

Nuclear power production continues to contribute to the United States electricity supply, with nearly 19 percent of the nation's electricity provided by 99 nuclear reactors operating in 30 states.[56] Over the past two decades, the operational performance of these reactors has improved[57], as demonstrated by an increase in operational capacity factor from approximately 53 percent in 1980 to over 90 percent today.[58] The US nuclear industry has also achieved gains in power plant utilization through improved maintenance, refueling and safety systems at existing plants. There is increasing private sector interest in expanding nuclear power in the United States. This has been spurred primarily by financial incentives in the 2005 Energy Policy Act, streamlined licensing that maintains safety while reducing risk of construction delay and, generally positive public sentiment about nuclear power. A March 2015 national poll found that 69 percent of Americans favor the use of nuclear energy.[59]

Since 2007, there have been 16 license applications filed to build new nuclear reactors in the United States.[60] However, reduced natural gas prices over the past few years have put most of

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53 www.instituteforenergyresearch.org/topics/encyclopedia/petroleum/
54 www.eia.gov/state/state-energy-profiles-data.cfm?sid=ID#Consumption
55 www.instituteforenergyresearch.org/topics/encyclopedia/petroleum/
56 www.world-nuclear.org/info/inf41.html
57 Nuclear Energy Institute; http://www.nei.org/Issues-Policy/Safety-Security
58 www.nei.org/Knowledge-Center/Nuclear-Statistics/US-Nuclear-Power-Plants
59 www.nei.org/Knowledge-Center/FAQ-About-Nuclear-Energy

these projects on hold. At present, only five new reactors (two each in Georgia and South Carolina and one in Tennessee) are under construction.

Although Idaho has no commercial nuclear power plant, Idaho National Laboratory (INL), as the U.S. Department of Energy's lead laboratory for nuclear energy, has had a significant influence on every reactor designed in the United States. Laboratory researchers are working on several initiatives that will help shape the future of nuclear energy worldwide.

Nuclear power production is an established and growing global industry. Over 435 power reactors operate in 31 countries producing almost 11 percent of the world's electricity.[61] There are several different types of nuclear power reactors, including light-water reactors, gas-cooled reactors, heavy-water reactors (reactors which use a "heavy" form of water – deuterium oxide – instead of typical "light" water) and breeder reactors. Each different type of reactor has certain s attributes and characteristics. The power reactors in the United States utilize light water technology, either pressurized water reactors (PWR), or boiling water reactors (BWR).[62] These reactors generate heat primarily from the splitting of atoms of Uranium-235 (an isotope of uranium making up about 0.72 percent of natural uranium) in a process known as nuclear fission. This heat is used to heat water and create steam, which turns a turbine connected to a generator to produce electricity.

The energy released from a pound of uranium through nuclear fission is much greater than the energy produced from burning a pound of coal (2.5 million times more), making it possible to generate vast amounts of energy from a very small amount of material. For example, a uranium fuel pellet roughly the size of a pencil eraser contains the same amount of energy as 17,000 cubic feet of natural gas, 1,780 pounds of coal or 149 gallons of oil. The heat produced in a nuclear reactor can also be used for industrial process heat.

NuScale Power, LLC, is developing a new kind of nuclear plant; a safer, smaller, scalable version of widely-used pressurized water reactor technology, designed with natural safety features and building on technology developed at the INL. Fluor Corporation, a global engineering, procurement and construction company with a 60-year history in commercial nuclear power, is the majority investor in NuScale.

In May 2014, NuScale Power finalized a cooperative agreement with the U.S. Department of Energy through which NuScale will receive up to $217M in matching federal funds over a five-year period. The company will use the funds to perform the engineering and testing needed to proceed through the Nuclear Regulatory Commission Design Certification Process. NuScale expects to submit the application for design certification in the second half of 2016. This will allow NuScale to meet a commercial operation date of 2023 for its first planned project, in Idaho. Known as the UAMPS Carbon-Free Power Project, it will be owned by the Utah Associated Municipal Power Systems and potentially operated by Energy Northwest.

[60] www.world-nuclear.org/info/inf41.html
[61] www.world-nuclear.org/info/inf01.html
[62] ibid

Energy Resources: Energy Efficiency

Efficient practices on the farm, at home, and in business and industry can save energy resources and money, as well as reduce dependence on foreign sources of energy. Energy efficiency is a way of restoring the growth in energy consumption. Something is more energy efficient if it delivers more services for the same energy input, or the same services for less energy input. The state of Idaho and Idaho utilities have options to assist consumers in making energy efficient choices.

The Idaho Strategic Energy Alliance has several Task Forces that deal with energy efficiency, including the Energy Efficiency and Conservation Task Force and the Industrial Energy Forum. These groups are composed of members from a wide range of Idaho companies, utilities, and the Idaho National Laboratory. They work to identify ways to reduce energy usage through application of energy-efficient technologies, energy-efficient applications, and demand-side management. Reduced energy consumption lowers costs, increases profits, and helps create jobs.

There are multiple state and federal incentives available for individuals who install energy efficiency retrofits. For a full listing of state energy incentives visit www.dsireusa.org. Also, visit your utility website for local incentives.

Smart Grid and Grid Investments in Idaho

Smart grid generally refers to integration of technology into the distribution system to enable automation and computer based communication and control essentially improving grid flexibility to respond to varying conditions.

As the country initiated investment in smart grid technology or grid modernization through federal grant assistance from the American Recover and Reinvestment Act (ARRA) of 2009, some Idaho utilities participated either in those investment grants or demonstration grants. Avista and Idaho Falls Power joined with regional partners, led by Battelle, to develop a smart grid demonstration project using matching stimulus monies from the U.S. Department of Energy (DOE). The project was the largest of the 16 grid demonstration projects funded by the US Department of Energy under ARRA, involved utilities in five states, involved more than 60,000 meters and tested many key functions of the future smart grid. The intent of the project was to show how smart grid technology can enhance the safety, reliability and efficiency of energy delivery on a regional and national level. The project was completed and report issued in June 2015.

Investor-owned utilities, electric cooperative, mutual, and municipal utilities in Idaho have made investments and improvements to the electric grid outside of ARRA funding.

Energy Research in Idaho

Idaho National Laboratory

Idaho National Laboratory (INL) occupies a unique niche at the nexus of energy supply and security. While it serves first as the U.S. Department of Energy's leading center for nuclear energy research, development, demonstration, and deployment, INL also plays a significant role in a wide range of other national priority energy supply, security, and sustainability initiatives.

Nuclear Leadership

Building on INL's unparalleled contributions to nuclear science and engineering and its legacy of nuclear energy leadership, its current nuclear mission is to develop advanced nuclear energy technologies that provide clean, abundant, affordable, and reliable energy to the United States and the world. This work includes research and development in reactor design, fuel cycle management, nuclear safety and nuclear fuels, and reactor life extension. Key to supporting these efforts is the Advanced Test Reactor, the world's premier materials test reactor.

A Diversified Energy Research Portfolio

INL scientists and engineers are also conducting crucial research in a robust non-nuclear energy portfolio directed at helping ensure U.S. energy security. Work is conducted in various renewable energy technologies including advanced bio-energy, geothermal, water power, and wind as well as in integrated (hybrid) energy systems, advanced vehicle technologies, energy storage systems, and unconventional fossil energy extraction. Employing 60 years of leadership in energy systems and technologies, INL works with government and industry to develop new technologies and approaches that address our national energy security challenges, – creating new ways to enhance economic stability, environmental sustainability, and resource security through clean energy research.

INL at a Glance

- **Management**: Battelle Energy Alliance
- **Location**: Southeastern Idaho
- **Major facilities**: Advanced Test Reactor Complex, Materials & Fuels Complex, Research & Education Campus
- **Employees**: More than 3,900
- **Annual Budget**: More than $1 Billion
- **Mission**: Ensure the nation's energy security with safe, competitive and sustainable energy systems, and unique national and homeland security capabilities.

A Critical Link in National Defense

On the security side of the energy equation, INL is home to the unparalleled Critical Infrastructure Test Range. The range provides customers with access to remote, secure space complete with industrial-scale infrastructure components that can be used for conducting comprehensive interoperability, vulnerability, and risk assessments. The Laboratory's test range includes access to hundreds of infrastructure protection and cybersecurity experts, and assets such as an isolable transmission and distribution system and a comprehensive communications test bed.

Taken in total, Idaho National Laboratory is a resource of exceptional depth and breadth for a state, nation, and world struggling to meet rapidly escalating demand for energy, securely delivered to the right place at the right time.

Idaho Universities

The universities in Idaho play a vital role in the research and exploration of new energy sources. There are multiple ways in which the universities collaborate and combine their talent in order to enhance their capabilities and energy-related research that are essential in keeping our energy production and transmission infrastructure secure.

The Center for Advanced Energy Studies (CAES) is a public/private partnership comprised of industry, Idaho National Laboratory, Idaho's three public universities: University of Idaho, Idaho State University, and Boise State University, as well as the University of Wyoming.

The Center for Advanced Energy Studies is a nation-leading center for innovation and collaboration that advances energy security, economic prosperity, and environmental sustainability between the national laboratory, universities, and industrial partners.[63] The mission of CAES is summarized by four components.

1. *Explore* energy and environmental research and knowledge by identifying critical energy challenges and conducting innovative research to solve these challenges by leveraging interdisciplinary talent, partnerships, and infrastructure.

2. *Educate* and extend knowledge through inventive educational programs at multiple levels and scales.

3. *Engage* with industry partners to provide solutions to energy-related challenges on a greatly expanded scale.

4. *Enable* energy transitions and economic development at a regional, national, and international scale.

[63] www.inlportal.inl.gov/portal/server.pt/community/caes_home/281

The Institute of Nuclear Science and Engineering (INSE) was established in 2003 with approval from the Idaho State Board of Education. This institute is also a collaborative entity among Idaho State University, University of Idaho, and Boise State University. Under the INSE's administrative umbrella, the three universities jointly focus on nuclear science and engineering education at the combined Idaho Falls campus.[64]

Through collaboration and a myriad of independent research initiatives, the universities in Idaho have become key contributors to energy research within the state.

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64 www.isu.edu/academic-info/current/Institutes.html

Idaho Strategic Energy Alliance

The goals of the Idaho Strategic Energy Alliance are to:

1. Provide credible, validated options, analyses, and supporting information
2. Educate stakeholders, decision-makers, and the public on energy issues and options

Background

Citizens, businesses, and state and local government in Idaho are all feeling the impact of higher energy prices and other energy challenges. Governor Otter established the Idaho Strategic Energy Alliance (ISEA) to help develop effective, long-lasting, and technically sound responses to these challenges. The Governor believes developing options and solutions for our energy future should be a joint effort among local, tribal, state, and federal governments, as well business and non-profit sector, fostering a coordinated approach to energy development and end-use.

The ISEA is Idaho's primary mechanism for identifying and analyzing options for and enabling advanced energy production, energy efficiency, and energy business in the state. The goal of the ISEA is the development of a responsive and responsible energy portfolio for Idaho that:

- Includes diverse energy resources and production methods
- Provides the highest value to the citizens of Idaho
- Functions as an effective, secure, and stable system

The ISEA consists of more than a dozen task forces, staffed by volunteer experts working in areas including wind, biofuels, geothermal, hydropower, and energy efficiency and conservation. The task forces provide research and analysis on the current landscape, potential issues, and barriers to energy development, while suggesting financial, policy, and research alternatives to overcome barriers.

The ISEA is governed by a board of directors comprised of representatives from Idaho stakeholders and industry experts. The primary purpose of the board is to provide options and support to the Governor regarding energy and energy efficiency activities for Idaho.

Through the ISEA, Idaho is working to achieve a secure, reliable, and stable energy portfolio. Availability of affordable and predictable energy is the foundation of sustainable economic growth, job creation, and rural development. Ultimately, the Governor expects that the ISEA and its teams of experts will provide the state with achievable and effective options for improving Idaho's energy future.

Thanks to more than 190 energy and environmental experts, ISEA has tackled issues such as the need for new transmission, the potential for increased clean energy production within the state, and opportunities for greater energy efficiency and conservation. ISEA is progressing toward achieving its goals by being an unbiased information resource and a leader of the energy dialogue in the state.

Board Of Directors

Jackie Flowers **- Idaho Falls Power – Chair**

Paul Kjellander **- Idaho Public Utilities Commission- Vice Chair**

Jay Larsen **- Idaho Technology Council**

Dr. Steven Aumeier **- Idaho National Laboratory**

Megan Ronk **- Idaho Department of Commerce**

Krista McIntyre **- Stoel Rives, LLP**

Larry La Bolle **- Avista**

Tom Schultz **- Idaho Department of Lands**

Kelly Pearce **- Idaho Division of Building Safety**

Jim Yost **- Northwest Power and Conservation Council**

John Chatburn **- Idaho Governor's Office of Energy Resources**

Jeff Larsen **- Rocky Mountain Power**

Mark Duffin **- Food Producers of Idaho**

Gary Spackman **- Idaho Department of Water Resources**

Emily Baker **- Gallatin Public Affairs**

Don Sturtevant **- J.R. Simplot Company**

David Solan **- Center for Advanced Energy Studies**

Byron Defenbach **- Intermountain Gas Company**

Karl Bokenkamp **- Idaho Power Company**

Robert Neilson **- retired, Idaho National Laboratory**

Task Forces

Baseload Task Force

Biofuels Task Force

Biogas Task Force

Carbon Issues Task Force

Communication and Outreach Task Force

Economic/Financial Development

Energy Efficiency and Conservation Task Force

Forestry Task Force

Geothermal Task Force

Hydropower Task Force

Solar Task Force

Transmission Task Force

Transportation Task Force

Wind Task Force

Industrial Energy Forum

For more information on energy in Idaho, please see the Idaho Strategic Energy Alliance publications at: http://energy.idaho.gov/energyalliance/index.htm

Contact List

Avista Corporation

MAILING ADDRESS:

Avista Utilities
Customer Service, MSC-34
P.O. Box 3727
Spokane, WA 99220-3727

PHONE: 1-800-227-9187
WEBSITE: www.avistautilities.com

Bonneville Power Administration

STREET ADDRESS:

905 N.E. 11th Ave.
Portland, OR 97232

MAILING ADDRESS:

P.O. Box 3621
Portland, OR 97232

PHONE: 1-800-282-3713
1-503-230-3000
WEBSITE: www.bpa.gov

Idaho Consumer-Owned Utilities Association

For a complete list of utilities and their individual contact information go to: www.icua.coop
Or contact: Idaho Consumer-Owned Utilities Association

P.O. Box 1898
Boise, ID 83701

PHONE: 1-208-344-3873

Idaho Governor's Office of Energy Resources

STREET ADDRESS:
304 N. 8th Street, Ste. 250
Boise, ID 83702-0199
MAILING ADDRESS:
P.O. Box 83720
Boise, ID 83720-0199

PHONE: 1-208-332-1660
FAX: 1-208-332-1661
WEBSITE: www.energy.idaho.gov

Idaho Power Company

STREET ADDRESS:
Corporate Headquarters
1221 W. Idaho St.
Boise, ID 83702
MAILING ADDRESS
Idaho Power Company
P.O. Box 70
Boise, ID 83707

PHONE: 1-208-388-2323
1-800-488-6151 OUTSIDE THE BOISE VALLEY
WEBSITE: www.idahopower.com

Idaho Public Utilities Commission

STREET ADDRESS:
472 W. Washington
Boise, ID 83702
MAILING ADDRESS:
P.O. Box 83720
Boise, ID 83720-0074

PHONE: 1-208-334-0300
FAX: 1-208-334-3762
WEBSITE: www.puc.state.id.us

Idaho Strategic Energy Alliance

STREET ADDRESS:

304 N. 8th Street, Ste. 250
Boise, ID 83702-0199

MAILING ADDRESS:

P.O. Box 83720
Boise, ID 83720-0199

PHONE: 1-208-332-1660
WEBSITE: www.energy.idaho.gov/energyalliance

Intermountain Gas Company

MAILING ADDRESS

P.O. Box 7608
Boise, ID 83707

PHONE: 1-800-548-3679
1-877-777-7442 EMERGENCIES
DIG LINE: 811
WEBSITE: www.intgas.com

Rocky Mountain Power

PHONE: 1-888-221-7070 CUSTOMER SERVICE
1-877-508-5088 POWER OUTAGE
WEBSITE: www.rockymountainpower.net

U.S. Energy Information Administration

STREET ADDRESS:

1000 Independence Ave., S.W.
Washington, DC 20585

PHONE: 1-(202) 586-8800
Live expert from 9:00 AM - 5:00 PM EST
Monday - Friday (Excluding Federal Holidays)
WEBSITE: www.eia.doe.gov
EMAIL: InfoCtr@eia.doe.gov

Other Energy Information

Energy-Saving Tips for Home and Work

When living in a typical U.S. home, appliances and home electronics are responsible for about 20 percent of energy bills. These appliances and electronics include everything from clothes washers and dryers, to computers, and water heaters. By turning off and/or unplugging appliances when they're not in use and by making some small adjustments Idahoans can significantly reduce their energy bills.

Electronics

- **Don't use a screen saver.** Screen savers are not necessary on modern monitors and studies show they actually consume more energy than allowing the monitor to dim when not in use.
- **Turn down the brightness setting on computer monitors.** The brightest setting on a monitor consumes twice the power used by the dimmest setting.
- **Check software**. Many computer games and other third-party software that run in the background will not allow the computer to go to sleep-even if they are paused or the active window is minimized.
- **Use power strips.** Plug home electronics, such as TVs and DVD players, into power strips; turn the power strips off when the equipment is not in use (TVs and DVDs in standby mode still use several watts of power).
- **Unplug battery chargers** when the batteries are fully charged or the chargers are not in use.
- **Air dry dishes** instead of using the dishwasher drying cycle.
- **Don't over-dry clothes**. If a machine has a moisture sensor, use it. Dry towels and heavier cottons in a separate load from lighter-weight clothes in order to minimize drying time.
- **Clean the lint filter** in the dryer after every load to improve air circulation.
- **Use the cool-down cycle** to allow the clothes to finish drying with the residual heat in the dryer.

Heating and Cooling

- Install patio covers, awnings and solar window screens to **shade your home from the sun**. For additional savings, use strategically planted trees, shrubs, and vines to shade your home.
- **Clean or replace filters** on furnaces once a month or as needed.
- **Use fans during the summer** to create a wind chill effect that will make a home more comfortable. If using air conditioning, a ceiling fan will allow you to raise the thermostat setting about 4°F with no reduction in comfort.
- **Turn off kitchen, bath and other ventilating fans** within 20 minutes after cooking or bathing to retain heated air.
- **Don't place lamps or TVs near a thermostat.** The thermostat senses heat from these appliances, which can cause the air conditioner to run longer than necessary.
- **Install a programmable thermostat** that can adjust the temperature according to a set schedule.[65]

Restoration of Power

Ensuring reliable electrical service is the core concern of every utility, but there are some events that utilities cannot control that may negatively impact service such as: severe weather, accidents, and other unpredictable situations.

If the lights go out, crews respond immediately and do everything possible - including working around the clock - to restore service quickly and safely.

During a power outage:

- First check fuses and circuit breakers. If the power failure is not caused inside the home or business, customers should report the outage. *(See utility contact information on pages 41-43.)*
- Never use kerosene or propane heaters inside without proper ventilation. They create dangerous fumes. Also, never burn charcoal in your house or garage.
- Make sure generators are properly wired for your home or business, and don't connect a generator directly to your home's main fuse box or circuit panel. This can create a dangerous back feed which is a hazard for line crews.
- Don't operate a portable generator inside your home or garage. Always ensure proper ventilation for a portable generator. Gasoline-powered generators produce deadly

[65] Information obtained from Idaho Power Company website and U.S. Department of Energy website

carbon monoxide. As an added protection, ensure that carbon monoxide and smoke detectors are installed and working properly.

- Limit the time refrigerator doors and freezer doors are open. This will keep food and perishables inside cold for a longer period of time.
- Preserve body heat by wearing multiple layers of clothing. Add a hat and blanket to stay warm. Blankets and towels around windows and doors help keep the heat in.
- Protect your pipes during freezing weather by wrapping them with insulation. Also, leave faucets dripping so water doesn't freeze and crack the pipes.
- Turn on your porch light when power is back in service. After crews complete repairs, they patrol the area of the power failure to see if lights are on.

Key causes of power outages:

- Trees or branches knock down power lines from wind, snow, or ice
- Lightning strikes a transformer or other electrical facilities
- Car accidents in which utility poles are knocked over or sway enough to knock lines into one another
- Equipment overload, especially on hot days when air conditioning is heavily utilized or during extremely cold weather when electric heaters overburden the system
- Digging too closely to and damaging an underground line
- In-home circuit overload
- Animal contact with the lines

Call Before You Dig

Call the 811 Dig Line at the One Call Center if you are planning to dig because utility lines may be located near your project. Hitting underground utility infrastructure during a dig project can be dangerous to the safety of you and others and may also result in utility outages.

Idaho law requires that you call the 811 Dig Line at the One Call Center two business days prior to the start of your project. After a caller provides the 811 Dig Line with information about a project, operators will alert the utilities and send a crew to the project site to mark the locations of underground facilities free of charge. Locating underground infrastructure prior to beginning your project helps to prevent personal injury and costly damage for you and the utility. When you call 811 Dig Line, be prepared to provide the dig location, scheduled start date of the project, type of work, and information about the company or contractor doing the work. These requirements apply to all contractors and homeowners.

You can call the Dig Line number from anywhere in the state by simply dialing 811; calling the 811 Dig Line automatically routes the caller to the closest local One Call Center.[66]

Trees

Falling trees and tree limbs can cause high voltage wires to break or sag to the ground, in some cases creating a life-threatening situation for motorists and pedestrians.

When tree branches or fallen trees come in contact with power lines they often cause outages. This happens most often in windy, stormy weather and accounts for a large percentage of all outages.

Utilities regularly trim trees in order to keep power lines clear.

[66] www.digline.com/aboutdigline

Glossary

Accelerated depreciation: Any method of depreciation used for accounting or income tax purposes that allow greater deductions in the earlier years of the life of an asset, as opposed to straight-line depreciation that spreads the cost evenly over the life of an asset. Accelerated depreciation encourages capital projects, the benefits of which are passed on to utility customers in the form of updated and expanded generation, transmission and distribution infrastructure.

Advanced Metering Infrastructure (AMI): AMI is the term coined to represent the networking technology of fixed network meter systems that go beyond automated meter reading (AMR) into remote utility management. The meters in an AMI system are often referred to as smart meters, since they often can use collected data based on programmed logic. Originally AMR devices just collected meter readings electronically and matched them with accounts. As technology has advanced, additional data could then be captured, stored and transmitted to the main computer and often the metering devices could be controlled remotely. Many AMR devices can also capture interval data and log meter events. The logged data can be used to collect or control time of use or rate of use data that can be used for energy or water usage profiling, time of use billing, demand forecasting, demand response, energy conservation enforcement, remote shutoff, etc.

Aggregator: Related to Direct Access; a company that consolidates a number of individual users and/or suppliers into a group in order to sell power in bulk.

Auction: In the context of a cap and trade system, a process of bidding for greenhouse gas emission allowances.

Automated meter reading (AMR): Technology of automatically collecting data from energy or water metering devices and transferring that data to a central database for billing and/or analysis. This form of utility data collection eliminates the need for each meter to be visually read by a technician, thereby reducing personnel costs.

Avoided cost: The cost to produce or otherwise procure electric power that an electric utility does not incur because it purchases this increment of power from a qualifying facility (QF). It may include a capacity payment and/or an energy payment component.

Backup power: Power provided by terms of the contract to a customer when the normal source is unavailable.

Balancing: That portion of generation capacity that must be set aside specifically to fill in any gaps between power demand and supply on a moment-to-moment basis to make sure the system stays in balance.

Baseload: The minimum amount of electric power or natural gas delivered or required over a given period of time at a steady rate. The minimum continuous load or demand in a power system over a given period of time.

Baseload plant: A plant that is normally operated to take all or part of the minimum continuous load of a system and that consequently produces electricity at an essentially constant rate. These plants are operated to maximize system mechanical and thermal efficiency and minimize system operating costs. Traditionally, coal, nuclear plants, and some high efficiency natural gas plants have been considered baseload plants. Baseload plants are also required to firm intermittent energy resources such as wind or solar.

Base rate: A charge normally set through rate proceedings by appropriate regulatory agencies and fixed until reviewed at future proceedings. It is calculated through multiplication of the rate from the appropriate electric rate schedule by the level of consumption.

Biomass: Plant materials and animal waste used as a source of fuel.

Bonneville Power Administration: A power marketing and electric transmission agency of the U.S. government with headquarters in Portland, Oregon.

Brokers: Agents who match wholesale power buyers to sellers for a fee. They are subject to Federal Energy Regulatory Commission jurisdiction.

Brownout: A reduction in the voltage at which customers are supplied due to a power shortage, system or mechanical failure, or overuse by customers. Loads may not actually be disconnected, but brownouts can still be very harmful to electronic equipment, especially if prolonged. Brownouts may be noticeable to the consumer (such as flickering or dimming of lights) but are not always apparent.

BTUs: British Thermal Unit is a traditional unit of energy equal to about 1,055 joules. Production of 1 kWh of electricity generated in a thermal power plant requires about 10,000 BTUs. 1 gallon gasoline ≈ 125,000 BTUs.

Cap and Trade: A market-based policy tool for reducing emissions. The program first sets a cap, or maximum limit, on emissions. Sources covered by the program then receive permits to emit in the form of emissions allowances. Sources are allowed to buy and sell emission allowances in order to continue operating in the most profitable manner available to them. Over time, the cap becomes stricter, leading to the reduction in emissions.

Capacity (electric): The maximum power that can be produced by a generating resource at specified times under specified conditions.

Capacity factor: A capacity factor is the ratio of the average power output from an electric power plant compared with its maximum output. Capacity factors vary greatly depending on the type of fuel that is used and the design of the plant. Baseload power plants are operated continuously at high output and have high capacity factors (reaching 100 percent). Geothermal, nuclear, coal plants, large hydroelectric and bioenergy plants that burn solid material are usually operated as baseload plants. Many renewable energy sources such as solar, wind and small hydroelectric power have lower capacity factors because their fuel (wind, sunlight or water) is not continuously available.

Capacity (gas): The maximum amount of natural gas that can be produced, transported, stored, distributed or utilized in a given period of time under design conditions.

Capacity, peaking: The capacity of facilities or equipment normally used to supply incremental gas or electricity under extreme demand conditions. Peaking capacity is generally available for a limited number of days at a maximum rate.

Carbon capture and sequestration: An approach to mitigate climate change by capturing carbon dioxide from large point sources such as power plants and storing it instead of releasing it into the atmosphere. Technology for sequestration is commercially available and is used at many locations at a modest scale primarily for oil and gas recovery. However, technology needed for capturing carbon dioxide from large point sources has yet to be developed. Although carbon dioxide has been injected into geological formations for various purposes (such as enhanced oil recovery), long-term storage on a large scale has yet to be demonstrated. To date, no large-scale power plant operates with a full carbon capture and storage system.

Carbon dioxide (CO_2): A gaseous substance at standard conditions composed of one carbon atom and two oxygen atoms produced when any carbon-based fuels are combusted. It is considered by many scientists a major contributor to global climate change. Plants use carbon dioxide for photosynthesis and for plant growth and development. The atmosphere contains about 0.039 percent CO_2.

Carbon offset (greenhouse gas emission offset): A financial instrument aimed at a reduction in greenhouse gas emissions. Offsets are typically achieved through financial support of projects that reduce the emission of greenhouse gases in the short- or long-term. The most common project type is renewable energy, such as wind farms, biomass energy or hydroelectric dams. Others include energy efficiency projects, forestry projects, the destruction of industrial pollutants or agricultural by-products, and the destruction of landfill methane.

Carbon tax: A direct tax on carbon dioxide and other greenhouse gas emissions intended to reduce emissions of carbon dioxide, which is generated as a by-product of the combustion of fossil fuels, among other processes. Unlike other approaches, such as a cap and trade system, a carbon tax lends predictability to energy prices for consumers.

Class of service: A group of customers with similar characteristics (e.g., residential, commercial, industrial, etc.) that are identified for the purpose of setting a rate for service.

The Climate Registry: A nonprofit partnership working to develop an accurate and transparent greenhouse gas emissions measurement protocol that is capable of supporting voluntary and mandatory greenhouse gas emission reporting policies. It will provide a verified set of greenhouse gas emissions data from reporting entities supported by a robust accounting and verification infrastructure.

Coal gasification: A process by which synthetic gases are made from coal by reacting coal, steam and oxygen under pressure and elevated temperature. These gases can be used in processes to produce electricity or to make a variety of carbon-based products, including methane (natural gas), gasoline, diesel fuel, and fertilizer.

Cogeneration: Also known as "combined heat and power" (CHP) or cogen. The simultaneous production of heat (usually in the form of hot water and/or steam) and power, utilizing one primary fuel. Cogeneration is often used to produce power as a secondary use of the waste steam/heat from a primary industrial process.

Commercial: A sector of customers or service defined as non-manufacturing business establishments, including hotels, motels, restaurants, wholesale businesses, retail stores and health, social and educational institutions. A utility may classify the commercial sector as all consumers whose demand or annual use exceeds some specified limit. The limit may be set by the utility based on the rate schedule of the utility.

Commission: State public utility commission(s); the Federal Energy Regulatory Commission.

Concentrating solar power (CSP): A process that uses lenses or mirrors and tracking systems to focus a large area of sunlight into a small beam. The concentrated light is then used as a heat source for a conventional power plant or is concentrated onto photovoltaic surfaces.

Conservation: Demand-side management (DSM) strategy for reducing generation capacity requirements by implementing programs to encourage customers to reduce their energy consumption. Program examples include incentives/savings for the installation of energy efficient appliances, lighting and electrical machinery, and weatherization materials.

Control area: A geographical area in which a utility is responsible for balancing generation and load. A control area approximates the service area of a utility.

Cooperative electric utility (Co-op): Private, not-for-profit electric utility legally established to be owned by and operated for the benefit of those using its service. It will generate, transmit and/or distribute supplies of electric energy to cooperative members. Such ventures are generally exempt from federal income tax laws. Many were initially financed by the Rural Electrification Administration, U.S. Department of Agriculture.

Cost-based rate: A rate based upon a projected cost of service and throughput level, contrasted with a market-based rate determined directly by supply and demand.

Cost of capital: The weighted average of the cost of various sources of capital, generally consisting of outstanding securities such as mortgage debt, preferred stock and common stock.

Cost of service: The total cost to provide service, including return on invested capital, operation and maintenance costs, capital costs, administrative costs, taxes, and depreciation expense. Traditional utility cost of service may be expressed as: *operating costs + taxes + (rate of return x [cost of plant - depreciation])* More frequently called revenue requirement.

Cross-subsidization: The practice of charging rates higher than the actual cost of service to one class of customers in order to charge lower rates to another class of customers.

Cubic foot: The most common unit of measurement of gas volume; the amount of gas required to fill a volume of one cubic foot under stated conditions of temperature, pressure and water vapor.

Curtailment: A temporary, mandatory power reduction under emergency conditions taken after all possible conservation and load management measures and prompted by problems of meeting peak energy demand.

Customer costs: Costs directly related to serving a customer, regardless of sales volume, such as meter reading, billing, and fixed charges for the minimum investment required to serve a customer.

Demand: The amount of power consumers require at a particular time. Demand is synonymous with load. It is also the amount of power that flows over a transmission line at a particular time. System demand is measured in megawatts.

Demand-side management (DSM): The term for all activities or programs undertaken by an electric system to influence the amount and timing of electricity use. Included in DSM are the planning, implementation and monitoring of utility activities that are designed to influence customer use of electricity in ways that will produce desired changes in a utility's load shape such as, among other things, direct load control, interruptible load. and conservation.

Depreciation: The loss of value of assets, such as buildings and transmission lines, to age and wear. Among the factors considered in determining depreciation are wear and tear, decay, action of the elements, inadequacy, obsolescence, changes in the technology, changes in demand, requirements of public authorities, and salvage value. Depreciation is charged to utility customers as an annual expense.

Deregulation: The reduction or elimination of government power in a particular industry usually enacted to create more competition within the industry. Since the mid 1990s, many states across the nation have embarked on some form of deregulation of the electric industry, allowing the sale of electricity at market prices with the theory that competition will keep prices low, compared to a regulated market in which customer rates are directly tied to costs. *(See also restructuring.)*

Direct Access: The ability of a retail customer to purchase commodity electricity directly from the wholesale market rather than through a local distribution utility. *(See also Industrial bypass.)*

Dispatch: The monitoring and regulation of an electrical or natural gas system to provide coordinated operation; the sequence in which generating resources are called upon to generate power to serve fluctuating load; the physical inclusion of a generator's output onto the transmission grid by an authorized scheduling utility.

Distribution (electrical): The system of lines, transformers and switches that connect the high-voltage bulk transmission network and low-voltage customer load. The transport of electricity to ultimate use points such as homes and businesses. The portion of an electric system that is dedicated to delivering electric energy to an end user at relatively low voltages.

Distribution (gas): Mains, service connections, and equipment that carry or control the supply of natural gas from the point of local supply to and including the sales meters.

Distributed generation: Electric power produced other than at a central station generating unit, such as that using fuel cell technology or on-site small-scale generating equipment.

Electric utility: A corporation, person, agency, authority, or other legal entity that owns and/or operates facilities for the generation, transmission, distribution or sale of electric energy primarily for use by the public. Facilities that qualify as co-generators or small power producers under the Public Utility Regulatory Policies Act (PURPA) are not considered electric utilities.

Electricity generation: The process of producing electric energy by transforming other forms of energy such as steam, heat or falling water. Also, the amount of electric energy produced, expressed in kilowatt-hours or megawatt-hours.

Electricity transmission congestion: Transmission congestion results when transmission lines reach their maximum capacity so no additional power transactions can take place, regardless of power needs. Attempting to operate a transmission system beyond its rated capacity is likely to result in line faults and electrical fires, so this can never occur. The only ways the congestion can be alleviated are to tune the system to increase its capacity, add new transmission infrastructure, or decrease end-user demand for electricity.

Emissions allowance allocation: In the context of a cap and trade system, the amount of greenhouse gas emissions that a regulated entity is allowed to lawfully emit per year. Each allowance constitutes a right to emit usually one ton of a regulated emission.

Exempt Wholesale Generator (EWG): A class of generators defined by the Energy Policy Act of 1992 that includes the owners and/or operators of facilities used to generate electricity exclusively for wholesale or that are leased to utilities.

Federal Energy Regulatory Commission (FERC): A quasi-independent regulatory agency within the U.S. Department of Energy having jurisdiction over interstate electricity sales, wholesale electric rates, hydroelectric licensing, natural gas transmission and related services, pricing, oil pipeline rates, and gas pipeline certification.

Filed rate doctrine: The doctrine established under the Natural Gas Act that requires rates to be on file with the commission and that prevents increased rates from being imposed retroactively; also known as “retroactive ratemaking.” This also applies to electric utilities.

Firm power: Electric power that is guaranteed by the supplier to be available during specified times except when uncontrollable forces produce outages.

First Jurisdictional Delivery: A hybrid approach to regulating greenhouse gas emissions generated in the electricity sector established by the Western Climate Initiative.

First jurisdictional deliveries are:

- All fossil-fuel generators located within the Western Climate Initiative jurisdiction
- The first party to import electricity generated outside the Western Climate Initiative region
- An importing deliverer could be an independent power producer, a retail provider, a power marketer or a power broker.

Force majeure: A common law concept borrowed from the French civil law meaning superior or irresistible force that excuses a failure to perform. It has been defined by the U.S. Supreme Court as a cause that is "beyond the control and without the fault or negligence" of the party excused. Force majeure events also must not have been reasonably foreseeable (e.g., a blizzard in Houston in January may be a force majeure event, but a January blizzard in Montana may not qualify).

Forecasting: The process of estimating or calculating electricity load or resource production requirements at some point in the future.

Franchise: A special privilege conferred by a government on an individual or corporation to occupy and use the public rights of way and streets for benefit to the public at large. Public utilities typically have exclusive franchises for utility service granted by state or local governments.

Fuel-switching: Substituting one fuel for another based on price and availability. Large industries often have the capability of using either oil or natural gas to fuel their operation and of making the switch on short notice.

Generator nameplate capacity (installed): The maximum rated output of a generator or other electric power production equipment under specific conditions designated by the manufacturer. Installed generator nameplate capacity is commonly expressed in megawatts (MW) and is usually indicated on a nameplate physically attached to the generator.

Geothermal power: Power generated from heat energy derived from hot rock, hot water or steam below the earth's surface.

Gigawatt: A gigawatt (GW) is equal to one billion (10^9) watts.

Gigawatt-hour: A gigawatt-hour (GWh) is a unit of electrical energy that equals one thousand megawatts of power used for one hour. One gigawatt-hour is equal to 1,000 megawatt-hours.

Green power: Term usually used to mean power produced from a renewable resource such as wind, solar, geothermal, biomass or small hydropower.

Greenhouse gas emission offset (Carbon offset): A means to a reduction, avoidance or sequestration of greenhouse gas emissions. Offsets are so named because they counteract or offset greenhouse gases that would otherwise have been emitted into the atmosphere. *(See also Carbon offset.)*

Greenhouse gas effect: A process by which the earth's temperature rises because certain gases in the atmosphere, known as greenhouse gases, trap energy from the sun.

Greenhouse gases: Gases found within the earth's atmosphere including carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFC), perfluorocarbons (PFC), and sulfur hexafluoride (SF_6) that trap energy from the sun and warm the earth. Some greenhouse gases are emitted from the earth's natural processes; others from human activities, primarily the combustion of fossil fuels.

Grid: The layout of the electrical transmission system or a synchronized transmission network.

Head: The vertical height of the water in a reservoir above the turbine. In general, the higher the head, the greater the capability to generate electricity due to increased water pressure.

Heat rate: The measure of efficiency in converting input fuel to electricity. The lower the heat rate, the more efficient the plant. The heat rate equals the BTU content of the fuel input divided by the kilowatt–hours of power output. Lower heat rates are associated with more efficient power generating plants.

High-voltage lines: Wires composed of conductive materials that are used for the bulk transfer of electrical energy from generating power plants to substations located near to population (load) centers. Transmission lines, when interconnected with each other, become high voltage transmission networks. In the U.S., these are typically referred to as "power grids" or sometimes simply as "the grid". Electricity is transmitted at high voltages (110 kV or above) to reduce the energy lost in long distance transmission. Power is usually transmitted through overhead power lines. Underground power transmission has a significantly higher cost.

Hydroelectric plant: A plant in which the power turbine generators are driven by falling water.

Incremental energy cost: Cost incurred by producing or purchasing next available unit of energy (gas, electricity, oil, coal, etc.).

Independent power producers: A non-utility power generating entity, defined by the 1978 Public Utility Regulatory Policies Act, that typically sells the power it generates to electric utilities at wholesale prices. *(See also Exempt Wholesale Generator.)*

Industrial bypass: A situation in which large industrial customers buy power directly from a non-utility generator, bypassing the local utility system. Deregulation of generation and transmission in some states has opened up the opportunity for large electricity users to purchase services from a supplier other than the local retail utility. *(See also Direct Access.)*

Industrial customer: The industrial customer is generally defined as manufacturing, construction, mining, agriculture, fishing, and forestry establishments. The utility may classify industrial service using the Standard Industrial Classification codes or based on demand or annual usage exceeding some specified limit. The limit may be set by the utility based on the rate schedule of the utility.

Integrated Gasification Combined Cycle (IGCC): Technology that combines both steam and gas turbines to produce electricity. In this process, coal is converted to syngas, a mixture of hydrogen and carbon monoxide. The syngas is then converted to electricity in a combined cycle power block consisting of a gas turbine process and a steam turbine process that includes a heat recovery steam generator. IGCC plants can achieve up to 45 percent efficiency, greater than 99 percent sulfur dioxide removal, and nitrogen oxide below 50 parts per million.

Integrated Resource Plan (IRP): A plan that utilities produce periodically for regulators and customers to share their vision of how to meet the growing need for energy. These plans contain a preferred portfolio of resource types and an action plan for acquiring specific resources to meet the needs of customers including conservation measures. Specific resources will be acquired as individual projects or purchases and, when appropriate, through a formal request for proposals (RFP) process.

Interconnection: A link between power systems enabling them to draw on one another's reserves in times of need to take advantage of energy cost differentials resulting from such facts as load diversity, seasonal conditions, time-zone differences, and shared investments in larger generating units.

Intermediate Plants: In between peakers and baseload plants is a class of plants called *intermediate* or *mid-merit plants*. These plants are run more often than peaking plants but not as often as base load plants. They are generally based on a combined-cycle combustion turbine design.

Interstate pipeline: A natural gas pipeline company that is engaged in the transportation of natural gas across state boundaries and is therefore subject to FERC jurisdiction and/or FERC regulation under the Natural Gas Act.

Investor-owned utility (IOU): A utility that is a privately owned, often publicly traded corporation whose operations are regulated by federal and state entities.

Joint use facilities: Facilities that are used in common by two or more entities. For example, a utility pole or structure may contain wires and equipment for electrical power service and wires and equipment for telephone/cable TV service.

Kilowatt (kW): A unit of electrical power or capacity equal to one thousand watts.

Kilowatt-hour (kWh): A unit of electrical energy that is equivalent to one kilowatt of power used for one hour. One kilowatt-hour is equal to 1,000 watt-hours. An average household will use between 800 and 1,300 kWhs per month, depending upon geographical area.

Leakage: Within the context of a cap and trade system with a limited geographic scope, a term to describe the potential for greenhouse gas emitters to move outside the geographic area of the cap to avoid compliance with the regulation.

Load: The amount of electric power delivered or required at any specific point or points on a system. The requirement originates at the energy-consuming equipment of the consumers. The load of an electric utility system is affected by many factors and changes on a daily, seasonal and annual basis, typically following a general pattern. Electric system load is usually measured in megawatts (MW). It is synonymous with demand.

Load-based cap: A cap on the amount of emissions from electricity based on total kilowatt-hour sales, regardless of the carbon content of the resources or where it was generated.

Load management: The management of load patterns in order to better utilize the facilities of the system. Generally, load management attempts to shift load from peak use periods to other periods of the day or year.

Load shedding: Usually an agreement arranged ahead of time to reduce electric system demand by dropping certain loads to keep others. For example, in exchange for cheaper power, an industrial customer may sign a contract agreeing to have its power interrupted, if needed, during peak demand periods.

Local distribution company (LDC): A company that obtains the major portion of its revenues from the operations of a retail distribution system for the delivery of electricity or gas for ultimate consumption.

Market-based price: The price of power on the open market.

Marketers: Organizations or individuals who take title to power in anticipation of selling it at a higher price to a buyer. Marketers are subject to FERC regulation.

Megawatt (MW): A unit of electrical power equal to 1 million watts or 1,000 kilowatts. Plant power output is typically measured in megawatts. (*See also capacity (electric)*.)

Megawatt-hour (MWh): One million watt-hours of electric energy. A unit of electrical energy that equals one megawatt of power used for one hour.

Metering: Use of devices that measure and register the amount and/or direction of energy quantities relative to time.

Multi-state Process (MSP): A regulatory forum for exploring issues pertaining to the PacifiCorp Inter-Jurisdictional Cost Allocation Protocol (Revised Protocol). The objectives of the Revised Protocol include:

- Allocating PacifiCorp's costs among its jurisdictional states in an equitable manner

- Ensuring PacifiCorp plans and operates its generation and transmission system on a six state integrated basis in a matter that achieves a least-cost/risk-balanced resource portfolio for its customers
- Allowing each state to independently establish its ratemaking policies
- Providing PacifiCorp the opportunity to recover 100 percent of its prudently incurred costs

Municipal utility: A utility owned and operated by a municipality or group of municipalities.

National Association of Regulatory Utility Commissioners (NARUC): A professional trade association, headquartered in Washington, D.C., composed of members of state and federal regulatory bodies that have regulatory authority over utilities.

Net metering: A method of crediting customers for electricity that they generate on site in excess of their own electricity consumption.

Network: An interconnected system of electrical transmission lines, transformers, switches, and other equipment connected together in such a way as to provide reliable transmission of electrical power from multiple generators to multiple load centers.

Normalization: The accounting method used to ensure that the sum total of taxes payable for an asset under an accelerated method of depreciation is congruent to what would be the sum total of taxes payable for that same asset under a straight-line method of depreciation. Normalization was instituted by Congress in 1969 to prevent the tax benefits of deferred payables from being directly passed on to customers instead of the proper governing authorities.

North American Electric Reliability Corporation (NERC): An organization subject to oversight by the Federal Energy Regulatory Commission and governmental authorities in Canada whose mission is to ensure the reliability of the bulk power system in North America. To achieve that, NERC develops and enforces reliability standards; assesses power adequacy annually via 10 year and seasonal forecasts; monitors the bulk power system; evaluates users, owners and operators for preparedness; and educates, trains, and certifies electric industry personnel.

Nuclear power plant: A facility in which nuclear fission produces heat that is used to generate electricity.

Obligation to serve: In exchange for the regulated monopoly status of a utility for a designated service territory with the opportunity to earn an adequate rate of return, comes the obligation to provide electrical service to all customers who seek that service at fair and reasonable prices. This has been part of what the utility commits to under the “regulatory compact” and also includes the requirement to provide a substantial operating reserve capacity in the electrical system. *(See also Regulatory compact.)*

Off peak: The period during a day, week, month, or year when the load being delivered by a natural gas or electric system is not at or near the maximum volume delivered by that system for a similar period of time (night vs. day, Sunday vs. Tuesday).

On peak: The period during a day, week, month, or year when the load is at or near the maximum volume.

Open access: The term applied to the evolving access to the transmission system for all generators and wholesale customers. Also, the use of a utility's transmission and distribution facilities on a common-carrier basis at cost-based rates.

Outage: Periods, both planned and unexpected, during which power system facilities (generating unit, transmission line or other facilities) cease to provide generation, transmission, or the distribution of power.

PCBs: Synthetic chemicals (polychlorinated biphenyls), manufactured from 1929 to 1977, found in electric equipment, such as voltage regulators and switches, and used to cool electrical capacitors and transformers. The manufacture of PCBs was banned by the U.S. Congress in 1979 and by the Stockholm Convention on Persistent Organic Pollutants in 2001.

Peak demand: The maximum load during a specified period of time.

Peak load plant or peaker unit: A plant usually housing low-efficiency, quick response steam units, gas turbines, diesels or pumped-storage hydroelectric equipment normally used during the maximum load periods. Peakers are characterized by quick start times and generally high operating costs, but low capital costs.

Photovoltaic (solar) conversion: The process of converting the sun's light energy directly into electric energy through the use of photovoltaic cells.

Pipeline system: A collection of pipeline facilities used to transport natural gas from source of supply to burner tip, including gathering, transmission or distribution lines, treating or processing plants, compressor stations, and related facilities.

Point of delivery: The physical point of connection between the transmission provider and a utility. Power is metered here to determine the cost of the transmission service.

Point of regulation: Refers to which entities are responsible for complying with regulations. Within the context of a cap and trade greenhouse gas emissions system, the point of regulation may occur upstream at the source of fuels or other greenhouse gas-containing substances; downstream with the distributors of fuel or electricity; or through a hybrid approach.

Point to point: Transmission service from one discrete point to another discrete point.

Power Marketing Administrations (PMAs): The federal government owns four power marketing agencies: the Western Area Power Administration, the Bonneville Power Administration, the Southeastern Power Administration, and the Southwestern Power Administration, all within the U.S. Department of Energy (DOE).

Power plant: A plant that converts mechanical energy into electric energy. The power is produced from raw material such as gas, coal, nuclear, or other fuel technologies.

Power Purchase Agreement (PPA): Typical name for bilateral wholesale or retail power contract.

Preference customers: Publicly owned utilities and not-for-profit cooperatives, which, by law, have preference over investor-owned systems and industrial customers for the purchase of power from federal power marketers, such as the Bonneville Power Administration.

Production Tax Credit (PTC): Production tax credits support the introduction of renewables by allowing companies which invest in renewables to write off this investment against other investments they make. A PTC can be used as the central mechanism for the support of renewables as part of a national or regional mechanism, or it can be used in support of other mechanisms, such as a quota mechanism. Production tax credits have been supplied at the federal level.

Public Utilities Regulatory Policies Act (PURPA): A federal law passed in 1978 as part of the National Energy Act. PURPA is meant to promote greater use of renewable energy and forced regulated electric utilities to buy power from other producers, if that cost was less than the utility's own "avoided cost" rate; the avoided cost rate represents the additional cost the utility would incur if it generated the required power itself or purchased the required power from another source. Implementation of PURPA was left to the individual states; in Idaho, the rules for PURPA implementation are set by the Idaho Public Utilities Commission.

Qualifying facility (QF): A designation created by PURPA for non-utility power producers that meet certain operating, efficiency and fuel-use standards set by FERC. To be recognized as a qualifying facility under PURPA, the facility must be a small power production facility whose primary energy source is renewable or a cogeneration facility that must produce electric energy and another form of useful thermal energy, such as steam or heat, in a way that is more efficient than the separate production of both forms of energy.

Rate base: The value of property upon which a utility is given the opportunity to earn a specified rate of return as established by regulatory authority. The rate base generally represents the value of property used by the utility in providing service and may be calculated by any one or a combination of the following accounting methods: fair value, prudent investment, reproduction cost or original cost. The rate base may include a working capital allowance covering such elements as cash, working capital, materials and supplies, prepayments, minimum bank balances, and tax offsets.

The rate base may be adjusted by deductions for accumulated provision for depreciation, contributions in aid of construction, accumulated deferred income taxes, and accumulated deferred investment tax credits.

Rate design: The development of electricity prices for various customer classes to meet revenue requirements dictated by operating needs and costs within current regulatory and legislative policy goals.

Rate of return: The gain (profit) or loss on an investment over a specified period, expressed as a percentage increase over the initial investment cost, and is also referred to as return on investment. An allowed rate of return for a utility is an authorized limit of profit expressed as a percentage determined by the jurisdictional state or federal commission based on standards including the cost of capital in other sectors with comparable risk. Investor-owned utilities are not guaranteed a return on investment, but are given the opportunity to earn a profit up to an authorized rate of return.

Rate schedule: The rates, charges and provisions under which service is supplied to a designated class of customers.

REA: Rural Electrification Administration; currently called *Rural Utility Service*.

Regional transmission organization/group (RTO/RTG): A proposal advanced by FERC to establish regional groups to expedite the coordination of wholesale wheeling. The group is voluntary in each region and may include transmission system owners, wholesale purchasers, and independent power generators.

Regulatory compact: A traditional covenant between customers in a state and investor-owned utilities (IOUs). In exchange for the obligation to provide service to all customers in a defined service territory, an IOU is given a territorial monopoly on service and allowed to earn a limited return set by state regulators. The commission enforces the terms of the regulatory compact. *(See also Obligation to serve.)*

Reliability: The ability to meet demand without interruption. The degree of reliability may be measured by the frequency, duration, and magnitude of adverse effects on consumer service.

Renewable energy credit/green tag: Tradable certificate confirming 1 megawatt-hour of electricity generated by an eligible renewable resource that is tracked and verified by an authorizing entity; includes all of the environmental attributes associated with that 1 megawatt-hour unit of electricity production.

Renewable Portfolio Standard (RPS): A policy that establishes a percentage of electric retail sales that must be derived from eligible renewable resources. Another common name for the same concept is renewable electricity standard (RES).

Renewable resource: A power source that is continuously or cyclically renewed by nature, i.e. solar, wind, hydroelectric, geothermal, biomass, or similar sources of energy.

Request for Proposal (RFP): Request For Proposal is a written solicitation that conveys to vendors a requirement for materials or services that the purchaser intends to buy. An RFP is a primary means of inviting a bid or proposal from prospective suppliers. The RFP process allows for the equitable and simultaneous comparison and analysis of competing businesses' product and service offerings.

Reserve capacity: Capacity in excess of that required to carry peak load, available to meet unanticipated demands for power or to generate power in the event of loss of generation.

Residential consumer: A consumer residing at a dwelling served by the company, and using services for domestic purposes. Does not include consumers residing in temporary accommodations, such as hotels, camps, lodges, and clubs.

Restructuring: The reconfiguration of the vertically integrated electric utility. Restructuring usually refers to separation of the various utility functions (such as power generation and transmission) into separate functions, typically to offer more competitive choices to customers. *(See also Deregulation.)*

Retail: Sales covering electrical energy supplied for end-use residential, commercial and industrial end-use purposes. Agriculture and street lighting, are also included in this category. Power sold at retail is not resold by the purchaser to another customer.

Retail competition: A system under which more than one electricity provider competes to sell to retail customers and retail customers are allowed to buy from different providers. *(See also Direct Access.)*

Retail wheeling: The sale of electricity by a utility or other supplier to a customer in another utility's retail service territory. Refers to the use of the local utility's transmission and distribution lines to deliver the power from a wholesale supplier to a retail customer by a third party.

Return on equity: Compensation for the investment of equity or ownership capital. Regulated public utilities are allowed to charge rates that provide them an opportunity - but not a guarantee - to earn a reasonable return on their equity invested.

Revenue requirement: The amount of funds (revenue) a utility must take in to cover the sum of its estimated operation and maintenance expenses, debt service, taxes and allowed rate of return. Revenue requirement is often defined as: *Revenue requirement = Operating expenses + depreciation expense + income taxes + (rate of return x rate base)*.

Rolling blackout: Shutting off power to groups or blocks of customers in a controlled and preplanned manner to reduce system demand. Interruptions happen in intervals and between blocks of customers so all customers share in the efforts to reduce demand.

Rural electric cooperative: *See Cooperative electric utility*.

RUS: Rural Utility Service; formerly called *Rural Electrification Administration*.

Sales for resale: Energy supplied at wholesale to other utilities, cooperatives, municipalities and federal and state agencies for resale to ultimate consumers. May be subject to FERC regulation.

Scheduled outage: The shutdown of a generating unit, transmission line or other facility, for inspection or maintenance in accordance with an advance schedule.

Scheduling: Operating a power system to balance generation and loads; managing the accounting, billing, and information reporting for such operations.

Service area: The territory in which a utility system is required or has the right to supply service to ultimate customers.

Shaping, or load shaping: The scheduling and operation of generating resources to meet changing load levels. Load shaping on a hydroelectric system usually involves the adjustment of water releases from reservoirs so that generation and load are continuously in balance.

Smart grid: Smart grid is a concept. At the moment that concept is undeveloped. The basic concept of smart grid is to add monitoring, analysis, control, and communication capabilities to the national electrical delivery system to maximize the throughput of the system. In theory, the smart grid concept might allow utilities to move electricity around the system as efficiently and economically as possible. It might also allow the homeowner and business to use electricity as economically as possible. Consumers will have the choice and flexibility to manage electrical use while minimizing bills. Smart grid hopes to build on many of the technologies already used by electric utilities. It also adds communication and control capabilities with the idea of optimizing the operation of the entire electrical grid. To reduce this concept to a single sentence, one might describe smart grid as overlaying a communication network on top of the power grid.

Solar generation: The use of radiation from the sun to substitute for electric power or natural gas heating.

Spot market: Commodity transactions in which the transaction commencement is near-term (e.g., within 10 days) and the contract duration is relatively short (e.g., 30 days).

Spot purchases: A short-term single shipment sale of a commodity, including electricity or gas, purchased for delivery generally on an interruptible or best efforts basis.

Standards of conduct: Requirements under FERC's marketing affiliate rule that prohibit discrimination in favor of the utility's own marketing affiliates and that require utilities to submit reports detailing compliance with the rules.

Substation: Equipment that switches, changes or regulates electric voltage. An electric power station that serves as a control and transfer point on an electrical transmission system. Substations route and control electrical power flow, transformer voltage levels, and serve as delivery points to industrial customers.

Tariff: A document filed by a regulated entity with either a federal or state commission; listing the rates the regulated entity will charge to provide service to its customers as well as the terms and conditions that it will follow in providing service.

Test period: In a rate case, a test period is used to determine the cost of service upon which the rates will be based. A test period consists of a base period of 12 consecutive months of actual operational experience, adjusted for changes in revenues and costs that are known and are measurable with reasonable accuracy at the time of the rate filing.

Thermal generation: The production of electricity from plants that convert heat energy into electrical energy. The heat in thermal plants can be produced from a number of sources such as coal, oil or natural gas.

Transmission: The network of high-voltage lines, transformers and switches used to move electrical power from generators to the distribution system (loads). This network is also utilized to interconnect different utility systems and independent power producers together into a synchronized network.

Transmission grid: An interconnected system of electric transmission lines and associated equipment for the transfer of electric energy in bulk between points of supply and points of demand.

Turbine: The part of a generating unit usually consisting of a series of curved vanes or blades on a central spindle that is spun by the force of water, steam or heat to drive an electric generator. Turbines convert the kinetic energy of such fluids to mechanical energy through the principles of impulse and reaction or a measure of the two.

Used and useful: The traditional test for whether a utility asset may be included in rate base.

Utility: A utility can be either a private or publicly owned company that provides a commodity or service that is considered vital to the general public, such as power, water, or gas for heating. Because utility services are considered necessities, utilities are allowed to operate as monopolies and prices and service conditions are regulated by the government or subject to review by citizens.

Volt: A unit of measurement of electromotive force or electrical potential. It is equivalent to the force required to produce a current of one ampere through a resistance of one ohm. Typical transmission level voltages are 115 kV, 230 kV and 500 kV.

Watt: A measure of real power production or usage equal to one joule per second.

Watt-hour (Wh): An electrical energy unit of measure equal to one watt of power supplied to, or taken from, an electric circuit steadily for one hour.

Western Climate Initiative: A collaboration which was launched in February 2007 by the governors of Arizona, California, New Mexico, Oregon and Washington to develop regional strategies to address climate change. Since February 2007, the group has expanded to include Utah, Montana, British Columbia, Manitoba and Quebec

The group has established a goal to reduce overall emissions within its member states by 15 percent below 2005 levels by 2020.

Western Electricity Coordinating Council (WECC): A group of utilities banded together to promote reliability by coordinating the power supply and transmission in the West.

Wheeling: The use of the transmission facilities of one system to transmit power for another system. Wheeling can apply to either wholesale or retail service. *(See also Retail wheeling.)*

Wholesale power market: The purchase and sale of electricity from generators to resellers (who sell to retail customers or to wholesale customers) along with the ancillary services needed to maintain reliability and power quality at the transmission level.

Wholesale sales: Energy supplied to other electric utilities, cooperative, municipals, federal and state electric agencies, and power marketers for resale to other wholesale customers or ultimate consumers.

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