Idaho Energy Primer

2015

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IDAHO STRATEGIC ENERGY ALLIANCE

Preface

The Idaho Strategic Energy Alliance is pleased to present this update of the Idaho Energy 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.

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

This material is based upon work supported by the Idaho Office of Energy Resources.

Disclaimer: This Idaho Energy Primer (Primer) is prepared by the Idaho Strategic Energy Alliance. Costs associated with this publication are available from the Idaho Office of Energy Resources in accordance with Section 60-202, Idaho Code, OER-01-2015-300. The views and opinions of authors expressed herein do not necessarily state or reflect those of the State of Idaho or agency thereof.

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 has changed.

[1] www.eia.gov/about/

Contents

IDAHO ENERGY SNAPSHOT

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

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

- Idahoans used 519 trillion British thermal units (BTUs) of energy in 2012. This is the equivalent of roughly 93 million barrels of oil per year.[2] About 70% of the total energy used in Idaho comes from outside the state.
- On a per capita basis, Idaho energy use ranks 21st highest in the nation as of 2012.[3]
- The residential, commercial, industrial, and transportation sectors in Idaho spent $6.7 billion on energy in 2012.
- The median Idaho household spends 23% of its income on energy. This ranks Idaho 32nd among all other states and includes household energy and transportation fuel.
- A greater percentage of electricity is generated from hydroelectricity in Idaho than in any other state. On average, about 70% of the electricity produced in Idaho is from hydroelectric sources, about 12 percent from natural gas, and the remainder 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.[4]
- In 2012, Idaho's in-state net electricity generation equaled 65% of the state's total electric industry retail sales. The remainder is imported, primarily from coal fired power plants in neighboring states.[5]
- Idaho does not produce coal; however there is oil and gas exploration and some natural gas production.
- In 2013, 78% 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.[6]
- Idaho ranked 45th among the states in total carbon dioxide output in 2011, largely due to abundant hydroelectric energy.[7]

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[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/state-energy-profiles.cfm?sid=ID
[4] www.eia.gov/state/print.cfm?sid=ID
[5] www.eia.gov/state/?sid=ID#tabs-2
[6] www.eia.gov/state/state-energy-profiles.cfm?sid=ID

- Petroleum, the large majority of which is used for transportation fuels, constituted 31% of Idaho's end-use energy consumption as of 2012.
- Idaho's wind generation rose by 35% in 2013, providing 16% of net electricity generation.[8]

Idaho Energy Usage and Generation Sources

Idaho Energy Use

Idaho is a net importer of energy. About 70% of Idaho's total energy comes from sources outside the state. Idaho has very few fossil fuel resources, and the state as a result must import the fossil fuels used within Idaho.

Idaho uses about 519 trillion BTUs of energy each year. (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 325 million BTUs per person each year, which ranks the state 21st in terms of per capita energy use. The energy consumed in Idaho can be divided into four sectors as shown below:[9]

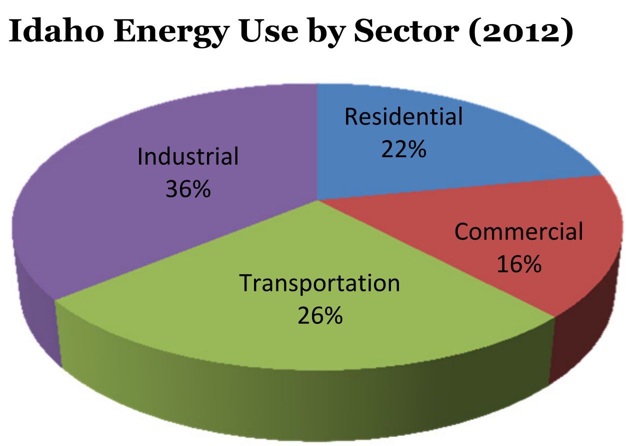

Figure 1. Idaho Energy Use by Sector (2012)

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7 www.eia.gov/state/rankings/?sid=ID#series/226
8 www.eia.gov/state/state-energy-profiles.cfm?sid=ID
9 www.eia.gov/state/rankings/?sid=ID#series/12

Electricity Consumption

Although electricity consumption has typically increased, consumption per capita in Idaho has declined since 1997. This may be due to a switch from electricity to natural gas and propane for space heating and hot water. Electricity consumption in Idaho increased by 15% from 2002 to 2008, but decreased 5% in 2009, coinciding with the economic recession. 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. Since 2010, electricity consumption has resumed growing and in 2012 was back at the level last seen in 2007. Looking to the future, growth is expected to average between 1-1.5% per year. While Idaho's electricity consumers are using electricity more efficiently, there is no doubt that additional electrical supply will be required to power Idaho's future.

Energy Sources

Transportation Fuel

Petroleum, the large majority of which is used for transportation fuels, constitutes 31%[10] of end-use energy consumption in Idaho. Although liquid fuels (ethanol and biodiesel) are produced in Idaho for transportation use, 100% of petroleum fuels utilized in Idaho come from out of the state.

Average gasoline prices in Idaho were the 44th lowest among U.S. states in August of 2014. However, each state has a different state fuel tax and gasoline price rankings can change rapidly and significantly.[11] Idaho's state gasoline tax rate is currently 25 cents per gallon, which has not increased since 1996.[12] Idaho's state gasoline taxes are 5 cents higher than the recent national average of 20 cents. Additionally, there is the cost of shipping transportation fuels into Idaho which has no refineries; these costs are included in gasoline prices.[13]

Heating Fuel

There are many different sources of heating fuel in Idaho. Some of the most common sources include: natural gas, propane, electricity, geothermal, and biomass.

Idaho is located between two major natural gas supply basins and has benefitted from natural gas prices that are below the national average. Historically, all of Idaho's natural gas supplies were imported from out of state. Recently there has been some interest in developing natural gas within Idaho's borders in the western portion of the state. The availability and increasing affordability of natural gas is important to industry in the state. Idaho also has several

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[10] www.eia.gov/state/seds/sep_sum/html/pdf/sum_use_tx.pdf
[11] www.fuelgaugereport.aaa.com/todays-gas-prices/
[12] www.idahogasprices.com/tax_info.aspx
[13] www.eia.gov/state/print.cfm?sid=ID

geothermal district heating systems that provide inexpensive, efficient heating, although they are available only in localized geographic areas.

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% 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.[14]

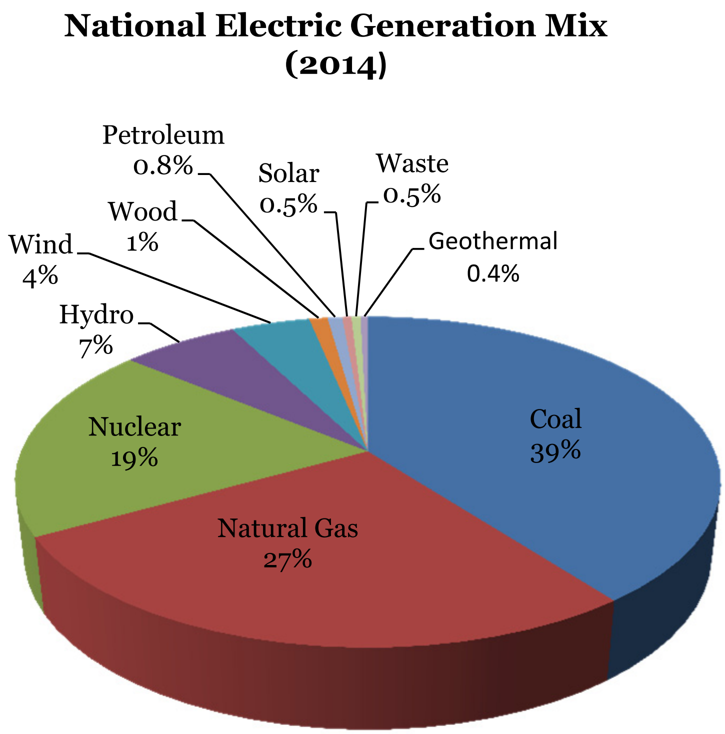

Figure 2. National Electric Generation Mix (2014)

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

Electricity in Idaho

Though Idaho is currently in the early stages of fossil fuel production in the form of natural gas, it is rich in renewable resources. In a typical year, about 65% of Idaho's electricity is generated in-state. The other 35% comes primarily from coal fired power plants located in neighboring states. All told, in a given year about half of the electricity used in Idaho comes from renewable resources such as hydropower, wind, and biomass.

As shown in the chart below, the majority of electricity generated in Idaho is through hydro dams. The utilization of this clean and renewable source of energy in the state results in the lower prices for ratepayers. On the national level, hydroelectricity is used as a source for only 7.3% of electricity generation. Idaho is well above the average in its utilization of this efficient, reliable, and renewable energy.[15] [16]

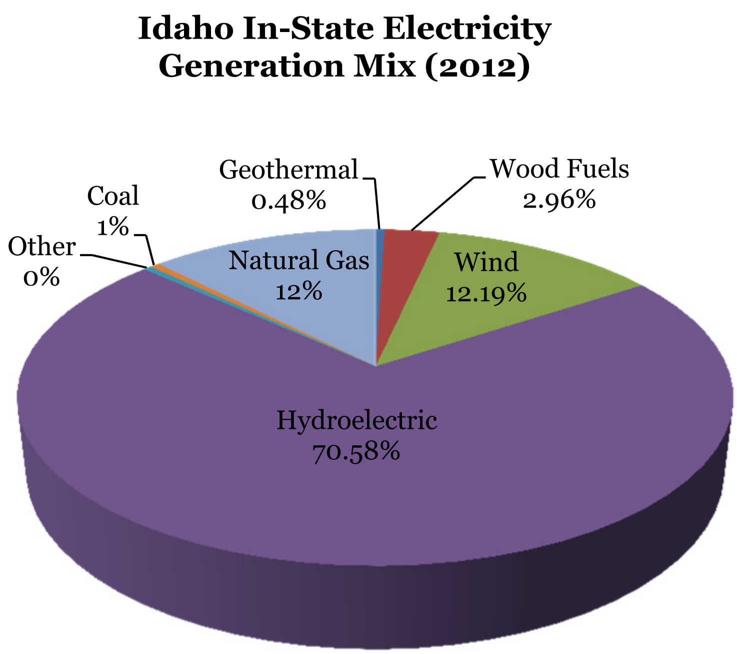

Figure 3. Idaho In-State Electricity Generation Mix (2012)

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[15] www.eia.gov/electricity/data.cfm#generation
[16] 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.[17] 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.

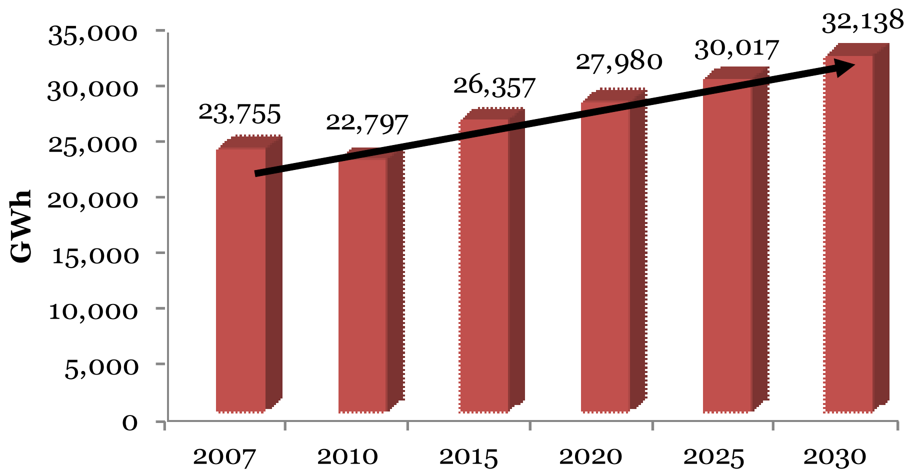


Figure 4. Electricity Use in Idaho

The investor-owned utilities develop 20-year Integrated Resource Plans 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.

[17] Information gathered from Montana Wind Report February Final, and from sources such as various FERC Form 1 documents, the CEC Demand Staff Forecast, and SNL Financial.

ELECTRICITY PROVIDERS IN IDAHO

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

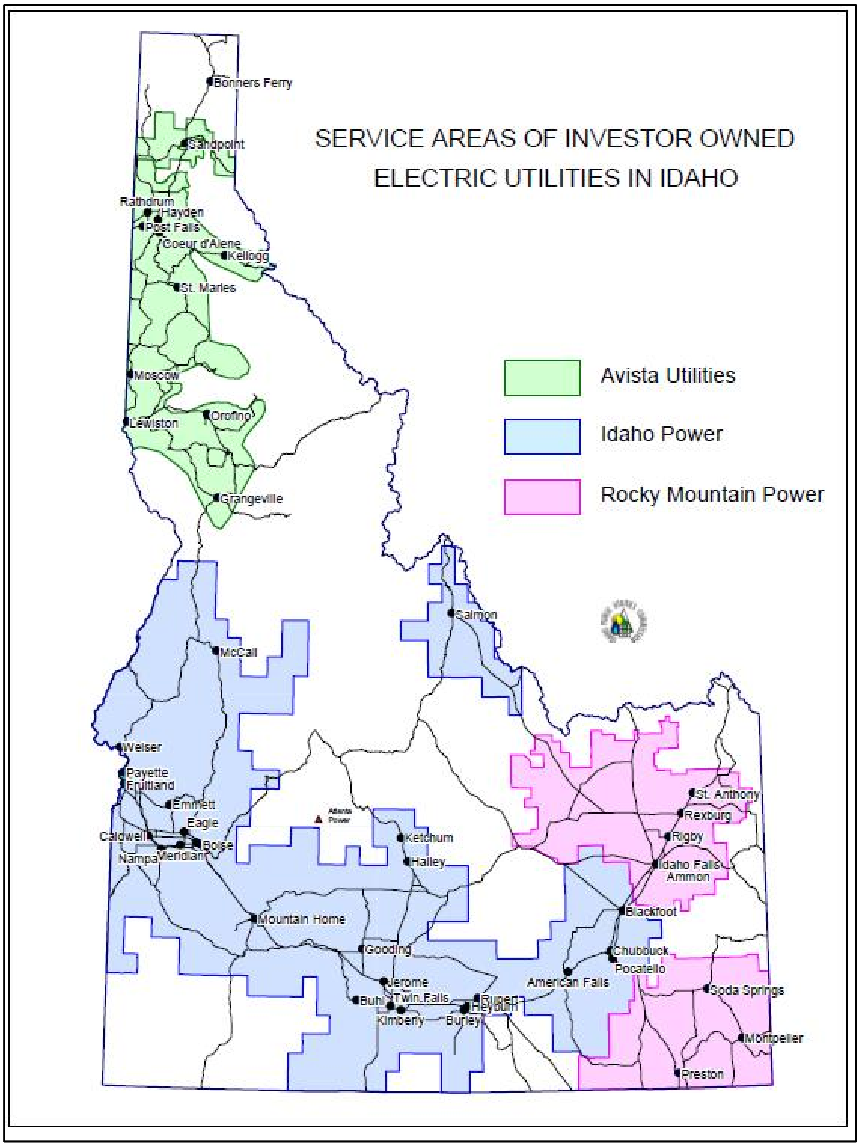


Figure 5. Service Areas of Investor Owned Electric Utilities in Idaho[18]

[18] www.puc.idaho.gov

Idaho Power Company

Founded in 1916, Idaho Power Company serves approximately 500,000 customers in southern Idaho and eastern Oregon across a 24,000 square mile service territory. 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 contracts with wind and geothermal facilities and it has contracts with 119 projects covered by the Public Utility Regulatory Policies Act (PURPA), including approximately 678 megawatts (MW) of wind generation as of 2012.

Idaho Power Company obtains energy from a diverse set of generation resources, long-term power purchase agreements, and short-term market purchases. The fuel mix for Idaho Power Company's resource portfolio in 2013 is shown here.[19]

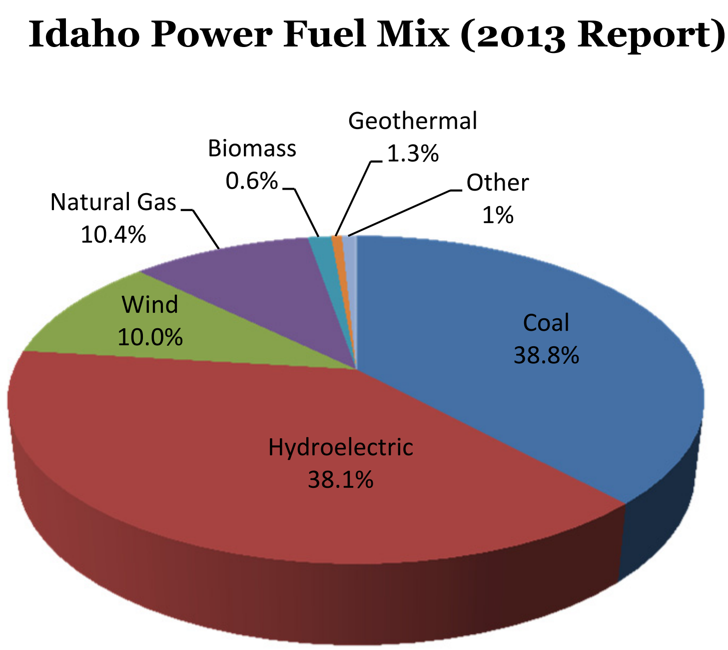


Figure 6. Idaho Power Fuel Mix (2013 Report)

Learn more at: www.idahopower.com

[19] www.idahopower.com/AboutUs/EnergySources/FuelMix/resourcePortfolio_2013.cfm

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 110,000 electric customers in Idaho's north and central regions, 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 2,100 miles of transmission line and 17,000 miles of distribution line. About half 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; ownership shares of Montana coal plants; and natural gas fired baseload and capacity in Idaho, Oregon, and Washington.

Avista Power Fuel Mix (2012 Report)

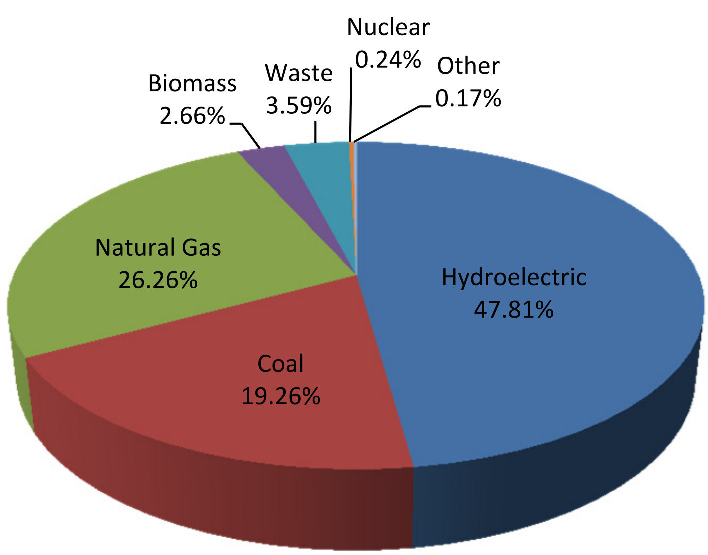


Figure 7. Avista Power Fuel Mix (2012 Report)

Learn more at: www.avistautilities.com

PacifiCorp/Rocky Mountain Power

PacifiCorp serves retail customers in six Western States- Washington, Oregon, Idaho, Wyoming, Utah, and California-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, and subsequently changed the name of its eastside retail operating division to Rocky Mountain Power. Rocky Mountain Power serves 73,356 customers in southern Idaho (approximately four percent of PacifiCorp's total customer base). PacifiCorp owns 74 generating plants capable of 10,595 MW of net generation capacity, including coal, hydroelectric, natural gas, and wind resources. As a stand-alone utility, PacifiCorp is second only to Mid-American Energy Company in the ownership of wind generation. Wind, hydro, geothermal, and other non-carbon-emitting resources currently make up more than 20% of PacifiCorp's owned and contracted generating capacity, accounting for about 17% of total energy output.

At year-end 2012, PacifiCorp had more than 1,000 megawatts of owned wind generation capacity and long-term purchase agreements for more than 850 megawatts from wind projects owned by others.[20]

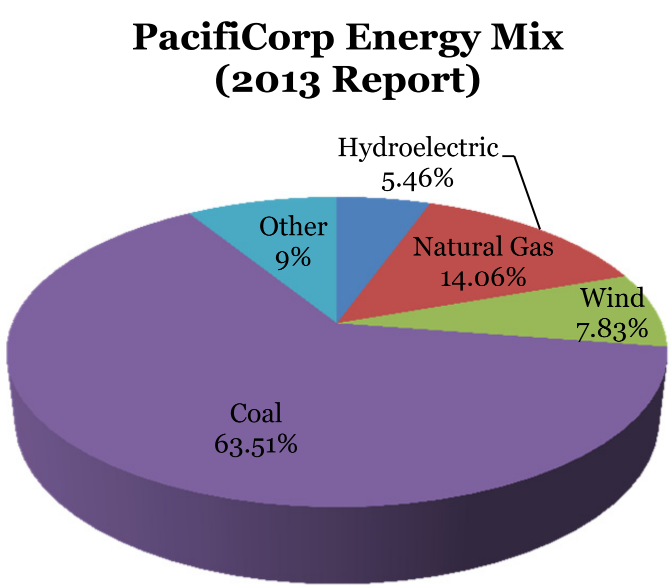


Figure 8. PacifiCorp Energy Mix (2013 Report)

Learn more at: www.rockymountainpower.net

[20] www.midamericanenergy.com/newsroom/aspx/facts9.aspx

Electric Cooperative, Mutual and Municipal Utilities in Idaho

There are 28 rural electric cooperatives, mutuals, and municipalities providing electric service in Idaho.

These utilities serve more than 130,000 customers in Idaho, accounting for 16% of Idaho's load. Most of these utilities collaborate under the Idaho Consumer Owned Utilities Association on issues of administrative, governmental, and regulatory significance.

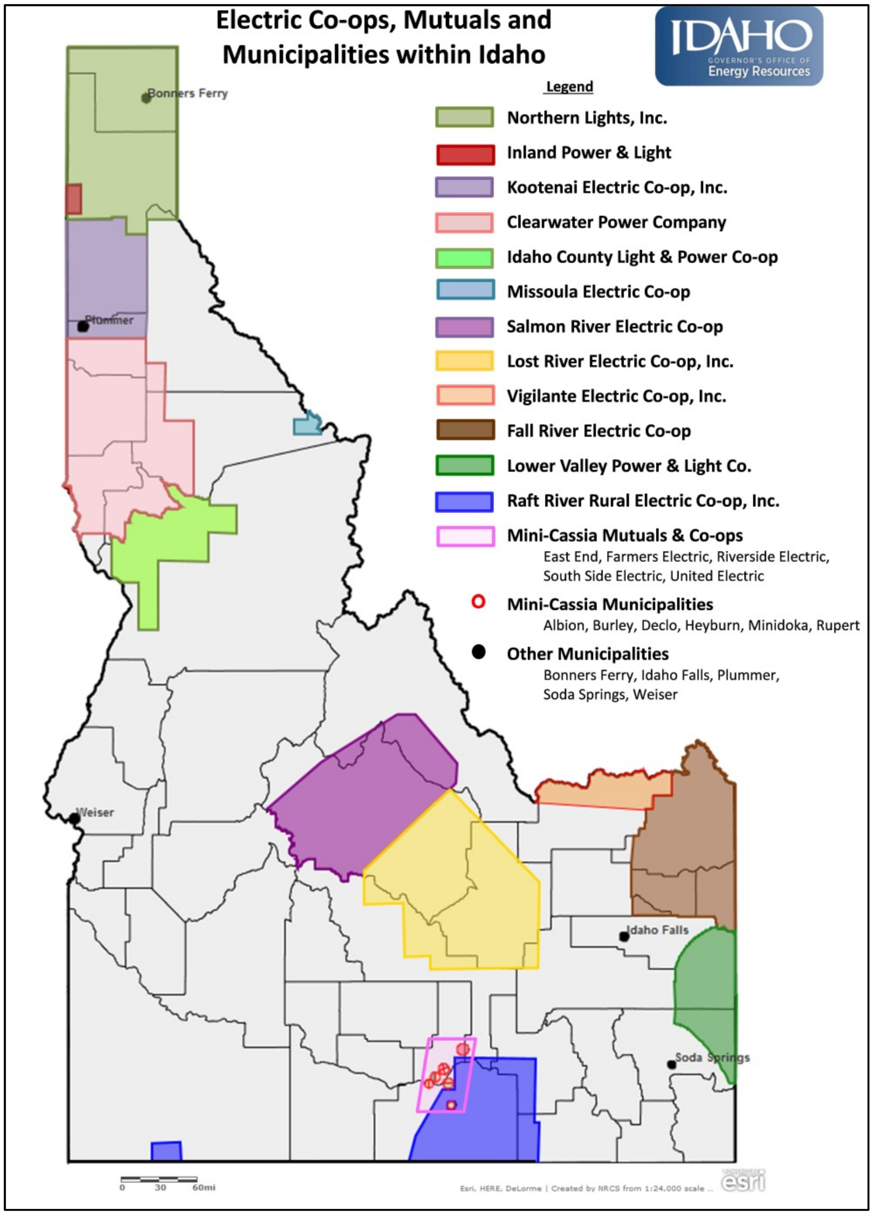


Figure 9. Electric Co-ops, Mutuals, and Municipalities within Idaho

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 are referred to collectively as 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% of the electric power used in the Northwest; Idaho's municipal and cooperative utilities account for approximately 5.5% of BPA's load. BPA provides limited benefits to residential and small farm customers of investor 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 and independent power producers, including some California and Canadian companies.

BPA Resources (2013 Average)

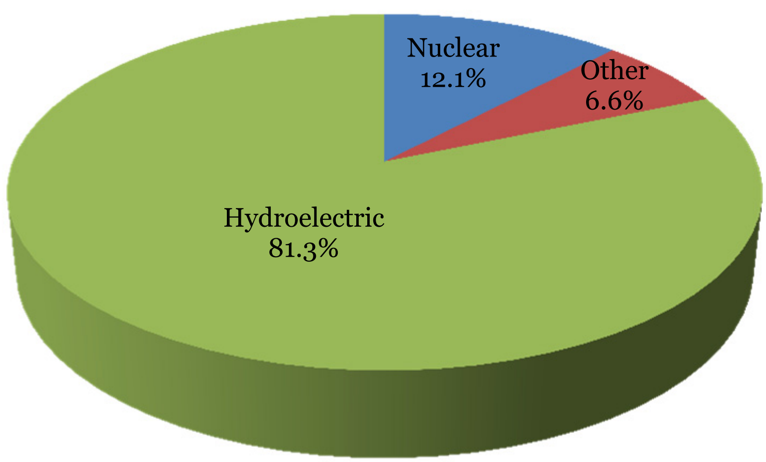


Figure 10. BPA Resources (2013 Average)

Learn more at: www.bpa.gov

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.[21]

Ten years ago, 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 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

[21] 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 320,000 residential, commercial, and industrial customers in 74 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 43% 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 19% of sales and residential about 38%.

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 more than 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 in the western energy corridor and substantial renewable energy generation resources with urban economic hubs in the west. This makes Idaho a critical link in the nation's economic and national security chain. 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 just begun to produce natural gas. As a result, a substantial percentage of the energy consumed in Idaho (approximately 70%) 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.[22] As a result, Idaho will require additional transmission capacity to keep up with growth. 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, or other factors. If constructed, new lines would help relieve congestion 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.

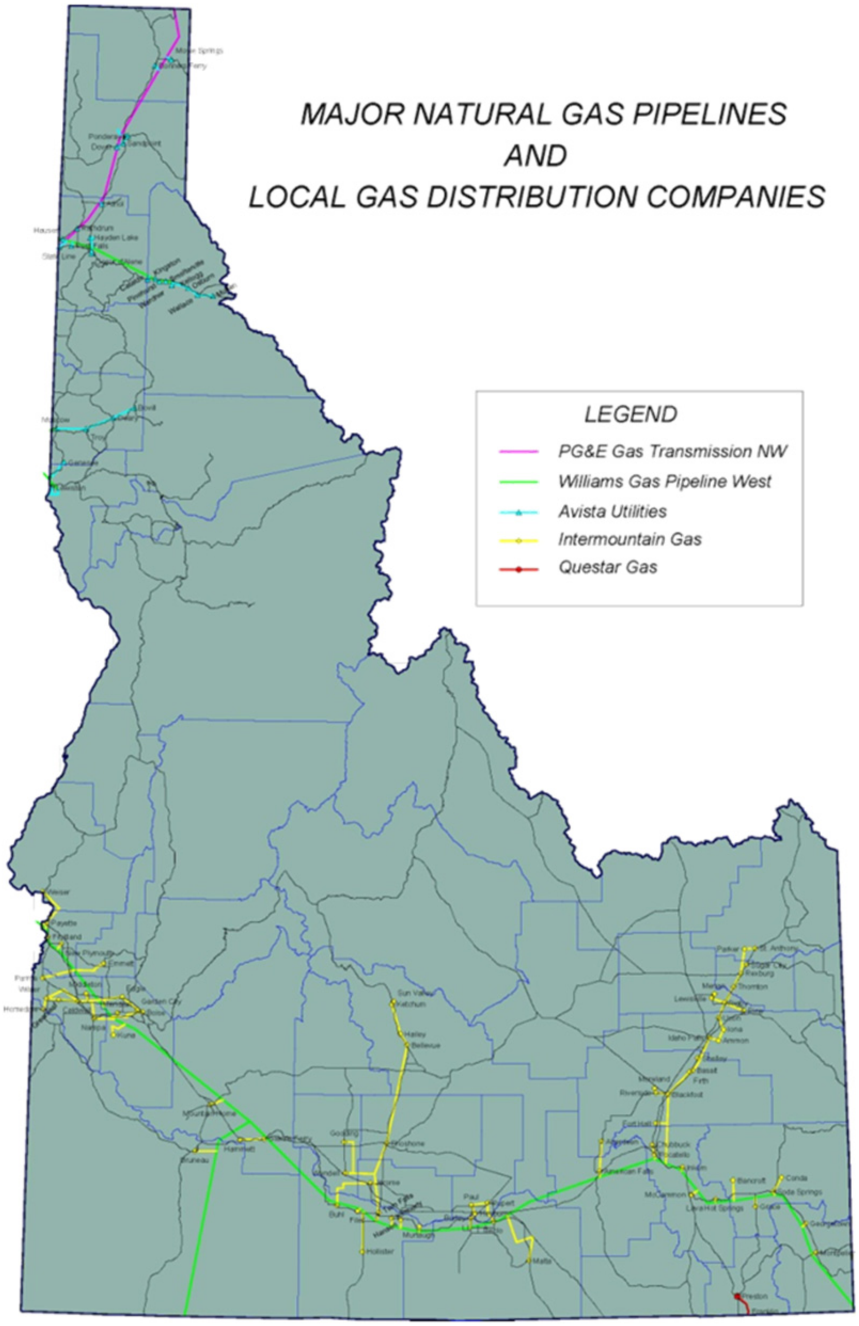


Figure 11. Major Natural Gas Pipelines and Local Gas Distribution Companies

[22] 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 ConocoPhillips (Yellowstone Pipeline) and the other by Tesoro (Northwest Products Pipeline). The Northwest Products pipeline connects Salt Lake City with Pocatello, Burley, and Boise before continuing on to Pasco, Washington. A single pipeline then continues from Pasco to Spokane, Washington, delivering fuel to northern Idaho. 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.

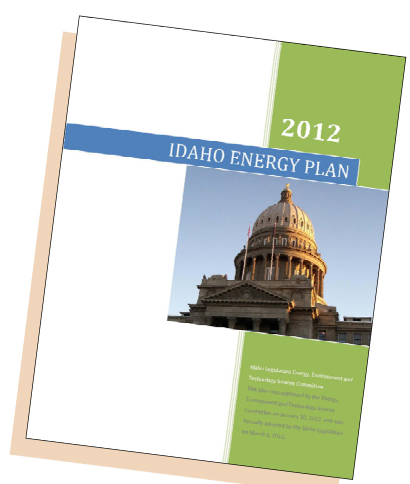
Policy and Pricing

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

In its quasi-judicial capacity, the Commission conducts hearings and decides cases brought before the Commission. The Commission regulates electric utilities, natural gas utilities, telecommunication companies, and water utilities. The Commission also exercises safety authority over pipelines and railroads, but does not regulate municipal or cooperative utilities.

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 Commission operations are funded by fees assessed on the utilities and railroads it regulates. The Legislature sets the Commission's annual budget and then the Commission collects proportional assessments from each utility and railroad within limits set by law. The Commission 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 PUC 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 (2013) was 22% less than the national average (see map below, U.S. Energy Information Administration, for average electricity price information by state) while residential natural gas prices are about 72% of the national average.

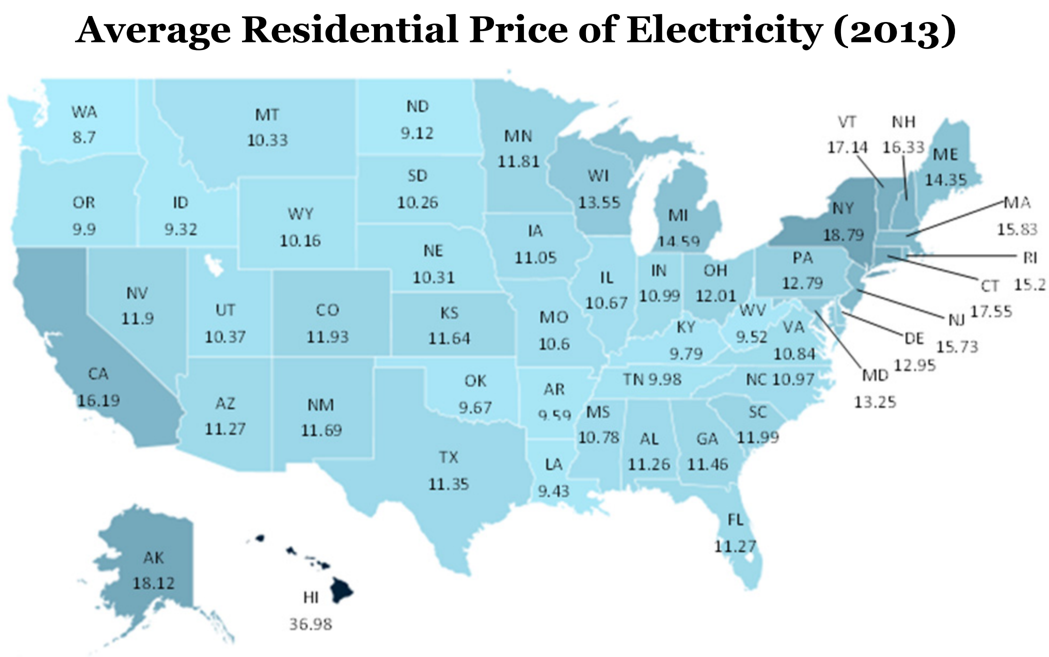


Figure 12. Average Residential Price of Electricity (2013)

The affordability of energy in Idaho is a foundation of 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.

Cost Factors and Considerations

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

- More than 15% of Idaho’s electricity demand is met by municipal and cooperative utilities which operate as not-for-profit entities.
- Energy facility sitting in Idaho is in most cases generally the responsibility of the counties.

- 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 emissions in the nation.

- The Idaho Public Utilities Commission has reduced the maximum size of a "qualifying facility" that can qualify for an "avoided-cost" rate contract under 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 is raising consumer rates and decreasing system reliability.

- Idaho does not require gasoline to be mixed with renewable fuels.

- Idaho requires new residential and commercial buildings to meet energy efficiency standards. Residential and commercial buildings must comply with the International Energy Conservation Code (IECC). The IECC, developed by the International Code Council, is a model code that mandates certain energy efficiency standards.

ENERGY RESOURCES

Increasing global energy demand makes the development of new, more efficient and effective energy options an economic necessity and opportunity. Idahoans are at the forefront of advanced energy research and development associated with fossil, renewable and nuclear energy, and energy transmission technologies.

- 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 remain under traditional ratemaking.

Renewable Energy

Geothermal

Idaho has some of the greatest potential in the country for geothermal energy production. The state uses geothermally-heated water for generating electricity, heating buildings, growing 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, which started providing baseload generation in January 2008.

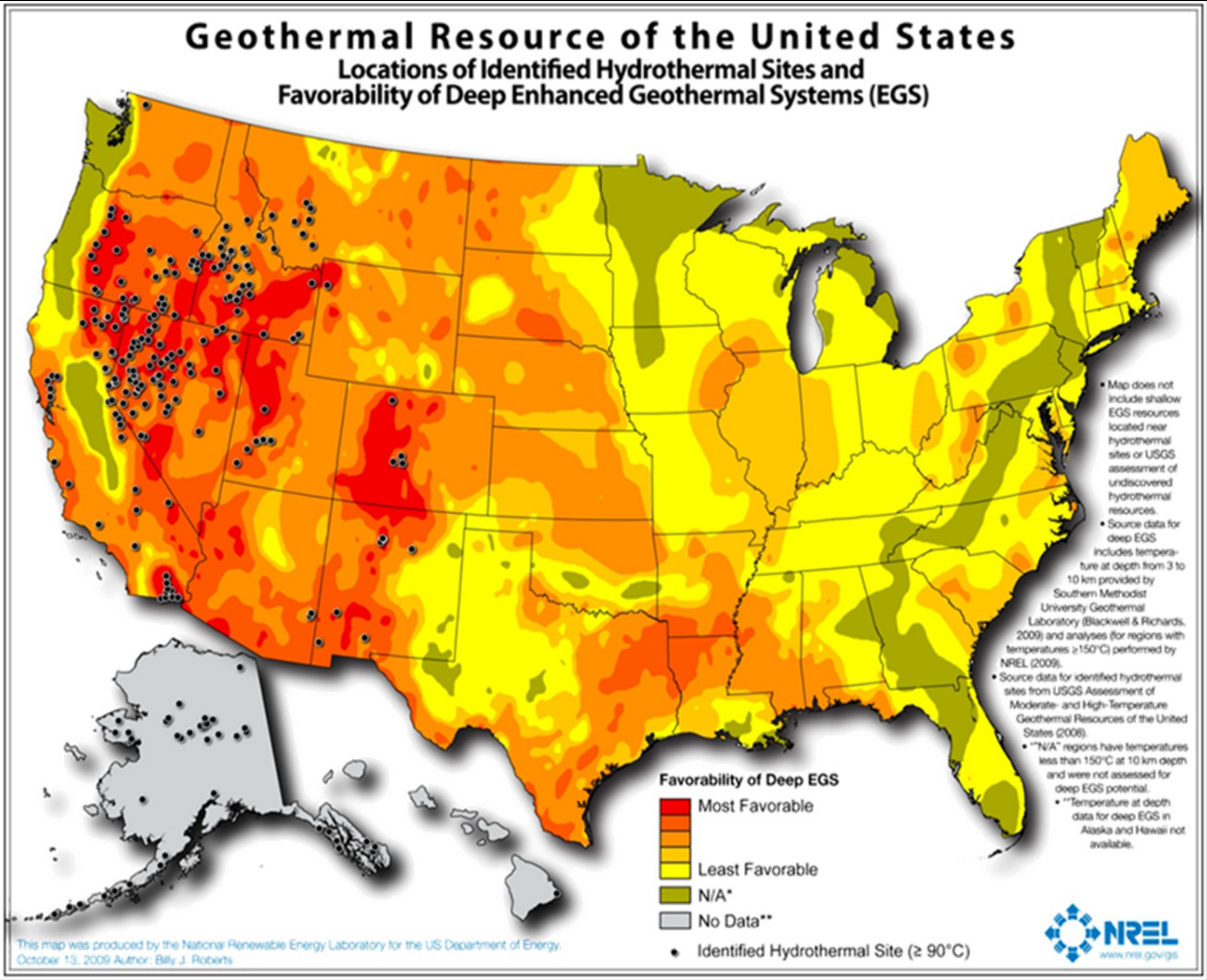


Figure 13. Geothermal Resource of the United States

Heating

Geothermal water heats homes and buildings throughout Idaho, ranging from the Idaho State Capitol to mobile homes. A 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 the 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 to transfer 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) or by steam that is produced either 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 a binary plant that 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. At present, geothermal plants provide less than 1% of the electric energy consumed in Idaho. Other geothermal power plants in Idaho are under consideration.[23]

For more information on geothermal energy in Idaho, please see the Idaho Strategic Energy Alliance Geothermal Task Force Report at: www.energy.idaho.gov

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. The power from these systems is integrated into the transmission and distribution grid to ensure a reliable energy supply even when the sun is not shining.. 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 south, or they can be mounted on a tracking device that follows the sun, allowing

[23] Geothermal Energy Association

them to capture the most sunlight. Many solar panels combined together to create one 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 generally are 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. 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. The PV material is more expensive, but because so little is needed, these systems are becoming cost-effective for use by utilities and industry. However, because the lenses must be pointed at the sun, 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 engine driving 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.[24]

Currently there are no utility-scale PVs or CSP installations in the state, however, since November 2014, the Commission has approved Idaho Power agreements for 13 solar projects, totaling 400 MW and valued at $1.4 billion. Idaho Power also recently signed contracts for 60 MW of solar generation in its Oregon territory.[25]

It is estimated that a total of 1.8 MW of solar PV is currently installed in Idaho. The U.S. installed 1,354 megawatts (MW) of solar photovoltaics (PV) in the third quarter of 2014 to total 16.1 gigawatts (GW) installed PV capacity, with another 1.4 GW of concentrating solar power (CSP) capacity, enough to power 3.5 million homes.[26] At present, solar facilities produce less than 0.0001% of the electric energy consumed in Idaho.

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[24] 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
[25] www.puc.idaho.gov/press/150108_IPCsixsolarprojects.pdf
[26] 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.

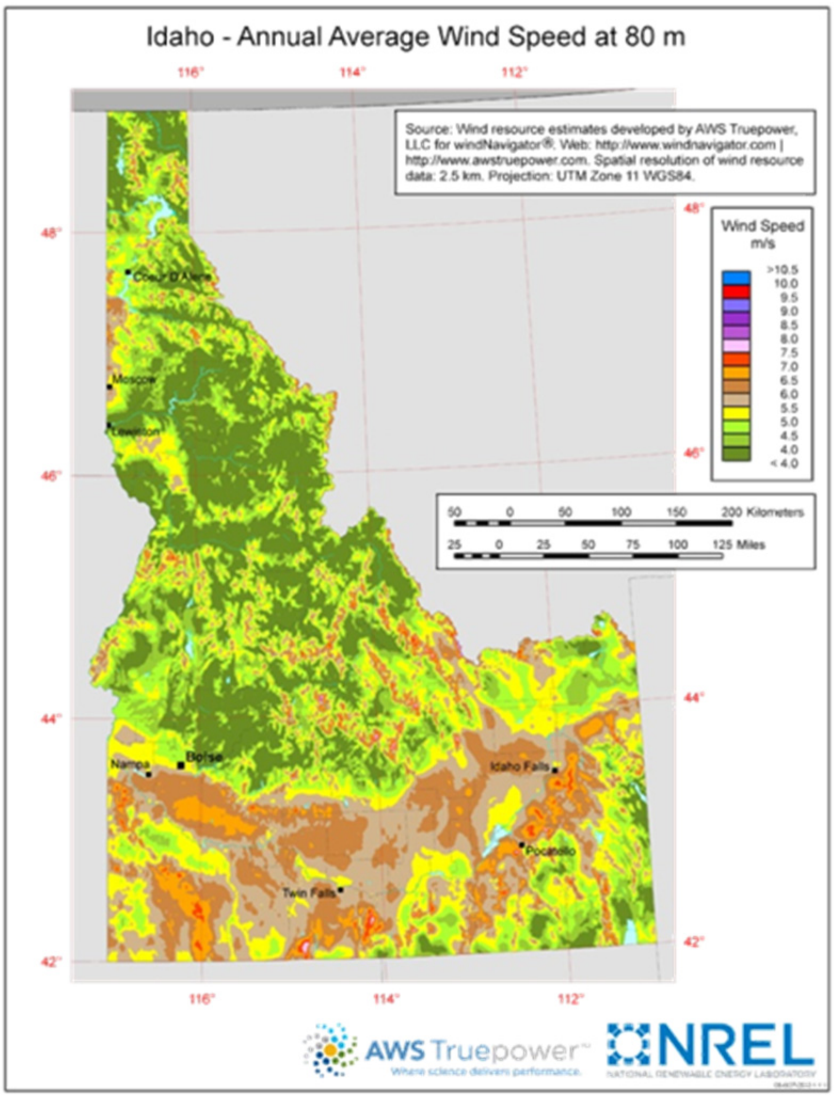

Figure 14. Idaho-Annual Average Wind Speed at 80 m

Source: www.windpoweringamerica.gov

Wind turbines can be used in stand-alone, small-scale systems that provide electricity to individual users, or directly to the electric grid in large-scale developments (hundreds of MW).

Wind power increased its share of total U.S. electricity generation in 2013 from 3.5% to 4.1%; Idaho was one of the states with more than twice the national share of wind power.[27] Over 61,000 MW of nameplate wind was in operation in the U.S. as of 2014, with another 12,000 MW (nameplate) under construction as of the end of 2013. Idaho has an installed capacity of 973 MW of wind energy generation capacity as of 2013. 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 2013.

Recent wind mapping studies estimate that Idaho has approximately 25,000 MW of wind generation potential, the 13th largest 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. The eastern end of the Plain in particular has seen high interest for wind development.

Electricity produced from wind does not produce carbon dioxide or other emissions and can reduce the demand for fossil fuels. Wind energy is an intermittent resource, however, producing energy only when the wind blows. Because it is intermittent, wind generators cannot be dispatched to meet load or counted on to produce at any particular capacity during times of high energy demand, or at 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 the wind generation is not available. As a result, only about five percent of a wind generator's nameplate generation capacity can be counted as firm capacity in a utilities resource planning.

Wind generation in Idaho increased by nearly 35% in 2013, providing 16% of net electricity generation.[28] At present, wind plants provide approximately 12% of the electric energy consumed in Idaho.

[27] Energy Information Administration, 2010 calendar year statistics from EIA-923 January-December
[28] www.eia.gov/state/?sid=ID

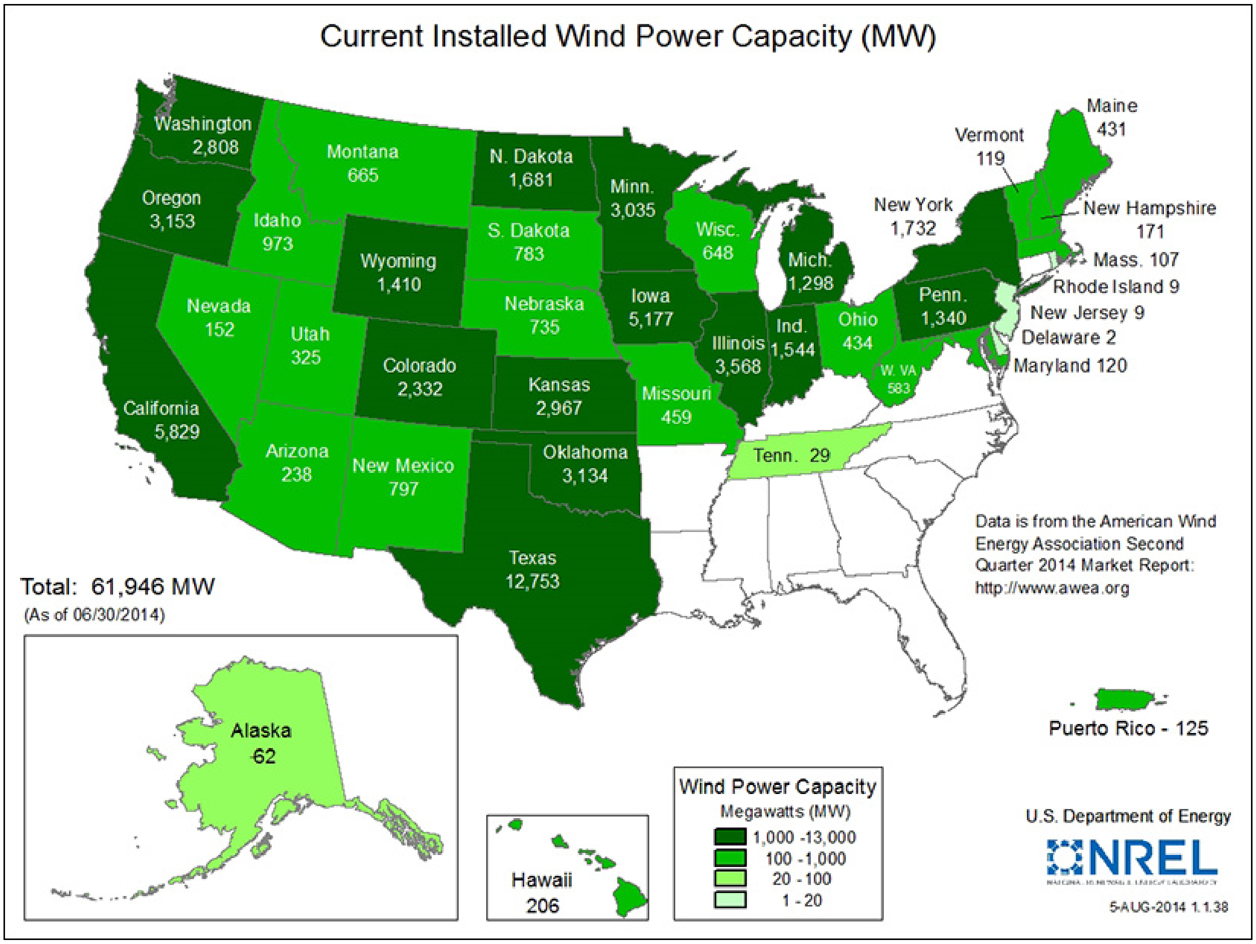

Figure 15. Current Installed Wind Power Capacity (MW)

Biomass

Humans have used biomass energy, or "bioenergy," the energy from plants and plant-derived materials, since people began burning wood to cook food and keep warm. Wood is still the largest biomass energy resource 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 wastes. 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.[29]

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 2012, there was 87 MW of installed capacity for biomass electricity that produced 549,000 MWh or 3.5% of Idaho's electricity production for that year.[30] As of 2011, there are more than 7,744 alternative fueled vehicles in use in Idaho. In 2014 Idaho has one operating ethanol plant capable of producing 63 million gallons per year.[31]

For more information on biomass energy in Idaho, please see the Idaho Strategic Energy Alliance Forestry/Biomass Task Force Report at: www.energy.idaho.gov

Hydroelectric

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 contribution of wind generators.

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

[29] www.energy.idaho.gov/renewableenergy/bioenergy.htm
[30] www.neo.ne.gov/statshtml/122.htm
[31] www.eia.gov/state/state-energy-profiles-data.cfm?sid=ID#Environment

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.[32] In 2010 hydroelectric generation was 9,154,000 MWh, providing about 76% of in-state electrical generation.[33]

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 the turbines can use, this additional flow passes through the dam's spill gates.[34]

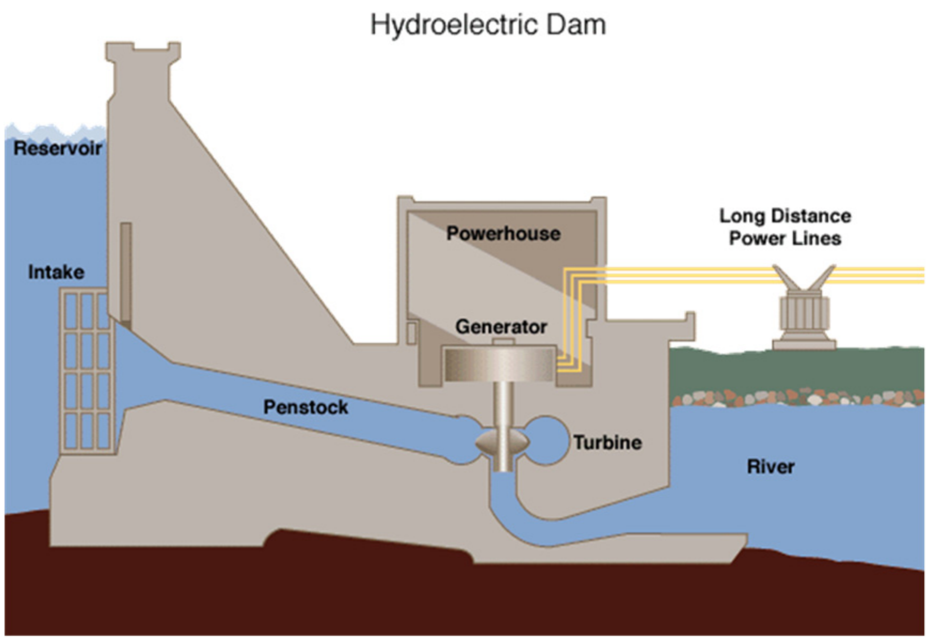

Figure 16. Hydroelectric Dam

More information can be found in the Hydropower Task Force report at: www.energy.idaho.gov

[32] Idaho Strategic Energy Alliance Hydropower Task Force Report, May 2009, Appendix F, Idaho Strategic Energy Alliance Hydropower Task Force Report, May 2009, Appendix F
[33] U.S. Energy Information Administration,2010 Renewable Electricity Profile, www.eia.gov/renewable/state/idaho
[34] The USGS Water Science School; http://water.usgs.gov/edu/hyhowworks.html

Energy Resources: Fossil Fuels

In 2013, fossil fuels, primarily natural gas, coal, and petroleum, provided about two-thirds of the nation's electricity (and about 82% of the nation's total energy demand).[35] In Idaho, fossil fuels provide approximately 35% 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.[36] Natural gas is used to produce an increasing share of the electricity generated in Idaho (about 12% in 2012) 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.[37] Fossil energy, in the form of gasoline and diesel, provides the bulk of transportation fuel. Idaho's neighboring states, Montana, Wyoming, and Utah are among the most fossil-energy rich areas in the country.

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 2012, natural gas was used to generate more than 7,500,000 MWh of electricity in Idaho, 23% of the state's total electricity consumption.[38]

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35 www.eia.gov/totalenergy/data/annual/perspectives.cfm
36 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.
37 www.eia.gov/electricity/state/idaho/, Table 5: Electric Power Industry Generation by Primary Energy Source, 1990 Through 2010
38 www.eia.gov/dnav/ng/ng_cons_sum_dcu_SID_a.htm

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 in neighboring states. Idaho Power Company partially owns 1,118 MW of coal-fired generation capacity in Wyoming, Nevada, and Oregon.[39] 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 a reliable source of baseload electricity. As a result of emission concerns, controls have become increasingly important to help reduce emissions and particulates. Coal-fired plants emit more carbon dioxide per kilowatt-hour (kWh) produced than do natural gas-fired plants.[40]

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; 93% of the transportation energy in the United States is provided by petroleum products (gasoline and diesel fuel).[41] In 2012, Idaho consumed 29.8 million barrels of petroleum products.[42] These fuels are burned in engines, producing expanding gases that provide mechanical forces that power the driveshaft and move the vehicle. About 1% 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.[43] 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 or burned directly to heat the air or a material being processed.

39 www.idahopower.com/AboutUs/CompanyInformation/Facts/generationResources.cfm
40 www.epa.gov/cleanenergy/energy-and-you/affect/natural-gas.html
41 http://instituteforenergyresearch.org/topics/encyclopedia/petroleum/
42 www.eia.gov/state/state-energy-profiles-data.cfm?sid=ID#Consumption
43 http://instituteforenergyresearch.org/topics/encyclopedia/petroleum/

Energy Resources: Nuclear Power

Nuclear power production continues to substantially contribute to the United States electricity supply, with approximately 20% of the nation's electricity provided by 104 nuclear reactors operating in 31 states.[44] Over the past two decades, the operational performance of these reactors has improved markedly[45], as evidenced by an increase in operational capacity factors from approximately 53% in 1980 to over 90% today.[46] This improvement, and the related safety record of the existing units, suggests maturity in the conduct of U.S. nuclear electric generation in general. There has been an increasing business 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, finally, generally positive public sentiment about nuclear power. Since 2007, there have been 16 license applications filed to build new nuclear reactors in the United States.[47] However, reduced natural gas prices over the past few years have put most of 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 shape the future of nuclear energy worldwide.

Nuclear power production is a mature and growing global industry. Over 430 power reactors operate in 31 countries producing almost 11% of the world's electricity.[48] 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 so-called "breeder" reactors - each having certain attributes and characteristics. The power reactors in the United States are all light water reactors, either pressurized water reactors (PWR) or boiling water reactors (BWR). These reactors generate heat primarily from the splitting of atoms of Uranium-235 (an isotope of uranium making up about 0.72% 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.

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[44] www.world-nuclear.org/info/inf41.html
[45] Nuclear Energy Institute; http://www.nei.org/Issues-Policy/Safety-Security
[46] www.nei.org/Knowledge-Center/Nuclear-Statistics/US-Nuclear-Power-Plants
[47] www.world-nuclear.org/info/inf41.html
[48] www.world-nuclear.org/info/info1.html

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. 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 operated by Energy NorthWest.

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. 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 use lowers costs, increases profits, and helps create jobs.

There are multiple state and federal incentives available for individuals who install energy efficiency retrofits. Individuals who produce their own renewable energy have the option to sell back to the grid, reduce their energy bill, and receive multiple tax breaks. For a full listing of state energy incentives visit www.dsireusa.org. Also, visit your utility website for local incentives.

For more information on Energy Efficiency in Idaho, please see the Idaho Strategic Energy Alliance Energy Efficiency & Conservation Task Force Report at: www.energy.idaho.gov

Energy Research in Idaho

Idaho National Laboratory

Idaho National Laboratory 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**: Southeast 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, the three Idaho public universities: University of Idaho, Idaho State University, and Boise State University, and the University of Wyoming. CAES delivers innovative, cost-effective, and credible energy research leading to sustainable technology-based economic development.[49]

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.[50]

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

[49] https://inlportal.inl.gov/portal/server.pt/community/caes_home/281
[50] 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 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 as the profit and non-profit private sectors, fostering coordinated approaches to energy development and end-use.

The Alliance 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 Alliance 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 Alliance 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 into the current situation, potential issues, and barriers to energy development; suggesting financial, policy, and research alternatives to overcome barriers.

The Alliance 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 Alliance, 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 Alliance and its teams of experts will provide the state with achievable and effective options for improving the energy future of Idaho.

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 towards achieving its goal by being an unbiased information resource and a leader in the energy dialogue in the state.

Board Of Directors

Jackie Flowers **- Idaho Falls Power - Chairman**

Jay Larsen **- Idaho Technology Council - Vice Chairman**

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

Paul Kjellander **- Idaho Public Utilities Commission**

Jeff Sayer **- Idaho Department of Commerce**

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Tim Clark **- Intermountain Gas Company**

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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

Contact List

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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

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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

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472 W. Washington
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MAILING ADDRESS:

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Boise, ID 83720-0074

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

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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% of energy bills. These appliances and electronics include everything from clothes washers and dryers, to computers, and to water heaters. By turning off and/or unplugging appliances when they're not in use and by making some small adjustments, a great deal of money can be saved on monthly 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.
- **Air dry dishes** instead of using the dishwasher drying cycle.
- **Turn down the brightness setting on computer monitors.** The brightest setting on a monitor consumes twice the power used by the dimmest setting.
- **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).
- **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.
- **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.
- **Unplug battery chargers** when the batteries are fully charged or the chargers are not in use.

Heating and Cooling

- Install patio covers, awnings and solar window screens to **shade your home from the sun**. For additional future 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.[51]

Restoration of Power

Ensuring reliable electrical service is the core concern of every utility, but there are some events that negatively impact service that our utilities are not able to control, 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 get them back on 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 hazard for line crews.
- Don't operate a portable generator inside your home or garage. Always properly ventilate a portable generator. Gasoline-powered generators produce deadly carbon

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

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. They will keep food and perishables inside cold for a longer period of time if not left open.
- 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 won'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 being knocked down onto power lines by wind, snow, or ice
- Lightning striking a transformer or other electrical facilities
- Car accidents in which utility poles are knocked over or sway enough to knock lines together and open up the circuit
- Equipment overload, especially on hot days when air conditioning is heavily utilized or during extremely cold weather when electric heaters are turned on across the system
- Digging too closely to underground lines or cutting a line
- In-home circuit overload
- Animal contact with the lines

Call Before You Dig

If you're planning to dig or build near overhead or underground electrical or other utility lines, call Dig Line at the One Call Center. Idaho law says you must call for permission first to ensure your safety and electric service reliability.

You can call 811 from anywhere to reach the One Call Center.

To avoid the danger of accidentally cutting into underground power lines, and to ensure your compliance with the law, call the One Call Center at least two working days before you dig. A new national number, 811, makes the notification process easier by reducing the problems created with having multiple numbers for different centers around the country. Calling 811 automatically routes the caller to the closest local One Call Center.

After providing the center with information about a digging project, operators will alert the appropriate utilities and send a crew to the job site to mark the locations of underground facilities free of charge. Locating these underground power lines and cables helps to prevent personal injury and costly damage to utility lines. When you call, be prepared to supply the location, scheduled date, type of work, and information about the company or contractor doing the work.[52]

Trees

Falling trees and tree limbs can cause high voltage wires to break or sag to the ground, in some cases causing life-threatening situations 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.

[52] Idaho Power Company website - About Us - Safety - Dig Line

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%). 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% 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% efficiency, greater than 99% 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% 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% 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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