

Idaho Energy Landscape 2022



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**Created by the Idaho Governor's
Office of Energy and Mineral Resources**

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Idaho's Energy Landscape

1.1 Energy and the Economy

The strength of Idaho's economy and quality of life for its citizens depend upon access to affordable and reliable energy resources. Idaho's resilient and diversified economy is fueled by energy-dependent sectors, including technology, manufacturing, agriculture, tourism, healthcare, and construction, all of which benefit from Idaho's low cost of energy.

Idaho's history is rich with energy innovation and its future is being propelled with pioneering technologies. From the first atomic-powered city in the world to the first public installation of solar-powered roads, parking lots and pathways, Idaho has long been a global energy innovator. The following key attributes enable a dynamic energy industry in Idaho:

- Low cost of doing business
- Access to affordable and reliable hydropower
- Availability of an energy-ready workforce
- Access to leaders in carbon-free energy and energy innovation
- Sizable and diverse industry supply chain

Historically, economic growth and energy consumption were strongly and positively correlated; however, technological changes and the increased utilization of energy efficiency have weakened this correlation. Idaho's Gross Domestic Product (GDP) grew on average of 4% annually from 1998 to 2019, while Idaho's energy consumption (transportation, heat, and power) only increased 0.5% annually during the same time period.¹ Despite the low growth in energy consumption, Idaho's access to natural resources have paved the way for energy producers to play a role in satisfying the state's energy needs. Idaho's energy industry contributes \$6.3 billion to the state's GDP and provides approximately 50,800 jobs distributed throughout the state, spurring technology innovation, launching of start-ups, and fueling research, growth and discovery.²

Energy statistics compiled for the Energy Landscape reflect the most recent data available from a wide variety of sources. Different sources will update energy data at irregular intervals, some more frequently than others. For that reason, the facts and statistics referenced in this document, including graphs and tables, represent the most up-to-date information available, but may be several years old. Each year, the Office of

¹ Federal Reserve Bank of St. Louis. "FRED: Total Gross Domestic Product for Idaho." <https://fred.stlouisfed.org/series/IDNGSP>; and U.S. Energy Information Administration. "Total End-Use Energy Consumption Estimates, 1960-2019, Idaho."

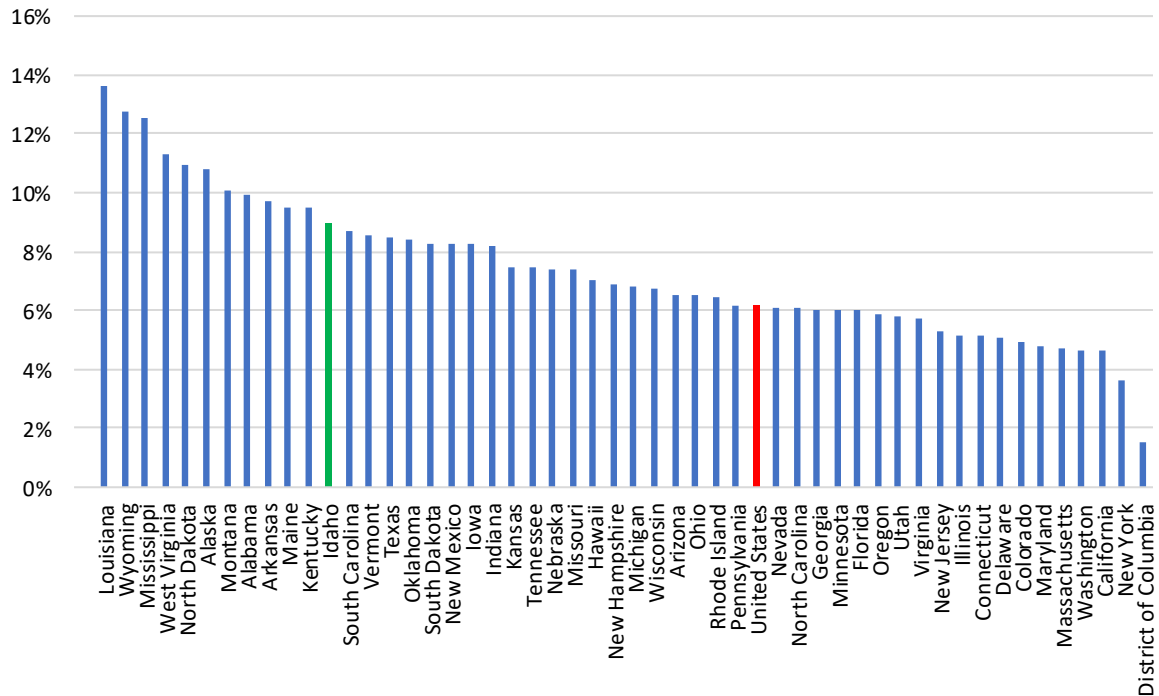
www.eia.gov/state/seds/data.cfm?incfile=/state/seds/sep_use/tx/use_tx_ID.html&sid=ID

² Idaho Department of Commerce. "Idaho's Energy Industry". <https://commerce.idaho.gov/site-selection/key-industries/idahos-energy-industry/>

Energy and Mineral Resources staff conducts thorough research to ensure that the data presented in this document is accurate and complete.

1.1.1. Energy Costs

Figure 1.1 Idaho's Energy Intensity as a Share of the Economy³



Low energy rates have consistently attracted energy-intensive industries to Idaho, including mining, pulp and paper, agriculture, food processing, and computer chip manufacturing. As a result, Idaho's energy expenditures equated to almost 8% of the State's Gross Domestic Product (GDP) in 2019, placing Idaho 12th for total energy costs compared to the rest of the states.⁴ The total energy costs per GDP illustrated in Figure 1.1 include the cost of gasoline to the State as well. Due to the rural nature of Idaho and the absence of a petroleum refinery in the State, Idahoans frequently spend more on transportation fuel than individuals who live in more densely populated regions of the country.

³ U.S. Energy Information Administration. "Total Energy Price and Expenditure Estimates, Ranked by State, 2019." https://www.eia.gov/state/seds/data.php?incfile=/state/seds/sep_sum/html/rank_pr.html&sid=US

⁴ U.S. Energy Information Administration. "Total Energy Price and Expenditure Estimates, Ranked by State, 2019." https://www.eia.gov/state/seds/sep_sum/html/pdf/rank_pr.pdf

Table 1.1 Average Energy Bill per Person, 2019⁵

Energy Source	Dollars Per Year	Percentage of Total Cost
Gasoline	\$1,185	63%
Electricity	\$481	26%
Natural Gas	\$112	6%
Propane	\$58	3%
Wood	\$43	2%
Coal	\$0	0%
Total	\$1,879	100%

Note: The fuel used to heat or power a home varies significantly across Idaho; therefore, the estimated cost per person is an average of all energy types. Some people may use more or less of a specific energy source.

Collectively, Idaho’s residential, commercial, industrial, and transportation sectors spent almost \$7 billion on energy in 2019.⁶ When those dollars were adjusted specifically for residential use, the average Idahoan spent about \$1,900 on direct energy products in 2019, as demonstrated in Table 1.1. This number was based on Idaho’s 2019 residential energy expenditures and population estimate.

Figure 1.2 Hells Canyon Hydroelectric Dam⁷



⁵ U.S. Energy Information Administration. “Idaho SEDS Data 2019 for the Residential, Commercial, Industrial and Transportation Sectors.” <https://www.eia.gov/state/seds/seds-data-complete.php?sid=ID>; and Idaho Department of Labor. “Census.” <https://lmi.idaho.gov/census>

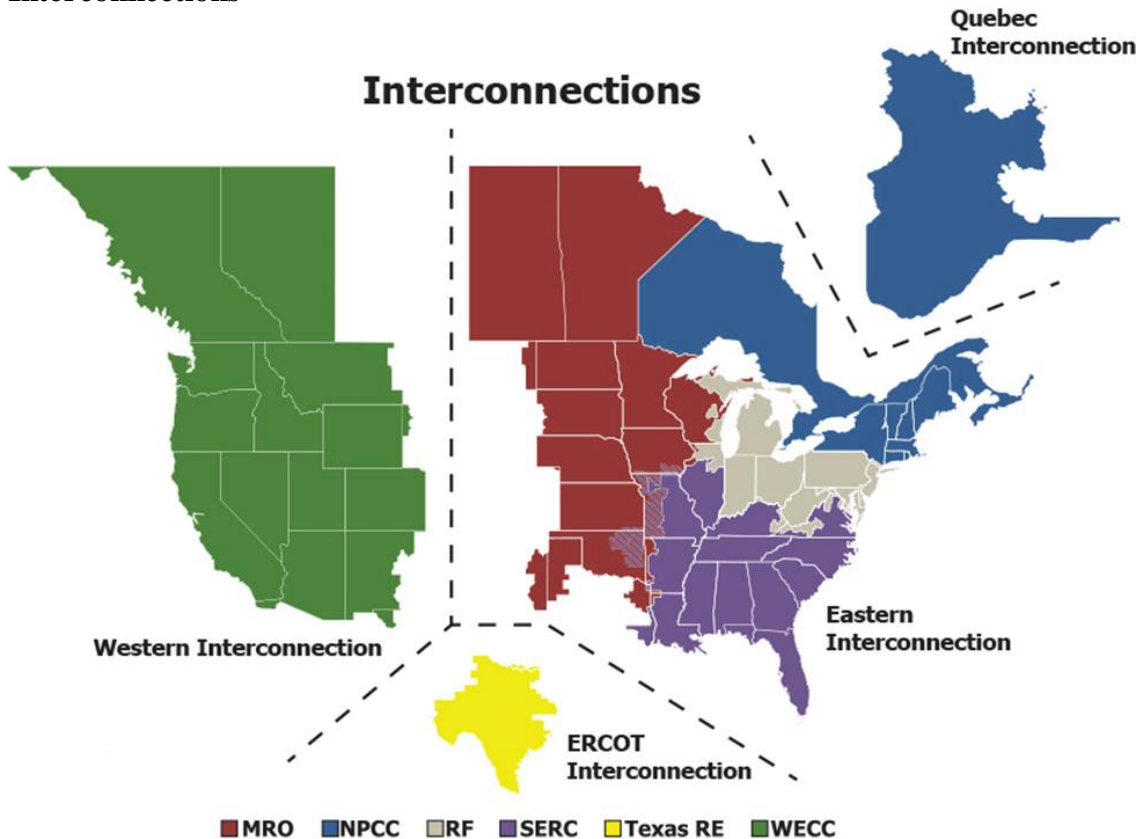
⁶ U.S. Energy Information Administration. “Idaho SEDS Data 2019 for the Residential, Commercial, Industrial and Transportation Sectors.” <https://www.eia.gov/state/seds/seds-data-complete.php?sid=ID#PricesExpenditures>

⁷ Sam Judy. Adobe Photo Stock License 225224371. https://stock.adobe.com/images/hells-canyon-dam/225224371?prev_url=detail

1.2 Idaho Utilities, and Electric and Natural Gas Systems

1.2.1. Electricity

Figure 1.3 North American Electric Reliability Corporation Regional Electric Interconnections⁸

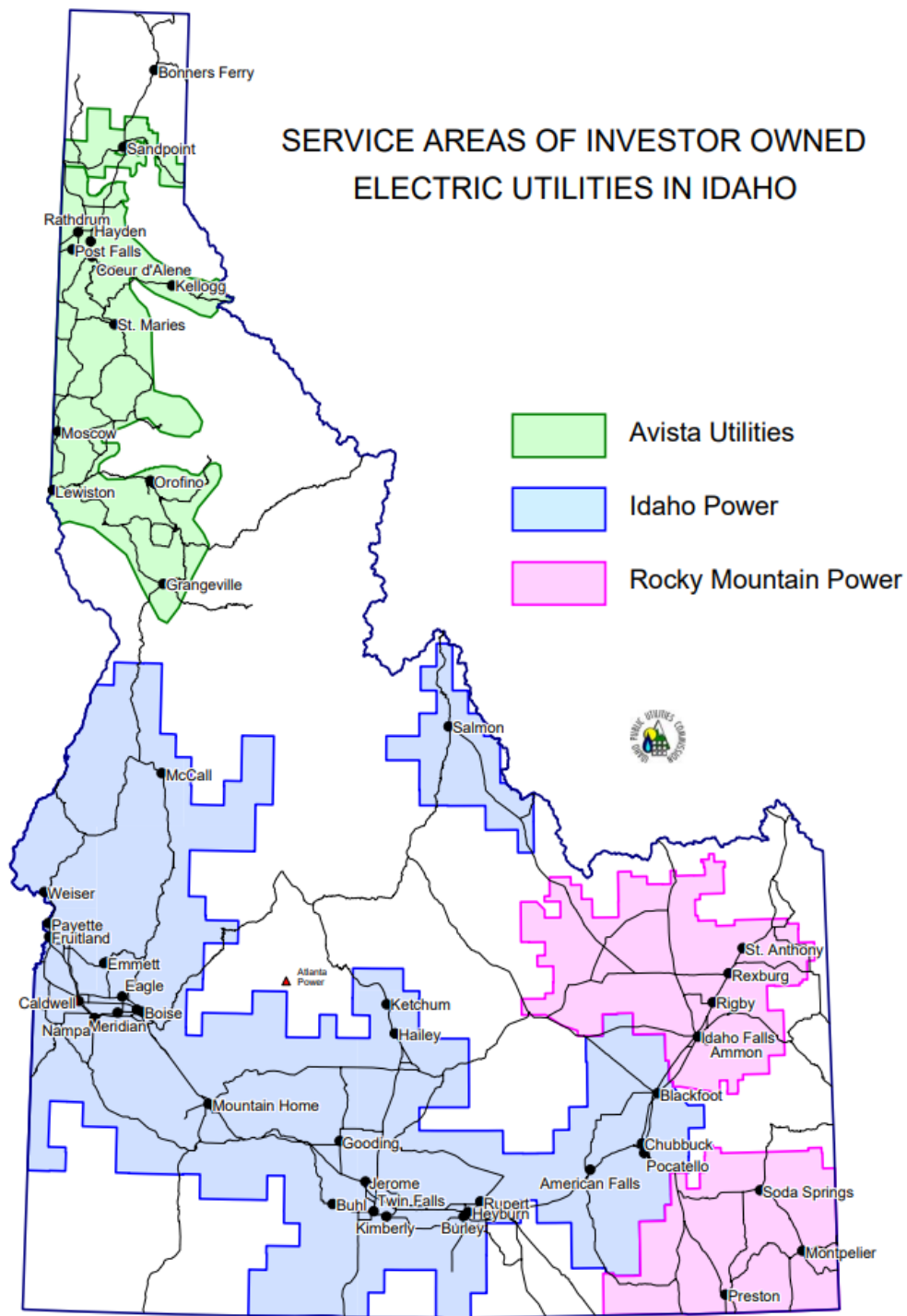


The electrical transmission network in the United States and Canada is made up of four separate interconnections. The Western Interconnection links Idaho with the rest of the western United States and two Canadian provinces as shown in Figure 1.3. Coordination throughout the Western Interconnection on a local, sub-regional, and regional basis ensures a reliable and adequate integrated system of electricity for consumers. The Western Electricity Coordinating Council (WECC) is the regional entity that monitors and enforces compliance with electricity reliability standards throughout the Western Interconnection, including Idaho.⁹

⁸ North American Electric Reliability Corporation. "Maps: NERC Interconnections." <https://www.nerc.com/AboutNERC/keyplayers/PublishingImages/NERC%20Interconnections.pdf>

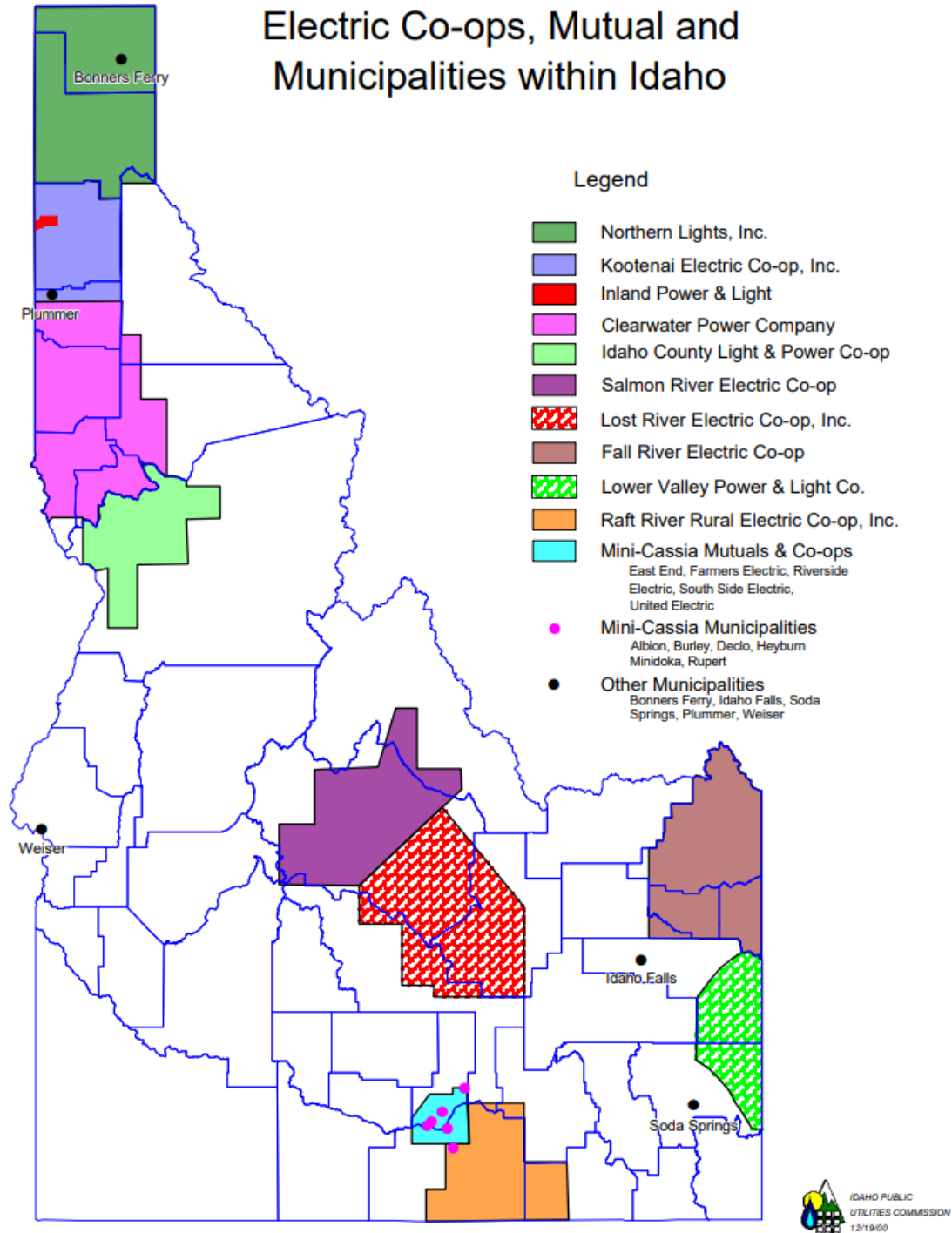
⁹ Western Electricity Coordinating Council. "About WECC." <https://www.wecc.org/Pages/AboutWECC.aspx>

Figure 1.4 Idaho's Investor-Owned Electric Utilities Service Territories¹⁰



¹⁰ Idaho Public Utilities Commission. "Service Areas of Investor-Owned Electric Utilities in Idaho." <https://puc.idaho.gov/Fileroom/PublicFiles/maps/elec.pdf>

Figure 1.5 Idaho's Municipal and Cooperative Utilities Service Territories¹¹



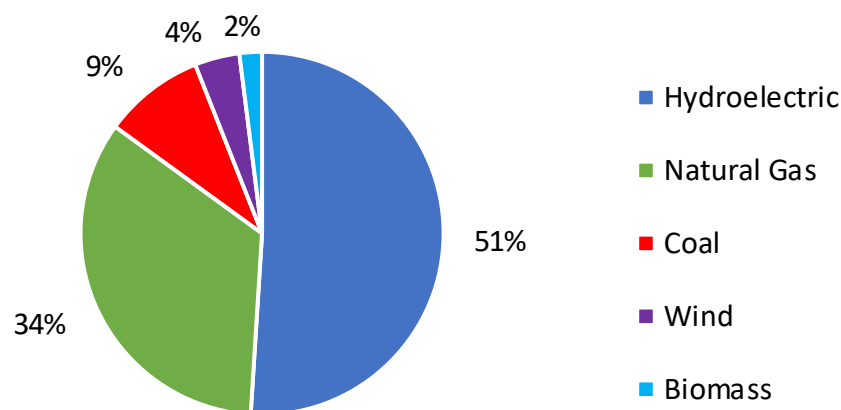
¹¹ Idaho Public Utilities Commission. "Electric Co-ops, Mutual and Municipalities within Idaho." <https://puc.idaho.gov/Fileroom/PublicFiles/maps/elecoop.pdf>

Idaho’s electrical grid is operated by three investor-owned utilities (IOUs), as well as municipal and rural electric cooperative utilities, which are listed in Appendix A. The three IOUs serve approximately 84% of the State’s electricity needs, while the municipal and rural electric cooperative utilities, or public utilities, serve the remaining 16%, as illustrated on the previous pages by Figures 1.4. and 1.5.¹²

1.2.1.1. Avista Corporation

Avista is an investor-owned electric and natural gas utility headquartered in Spokane, Washington. Avista serves nearly 231,000 electric and natural gas customers in Idaho’s northern and central regions. In April 2019, the company signed an agreement with the California Independent System Operator (CAISO) to participate in the Western Energy Imbalance Market (EIM) by the end of April 2022.¹³ Additionally, in April 2019, Avista announced its goal to serve its customers with 100% clean electricity by 2045, as required under Washington law, and to have a carbon neutral portfolio by the end of 2027. Avista has a near-term goal of 30% reduction in greenhouse gas emissions by 2030.¹⁴

Figure 1.6 Avista Energy Production Mix (2019)¹⁵



Avista generates electricity by utilizing a mix of hydroelectric, natural gas, coal, biomass, and wind generation delivered over 2,770 miles of electrical transmission lines, 19,100 miles of electrical distribution lines, and 8,000 miles of natural gas lines.¹⁶ Avista’s current annual energy production mix and long-term contracted resources is shown in Figure 1.6. Hydroelectric generation accounts for over half of its electricity mix, which

¹² U.S. Energy Information Administration. “Annual Electric Power Industry Report, Form EIS-861 detailed data files.” <https://www.eia.gov/electricity/data/eia861/>

¹³ Avista. April 25, 2019. “Avista builds on commitment to renewable energy by joining the Western Energy Imbalance Market.” <https://investor.avistacorp.com/node/21551/pdf>

¹⁴ Avista. “Avista Announces Natural Gas Emission Reduction Goal.” <https://www.myavista.com/about-us/our-commitment>

¹⁵ Avista. “About Our Energy Mix.” <https://www.myavista.com/about-us/about-our-energy-mix>

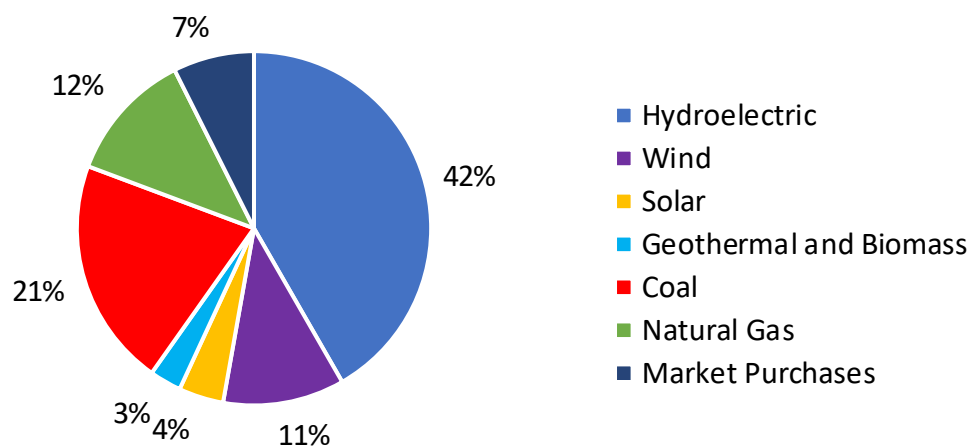
¹⁶ Avista. “2020 Quick Facts.” <https://investor.avistacorp.com/static-files/437ad3b9-9fbf-4c20-a891-cbb4c2f1dcff>

provides a significant price benefit for its customers. Avista’s company-owned and contract hydroelectric resources are located in western Montana, eastern Washington, and northern Idaho; and its natural gas-fired baseload and capacity resources are located in Idaho, Oregon, and Washington. It also has an ownership share in the Colstrip coal-fired power plant in Montana.¹⁷

1.2.1.2 Idaho Power Company

Founded in 1916, Idaho Power Company is the largest electricity provider in the state. Headquartered in Boise, as of December 31, 2021, Idaho Power services more than 600,000 customers in a 24,000 square mile service territory in southern Idaho and eastern Oregon.¹⁸ Electricity is supplied through 4,800 miles of transmission lines and more than 27,000 miles of distribution lines.¹⁹ Idaho Power has a significant hydroelectric generation power base. It has 17 low-cost, emission-free hydroelectric projects at the core of its generation portfolio, including a 1,167 megawatt (MW), three-dam complex in Hells Canyon.²⁰ Idaho Power entered the Western EIM in April 2018,²¹ and announced its goal to provide 100% clean energy to its customers by 2045 in March 2019.

Figure 1.7 Idaho Power Energy Mix (2020)²²



Idaho Power also generates electricity using natural gas at a combined-cycle combustion plant at Langley Gulch, near New Plymouth, Idaho, and two simple-cycle plants near Mountain Home. Additionally, it has partial ownership in baseload coal facilities located in Wyoming and Nevada, the Bridger and Valmy plants. Idaho Power exited the

¹⁷ Avista. “2021 Electric IRP.” <https://www.myavista.com/about-us/integrated-resource-planning>

¹⁸ Idaho Power. “Company Facts.” <https://www.idahopower.com/about-us/company-information/company-facts/>

¹⁹ Idaho Power Company. “Transmission and Power Lines.” <https://www.idahopower.com/energy-environment/energy/delivering-power/transmission-and-power-lines/>

²⁰ Idaho Power Company. “Hydroelectric Plants.” <https://www.idahopower.com/energy-environment/energy/energy-sources/hydroelectric/hydroelectric-plants/>

²¹ Western EIM. “About.” <https://www.westerneim.com/Pages/About/default.aspx>, and Idaho Power Company. “Clean Today. Cleaner Tomorrow.” <https://www.idahopower.com/energy/clean-today-cleaner-tomorrow/>

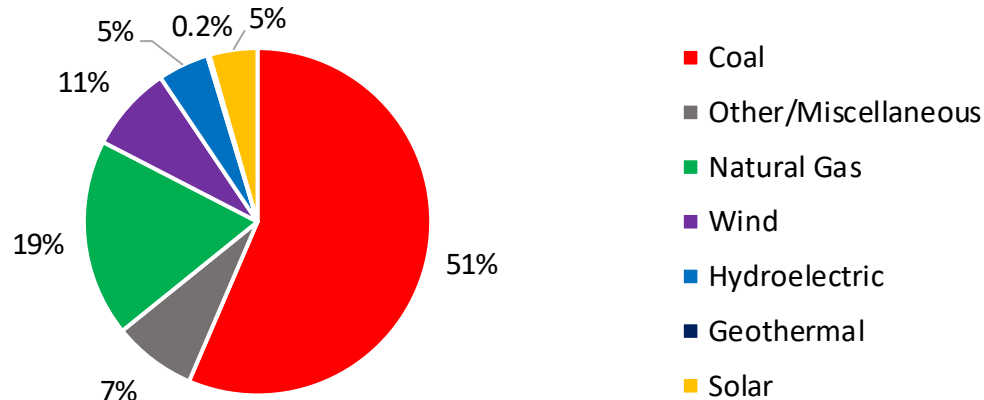
²² Idaho Power Company. “Our Energy Sources.” <https://www.idahopower.com/energy-environment/energy/energy-sources/>

Boardman coal facility located in Oregon in 2020 and half of its share of the Valmy coal facility in 2019. Idaho Power’s resource portfolio fuel mix for 2020 is shown in Figure 1.7. Idaho Power-owned generating capacity was the source for 72.4% of the energy delivered to customers. Purchased power comprised 27.6% of the total energy delivered to customers.²³

1.2.1.3 PacifiCorp / Rocky Mountain Power

PacifiCorp operates under the name Rocky Mountain Power in Idaho, Utah, and Wyoming, and serves 82,000 customers in 14 Idaho counties. PacifiCorp serves more than 2 million retail customers across 141,390 square miles of service territory in California, Idaho, Oregon, Utah, Washington, and Wyoming.²⁴ In 2014, PacifiCorp helped launch the Western EIM.²⁵ In 2017, the company announced the Energy Vision 2020 initiative.²⁶ This initiative aims to add 1,150 MW of new wind resources, upgrade the existing wind fleet and construct/rebuild transmission segments.

Figure 1.8 PacifiCorp’s Energy Production Mix (2020)²⁷



PacifiCorp owns 11,574 MW of generation capacity from a diverse mix of hydro, wind, natural gas, coal, solar and geothermal sources.²⁸ PacifiCorp’s energy mix is shown in Figure 1.8. Wind, hydro, geothermal, and other non-carbon-emitting resources currently make up about 48% of PacifiCorp’s owned and contracted generating capacity. PacifiCorp owns 2,255 MW of wind generation capacity and has long-term power purchase agreements for 1,556 MW from wind projects owned by others.²⁹ PacifiCorp’s customers receive electricity through approximately 16,500 miles of transmission lines,

²³ Idaho Power. “2021 Integrated Resource Plan.”

https://docs.idahopower.com/pdfs/aboutus/planningforfuture/irp/2021/2021%20irp_web.pdf

²⁴ PacifiCorp. “About.” <https://www.pacifiCorp.com/about.html>

²⁵ PacifiCorp. “Grid Modernization.” <https://www.pacifiCorp.com/energy/grid-modernization.html>

²⁶ PacifiCorp. “Renewable Energy.” <https://www.pacifiCorp.com/environment/renewable-energy.html>

²⁷ PacifiCorp. “Rocky Mountain Power – Power Content Label.”

<https://www.rockymountainpower.net/savings-energy-choices/blue-sky-renewable-energy/product-content-label.html>

²⁸ PacifiCorp. “Energy.” <https://www.pacifiCorp.com/energy.html>

²⁹ PacifiCorp. “2021 Integrated Resource Plan – Volume I (Chapter 6, pages 137-144).”

<https://www.pacifiCorp.com/content/dam/pcorp/documents/en/pacifiCorp/energy/integrated-resource-plan/2021-irp/Volume%20I%20-%209.15.2021%20Final.pdf>

64,000 miles of distribution lines, and 900 substations.³⁰ PacifiCorp's 2021 Integrated Resource Plan (IRP) identifies investments in modernized transmission, renewable energy, storage, demand response and advanced nuclear resources. The plan results in a 74% reduction of greenhouse gas emissions from 2005 levels by 2030.³¹

1.2.1.4. Idaho's Municipal and Cooperative Utilities

Twenty-two electric utility municipalities and cooperatives are members of the Idaho Consumer Owned Utilities Association (ICUA), serving more than 130,000 customers throughout Idaho, accounting for about 16% of Idaho's electric consumers.³² Municipal and cooperative utilities are not subject to regulation by the Idaho Public Utilities Commission (PUC).³³ Instead, Idaho's municipal and cooperative electric utilities provide competitively priced energy services to their members and residents and are generally governed by an independently elected Board of Directors or city councils.

Most of Idaho's municipalities and cooperatives purchase the bulk of their electricity, over 96%, from Bonneville Power Administration (BPA); however, some are beginning to acquire their own power generation resources and enter into power purchase agreements with other energy providers.³⁴ For example, Idaho Falls Power owns and operates five hydroelectric projects, owns a portion of the Horse Butte Wind project, and operates a small amount of solar.³⁵ The low-cost, renewable electricity provided by the Federal Columbia River Power System, including BPA and the four lower Snake River dams, is vital to public power utilities across Idaho and the communities they serve.

1.2.1.5. Utah Associated Municipal Power Systems

Three of Idaho's municipal and cooperative utilities and the Idaho Energy Authority, Inc. are members of the Utah Associated Municipal Power Systems (UAMPS). UAMPS is a project-based joint action agency headquartered in Salt Lake City, comprised of 48 public utilities in six western states. It provides comprehensive wholesale electric-energy services on a nonprofit basis to community-owned power systems throughout the Intermountain West. UAMPS conducts resource planning, evaluation of power resources or services for its members, and develops power-generating facility projects.³⁶

³⁰ PacifiCorp. "Transmission." <https://www.pacificorp.com/transmission.html>

³¹ PacifiCorp. "Integrated Resource Plan." <https://www.pacificorp.com/energy/integrated-resource-plan.html>

³² Idaho Consumer-Owned Utilities Association. "Members." <https://www.icua.coop/members/>

³³ Idaho Public Utilities Commission. "About the Commission." <https://puc.idaho.gov/Home/About>

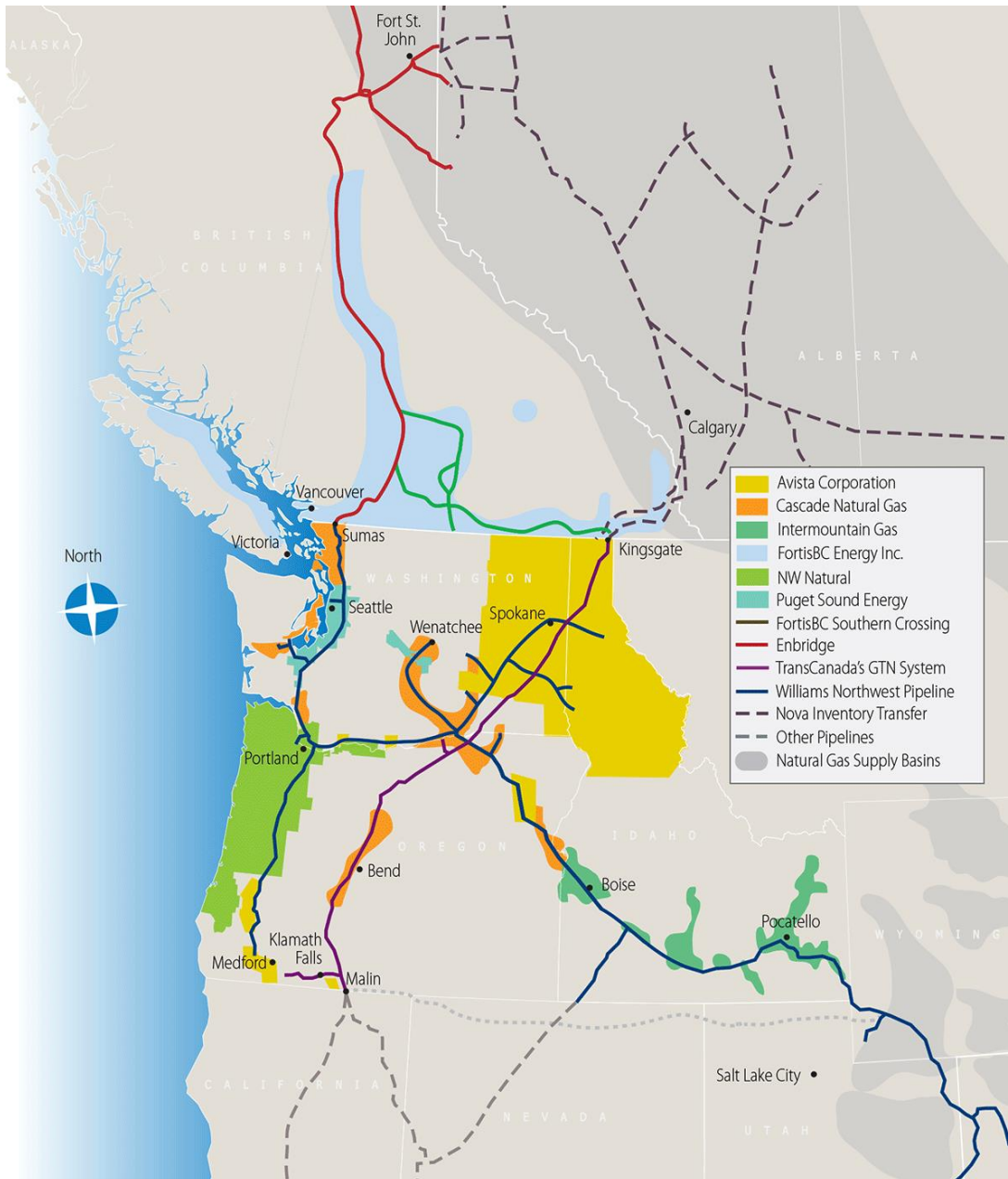
³⁴ Idaho Consumer-Owned Utilities Association. "Members." <https://www.icua.coop/members/>

³⁵ Idaho Falls Power. "Power Portfolio." <https://www.ifpower.org/about-us/generation-power-statistics>

³⁶ UAMPS. "About Us." <http://www.uamps.com/About-Us>

1.2.2. Natural Gas

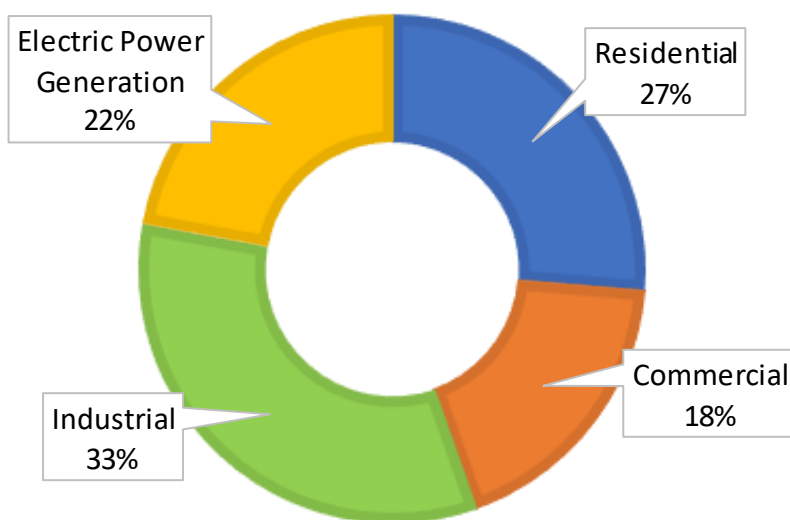
Figure 1.9 Western U.S. Interstate Natural Gas Pipeline System and Natural Gas Service Territories³⁷



³⁷ Northwest Gas Association. "Natural Gas Facts." https://www.nwga.org/wp-content/uploads/2017/06/NWGA_FactsWEBF.pdf

Natural gas consumption per capita in Idaho ranks among the lowest one-third of states, despite about half of Idaho households using natural gas as their primary energy source for heating.³⁸ Avista Utilities and Intermountain Gas Company provide the majority of natural gas service in Idaho. A third utility, Dominion Energy, provides service to Idaho customers in a portion of Franklin County in the southeastern part of the state.³⁹ Figure 1.9 shows the major natural gas infrastructure in Idaho and Idaho utility service territories. Figure 1.10 shows natural gas consumption by sector.

Figure 1.10 Natural Gas Consumption⁴⁰



1.2.2.1 Avista Utilities

Avista serves 87,000 Idahoans in its northern Idaho natural gas service area, 90% of whom are residential customers.⁴¹ Avista’s natural gas distribution system consists of approximately 3,300 miles of distribution pipelines in Idaho. Its North Division, which covers about 26,000 square miles primarily in eastern Washington and northern Idaho, is supplied by more than 40 points along interstate pipelines.⁴²

³⁸ U.S. Energy Information Administration. “State Energy Data System.”
<https://www.eia.gov/state/seds/seds-data-complete.php?sid=ID#>

³⁹ Dominion Energy “About Us – Western Gas Operations.”
<https://www.dominionenergy.com/about-us/moving-energy/western-gas-operations>

⁴⁰ U.S. Energy Information Administration. “Natural Gas Consumption by End Use.”
https://www.eia.gov/dnav/ng/ng_cons_sum_dcu_SID_a.htm

⁴¹ Avista. “2021 Natural Gas Integrated Resource Plan.”
<https://www.myavista.com/about-us/integrated-resource-planning>

⁴² Avista. “2021 Natural Gas Integrated Resource Plan.”
<https://www.myavista.com/about-us/integrated-resource-planning>

Avista holds firm access rights to both Canadian and Rocky Mountain natural gas supplies through the Williams Northwest and Gas Transmission Northwest pipelines. Avista also holds rights to the Jackson Prairie storage facility in Washington. According to Avista's Natural Gas IRP, the number of customers in Washington and Idaho is projected to increase at an average annual rate of 1.1%.⁴³

1.2.2.2. Intermountain Gas Company

Intermountain Gas Company (IGC) was founded in Idaho in 1950 and is a subsidiary of MDU Resources Group.⁴⁴ IGC distributes natural gas to approximately 387,000 residential, commercial, and industrial customers in 76 Idaho communities. IGC uses approximately 13,300 miles of pipelines across 50,000 square miles in southern Idaho. IGC's 140 industrial and transport customers comprise 49% of its annual energy demand, while residential and commercial customers comprise 34% and 17% respectively.

IGC holds firm capacity rights on William's Northwest Pipeline as well as three upstream pipelines to deliver gas to the distribution system. The upstream systems are: Gas Transmission Northwest, Foothills Pipeline and Nova Gas Transmission. IGC owns and operates the Nampa liquified natural gas (LNG) storage facility and leases storage at the Jackson Prairie underground facility, the Plymouth LNG facility, and from Dominion Energy's Clay Basin underground storage field. Residential, commercial, and industrial peak day load on IGC's system under design conditions is forecast to grow at an average annual rate of 2.08% over the five-year period of 2019-2023.⁴⁵

1.2.2.3. Dominion Energy

Dominion Energy, formerly called Questar Gas, based in Salt Lake City, provides natural gas service to residential, commercial, and industrial customers in Utah, southwestern Wyoming and about 2,200 customers in Franklin County, Idaho.⁴⁶ The Idaho Public Utilities Commission has elected to allow the Utah Public Service Commission to regulate Dominion Energy's activities in its small Idaho service area.⁴⁷

⁴³ Avista. "2021 Natural Gas Integrated Resource Plan."

<https://www.myavista.com/about-us/integrated-resource-planning>

⁴⁴ Intermountain Gas. "About Us." <https://www.intgas.com/in-the-community/about-us/>

⁴⁵ Intermountain Gas. "2019-2023 IRP."

https://www.intgas.com/wp-content/uploads/PDFs/commission_filings/IRP-Write-Up-Book-2019.pdf

⁴⁶ Idaho Public Utilities Commission. "2018 Annual Report – Natural Gas."

<https://puc.idaho.gov/Fileroom/PublicFiles/annualreports/ar2018/Section%20III%20Natural%20Gas.pdf>;

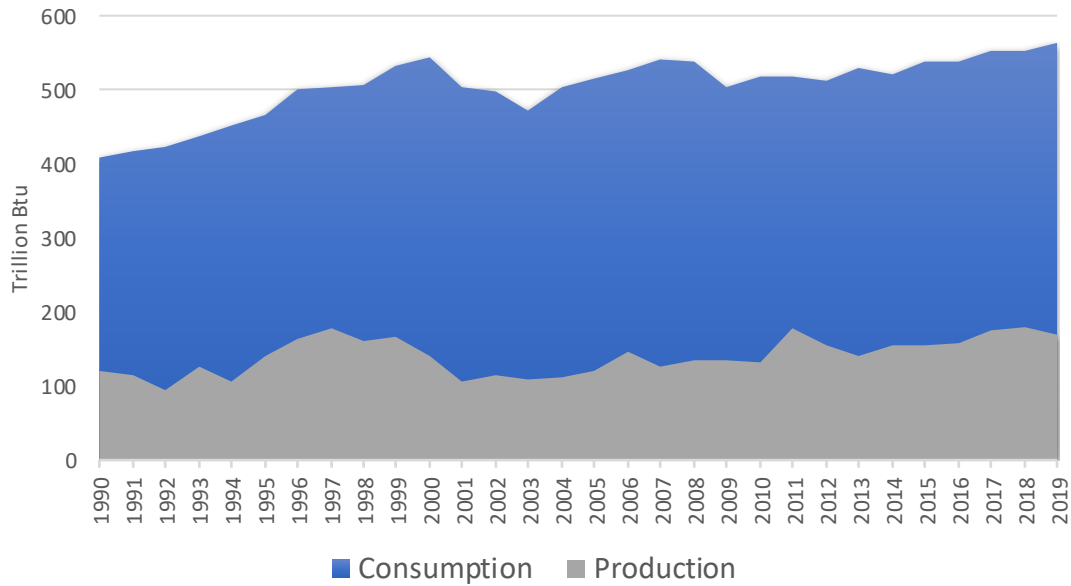
and Dominion Energy. "Western Gas Operations."

<https://www.dominionenergy.com/company/moving-energy/western-gas-operations>

⁴⁷ Idaho Public Utilities Commission. "Merger Agreement." <https://puc.idaho.gov/Case/Details/3245>

1.3. Energy Consumption, Production, and Prices

Figure 1.11 Idaho Energy Production and Consumption⁴⁸

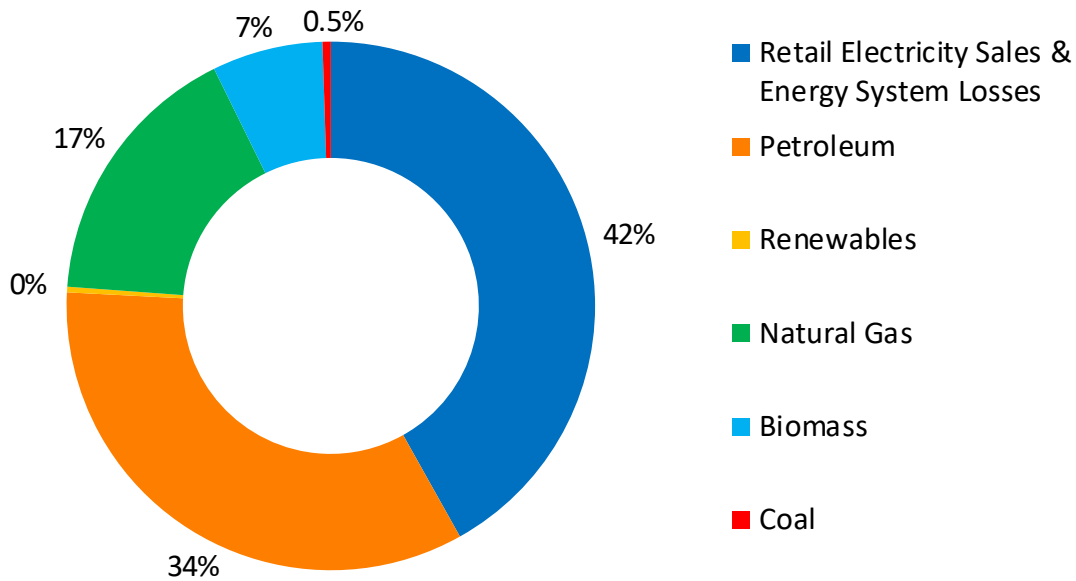


In 2019, Idaho produced approximately 30% of the total energy it consumed, including electricity, transportation fuels, and heating fuels. This is demonstrated in Figure 1.11, with consumption and production of heat measured in increments of trillion BTUs, or British Thermal Units. The state’s reliance upon imported energy requires a robust and well-maintained infrastructure of highways, railroads, pipelines, and transmission lines to facilitate economic development and maintain a high quality of life for Idaho’s citizens.

⁴⁸ U.S. Energy Information Administration. “State Energy Data System.”
<https://www.eia.gov/state/seds/seds-data-complete.php?sid=ID#>

1.3.1. Sources of Idaho's Energy

Figure 1.12 Sources of End Use Energy Consumed in Idaho in 2018⁴⁹



As shown in Figure 1.12, petroleum—including those blended with ethanol—used primarily for transportation, accounts for approximately 34% of Idaho's end-use energy consumption. Important energy commodities such as electricity sales and system losses account for 42% and natural gas accounts for approximately 17%, while the remaining 8% is attributable to coal, biomass, and other renewable energy sources. Idaho's total end-use energy consumption in 2018 was 553.9 trillion BTUs.

⁴⁹ U.S. Energy Information Administration. "State Energy Data System." <https://www.eia.gov/state/seds/seds-data-complete.php?sid=ID#>

Figure 1.13 Idaho's 2019 Electricity Sources⁵⁰

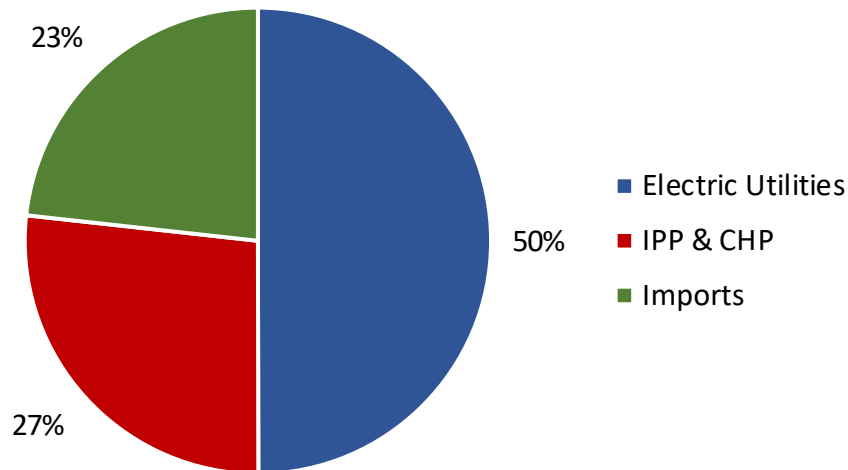
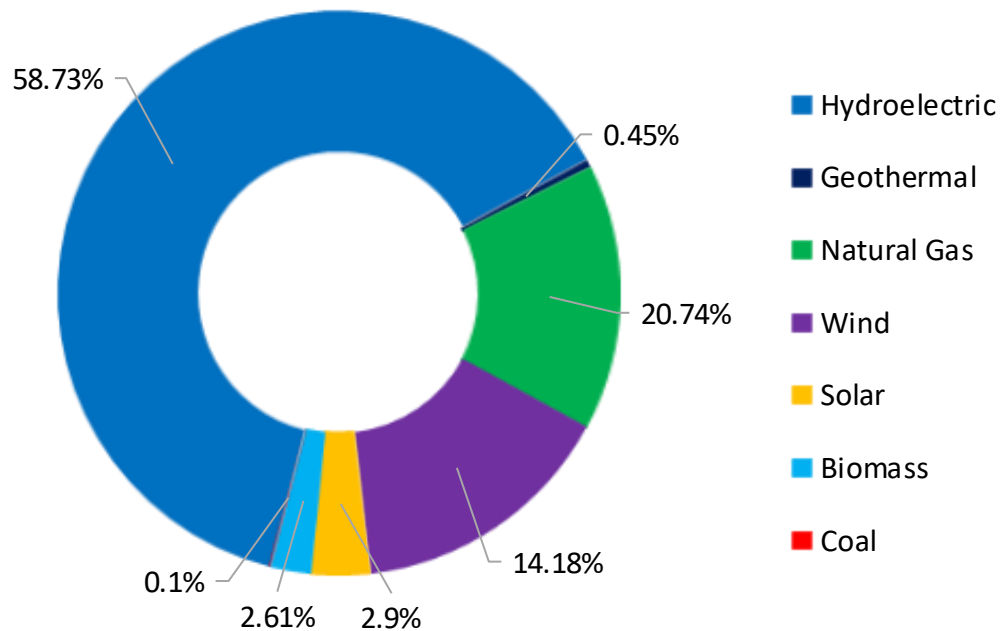


Figure 1.13 illustrates Idaho's dependence upon imported electricity to meet load demands. Idaho's utilities generate approximately 50% of the energy utilized in-state. 27% is provided by combined heat and power (CHP) or independent power producers (IPP). The remaining 23% is comprised of market purchases and energy imports from out-of-state generating resources owned by Idaho utilities. Idaho's retail sales of electricity totaled 23,985,275 MWh.

⁵⁰ U.S. Energy Information Administration. "Idaho Electricity Profile 2019." www.eia.gov/electricity/state/idaho/index.cfm

Figure 1.14 Idaho's 2019 Electric Grid Mix⁵¹



Note: The fuel mix percentages in this figure are based on Idaho's power sector electrical consumption data and not by generation data since Idaho consumes more electricity than it generates. These percentages only account for electric use of energy resources; neither thermal nor fuel usage are calculated into the percentages.

In 2019, 76% of the electricity generated in Idaho at utility-scale power plants was produced from renewable energy sources, the third-highest share for any state after Vermont and Maine.⁵² Hydroelectric power plants have typically supplied more than two-thirds of Idaho's in-state generation. However, in recent years, drought and increased generation from other renewables has reduced hydropower's share of the state's total annual generation to around three-fifths. Shown in Figure 1.14, hydroelectricity comprises approximately 58% of Idaho's electric grid mix.

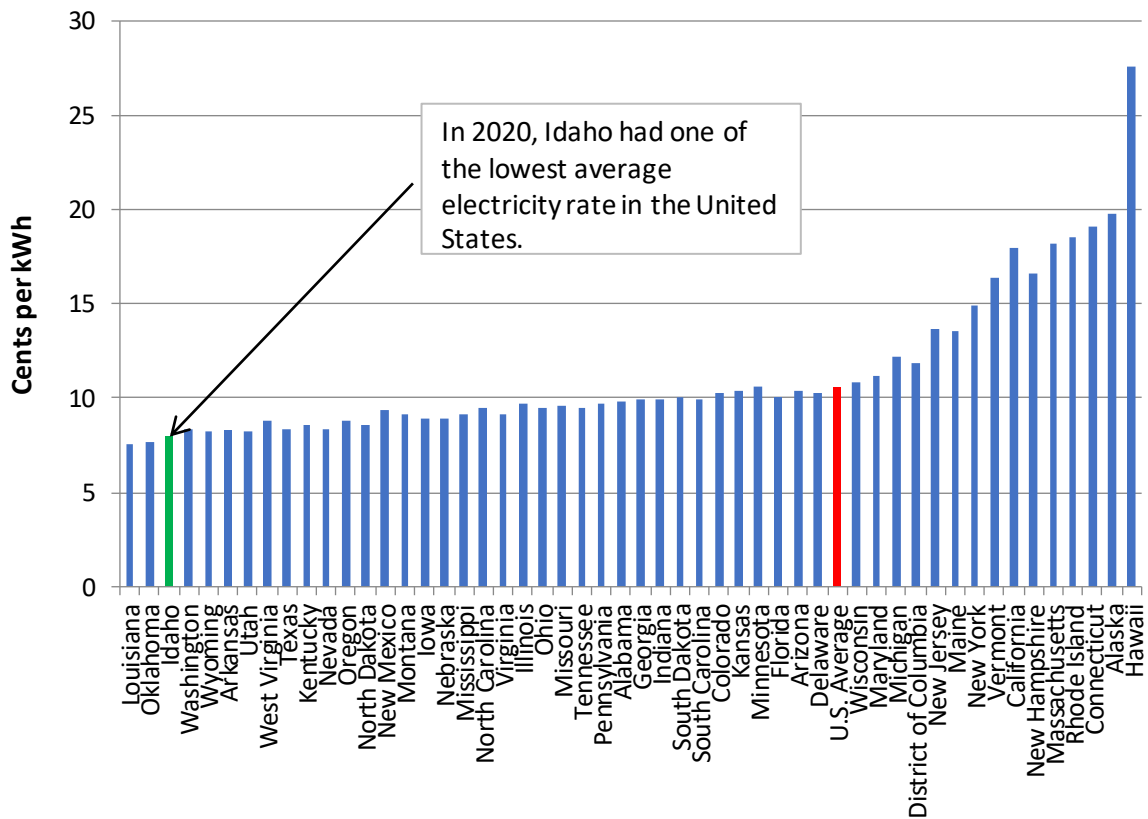
The balance of Idaho's electric grid mix is mostly supplied by natural gas and wind power. In 2019, natural gas accounted for about almost one-fourth (20%) of Idaho's generation and wind accounted for about one-seventh (14%). Other renewable energy sources, principally solar power, geothermal and biomass, account for approximately 6%.

⁵¹ U.S. Energy Information Administration. "Idaho State Electricity Profile." <https://www.eia.gov/electricity/state/idaho/index.php>

⁵² U.S. Energy Information Administration. "State Energy Data System." <https://www.eia.gov/state/seds/seds-data-complete.php?sid=ID#>

1.3.2. Energy Rates Compared to Other States

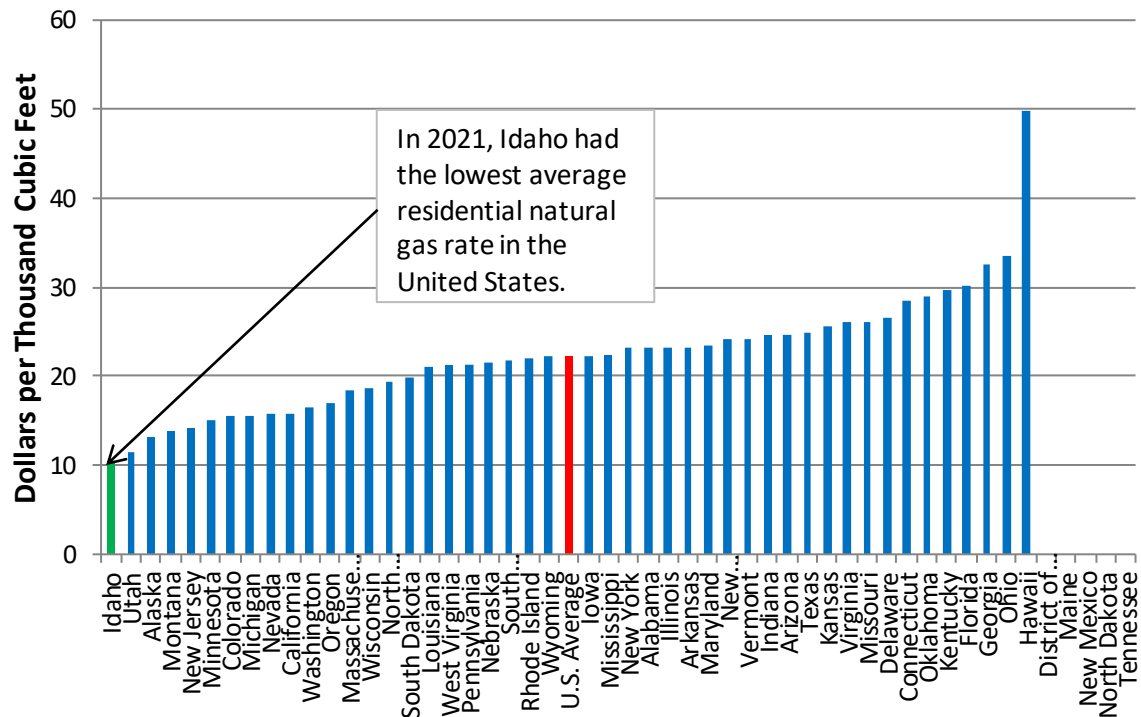
Figure 1.15 Idaho's 2020 Average Electricity Rates Compared to Other States⁵³



Idaho's baseload resources, including hydro, thermal, and geothermal, provide a constant source of reliable low-cost electricity to Idaho utilities. As a result, Idaho's average electricity rates were one of the lowest among the fifty states in 2020, shown in Figure 1.15.

⁵³ U.S. Energy Information Administration. "State Electricity Profiles." <https://www.eia.gov/electricity/state/#:~:text=Archived%20State%20Electricity%20Profiles%20%20%20Name,%20%2045%2C851%2C003%20%2039%20more%20rows%20>

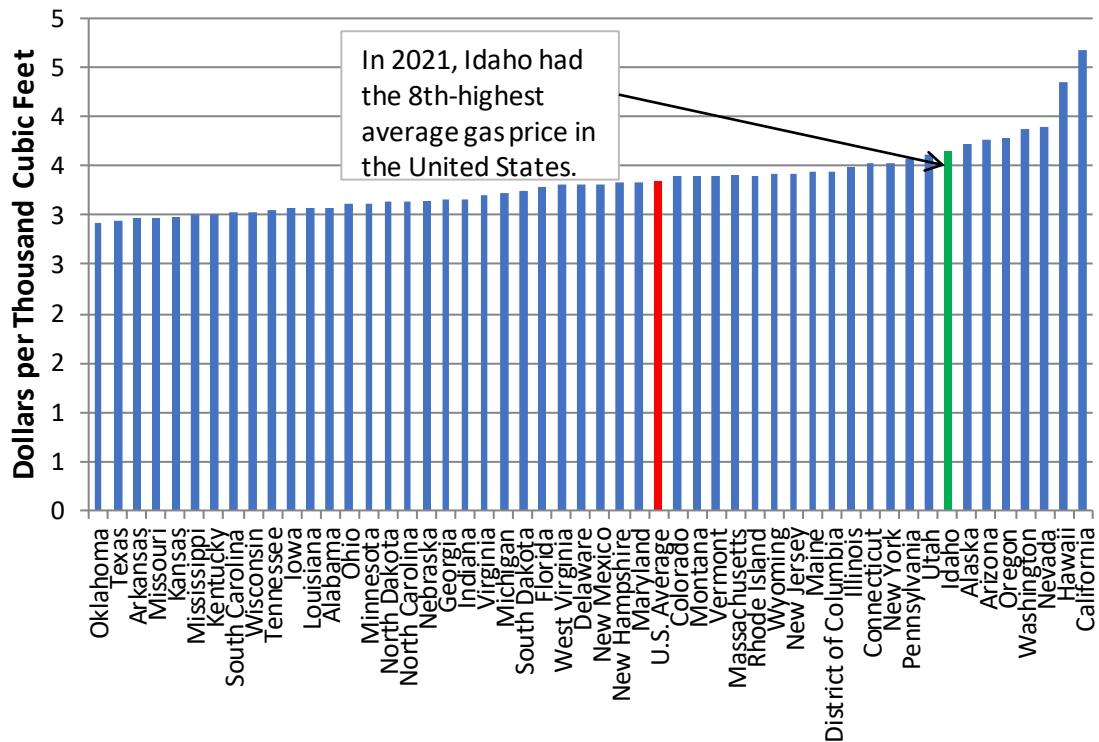
Figure 1.16 Idaho's 2021 Residential Natural Gas Prices Compared to Other States⁵⁴



In 2021, Idaho's average residential natural gas rates were the lowest in the U.S., as shown in Figure 1.16.

⁵⁴ U.S. Energy Information Administration. "Natural Gas Prices." <https://www.eia.gov/energyexplained/natural-gas/prices.php>

Figure 1.17 Idaho's 2021 Retail Gasoline Prices Compared to Other States⁵⁵



Note: The average combined (local, state and federal) gasoline tax in 2021 was 56.59 cents per gallon. Idaho's combined gasoline tax rate in 2021 was 51.40 cents per gallon.⁵⁶

Idaho's small population contributes to it being among the 10 states with the lowest total petroleum consumption, but Idaho's per capita petroleum use is near the national average. Idaho relies principally upon refineries in Utah and Montana for its supply of gasoline, diesel, and other refined petroleum products. Idaho's prices for these products are typically higher than the national average. Idaho had the eighth highest average gasoline price in the United States in 2021, as shown in Figure 1.17.

⁵⁵ AAA. "Gas Prices." <https://gasprices.aaa.com/>

⁵⁶ American Petroleum Institute. "Gasoline Taxes." <https://www.api.org/-/media/files/statistics/state-motor-fuel-taxes-charts-july-2021.pdf?la=en&hash=55be585beab89e19ecf7cae7dc550a5f501b0747>

1.4. State, Regional, and Federal Energy Regulators

The entities listed below are involved in regulating aspects of Idaho's energy systems. A regulator is a government agency with authority to control energy services.

1.4.1. Idaho Public Utilities Commission

The Idaho PUC regulates Idaho's investor-owned electric, natural gas, telecommunications, and water utilities to ensure adequate service at just, reasonable, and sufficient rates. The Idaho PUC has authority to promulgate administrative rules under the Idaho Administrative Procedures Act.⁵⁷ The Idaho PUC consists of three commissioners, appointed by the Governor and subject to Senate confirmation, who serve staggered six-year terms. No more than two commissioners may be of the same political party. The Idaho PUC renders decisions about utilities based upon all the evidence that is presented in the case record. Idaho PUC orders may be appealed directly to the Idaho Supreme Court.

The Idaho PUC holds formal hearings that resemble judicial proceedings in which parties to the case may present testimony and evidence and may conduct cross-examinations. All cases are a matter of public record.

To ensure its decisions are based upon the best information available, the Idaho PUC employs approximately 50 people – including engineers, accountants, economists, and investigators – to analyze each matter before the Idaho PUC and issue recommendations. In the Idaho PUC's formal proceedings, the staff is a separate party to the case and may present its own testimony, evidence, and expert witnesses. Staff recommendations are considered by the Idaho PUC along with those of other parties to each case, which may include utilities, the public, and agricultural, industrial, business, or consumer groups.

1.4.2. Idaho Department of Lands and Oil and Gas Conservation Commission

The Idaho Department of Lands (IDL) leases and issues rights-of-way for energy projects on state endowment lands and provides some regulation of Idaho's mining industry.⁵⁸ IDL services are provided by 10 Supervisory Areas that include 14 offices.

The Oil and Gas Conservation Commission (OGCC) is administratively housed within the IDL.⁵⁹ The OGCC regulates the exploration, drilling, and production of oil and gas resources in Idaho to ensure the conservation of resources and the protection of surface water and groundwater.⁶⁰

The IDL reviews applications for drilling, well treatment, pit construction, and other activities in conjunction with the Idaho Department of Water Resources and the Idaho Department of Environmental Quality. The Director or her/his designee may hold

⁵⁷ Idaho Legislature. "Idaho Statutes § 61 and § 62." <https://legislature.idaho.gov/statuterules/idstat/>

⁵⁸ Idaho Department of Lands. "About Us." <https://www.idl.idaho.gov/about-us/>; and "Oil & Gas Leasing." <https://www.idl.idaho.gov/leasing/oil-gas-leasing/>

⁵⁹ Idaho Legislature. "Idaho Statutes § 47-314." <https://legislature.idaho.gov/statuterules/idstat/>

⁶⁰ Idaho Oil and Gas Conservation Commission. "About the Commission." <https://ogcc.idaho.gov/>

administrative hearings on applications for activities that may affect other mineral interest owners. The OGCC consists of the Director of IDL, as well as a Governor-appointed County Commissioner from an oil and gas producing county and three Governor-appointed technical experts with degrees in geosciences or engineering and at least ten years of experience in the oil and gas industry.

1.4.3. Idaho Department of Environmental Quality

The Idaho Department of Environmental Quality (DEQ) is responsible for enforcing state environmental regulations and administers a number of federal environmental protection laws including the Clean Air Act, the Clean Water Act, and the Resource Conservation and Recovery Act.⁶¹ DEQ issues permits for energy and mining projects under the Idaho Pollutant Discharge Elimination System, in which DEQ received full permitting authority as of July 1, 2021.⁶² DEQ has six regional offices across the State that work in partnership with local communities, businesses, and citizens to identify and implement cost-effective environmental solutions for projects.⁶³

1.4.4. Idaho State Department of Agriculture, Bureau of Weights and Measures

Agriculture is Idaho's largest industry. The Idaho State Department of Agriculture (ISDA) oversees more than 60 sections of Idaho Code.⁶⁴ The Bureau of Weights and Measures (Bureau) is responsible for assuring the accuracy of commercial weighing and measuring devices such as petroleum meters, fuel pumps, and propane meters. The Bureau monitors gasoline octane levels and is responsible for Idaho's fuel quality and labeling.⁶⁵ It assures national traceability to Idaho's primary mass and volume standards through a nationally recognized metrology laboratory.

1.4.5 Idaho Department of Water Resources

The Idaho Department of Water Resources (IDWR) approves or denies proposals to appropriate water or change existing water rights, archives water right records, recommends and records adjudicated water rights, and oversees the delivery of water in times of shortage.⁶⁶ This is important in the development of energy and mineral projects to ensure all water rights during project construction and operation are protected. IDWR is responsible for the safety of dams, ground water protection (well construction oversight), the regulation of stream channel alterations, and coordination with local communities to comply with the National Flood Insurance Program.

⁶¹ Idaho Department of Environmental Quality. "About." <http://deq.idaho.gov/about-us/>

⁶² Idaho Department of Environmental Quality. "Idaho Pollutant Discharge Elimination System." <http://deq.idaho.gov/water-quality/wastewater/>

⁶³ Idaho Department of Environmental Quality. "Regional Offices & Issues." <http://deq.idaho.gov/regional-offices/>

⁶⁴ Idaho State Department of Agriculture. "About ISDA." <https://agri.idaho.gov/main/about/about-isda/>

⁶⁵ Idaho State Department of Agriculture. "Weights and Measures." <https://agri.idaho.gov/main/weights-and-measures/>

⁶⁶ Idaho Department of Water Resources. "Strategic Plan FY2022-2025." https://idwr.idaho.gov/wp-content/uploads/sites/2/general/IDWR-SP-FY22-25_FINAL.pdf

1.4.6 Idaho Department of Fish and Game

The Idaho Department of Fish and Game (IDFG) protects, preserves, perpetuates, and manages Idaho's wildlife resources.⁶⁷ IDFG provides data and technical assistance for energy and mineral projects to evaluate potential effects to fish, wildlife, and habitat as in-state and out-of-state energy demands are addressed. IDFG cooperates with project developers to mitigate and reduce impacts to wildlife. The agency is split into seven regions and one sub-region coordinated from the headquarters office in Boise.

1.4.7 Idaho Governor's Office of Species Conservation

The Idaho Governor's Office of Species Conservation (OSC) is dedicated to planning, coordinating, and implementing the State's actions to preserve, protect and restore species listed as candidate, threatened, and endangered under the federal Endangered Species Act.⁶⁸ This work is done in coordination with other state agencies and input from the citizens of Idaho for energy and mineral projects to ensure responsible development of resources and adequate protection for species. OSC is headquartered in Boise and has staff in Salmon and Moscow, Idaho.

1.4.8 Idaho Department of Parks and Recreation

The Idaho Department of Parks and Recreation (IDPR) is the state authority on outdoor recreation and resource stewardship. IDPR manages thirty state parks and recreation programs throughout the state. IDPR analyzes impacts to recreation from energy and mineral project development, and administers the recreation programs for boats, snowmobiles, and other off-highway vehicles.⁶⁹

1.4.9 State Historic Preservation Office

The Idaho State Historic Preservation Office (SHPO) is administratively housed within the Idaho State Historical Society. SHPO offices nationwide encourage the preservation, documentation, and use of cultural resources. For energy and mineral projects, the Idaho SHPO consults with federal agencies to review effects to historic properties under Section 106 of the National Historic Preservation Act.⁷⁰ SHPO maintains the Idaho State inventory of documented cultural resources in the state, administers the Federal tax incentives program, and provides educational and technical assistance on historic preservation issues.

1.4.10. Idaho Energy Resources Authority

The Idaho Energy Resources Authority (IERA) is an energy lending/financing entity authorized to issue revenue bonds to municipal and cooperative electric utilities. It was established by the Idaho State Legislature in 2005 to promote transmission, generation, and renewable energy development in the State and the region.

⁶⁷ Idaho Department of Fish and Game. "About Fish and Game." <https://idfg.idaho.gov/about>

⁶⁸ Idaho Governor's Office of Species Conservation. "Home – About OSC." <https://species.idaho.gov/>

⁶⁹ Idaho Department of Parks and Recreation. "Strategic Plan Fiscal Year 2022." https://parksandrecreation.idaho.gov/wp-content/uploads/IDPR_2021-2025_Strategic_Plan.pdf

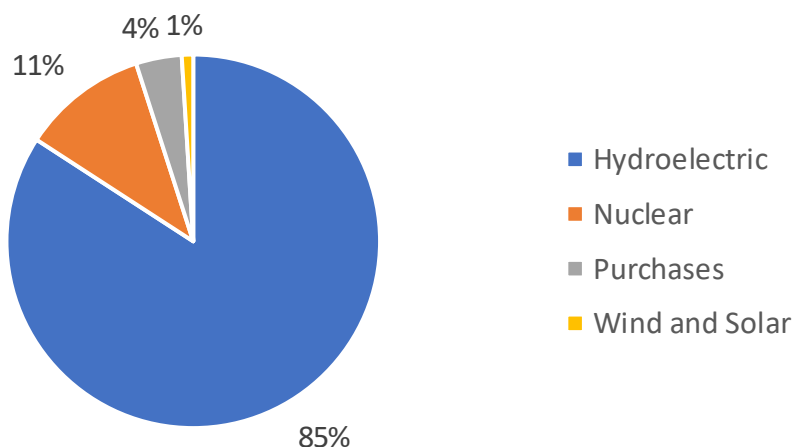
⁷⁰ Idaho State Historic Preservation Office. "Section 106 Project Review." <https://history.idaho.gov/section-106/>

The IERA allows for Idaho utilities to jointly own and finance transmission and generation projects for the benefit of their ratepayers. The IERA can participate in planning, financing, constructing, developing, acquiring, maintaining, and operating electric generation and transmission facilities and their supporting infrastructure. While the IERA has bonding authority to promote specific projects, it has no legislative appropriation, no full-time staff, and no ability to finance projects that are not backed by ratepayers. The services provided by the IERA offer unique opportunities for Idaho's municipal and cooperative electric utilities to help materially lower the development costs of critical energy projects in the State.

1.4.11. Bonneville Power Administration

The Bonneville Power Administration (BPA) is one of four Power Marketing Administrations (PMAs) under the U.S. Department of Energy (DOE) that supply power throughout their regions.⁷¹ BPA is a separate and distinct entity in the DOE under the DOE Organization Act of 1977.⁷² BPA is self-funded and has its own federal borrowing and procurement authorities which it utilizes to serve the Northwest. BPA supplies about 28% of regional power.⁷³ BPA's territory includes Idaho, Oregon, Washington, western Montana and small parts of eastern Montana, California, Nevada, Utah and Wyoming. BPA works with cooperatives, municipalities, IOUs, and directly provides electric power to several federal installations, industrial, and irrigation customers in a practice known as direct service.⁷⁴

Figure 1.18 BPA Resources (2019)⁷⁵



⁷¹ U.S. Energy Information Administration. "Federal Power Marketing Administrations operate across much of the United States." <https://www.eia.gov/todayinenergy/detail.php?id=11651>

⁷² Bonneville Power Administration. "About Us." <https://www.bpa.gov/news/AboutUs/Pages/default.aspx>

⁷³ Bonneville Power Administration. "BPA Facts." <https://www.bpa.gov/news/pubs/GeneralPublications/gi-BPA-Facts.pdf>

⁷⁴ Bonneville Power Administration. "BPA Facts." <https://www.bpa.gov/news/pubs/GeneralPublications/gi-BPA-Facts.pdf>

⁷⁵ Bonneville Power Administration. "Fuel Mix." <https://www.bpa.gov/p/Generation/Fuel-Mix/FuelMix/BPA-Official-Fuel-Mix-2019.pdf>

BPA sources power from 31 federal hydroelectric dams that are operated by the U.S. Army Corps of Engineers and the Bureau of Reclamation. These dams are referred to as the Federal Columbia River Power System. It also markets power generated from some non-federal plants in the Northwest, as well as additional power from the 1,169 MW Columbia Generating Station nuclear power plant in Richland, Washington.⁷⁶ BPA's energy resources are shown in Figure 1.18. BPA operates and maintains approximately 15,000 miles of the high-voltage transmission lines and 261 substations to 546 transmission customers that serve about 14 million people in its service territory.⁷⁷

BPA annually updates a Pacific Northwest Loads and Resources Study (White Book) which documents regional retail loads and resource capabilities that serve the federal system and Pacific Northwest for 10 years. The most recent White Book details resource capabilities from 2021 through 2030. The study uses public resource planning reports submitted by individual utilities, the Northwest Power and Conservation Council, and the Pacific Northwest Utilities Conference Committee. Under average water conditions, the Federal System is projected to have annual energy surpluses through the study period.⁷⁸ Under the Northwest Power Act, BPA is responsible for providing the net load requirements of its requesting customers. This includes IOUs in the Pacific Northwest.

Under BPA's current 20-year power sales contract, Idaho municipal and cooperative utilities (customers) purchase power under a tiered rate methodology. Tier 1 locks in the federal base system's lowest cost generation portfolio. When the customer exceeds their Tier 1 allocation, they can purchase a Tier 2 resource from BPA, acquire resources independently, or jointly with other utilities to meet future demands.

1.4.12. U.S. Department of Energy

The U.S. Department of Energy (DOE) administers national energy, environmental, and nuclear policies through science and technology solutions.⁷⁹ DOE oversees the nation's nuclear infrastructure, and operates energy research facilities throughout the nation, including 17 national laboratories, among them Idaho National Laboratory.

The DOE provides state energy program funding to states to enhance energy security, advance state-led energy initiatives, and maximize the benefits of decreasing energy waste. DOE also administers the Weatherization Assistance Program, which reduces energy costs for low-income households by increasing the energy efficiency of their homes, while ensuring their health and safety.

⁷⁶ U.S. Nuclear Regulatory Commission. "Columbia Generating Station." <https://www.nrc.gov/info-finder/reactors/wash2.html>

⁷⁷ Bonneville Power Administration. "Newsroom." <https://www.bpa.gov/news/newsroom/Pages/BPA-powers-up-future-energy-industry-workers.aspx>

⁷⁸ Bonneville Power Administration. "2019 Pacific Northwest Loads and Resources Study." <https://www.bpa.gov/p/Generation/White-Book/wb/2019-WBK-Summary.pdf>

⁷⁹ U.S. Department of Energy. "About Us." <https://www.energy.gov/about-us>

1.4.13. U.S. Federal Energy Regulatory Commission

The Federal Energy Regulatory Commission (FERC) is an independent regulatory agency within the U.S. DOE. FERC has jurisdiction over interstate electricity sales, wholesale electric rates, hydroelectric licensing, natural gas transmission and related services, pricing, oil pipeline rates and gas pipeline certification.⁸⁰

1.4.14. North American Electric Reliability Corporation

The North American Electric Reliability Corporation (NERC) is a non-profit subject to oversight by the FERC and governmental authorities in Canada whose mission is to ensure the reliability and security of the bulk power system in North America. NERC accomplishes this by developing and enforcing reliability standards and assessing seasonal and long-term reliability. NERC has four interconnection regions and Idaho is located in the Western Interconnection.⁸¹

NERC's GridEx exercise is an opportunity for utilities to train how they would respond to and recover from simulated coordinated cyber and physical security threats and incidents, strengthen their crisis communications relationships, and provide input for lessons learned. The first exercise facilitated by NERC took place in November 2011. The fifth exercise, GridEx V, was held in November 2019 and had more than 7,000 participants representing 526 organizations. The most recent GridEx simulation, GridEx VI, was held in November 2021.

1.4.15. Western Electricity Coordinating Council

The Western Electricity Coordinating Council (WECC) is the regional entity that monitors and enforces reliability standards in the Western Interconnection subject to oversight by NERC and FERC. These reliability standards apply to electric utilities and other entities that own or operate generation, transmission, or other facilities in the bulk electric system. WECC promotes reliability in the Western Interconnection by serving as a central repository of data and other technical metrics about the grid.⁸²

1.4.16. RC West

A Reliability Coordinator (RC) coordinates with electric utilities and transmission operators to ensure the bulk electric system is operated within specified limits and that system conditions are stable across the area. RC West is currently the RC for 42 entities in the Western Interconnection, overseeing 87% of the load in the western United States.⁸³

⁸⁰ Federal Energy Regulatory Commission. "About FERC." <https://ferc.gov/what-ferc>

⁸¹ North American Electric Reliability Corporation. "About NERC." <https://www.nerc.com/aboutnerc/pages/default.aspx>

⁸² Western Electricity Coordinating Council. "About WECC." <https://www.wecc.biz/Pages/AboutWECC.aspx>

⁸³ California ISO. "Reliability Coordinator FAQ." <http://www.caiso.com/Documents/ReliabilityCoordinatorFAQ.pdf>

1.4.17. Western Energy Imbalance Market and Extended Day-Ahead Market

The California Independent System Operator (CAISO) is one of nine independent system operators/regional transmission organizations (ISOs/RTOs) in the country and serves all three of Idaho's IOU providers. ISOs/RTOs operate and provide non-discriminatory access to transmission systems for regions of the country where they provide wholesale energy marketplaces.

The Western Energy Imbalance Market (EIM) was first launched in 2014 as an agreement between PacifiCorp and CAISO. The EIM's daily operations are managed by CAISO.⁸⁴ In 2021, 15 utilities with service territories in the western U.S. and British Columbia, Canada have joined, and seven confirmed pending participants will enter the EIM before the end of 2023.⁸⁵ Idaho Power joined the EIM in April 2018 and Avista will begin participating in April 2022.

The EIM utilizes regional transmission systems to balance supply and demand across a larger geographical footprint in real time. The EIM manages transmission congestion and optimizes procurement of imbalance energy (positive or negative) through economic bids submitted by the EIM Participating Resource Scheduling Coordinators in the fifteen-minute and five-minute markets.⁸⁶

In 2019, CAISO announced an initiative to develop an extended day-ahead market (EDAM) to improve market efficiency by integrating renewable resources using day-ahead unit commitment and scheduling across a larger area.⁸⁷ Fifteen EIM entities participated in the EDAM Feasibility Assessment in January 2019. Onboarding of the initial EDAM participants is expected to begin in early 2024.

1.4.18. U.S. Nuclear Regulatory Commission

The U.S. Nuclear Regulatory Commission (NRC) is an independent federal agency that oversees licensing, safety, security, storage, and disposal of nuclear materials. The State works with NRC on small-scale nuclear projects at INL, and to ensure that materials transported through the State for disposal and the materials present at INL adhere to appropriate safety guidelines.⁸⁸

1.4.19. U.S. Department of the Interior

The U.S. Department of the Interior (DOI) manages public lands, territories, and tribal matters in the United States through the bureaus and offices it administers, which includes the Bureau of Land Management (BLM), the Bureau of Reclamation (BOR), the National Park Service (NPS), the U.S. Fish and Wildlife Service (FWS), and many

⁸⁴ Western Energy Imbalance Market. "About." <https://www.westerneim.com/Pages/About/default.aspx>

⁸⁵ Western Energy Imbalance Market. "About." <https://www.westerneim.com/Pages/About/default.aspx>

⁸⁶ Western Energy Imbalance Market. "EIM Track 2 Overview – Agreements." <https://www.westerneim.com/Documents/EIMTrack2Overview-Agreements.pdf>

⁸⁷ California ISO. "Public Comment Letter."

<http://www.caiso.com/Documents/PublicCommentLetter-EIMEntites-EDAM-Sep16-2019.pdf>

⁸⁸ U.S. Nuclear Regulatory Commission. "The Commission."

<https://www.nrc.gov/about-nrc/organization/commfuncdesc.html>

others. The State and developers must work with DOI and its offices to secure permitting approval under the National Environmental Policy Act (NEPA), among other federal laws, for energy and mineral projects on federal land.⁸⁹

Examples of cooperative efforts include the following: the BOR oversees federal water resource management efforts and manages several dams in Idaho including Anderson Ranch, Arrowrock, American Falls, and Palisades; the BLM administers mineral leases throughout Idaho and is the lead permitting agency for transmission line siting projects; the State and developers work closely with the FWS on the impact of energy generation and transmission on endangered species and migratory birds.

1.4.20. U.S. Forest Service

The U.S. Forest Service (USFS), administered under the U.S. Department of Agriculture, is responsible for managing and protecting national forests and grasslands. The State and developers work with USFS on transmission rights-of-way through national forests, energy and mineral development on National Forest System lands, revision of forest land management plans, and development of woody biomass as a source of energy.⁹⁰

1.4.21. National Marine Fisheries Service

The National Marine Fisheries Service (NMFS), administered under the U.S. Department of Commerce through the National Oceanic and Atmospheric Administration, oversees endangered anadromous fish species and ensures compliance with fisheries regulations. The State and utilities work closely with NMFS on fisheries issues, including those related to salmon, steelhead, and hydroelectric facilities in the Federal Columbia River Power System.⁹¹

1.4.22. U.S. Environmental Protection Agency

The U.S. Environmental Protection Agency (EPA) establishes minimum standards for clean air, land and water in energy-generating processes including those involving nuclear, coal, and hydroelectric. EPA works closely with the state departments responsible for air and water quality, including DEQ, to develop and ensure compliance with environmental standards.⁹² EPA administers the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), commonly known as “Superfund,” which allows EPA to clean up contaminated sites.⁹³ There are currently six sites in Idaho on the Superfund National Priorities List.⁹⁴

⁸⁹ U.S. Department of Interior. “About.” <https://www.doi.gov/about> ; and National Environmental Policy Act. “Laws & Regulations.” <https://ceq.doe.gov/laws-regulations/states.html>

⁹⁰ U.S. Forest Service. “About the Agency.” <https://www.fs.fed.us/about-agency>

⁹¹ National Oceanic and Atmospheric Administration Fisheries. “About Us.” <https://www.fisheries.noaa.gov/about-us>

⁹² U.S. Environmental Protection Agency. “About EPA.” <https://www.epa.gov/aboutepa/our-mission-and-what-we-do>

⁹³ U.S. Environmental Protection Agency. “What is Superfund?” <https://www.epa.gov/superfund/what-superfund>

⁹⁴ U.S. Environmental Protection Agency. “National Priorities List by State.” <https://www.epa.gov/superfund/national-priorities-list-npl-sites-state#ID>

1.5. State, Regional, and Federal Energy Coordinators

The entities listed below are involved in the coordination of Idaho's energy systems, providing direction and organization in energy policy and project development.

1.5.1. Idaho Governor's Office of Energy and Mineral Resources

The Idaho Governor's Office of Energy and Mineral Resources (OEMR), continued by Executive Order 2020-17, coordinates energy and mineral planning and policy development in the State of Idaho.⁹⁵ OEMR works to ensure that Idaho's energy and mineral resources are developed and utilized in an efficient, effective, and responsible manner that enhances the economy and sustains the quality of life for its residents.

OEMR serves as the clearinghouse and first point of contact for the State on energy and mineral matters. It oversees the Idaho Strategic Energy Alliance, serves as a resource for policymakers, and coordinates efforts with federal and state agencies and local governments. OEMR administers energy efficiency programs, including Government Leading by Example and the State Energy Loan Program. In addition to the programs the office administers, OEMR advises the public on electric vehicle state programs as well.⁹⁶

1.5.2. Idaho Strategic Energy Alliance

Idaho Strategic Energy Alliance (ISEA), continued by Executive Order 2020-18, engages stakeholders through its Board of Directors and Task Forces to develop recommendations for effective and long-lasting responses to existing and future energy challenges. The information and recommendations provided by ISEA will: increase the public's understanding of Idaho's diverse energy resources; increase awareness of cost-effective energy efficiency opportunities within Idaho; improve communication and collaboration between Idaho's public and private sector on energy efficiency, conservation and sustainable energy development; and showcase new and innovative energy technologies.⁹⁷

1.5.3. Leadership in Nuclear Energy Commission

The Leadership in Nuclear Energy Commission (LINE), continued by Executive Order 2021-02, makes recommendations to the Governor on policies and actions of the State of Idaho to support and enhance the long-term viability and mission of Idaho National Laboratory (INL) and other nuclear industries in Idaho.⁹⁸ Membership of the Commission includes cabinet officials, local government leaders, representatives from Idaho tribes, INL, Idaho universities, the nuclear industry, and members of the public.

1.5.4. Northwest Power and Conservation Council

The U.S. Congress created the Northwest Power and Conservation Council (Council) in 1980 through the Northwest Power Act, to better engage with Idaho, Montana, Oregon, and Washington to ensure an affordable and reliable energy system while enhancing fish

⁹⁵ Governor Brad Little. "Executive Order 2020-17." <https://gov.idaho.gov/executive-orders/>

⁹⁶ Idaho Governor's Office of Energy and Mineral Resources. "Welcome." <https://oemr.idaho.gov/>

⁹⁷ Governor Brad Little. "Executive Order 2020-18." <https://oemr.idaho.gov/wp-content/uploads/eo-2020-18.pdf>

⁹⁸ Idaho Leadership in Nuclear Energy Commission 3.0. "LINE Home." <https://line.idaho.gov>

and wildlife in the Columbia River Basin.⁹⁹ The Council is an independent entity controlled by the states that does not have a vested interest in selling electricity. It forecasts future electricity load growth in the region and helps plan how to best meet future needs. The Council informs the public about regional energy issues.

The Council prepares and updates a least-cost Power Plan to advise the BPA, which is updated at least every five years. Included are electricity demand forecasts, electricity and natural gas price forecasts, an assessment of cost-effective energy efficiency that can be acquired over the life of the plan, and a least-cost generating resources portfolio.¹⁰⁰ The Council is currently in the process of developing the eighth Power Plan.

Additionally, the Council updates the BPA-funded Columbia River Basin Fish and Wildlife Program every five years. The latest complete update was adopted in October of 2014, with a two-part Addendum completed in October 2020.¹⁰¹

1.5.5. Northwest Power Pool

The Northwest Power Pool (NWPP) is a Portland-based voluntary organization that coordinates power plant operational data and provides guidelines for power system operations in the Northwest. NWPP's members include electric utilities that own generating plants and sell power throughout the Northwestern US and Western Canada. NWPP activities are largely determined by major committees – the Operating Committee, the PNCA Coordinating Group, the Reserve Sharing Group Committee, and the Transmission Planning Committee.¹⁰²

Given the recent trend in decommissioning coal plants and increasing renewable integration, NWPP is working to coordinate activities related to a comprehensive review of resource adequacy in the NWPP region and the development and implementation of a Western Resource Adequacy Program (WRAP). The increased quantity and quality of information related to the WRAP will provide significantly enhanced visibility into the forward supply that enable load to be served reliably in the region.

In December 2021, the WRAP, administered by NWPP, announced that it entered the first stage of program implementation, a non-binding phase titled Phase 3A. Twenty-six western utilities are participating in Phase 3A of the WRAP, including Avista, Bonneville Power Administration, Idaho Power, and PacifiCorp. These twenty-six participants represent an estimated peak winter load of 65,122 MW and an estimated peak summer load of 66,768 MW across 10 states and one Canadian province.¹⁰³

⁹⁹ Northwest Power and Conservation Council. "About." <https://www.nwcouncil.org/about>

¹⁰⁰ Northwest Power and Conservation Council. "Seventh Northwest Power Plan Summary Brochure." <https://www.nwcouncil.org/sites/default/files/finalplanbrochure.pdf>

¹⁰¹ Northwest Power and Conservation Council. "Columbia River Basin Fish and Wildlife Program Amendment Process." <https://www.nwcouncil.org/fw/program/2018-amendments>

¹⁰² Northwest Power Pool. "About." <https://www.nwpp.org/resources/?tags=47>

¹⁰³ Northwest Power Pool. "WRAP Announces Full Participation of Phase 3A." <https://www.nwpp.org/news/wrap-announces-full-participation-of-phase-3a>

1.5.6. Western Interstate Energy Board

The Western Interstate Energy Board (WIEB) is an organization of 11 western states and two western Canadian provinces. WIEB provides the instruments and framework for cooperative state efforts to enhance the economy of the west and contribute to the well-being of the region's people. The legal basis of the Energy board is the Western Interstate Nuclear Compact.¹⁰⁴ The Board seeks to achieve this purpose by promoting energy policy that is developed cooperatively among member states and provinces and with the federal government. Much of the work of the Board is conducted through its two committees, the Committee on Regional Electric Power Cooperation (CREPC) and the High-Level Radioactive Waste Committee (HLRW).

1.5.6.1. Committee on Regional Electric Power Cooperation

CREPC was established in 1984. CREPC is a joint committee of WIEB and the Western Conference of Public Service Commissioners (WCPSC). Membership in CREPC is not formal. CREPC is comprised of the public utility commissions, energy and facility siting agencies, and consumer advocates in the western states and Canadian provinces and works to improve the efficiency of the western electric power system.¹⁰⁵

1.5.6.2. WIEB's High-Level Radioactive Waste Committee

HLRW is composed of nuclear waste transportation experts appointed by the Governors of 11 western states. The Committee works with DOE to develop a safe and publicly acceptable system for transporting spent nuclear fuel and high-level radioactive waste under the Nuclear Waste Policy Act.¹⁰⁶ HLRW's primary management directives come from a series of Western Governors' Resolutions dating back to 1985, which express the Governors' goal of safe and uneventful transport of nuclear waste.¹⁰⁷

1.5.7. Western Interconnection Regional Advisory Body

The Western Interconnection Regional Advisory Body (WIRAB) was created by Western Governors under Section 215(j) of the Federal Power Act of 2005, which provides for the establishment of a federal regulatory system of mandatory and enforceable electric reliability standards for the nation's bulk power system. WIRAB's membership is composed of representatives from all states and international provinces that have load within the Western Interconnection. Members are appointed by Governors or Premiers.¹⁰⁸

WIRAB was established in the Western Interconnection to advise the NERC, FERC, and WECC on whether proposed reliability standards within the region, as well as the governance and budgets of NERC and WECC, are just, reasonable, not unduly discriminatory or preferential, and in the public interest.

¹⁰⁴ Western Interstate Energy Board. "WIEB- Western Interstate Energy Board."

<https://www.westernenergyboard.org/western-interstate-energy-board/>

¹⁰⁵ WIEB. "CREPC." <https://www.westernenergyboard.org/committee-on-regional-electric-power-cooperation/>

¹⁰⁶ U.S. Department of Energy. "Nuclear Waste Policy Act."

<https://www.energy.gov/downloads/nuclear-waste-policy-act>

¹⁰⁷ WIEB. "High-Level Radioactive Waste."

<https://www.westernenergyboard.org/high-level-radioactive-waste-committee/>

¹⁰⁸ WIEB. "WIRAB." <https://www.westernenergyboard.org/western-interconnection-regional-advisory-body/>

1.6 Regional and National Energy Issues

1.6.1. Transmission Planning

Pursuant to rules adopted by the FERC, Idaho’s Investor-Owned Utilities (IOUs) are required to participate in local and sub-regional transmission planning and to coordinate with neighboring sub-regional planning groups and local stakeholders.¹⁰⁹ NorthernGrid, the planning association which facilitates regional transmission planning across the Pacific Northwest and Intermountain West, is responsible for producing transmission expansion and economic study plans on a periodic basis.¹¹⁰ These local, sub-regional, and regional planning processes identify transmission project costs, benefits, and risks and their allocation to customer group beneficiaries. They explore opportunities for project coordination at the sub-regional and regional levels to avoid costly duplication of facilities. OEMR and the Idaho Public Utilities Commission (PUC) participate in the development of these plans.

1.6.2. Public Utility Regulatory Policies Act of 1978

The Public Utility Regulatory Policies Act of 1978 (PURPA), requires utilities to purchase energy from qualifying facilities (QFs)—such as wind, solar, geothermal, and biomass—at the cost that the utility would otherwise incur if it self-generated the electricity or obtained it from elsewhere. This calculation is called the avoided cost rate.¹¹¹

PURPA categorizes QFs as either small power production facilities, or cogeneration facilities. To qualify for the required purchase at the avoided cost rate, a **small power production facility** must generate 80 MW or less, with a primary energy source that is renewable, biomass, waste, or geothermal resources. In 2020, the Idaho PUC established a separate QF category for energy storage. Energy storage QFs over 100 kW are limited to two-year-long power purchase agreements using published, rather than negotiated, rates.

Furthermore, to qualify as a QF, a **cogeneration facility** must sequentially produce electricity and another form of useful thermal energy in a manner that is more efficient than the separate production of both forms of energy. For example, a large cogeneration facility may produce both electricity and provide steam for industrial uses.¹¹²

While PURPA requires utilities to buy from QFs, it is the responsibility of the Idaho PUC to determine the avoided-cost rate and other contract terms and conditions for utilities within the State. 200 MW of QF resources were developed in Idaho by the early 1990s, consisting principally of industrial co-generation and small hydroelectric projects.

¹⁰⁹ Federal Energy Regulatory Commission. FERC Order Nos. 890 and 1000. <https://ferc.gov/industries-data/electric/industry-activities/open-access-transmission-tariff-oatt-reform/summary-compliance-filing-requirements-order-no-890> and <https://www.ferc.gov/electric-transmission/order-no-1000-transmission-planning-and-cost-allocation>

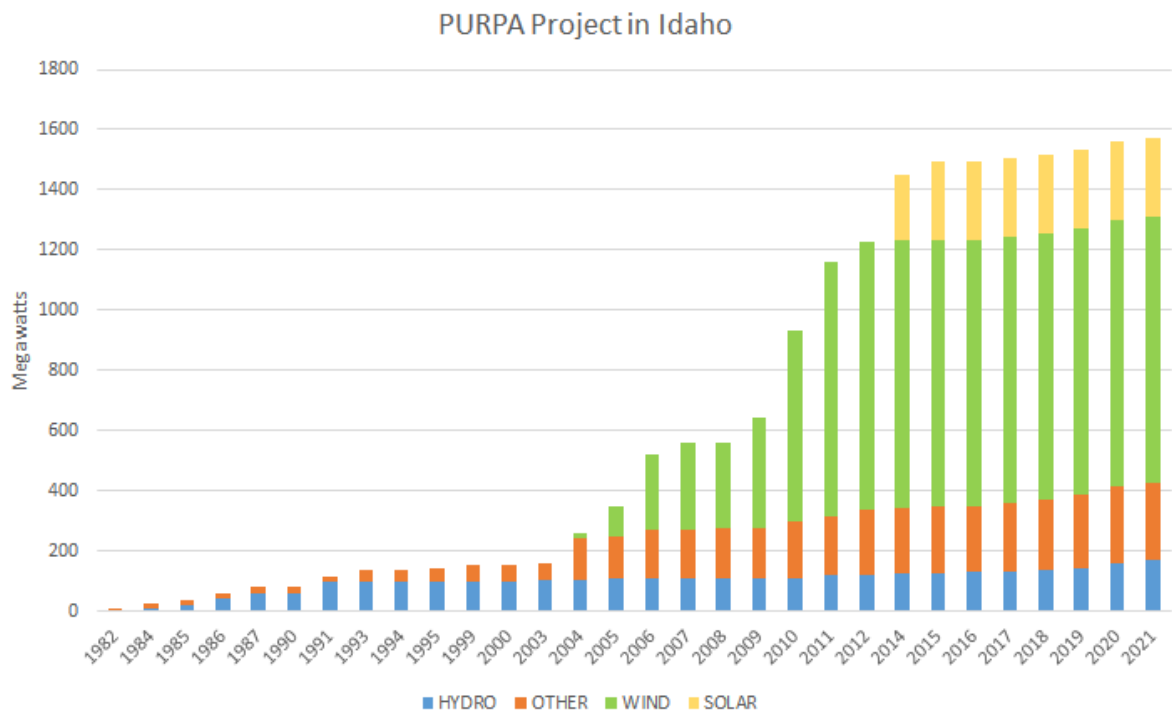
¹¹⁰ Northern Grid. “Purpose.” <https://www.northerngrid.net/northerngrid/purpose/>

¹¹¹ Federal Energy Regulatory Commission. “PURPA Qualifying Facilities.” <https://www.ferc.gov/qf>

¹¹² Federal Energy Regulatory Commission. “PURPA Qualifying Facilities.” <https://www.ferc.gov/qf>

In recent years, wind developers disaggregated large-scale projects into 10 MW units in order to qualify for the published PURPA rates. In response, the Idaho PUC reduced the eligibility to published rate contracts from 10 MW to 100 kW for intermittent resources (wind and solar) in 2010.¹¹³ Additionally, the Idaho PUC reduced contract length in 2015 for non-published rate (a.k.a. negotiated) PURPA contracts from 20 years to two years.¹¹⁴ The change in contract length does not abrogate or eliminate the utility’s mandatory purchase obligation. As illustrated in Figure 1.18, as of 2021 almost 1,600 MW of QF resources were online in Idaho, comprised principally of wind and solar projects.

Figure 1.19 PURPA Generation in Idaho, 1982-2021¹¹⁵



¹¹³ Idaho Public Utilities Commission. “CASE NO. GNR-E-10-04, PRESS RELEASE.”

<https://puc.idaho.gov/fileroom/cases/elec/GNR/GNRE1004/staff/20110329PRESS%20RELEASE.PDF>

¹¹⁴ Idaho Public Utilities Commission. “CASE NO. IPC-E-15-01, AVU-E-15-01, PAC-E-15-03, ORDER NO. 33357.”

http://www.puc.idaho.gov/fileroom/cases/elec/IPC/IPCE1501/ordnotc/20150820FINAL_ORDER_NO_33357.PDF

¹¹⁵ Idaho Public Utilities Commission. <https://puc.idaho.gov/>

2. Idaho Energy Sources

2.1. Hydroelectricity

Hydroelectricity is a carbon-free energy resource generated by using the force of moving water. Idaho has more than 140 generating hydropower plants with a combined capacity of 2,704 MW, which is the sixth-largest in the nation.¹¹⁶ Idaho's largest hydroelectric projects are the 1,167 MW Hells Canyon Complex (consisting of the Hells Canyon, Oxbow, and Brownlee dams) owned by Idaho Power Company, the 400 MW Dworshak dam operated by the U.S. Army Corps of Engineers, and the 260 MW Cabinet Gorge Project owned by Avista Corporation.¹¹⁷ Depending on water supply, the actual output of energy produced by hydropower may vary.

The flexible nature of hydroelectricity enables it to meet the fluctuating demands of the electric grid and mitigate losses of supply associated with intermittent resources such as wind and solar. Hydroelectric power supplies about 52% of Idaho's in-state electricity and contributes to Idaho-based energy providers' ability to supply low-cost power to customers.¹¹⁸

Figure 2.1 Cabinet Gorge Hydroelectric Dam on the Clark Fork River¹¹⁹



¹¹⁶ U.S. Energy Information Administration. "Where Hydropower is Generated." <https://www.eia.gov/energyexplained/hydropower/where-hydropower-is-generated.php>

¹¹⁷ Idaho Governor's Office of Energy and Mineral Resources. "Hydroelectric" <https://oemr.idaho.gov/sources/re/hydropower/>

¹¹⁸ U.S. Energy Information Administration. "Idaho: State Profile and Energy Estimates." <https://www.eia.gov/state/?sid=ID#tabs-4>

¹¹⁹ Avista. "Part of this Small Town's Appeal Is It's Proximity to Two Very Large Attractions." <https://www.myavista.com/connect/articles/2018/06/part-of-this-small-towns-appeal-is-its-proximity-to-two-very-large-attractions>

2.2. Wind

Wind is a renewable energy resource that utilizes a turbine to harness power and generate electricity. Idaho's wind production grew from 207,000 MWh at the end of 2008 to a total of 2,771,000 MWh in 2020.¹²⁰ Wind power accounts for approximately 16% of Idaho's electricity and there are currently 33 wind projects and 3 wind-related manufacturing facilities in the state. At the end of 2019, the wind industry directly employed over 500 Idahoans.¹²¹

Figure 2.2 Power County Wind Farm in Eastern Idaho¹²²



Wind mapping studies estimate that Idaho has almost 213,000 MW of potential wind generation.¹²³ Idaho's best wind resources are located in the Snake River Plain area of Southern Idaho.¹²⁴ The State of Idaho through the Department of Lands encourages the development of wind power on state endowment lands. Projects developed on endowment lands, create income for the Idaho State Endowment Fund, which funds schools and other state institutions.

¹²⁰ U.S. Energy Information Administration. "Electricity Data Browser."

<https://www.eia.gov/electricity/data/browser/#/topic/0?agg=1,0,2&fuel=008&geo=00000000008&sec=g&freq=A&start=2001&end=2020&ctype=linechart<ype=pin&rtype=s&pin=&rse=0&maptype=0>

¹²¹ American Wind Energy Association. "AWEA Wind Energy in the United States."

<https://public.tableau.com/app/profile/american.wind.energy.association/viz/WindEnergyintheUnitedStates/AnnualReportViz>

¹²² American Wind Energy Association. <https://awea.filecamp.com/s/v8rp4uKcLm4PpFiS/d/u3ECi7PXaFHZmj1v>

¹²³ Wind Exchange. "US Installed and Potential Wind Power Capacity and Generation."

<https://windexchange.energy.gov/maps>

¹²⁴ U.S. Energy Information Administration. "Profile Analysis." <https://www.eia.gov/state/analysis.php?sid=ID#88>

To supplement wind's intermittent nature, storage and dispatchable resources, including hydroelectric, nuclear power, and natural gas-fired generators, must be ready to meet and/or supplement load requirements when wind generation is not available.

The federal renewable electricity production tax credit (PTC) for land-based wind is a federal tax credit included under Section 45 of the U.S. tax code for electricity generated by wind energy on a per kilowatt-hour (kWh) basis.¹²⁵ The PTC for land-based wind power projects has been extended an additional year and will remain at 60% of the project's value, on a per kWh basis, for projects that begin construction by the end of 2021.

2.3. Solar

Solar power is a carbon-free renewable energy resource that harnesses the abundance of energy coming from the sun. Electricity can be produced either through photovoltaic (PV) solar cells, or through concentrated solar power (CSP). PV solar cells convert sunlight directly into electricity using solar plates stationed on an array angled towards the sun. CSP technologies reflect sunlight from mirrors and concentrate it onto receivers that convert the solar energy into heat. This thermal energy can then be used to produce electricity via a steam turbine, or to heat an engine that drives a generator.¹²⁶

Figure 2.3 American Falls II Solar Project¹²⁷



¹²⁵ 26 U.S. Code § 45 - Electricity Produced from Certain Renewable Resources, etc.

¹²⁶ U.S. Department of Energy. "Solar Energy Technology Basics."
<https://energy.gov/eere/energybasics/articles/solar-energy-technology-basics>

¹²⁷ Swinerton Renewable Energy. "American Falls 2." <https://www.swinertonrenewable.com/projects/american-falls-2>

Utility-scale solar power generation in Idaho began in August 2016 and produced 0.2% of the total power generated in Idaho that year. As of September 2021, the total installed solar had grown to 583.03 MW, enough to power 78,795 homes. There are currently 40 total solar companies consisting of manufacturers, developers, installers, and other companies operating in Idaho that employ nearly 500 people.¹²⁸ At 108 MW, Grand View Solar is currently the largest operating solar installation in Idaho. Another large project is the 40 MW American Falls Solar Project located in southeastern Idaho.

Solar energy can be used to generate hot water and heat residential and commercial buildings. There are two types of solar water heating systems, active and passive. Active solar water heating systems circulate liquid, either water or an anti-freezing heat-transfer fluid, through a series of pumps and controls located in pipes throughout a home. Passive solar water heating systems use the movement of hot water rising and cool water sinking to push water through a pipe system in the home without the use of pumps. Both types of systems need a storage tank for the water and solar panels to collect the heat.¹²⁹

The federal renewable investment tax credit (ITC) for solar is a tax credit that can be claimed on the federal income taxes of individuals or corporations for a portion of the cost of installing. The ITC is currently a federal tax credit claimed against the tax liability of residential¹³⁰ and commercial/utility¹³¹ investors in solar energy property. Section 25D of the residential ITC allows the homeowner to apply the credit to their personal income taxes. This credit is used when homeowners purchase solar systems and have them installed on their homes. Section 48 of the ITC allows the business that installs and/or finances the project claims the credit.

The State of Idaho offers financial incentives for renewable energy such as the Residential Alternative Energy Tax Deduction and through the State Energy Loan Program which provides 4% interest loans for qualifying renewable energy projects.

2.4. Bioenergy

Bioenergy is renewable and derived from biological sources, such as agricultural crops, animal and plant waste, algae, and wood products for uses associated with heating, electricity, or vehicle fuel. It can be produced efficiently from agricultural wastes and dedicated energy crops such as switchgrass, miscanthus, and poplar, that are used to make advanced biofuels.

¹²⁸ Solar Energy Industries Administration. "Idaho Fact Sheet."

<https://www.seia.org/sites/default/files/2021-09/Idaho.pdf>

¹²⁹ U.S. Department of Energy. "Solar Water Heaters." <https://energy.gov/energysaver/solar-water-heaters>

¹³⁰ 26 U.S. Code § 25D - Residential Energy Efficient Property

¹³¹ 26 U.S. Code § 48 - Energy Credit

Biomass is used to generate 84 MW of electricity in Idaho, which accounted for about 465,402 MWh, or 2.6%, of the state's electricity generation in 2021. As of 2021, Idaho has one operating ethanol plant located in Burley, Idaho. The plant is capable of producing 60 million gallons per year.¹³² There is currently no commercial production of biodiesel in Idaho.

Feedstock projections indicate that Idaho produces over 2.5 million metric tons of wood-waste from forests, mills, and urban sources respectively.¹³³ Idaho has three dedicated biomass production facilities and many research-based operations across the state.¹³⁴ While the state does not currently play a role in the production of biodiesel, its biogas or renewable natural gas (RNG) potential is promising.

The Department of Energy's (DOE) Bioenergy Program provides technical assistance, educational workshops, and cost sharing to help the citizens and companies of Idaho take advantage of local renewable biomass energy resources. Since 2005, the DOE has awarded more than \$77 million to national laboratory, university, and industrial partners in Idaho to research, develop, and deploy sustainable bio-based fuels and products¹³⁵

2.5. Geothermal

Geothermal energy is a renewable energy resource derived from the heat within the subsurface of the Earth. Unlike intermittent resources, geothermal energy provides reliable baseload power generation because it can be utilized 24 hours a day, or whenever it is needed. An estimated 13,550 MW worth of undiscovered geothermal power exists in Idaho, much of it in the southern portions of the state.¹³⁶ Ormat manages Idaho's only operating commercial geothermal power plant, the 11 MW Raft River Enhanced Geothermal System Project, located in Cassia County.¹³⁷ Idaho is one of seven states with utility-scale electricity generation from geothermal energy.¹³⁸

In addition to electric generation, direct use of geothermal waters is the oldest, most versatile, and most prevalent utilization of geothermal energy.¹³⁹ There are over 1,000 wells and 200 springs across Idaho. Wells that have a bottom hole temperature greater than 85 degrees Fahrenheit and less than 212 degrees Fahrenheit are designated as low-temperature geothermal (LTG) resource wells.¹⁴⁰ These LTG resources are used for space heating, aquaculture, greenhouses, and recreation throughout the state.

¹³² Alto Ingredients. "Alto Ingredients." <https://www.altoingredients.com/>

¹³³ U.S. Department of Energy. "Benefits of Biofuel Production and Use in Idaho." https://www.energy.gov/sites/prod/files/2015/10/f27/idaho_biofuels_benefits.pdf

¹³⁴ EIA. "Monthly Biomass Fuel Report." <https://www.eia.gov/biofuels/biomass/#dashboard>

¹³⁵ U.S. Department of Energy. https://www.energy.gov/sites/prod/files/2015/10/f27/idaho_biofuels_benefits.pdf

¹³⁶ Geothermal Energy Association. "Geothermal Development Needs In Idaho."

https://www.idahogeology.org/pub/Geothermal/References/Miscellaneous/Fleischman.2006_GeothermalReport.pdf

¹³⁷ Ormat. "Global Projects." <https://www.ormat.com/en/projects/all/main/>

¹³⁸ U.S. Energy Information Administration. "Profile Analysis." <https://www.eia.gov/state/analysis.php?sid=ID#88>

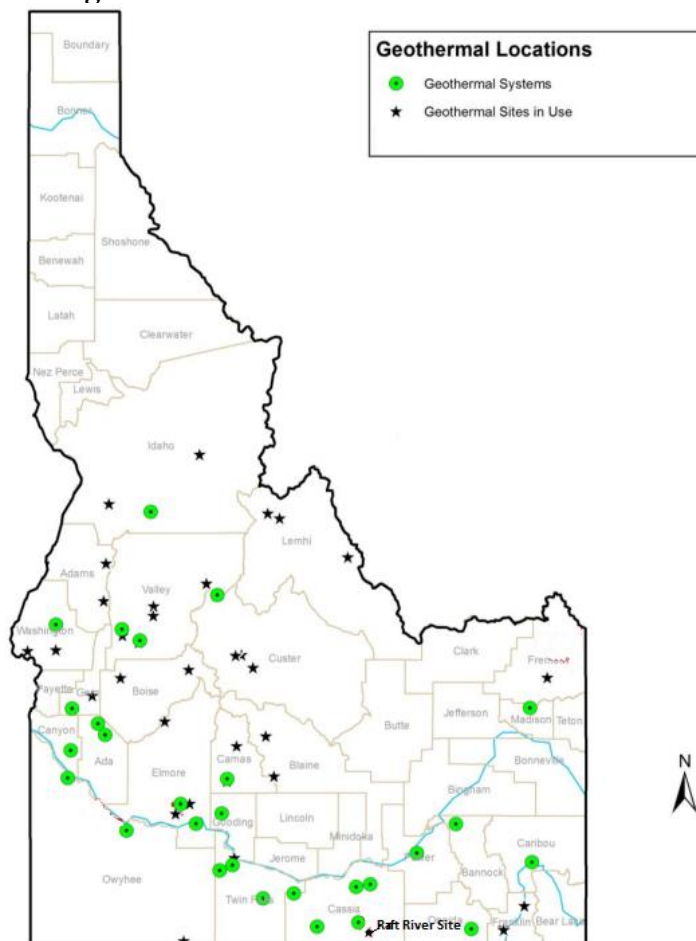
¹³⁹ U.S. Department of Energy. "Low Temperature Deep Direct-Use Program Draft White Paper."

<http://energy.gov/eere/geothermal/low-temperature-deep-direct-use-program-draft-white-paper>

¹⁴⁰ Idaho Department of Water Resources. "Geothermal Resource Wells." <https://idwr.idaho.gov/wells/geothermal-wells.html>

Idaho's capital city, Boise, is home to the nation's first geothermal district heating system, Warm Springs Heating District, which was built in the late 19th century and continues to service over 300 customers in the East End neighborhood of Boise.¹⁴¹ The City of Boise's geothermal heating utility delivers naturally heated water to more than 6 million square feet of building space and is planned to expand by 40% to help Boise achieve carbon neutrality by 2050.¹⁴² The Capitol Mall Geothermal Energy Project was completed in 1982 and continues to provide low-cost space and hot water heating to the Idaho State Capitol and eight other major State buildings. The Idaho Statehouse is the only geothermally heated capitol building in the nation. District heating is also currently being used for space heating at several of the Boise State University campus buildings.¹⁴³

Figure 2.4 Geothermal Locations in Idaho¹⁴⁴



¹⁴¹ Boise Warm Springs Water District. "About." <https://bwswd.com/about/>

¹⁴² City of Boise. "Boise's Climate Action Roadmap." <https://www.cityofboise.org/media/12984/boise-climate-roadmap.pdf>

¹⁴³ Idaho Capitol Commission. "Facts about the Idaho Capitol Building." <https://capitolcommission.idaho.gov/education/facts-about-the-idaho-capitol-building/>; and City of Boise. "Geothermal Heating." <https://publicworks.cityofboise.org/services/geothermal/>

¹⁴⁴ Idaho Governor's Office of Energy and Mineral Resources. "Direct Use." <https://oemr.idaho.gov/sources/re/geothermal/>

2.6. Combined Heat and Power

Several Idaho facilities and industrial users have incorporated systems that generate on-site electricity and thermal energy in a process known as combined heat and power (CHP). CHP is typically deployed at sites such as industrial operations and university or corporate campuses, which have high demand for electricity and hot water or steam. As of the end of 2020, there are 21 CHP systems in Idaho, predominantly used in wood product facilities, dairies, hotels, and large industrial food processors. Half of the 21 facilities utilize renewable fuels.¹⁴⁵

2.7. Nuclear

Nuclear energy is a carbon-free power source. While no commercial-scale nuclear power generation exists in Idaho today, the state does receive some electricity from the Columbia Generating Station through BPA. In 2020, 93 nuclear reactors in 28 states provided the most reliable and largest source of clean energy in the United States, providing 790 billion kilowatt hours of electricity.¹⁴⁶

The Idaho National Laboratory (INL), located in southeastern Idaho, is the nation's lead laboratory for nuclear energy research. INL has influenced every reactor designed in the United States and INL researchers are working on several initiatives, including advanced nuclear reactors such as microreactors and small modular reactors, that will help shape the future of nuclear energy worldwide.

Figure 2.5 Idaho National Lab Advanced Test Reactor Facility¹⁴⁷



¹⁴⁵ U.S. Department of Energy. "Combined Heat and Power Installations in Idaho." <https://doe.icfwebservices.com/chpdb/state/ID>

¹⁴⁶ U.S. Department of Energy. "Five Fast Facts about Nuclear Energy (2020)." <https://www.energy.gov/ne/articles/infographic-five-fast-facts-about-nuclear-energy-2020>

¹⁴⁷ Idaho National Laboratory. "Capabilities of Idaho National Laboratory." <https://inl.gov/about-inl/capabilities/>

2.8. Natural Gas

Natural gas is utilized in Idaho to heat homes, power businesses, move vehicles, and serve as a key component in many industrial processes. More than half of Idaho households use natural gas as their primary energy source to heat their home.¹⁴⁸ Natural gas power plants can adjust generation in real-time in response to the ebbs and flows of electricity generated by intermittent resources. Advances in gas turbine design and natural gas-fired internal combustion engines have improved the operating flexibility of natural gas generation. Natural gas reserves were detected in the Payette Basin of western Idaho in 2010.¹⁴⁹ These discoveries led to Idaho's first commercial production of natural gas and natural gas liquids in 2015.¹⁵⁰ In 2020, Idaho produced over 180 million cubic feet of natural gas.¹⁵¹

As a transportation fuel, natural gas is used as compressed natural gas (CNG) or as liquefied natural gas (LNG). Both compression and liquefaction are methods employed to increase the amount of natural gas storage in the vehicle and thus increase its driving range. Renewable natural gas (RNG) is an emerging resource essentially made of biogas, the gaseous product of the decomposition of organic matter. Like conventional natural gas, RNG is pipeline-quality gas that is fully interchangeable with conventional natural gas and can be used as a transportation fuel in the form of CNG or LNG. Furthermore, RNG qualifies as an advanced biofuel under the Renewable Fuel Standard.¹⁵²

Idaho has two public CNG vehicle refueling stations, one in Boise and another in Nampa.¹⁵³ Some municipal and commercial fleets utilize natural gas and operate their own CNG refueling stations.¹⁵⁴ There are no commercial RNG facilities in Idaho as of 2021, however, the State expects to see increased interest in RNG development given Idaho's unique resource portfolio and noted success in other biomass industries.

¹⁴⁸ U.S. Energy Information Administration. "Idaho State Profile and Energy Estimates – Profile Analysis." <https://www.eia.gov/state/analysis.php?sid=ID>

¹⁴⁹ Dunnahoe, Tayvis. "Idaho enters ranks of hydrocarbon-producing states." *Oil and Gas Journal* (February 6, 2017).

¹⁵⁰ U.S. Energy Information Administration. "Natural Gas Gross Withdrawals and Production, Gross Withdrawals, Annual, 2012-2017." https://www.eia.gov/dnav/ng/NG_PROD_SUM_DC_NUS_MMCF_A.htm

¹⁵¹ U.S. Energy Information Administration. "Natural Gas – Idaho Marketed Production of Natural Gas." https://www.eia.gov/dnav/ng/hist/ngm_epg0_vgm_sid_mmcf.htm

¹⁵² U.S. Department of Energy. "Alternative Fuels Data Center."

https://afdc.energy.gov/fuels/natural_gas_renewable.html

¹⁵³ U.S. Department of Energy Alternative Fuels Data Center. "Natural Gas Fueling Station Locations."

https://afdc.energy.gov/fuels/natural_gas_locations.html#/find/nearest?fuel=CNG

¹⁵⁴ U.S. Department of Energy. "Boise Buses Running Strong with Clean Cities."

<https://energy.gov/articles/boise-buses-running-strong-clean-cities>

and Intermountain Gas. "Natural Gas Vehicles." <https://www.intgas.com/rates-services/naturalgas-vehicles>

2.9. Propane

Propane is used to heat homes and businesses throughout the State of Idaho, particularly in rural areas. Residential propane prices in Idaho fluctuated between \$1.89/gallon to \$2.68/gallon in 2021.¹⁵⁵ Since January 2021, propane prices have risen approximately 40%. Propane consumption is highly seasonal, with peak consumption in fall and winter.

Propane is also used as a transportation fuel, for which there are 10 publicly available stations for refueling. As a transportation fuel, propane is most commonly used in specialized medium and heavy-duty vehicles with engines capable of running on liquified petroleum gas. In Idaho, there are several school buses that are on the road as a result of the Idaho Department of Environmental Quality's Diesel Engine Replacement Act (DERA) program.¹⁵⁶

2.10. Petroleum

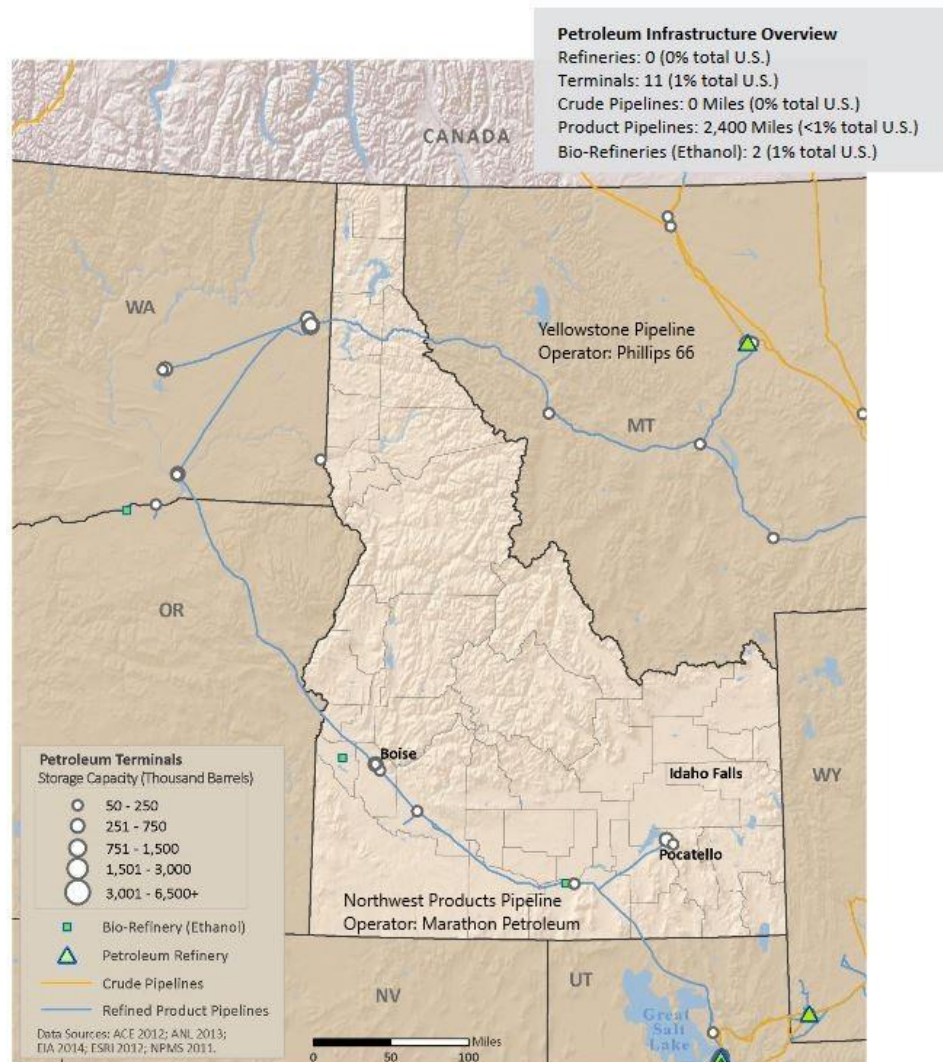
There are no petroleum refineries located in Idaho and there is limited storage capacity. Petroleum in Idaho is moved via four major modes of transportation: pipelines, railcars, barges, and truck delivery. Pipeline routes are depicted in Figure 2.6.

Petroleum pipeline infrastructure within Idaho includes the Northwest Products Pipeline, which connects Salt Lake City refineries with Idaho Falls, Pocatello, Burley and Boise, and continues to Pasco and Spokane in Washington state. This pipeline delivers refined petroleum products predominately to southern Idaho. Much of the refined petroleum products for northern Idaho are sourced from refineries near Billings in Montana, with the product being moved via the Yellowstone Pipeline and terminating in Moses Lake in Washington state. Idaho's petroleum products are mostly transported via pipelines, while some are shipped on the Snake River to Lewiston, via barge, and others are transported via truck. End use refined petroleum products are typically delivered via truck.

¹⁵⁵ U.S. Energy Information Administration. "Weekly Idaho Propane Residential Price (Dollar per Gallon)." https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=W_EPLLPA_PRS_SID_DPG&f=W

¹⁵⁶ Idaho Department of Environmental Quality. "Volkswagen and Diesel Funding." <https://www.deq.idaho.gov/air-quality/improving-air-quality/volkswagen-and-diesel-funding/>

Figure 2.6 Transportation Fuel Pipelines and Refineries Serving Idaho¹⁵⁷



2.11. Coal

Idaho has no in-state utility-scale coal-fired power plants. However, Idaho utilities hold ownership shares in coal-fired power plants located in neighboring states.¹⁵⁸ In close proximity to Idaho, Wyoming is the nation's largest coal exporter and Montana has the nation's largest identified recoverable coal reserve. Some industrial users in Idaho utilize coal at their facilities for power and steam generation (cogeneration) purposes.

¹⁵⁷ U.S. Department of Energy. "State of Idaho Energy Sector Risk Profile."

https://energy.gov/sites/prod/files/2016/09/f33/ID_Energy%20Sector%20Risk%20Profile.pdf

¹⁵⁸ U.S. Energy Information Administration. "Idaho State Profile and Energy Estimates."

www.eia.gov/state/analysis.cfm?sid=ID&CFID=19979425&CFTOKEN=6ac60633ec26f3b3-9C7FAA90-237D-DA68-24023FFD41A835EC&jsessionid=8430bccceb80dc2263757c222e31663d5a40

3. Minerals

3.1 Idaho Mineral Uses

Minerals play an important role in the development of energy technologies. Idaho is home to a wealth of different minerals that are featured prominently in everyday life and in the advancement of modern science. Idaho's mining legacy has shaped the settlement of the state, brought worldwide recognition to Idaho's natural resources, and should continue to provide domestically sourced raw materials to advance modern technology. Without the essential application of minerals, the economy, innovation for the future, and national security would be impacted.

3.1.1. Minerals in Energy Technology

Conductive metals are used in electronic components for all modern technologies. As renewable energy technology advances, demand for minerals is rapidly increasing. For instance, copper is used in the wiring of solar panels and is a critical component to function for wind turbines on and offshore. Another example is manganese, used as a steel alloy in the power-storing batteries for hybrid and electric vehicles. Rare-earth elements are used in electronics such as smartphones, tablets and even nuclear reactor components.

In 2018 the U.S. Department of the Interior, through the U.S. Geological Survey, released a list of 35 minerals deemed critical to national security for the United States.¹⁵⁹ This list changes with time as supply and society's needs shift. Idaho has a reserve of naturally occurring raw critical minerals which could contribute to the integrity of the national economy. Idaho has the most desirable mining policies for investors due to administration of current environmental regulations, lack of regulatory duplication, socioeconomic and community development conditions, political stability, quality of the geological database, security, and labor and skills availability.¹⁶⁰

Minerals are also vital for the development of electric vehicles. Lithium, cobalt, and nickel are used in the lithium-ion batteries and the wiring that power electric vehicles. Differing electric motor and battery technologies require numerous minerals that impact the cost and efficiency of the motors and batteries. As the technology develops, policy developments for the sources and supply chains of minerals will be paramount as global demand for electric vehicles increases.

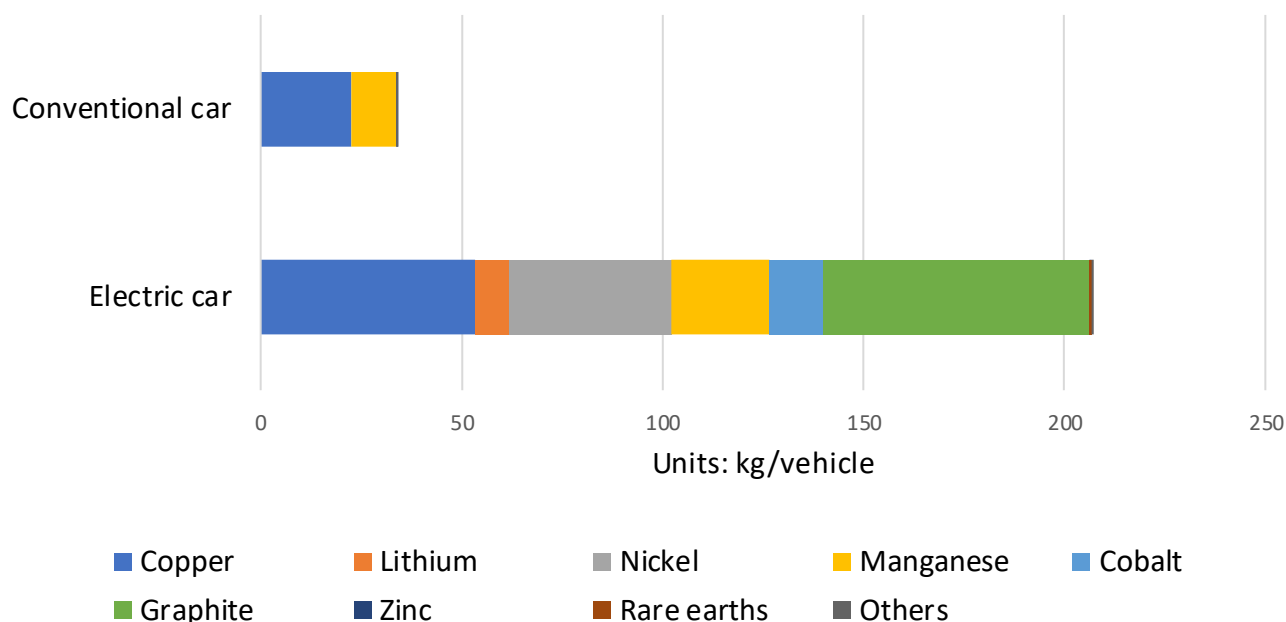
¹⁵⁹ U.S. Geological Survey. "Interior Releases 2018's Final List of Critical Minerals."

<https://www.usgs.gov/news/national-news-release/interior-releases-2018s-final-list-35-minerals-deemed-critical-us>

¹⁶⁰ Fraser Institute. "Annual Survey of Mining Companies, 2020."

<https://www.fraserinstitute.org/studies/annual-survey-of-mining-companies-2020>

Figure 3.1 Minerals Used in Electric Cars Compared to Conventional Cars¹⁶¹



3.1.2. Minerals in Manufacturing

Minerals are one of the most important raw materials used in manufacturing. Platinum is used in over 20 percent of manufactured goods. In order to produce more manufactured goods domestically, more minerals and metals are needed to supply that demand. Aluminum, iron ore, steel, and titanium are the bedrock of most metallic manufactured goods. In 2020, manufacturing of mineral products contributed 98 billion dollars to the U.S. Gross Domestic Product (GDP).¹⁶²

3.1.3. Minerals in Construction

Sand and gravel are the basic building blocks for all construction materials. Aggregate is used to pave roadways, create concrete building foundations, and serve important environmental functions like drainage for stormwater. Natural aggregates (construction sand and gravel and crushed stone) make up the largest component of nonfuel mineral materials consumed in the United States.¹⁶³ Concrete is essential for the construction and long-term reliability of energy projects. Mineral materials used in construction are important to Idaho’s construction industry, which employs nearly 80,000 Idahoans each year.¹⁶⁴

¹⁶¹ International Energy Agency. “Minerals used in electric cars compared to conventional cars.” <https://www.iea.org/data-and-statistics/charts/minerals-used-in-electric-cars-compared-to-conventional-cars>

¹⁶² U.S. Geological Survey. “Mineral Commodity Summaries 2021.”

<https://pubs.usgs.gov/periodicals/mcs2021/mcs2021.pdf>

¹⁶³ U.S. Geological Survey. “Materials in Use in U.S. Interstate Highways”.

<https://pubs.usgs.gov/fs/2006/3127/2006-3127.pdf>

¹⁶⁴ Idaho Department of Commerce. “Idaho: Employment by Industry.”

<http://indicatorsidaho.org/DrawRegion.aspx?RegionID=16000&IndicatorID=17>

3.1.4. Minerals in Agriculture

Minerals and agriculture share a single common interest: fertilizer. Mineral fertilizer is essential to the productivity of farmland as the balance of minerals in soil is required for the growth and development of plant life. Phosphorus, calcium, and sulfur are some of the most common nutrient elements used for plant growth. Southeastern Idaho is home to one of the largest sources of phosphate ore in the United States, making phosphate mining one of the most important industries in the area.¹⁶⁵ Calcium mining is mined in Idaho as calcium occurs primarily in limestone deposits. Small sulfur deposits throughout the state also contribute to the agricultural industry in Idaho.

3.2. Minerals and the Economy

In 2020, mining contributed to 0.4% of the total industry workforce in Idaho.¹⁶⁶ Currently mining in Idaho supports over 15,000 direct and indirect jobs and contributes over 1 billion dollars to the annual Gross Domestic Product (GDP).¹⁶⁷ Direct mining jobs require highly specialized engineering and skilled labor, in addition to administrative support workers and transportation workers. As demand for domestically sourced raw materials increases, the mining industry will need a skilled and diverse workforce to meet the needs of the country's increased standard of living.

¹⁶⁵ U.S. Geological Survey. "A History of Phosphate Mining in Southeastern Idaho." <https://pubs.usgs.gov/of/2000/of00-425/of00-425.pdf>

¹⁶⁶ U.S. Bureau of Economic Analysis. "Total Full-Time and Part-Time Employment by NAICS Industry." <https://apps.bea.gov/iTable/iTable.cfm?ReqID=70&step=1>

¹⁶⁷ National Mining Association. "Economic Impact of Mining – Idaho." <https://nma.org/map/idaho/>

4. Conservation, Energy Efficiency, and Energy Storage

Conservation, energy efficiency, and demand response practices may not generate any new energy, but they do constitute another economically attractive resource that can be utilized to meet the energy needs of customers.

“Conservation” refers to a consumer’s personal actions that reduce their use of energy-consuming devices. For example, turning the lights off when leaving a room.¹⁶⁸

“Energy efficiency” refers to processes of utilizing technology that consumes a lower amount of electricity while providing sufficient service. For example, switching from incandescent lights bulbs to LED light bulbs, turning your computer off rather than switching it to sleep mode and unplugging appliances when not in use, such as cell phone charges, coffeemakers, etc.¹⁶⁹

“Demand response” refers to customers temporarily altering their energy-consuming behavior during times of higher demand for electricity, usually in response to signals from the utility or grid operator. For example, authorizing a utility to remotely control heating and ventilation systems during times of high electricity demand.¹⁷⁰

Collectively, these resources are often referred to as “demand-side management” (DSM), by utilities and other companies in the power industry. Sometimes the terms “conservation” or “efficiency” are used to refer to all DSM measures.

Idaho utilities have utilized cost-effective, sustainable energy efficiency programs for over four decades to conserve both company and customer resources. Cost-effectiveness of an energy measure means that the lifecycle energy, capacity, transmission, distribution, and other quantifiable savings to Idaho residents and businesses exceeds the direct costs of the measure to the utility and participant. Cost-effective energy measures provide economic benefits to Idaho utilities by increasing the capacity for energy within their system to meet future energy demands.

The Idaho Public Utilities Commission directs Idaho investor-owned electric utilities to continue to place an emphasis on cost-effective conservation, energy efficiency, and demand response.¹⁷¹ Each IOU calculates the level of cost-effective efficiency potential in their IRP and offers a suite of efficiency programs for customers to achieve energy efficiency goals.

¹⁶⁸ U.S. Energy Information Administration. “Use of Energy Explained.”
https://www.eia.gov/energyexplained/index.cfm?page=about_energy_efficiency

¹⁶⁹ U.S. Energy Information Administration. “Use of Energy Explained.”
https://www.eia.gov/energyexplained/index.cfm?page=about_energy_efficiency

¹⁷⁰ U.S. Energy Information Administration. “Demand response saves electricity during times of high demand.”
<https://www.eia.gov/todayinenergy/detail.php?id=24872>

¹⁷¹ Idaho Public Utilities Commission. “CASE NO. IPC-E-10-27, ORDER NO. 32245.”
www.puc.idaho.gov/fileroom/cases/elec/IPC/IPCE1027/ordnotc/20110517ORDER_NO_32245.PDF

Idaho Power, BPA and Avista belong to the Northwest Energy Efficiency Alliance (NEEA), which provides support to regional utilities and groups in the northwest that implement energy efficiency and conservation programs. NEEA provides funding for initiatives such as increasing compliance of energy codes and provides a vehicle through which collective industry consensus can be achieved on market acceptance of energy efficient products, like LED light bulbs.¹⁷²

4.1. Northwest Power and Conservation Council's Seventh Power Plan

The Northwest Power Planning Council's Seventh Power Plan, released in 2016, identifies the potential of cost-effective energy measures for the region. It estimates that approximately 4,300 aMW of cost-effective energy efficiency can be developed in the Pacific Northwest region of Washington, Oregon, Idaho and Montana by 2035.¹⁷³ An important finding of the plan is that future electricity needs can no longer be adequately addressed by only evaluating average annual energy requirements. Planning for flexibility and capacity to meet peak loads will need to be considered. The Council is currently in the process of developing the eighth Power Plan.¹⁷⁴

4.2. Bonneville Power Administration Energy Efficiency

BPA works with its public utility customers to fund and implement energy-efficiency programs. Since the early 1980s, BPA and its customers have acquired more than 2,357 average megawatts (aMW) in electricity savings through energy efficiency efforts.¹⁷⁵ The municipal and cooperative utilities BPA supplies wholesale electric power to typically engage in the Integrated Program Review processes. In 2022, BPA will be updating its Energy Efficiency Action Plan targets to reflect new input from the Northwest Power and Conservation Council's 2021 Power Plan and its own Resource Program analysis. BPA will continue to offer its municipal and cooperative customers an extensive energy-efficiency program, which includes rebates and incentives that are passed on to the retail customer. BPA sets an energy efficiency incentive budget every two-year rate period and supports cost-effective efforts of individual public utilities.

Idaho Public Power utilities, through their rates with BPA, invested over \$5 million dollars in energy efficiency measures through direct payments to customers in 2020 and 2021. Public Power utilities in Idaho have been utilizing energy efficiency programs to help meet additional resource needs for over 30 years. Since 2013 the energy savings is over 16 average megawatts or over 140,000 megawatt hours per year.

¹⁷² Northwest Energy Efficiency Alliance. "About NEEA." <http://neea.org/about-neeaa>

¹⁷³ The Northwest Power and Conservation Council. "About the Seventh Power Plan." www.nwcouncil.org/energy/powerplan

¹⁷⁴ The Northwest Power and Conservation Council. "The 2021 Northwest Power Plan." <https://www.nwcouncil.org/2021-northwest-power-plan>

¹⁷⁵ Bonneville Power Administration. "Fiscal Year 2020 Red Book" https://www.bpa.gov/EE/Utility/researcharchive/Documents/The_Red_Book_FY2020.pdf

4.3. Idaho Power Energy Efficiency

Since 2002, Idaho Power has achieved a cumulative average annual load reduction of 278 aMW due to their energy efficiency investments. In its 2021 IRP, Idaho Power analyzed the amount of achievable, cost-effective energy efficiency potential for the period of 2021 – 2040. Idaho Power predicts their potential energy efficiency savings to be approximately 300 aMW. As part of the 2023 IRP process Idaho Power will complete a new potential study and determine a new forecast for energy efficiency.

In 2020, Idaho Power’s energy efficiency programs had energy savings of 196,809 MWh; this is enough energy to power more than 17,000 average homes for one year.¹⁷⁶ The 2020 savings from Idaho Power’s energy efficiency programs alone, without the estimated savings from the Northwest Energy Efficiency Alliance, was 180,818 MWh. This is a 2% decrease from the 2019 energy savings of 184,934 MWh.¹⁷⁷ In addition, Idaho Power successfully operated all three of its demand response programs in 2020. The total demand response capacity from the company's programs was 366 megawatts (MW) with actual load reduction of 336 MW.¹⁷⁸ Idaho Power offers educational information to all customer segments to drive behavior change and create awareness of, and demand for, energy efficiency programs.

4.4. PacifiCorp Energy Efficiency

PacifiCorp plans to increase their DSM resources across their entire service territory over the next twenty years. By the end of 2024, PacifiCorp’s preferred portfolio anticipates more than 1,150 MW of energy efficiency and demand response resource capacity. By the end of their 2021 IRP’s 20-year planning horizon, PacifiCorp expects to have more than 6,700 MW of energy efficiency and demand response resource capacity. Energy efficiency programs are expected to meet about 64% of that predicted capacity.¹⁷⁹

4.5. Avista Energy Efficiency

Avista has acquired a total of 252 aMW of electricity savings since it began offering energy efficiency incentives to consumers in 1978. Current Avista energy efficiency programs reduce loads by nearly 12.2 percent, or by 153 aMW.¹⁸⁰ In their 2020 IRP, the company highlights that, over their 25-year forecast, their energy efficiency programs are expected to reduce regional emissions by 4.8 million metric tons between 2021 and 2045. Avista predicts that energy efficiency will serve 71 percent of their future load growth, an increase from 53% in their 2017 IRP.¹⁸¹

¹⁷⁶ Idaho Power Company. “Demand-Side Management 2020 Annual Report” <https://docs.idahopower.com/pdfs/EnergyEfficiency/Reports/2020DSM.pdf>

¹⁷⁷ Idaho Power Company. “Demand-Side Management 2020 Annual Report” <https://docs.idahopower.com/pdfs/EnergyEfficiency/Reports/2020DSM.pdf>

¹⁷⁸ Idaho Power. “2020 Annual Report.” <https://docs.idahopower.com/pdfs/energyefficiency/reports/2020dsm.pdf>

¹⁷⁹ PacifiCorp. “2021 Integrated Resource Plan.”

[https://www.pacificorp.com/content/dam/pcorp/documents/en/pacificorp/energy/integrated-resource-plan/2021-irp/Volume I - 9.15.2021 Final.pdf](https://www.pacificorp.com/content/dam/pcorp/documents/en/pacificorp/energy/integrated-resource-plan/2021-irp/Volume%20I-9.15.2021%20Final.pdf)

¹⁸⁰ Avista. “2020 Electric IRP.” <https://www.myavista.com/about-us/integrated-resource-planning>

¹⁸¹ Avista. “2020 Electric IRP.” <https://www.myavista.com/about-us/integrated-resource-planning>

4.6. Intermountain Gas Energy Efficiency

In 2019, Intermountain Gas commissioned the first independent review of the Program called Evaluation, Measurement and Verification (EM&V). The EM&V study served as the basis for changes to the Program offering. In April 2021, Intermountain added more appliance rebates to the offering, and revised high-efficient appliance rebates to better serve energy saving needs of residential customers. The rebate for the construction of new energy efficient homes requires a Home Energy Rating System (HERS) rating, and specific above code energy performance targets for improved air sealing, reduced duct leakage and high-efficiency space and water heating appliances. In addition, April 2021 also marked the launch of the company's first energy efficiency program for Commercial customers.¹⁸²

In 2020, a total of 4,537 high-efficiency measures were rebated to Intermountain Gas customers, representing a 36% increase from the previous year.¹⁸³ For the third year in a row, Intermountain received the Energy Star® Certified Home Market Leader Award from the Environmental Protection Agency (EPA). This award recognizes outstanding commitment to energy-efficient new homes and important contributions to energy-efficient construction and environmental protection.

4.7. Energy Storage Technologies and Approaches

Energy storage technologies provide the ability to store energy for use at later times, adding enhanced control, reliability, and resiliency to our electricity grid. In 2020, the United States had 23 GW of installed energy storage it is projected that installed energy storage will exceed 125 GW by 2050.¹⁸⁴ Almost all existing storage is pumped-hydropower storage. Other common storage technologies include pumped-storage hydropower, batteries, hydrogen, thermal, and other mechanical storage. Energy storage is important as the grid incorporates more intermittent renewable and emissions-free energy resources such as wind and solar. These resources are not able to consistently supply our grid with energy at all times of the day; therefore, storage helps balance energy demands when the sun is not shining, or the wind is not blowing.

Energy storage can play a key role in providing overall grid security and resilience, while allowing critical infrastructure such as hospitals, police stations, and other key services to remain operational during emergency situations. The federal government has programs promoting the adoption of more energy storage in the United States, particularly for resiliency purposes at critical facilities. The cost of energy storage infrastructure is a significant hurdle; however, more affordable utility-scale storage systems are currently under development.¹⁸⁵

¹⁸² Intermountain Gas. "Energy Efficiency Commercial Program."

https://www.intgas.com/energy-efficiency_program/commercial-energy-efficiency/

¹⁸³ Intermountain Gas. "2020 Annual Energy Efficiency Report." https://www.intgas.com/energy-efficiency_program/

¹⁸⁴ National Renewable Energy Laboratory. "Storage Futures Study: Economic Potential of Dinural Storage in the U.S. Power Sector." <https://www.nrel.gov/docs/fy21osti/77449.pdf>

¹⁸⁵ U.S. Department of Energy: Office of Electricity. "Energy Storage."

<https://www.energy.gov/oe/activities/technology-development/energy-storage>

4.8. Distributed Energy Resources

Distributed energy resources (DER), also called on-site generation, dispersed or decentralized generation, are small power sources that can be combined to provide power to satisfy demand.¹⁸⁶ Typically producing less than 10 MW, such sources can include micro-turbines, small natural gas-fueled generators, combined heat and power plants, battery storage, biomass, wind and solar thermal or photovoltaic installations. The use of DERs is becoming more common due to the potential for more affordable renewable energy, and an increased desire for grid resiliency, largely motivated by increased occurrences of natural disasters such as storms and wildfires.¹⁸⁷ However, complex and expensive integration upgrades and power-balancing mechanisms will be required as use of DERs increases.

In September 2020, FERC issued Order No. 2222, directing Regional Transmission Organizations and Independent System Operators (RTOs/ISOs) to open their electricity markets to participation by aggregated DERs. To comply, each RTO/ISO must file with FERC tariff provisions that establish market rules addressing specific technical and operational details impacting market participation by DER aggregations.¹⁸⁸

4.9. Pumped Hydroelectric Storage

Pumped hydroelectric storage facilities, commonly referred to as pumped-hydro or pumped-storage, store energy by utilizing excess electricity when energy demand is low and pumping water from a lower to a higher reservoir to be released through turbines when energy demand is high. Pumped hydroelectric storage is a form of mechanical storage that provides storage in addition to added reliability or ancillary services.¹⁸⁹ Much of the pumped hydroelectric storage infrastructure across the nation emerged during the 1970s. Today 93% of United States' utility-scale energy storage is pumped-hydro.¹⁹⁰

¹⁸⁶ Electric Power Research Institute. "The Integrated Grid: Realizing the Full Value of Central and Distributed Energy Resources 2014." <https://www.epri.com/#/pages/product/3002002733/?lang=en-US>

¹⁸⁷ North American Electric Reliability Corporation. "Distributed Energy Resources: Connection Modeling and Reliability Considerations."

https://www.nerc.com/comm/Other/essntlrbltysrvscstskfrDL/Distributed_Energy_Resources_Report.pdf

¹⁸⁸ Advanced Energy Economy. "Opening the Door to DERs."

<https://info.aee.net/hubfs/Order%202222%20Explainer%20final.pdf>

¹⁸⁹ Energy Storage Association. "Pumped Hydropower."

<https://energystorage.org/why-energy-storage/technologies/pumped-hydropower/>

¹⁹⁰ Office of Energy Efficiency and Renewable Energy. "U.S. Hydropower Market Report."

<https://www.energy.gov/eere/water/events/key-industry-trends-us-hydropower-overview-2021-edition-us-hydropower-market>

4.10. Battery Storage

Battery storage can be utilized to store excess energy at the residential and commercial-scales, as well as at the utility-scale. Energy storage batteries work similarly to smaller batteries used in our everyday lives but have much greater storage capacities. Battery storage technology is rapidly growing and evolving because of its scalability and accessibility, and projections show an estimated 25-35 GW of battery storage being added online by 2025.¹⁹¹ Small-scale batteries are being added to approximately one-third of residential solar systems amongst the nation's leading solar installers. A fast-growing trend is utility-scale hybrid generation plants which combine renewable energy with on-site storage that offers increased stability and flexibility to the system. In 2020, 36% of solar project that connected to the grid were paired with batteries.¹⁹²

Energy storage batteries usually have short to mid-range response times of a few seconds to a few hours. There are two categories of batteries used for energy storage, these being solid-state and flow batteries. Solid-state batteries utilize different solid chemical compounds for varying grid services while flow batteries utilize chemical compounds that are dissolved in liquid within the battery to create a reaction that produces electricity. Typical solid-state battery types include the highly popular lithium ion as well as the sodium ion, but hybrid batteries and flow or redox flow batteries with a wide range of chemistries are becoming increasingly popular. Research studies are being conducted on both types of batteries to discover more effective ways to use battery storage.¹⁹³

4.11. Thermal Storage

Thermal storage traps energy temporarily in the form of heat or cold which allows the energy to be turned into electricity at a later time. An example of this on a utility scale includes solar thermal power plants that use molten salt or other heat-retaining substance to store the sun's energy, which can be utilized later in steam generating processes.¹⁹⁴

4.12. Mechanical Storage

Mechanical storage systems use kinetic or gravitational forces to store inputted energy. One example of a mechanical storage system is the flywheel, a mechanism in which rotational energy is stabilized and maintained through movement of an accelerating wheel that can then store the energy kinetically for future use. A generator is then applied to easily convert the stored energy from mechanical to electrical energy.¹⁹⁵

¹⁹¹ Energy Storage Association. "Enabling the Clean Power Transformation." <https://energystorage.org/wp/wp-content/uploads/2020/08/100x30-Empowering-Clean-Power-Transformation-ESA-Vision.pdf>

¹⁹² Lawrence Berkeley National Lab. "Keep it short: Exploring the impacts of configuration choices on the recent economic of solar-plus-battery and wind-plus-battery hybrid energy plants." https://eta-publications.lbl.gov/sites/default/files/doe_webinar_hybrid_configuration_briefing_final.pdf

¹⁹³ Energy Storage Association. "Batteries." <https://energystorage.org/why-energy-storage/technologies/solid-electrode-batteries/>

¹⁹⁴ Energy Storage Association. "Thermal Energy Storage." <https://energystorage.org/why-energy-storage/technologies/thermal-energy-storage/>

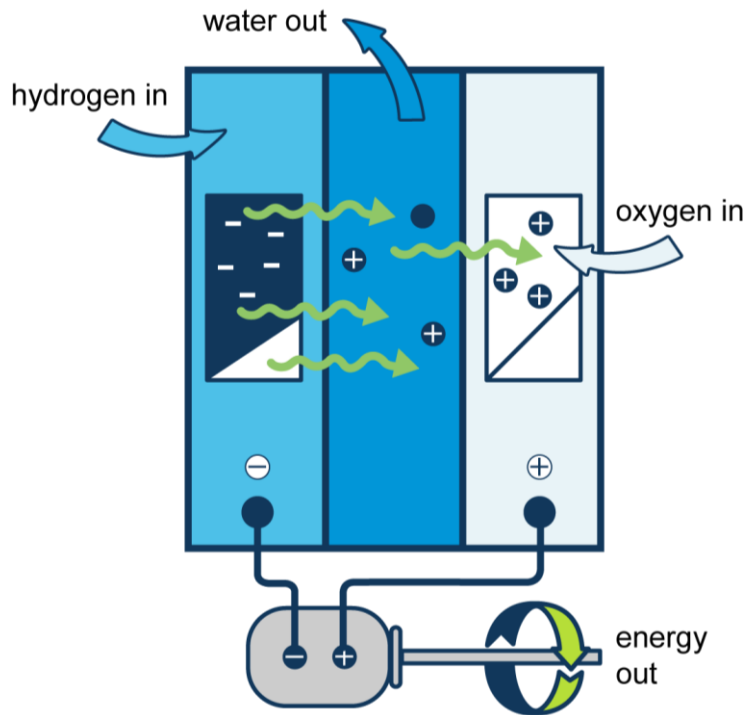
¹⁹⁵ Energy Storage Association. "Mechanical Energy Storage."

4.13. Hydrogen Storage

Electricity can be converted into hydrogen through electrolysis. The hydrogen can then be stored and eventually re-electrified; this can occur in fuel cells or through burning in combined cycle gas power plants. Small amounts of hydrogen can be stored in pressurized vessels, and very large amounts of hydrogen can be stored in constructed underground salt caverns. This method of storage can mitigate the grid impacts associated with excess wind or solar production, including seasonal-scale variations.¹⁹⁶ Hydrogen projects range in size from 1 GWh to 1 TWh, while battery projects typically range from 10 kWh to 10 MWh and pumped hydroelectric storage projects range from 10 MWh to 10 GWh.

Like pumped-storage, hydrogen storage relies on using energy when demand is low (or generation is particularly high) to power an electrolysis mechanism and ultimately create hydrogen. This hydrogen has a multitude of uses once it is created – it can be used in stationary fuel cells, for power generation, to provide fuel for fuel cell vehicles, injected as hydrogen generated from renewable energy into natural gas pipelines, or stored as compressed gas or other compounds for later use. Unlike batteries that degrade over time, hydrogen can be stored for long periods of time and in very large quantities.

Figure 4.1. Hydrogen Fuel Cell Depiction¹⁹⁷



¹⁹⁶ Energy Storage Association. “Hydrogen Energy Storage.”

<https://energystorage.org/why-energy-storage/technologies/hydrogen-energy-storage/>

¹⁹⁷ U.S. Energy Information Administration. “Hydrogen Explained. Adapted from the National Energy Education Project (public domain).” <https://www.eia.gov/energyexplained/hydrogen/use-of-hydrogen.php>

5. Outlook

5.1. Utility Integrated Resource Plans

Idaho’s Investor-Owned Utilities (IOUs) work with local stakeholders to develop Integrated Resource Plans (IRPs) that must be filed with the Idaho PUC every two years. IRPs forecast energy demands over 20 years and evaluate a variety of different resources to meet demand, including the addition of generation resources and demand-side measures such as conservation and energy efficiency programs. IRPs typically select a “preferred resource strategy” based on evaluation criteria including cost, risk, reliability and environmental concerns. Idaho IOU IRPs are available to the public on the Idaho PUC’s website and via the utility’s websites listed below:

Avista:

<https://www.myavista.com/about-us/integrated-resource-planning>

Idaho Power:

<https://www.idahopower.com/energy-environment/energy/planning-and-electrical-projects/our-twenty-year-plan/>

PacifiCorp/Rocky Mountain Power:

<https://www.pacifiCorp.com/energy/integrated-resource-plan.html>

Intermountain Gas:

https://www.intgas.com/wp-content/uploads/PDFs/commission_filings/IRP-Write-Up-Book-2019.pdf

Idaho PUC:

<http://www.puc.idaho.gov>

5.2. Future Planned Development

Table 5.1. Planned Investments in Electric Generating Facilities by Idaho Investor-Owned Utilities, 2021-2031¹⁹⁸

Year	Utility	Investment Type	Nameplate Capacity (MW)
2023	Idaho Power	Jackpot Solar	120
2023	Avista	New Wind	100
2023	Idaho Power	New Solar	120
2023	Idaho Power	New Battery Storage	100
2024	Avista	New Wind	100
2024	Idaho Power	New Natural Gas ¹⁹⁹	357
2024	PacifiCorp	New Solar	1,302
2024	PacifiCorp	New Wind	1,920
2024	PacifiCorp	New Battery Storage ²⁰⁰	700
2025	Idaho Power	New Solar	300
2025	Idaho Power	New Battery Storage	105
2026	Avista	Kettle Falls Generating Station Modernization	12
2026	Avista	Post Falls Hydroelectricity Facility Modernization	8
2026	Idaho Power	New Solar	215
2026	PacifiCorp	New Solar	1,902
2026-2029	Avista	Rathdrum CT 1&2 Modernization	24
2027	Avista	New Natural Gas Peaker	200
2027	Idaho Power	New Solar	250
2028	Avista	New Wind	100
2028	Idaho Power	New Solar	120
2028	PacifiCorp	Advanced Nuclear	500
2029	Idaho Power	New Solar	100
2031	Avista	NW Hydro Slice	75
2031	Idaho Power	New Natural Gas Peaker	300

Table 5.1. shows planned generation projects listed by Idaho’s three electric IOUs in their most recent IRPs or IRP updates. These resources may be physically located outside of Idaho. Additional renewable generation may be developed by independent power producers under Public Utility Regulatory Policies Act (PURPA) or developed as net metering projects.

¹⁹⁸ Avista. “2021 Electric IRP.” <https://www.myavista.com/about-us/integrated-resource-planning>; PacifiCorp. “2021 IRP Volume I.” <https://www.pacificorp.com/content/dam/pcorp/documents/en/pacificorp/energy/integrated-resource-plan/2021-irp/Volume%20I%20-%202015.2021%20Final.pdf>; and Idaho Power. “2021 Integrated Resource Plan.” https://docs.idahopower.com/pdfs/AboutUs/PlanningforFuture/irp/2021/2021%20IRP_WEB.pdf

¹⁹⁹ John Bridger 1&2 expected to be converted to natural gas. “2021 Integrated Resource Plan.” https://docs.idahopower.com/pdfs/aboutus/planningforfuture/irp/2021/2021%20irp_web.pdf

²⁰⁰ 200 MW of which is standalone battery and the remaining portion paired with solar resources.

Table 5.2. Major Planned Transmission Projects by Idaho Investor-Owned Utilities, 2020-2027²⁰¹

Year	Utility	Investment Type	Capacity (kV)
2024	PacifiCorp	Windstar to Aeolus (Gateway West)	230
2024	PacifiCorp	Aeolus to Mona	500
2026	PacifiCorp	Oquirrh to Terminal	345
2026	PacifiCorp, BPA, Idaho Power	Boardman to Hemingway	500
2027	PacifiCorp	Bridger/Anticline-Populous (Gateway West)	500
2030	PacifiCorp, Idaho Power	Populus to Hemingway (Gateway West)	500

Note: Tables 5.1. & 5.2. report the generation and transmission facilities included in the preferred resource strategy from each utility based upon their most recent IRPs or IRP Updates.

IOU planned transmission projects are listed in Table 5.2. Other organizations are continuing plans on transmission projects around Idaho. BPA's Hooper Springs transmission line completed construction in southeast Idaho in Fall 2019.²⁰² LS Power, a commercial energy developer, is continuing to explore development of the Southwest Intertie Project, Northern Section (SWIP North) through southern Idaho.

Figure 5.1 Construction of the Gateway West Transmission Line²⁰³



²⁰¹ Avista. "2021 Electric IRP." <https://www.myavista.com/about-us/integrated-resource-planning>; PacifiCorp. "2021 IRP Volume I." <https://www.pacificorp.com/content/dam/pcorp/documents/en/pacificorp/energy/integrated-resource-plan/2021-irp/Volume%20I%20-%202019.15.2021%20Final.pdf>; and Idaho Power. "2021 Integrated Resource Plan." https://docs.idahopower.com/pdfs/AboutUs/PlanningforFuture/irp/2021/2021%20IRP_WEB.pdf

²⁰² Bonneville Power Administration. "Project models new collaborative approach for transmission expansion." <https://www.bpa.gov/news/newsroom/Pages/Project-models-new-collaborative-approach-for-transmission-expansion.aspx>

²⁰³ HDR Engineering. "Gateway West Transmission Line, Aeolus to Jim Bridger." <https://www.hdrinc.com/portfolio/gateway-west-transmission-line-aeolus-jim-bridger>

Table 5.3. Announced Coal-fired Generation Facility Exits or Retirements by Idaho Investor-Owned Utilities, 2022-2037²⁰⁴

Year	Utility	Investment Type	Capacity (MW)
2022	Idaho Power	Jim Bridger 1 ²⁰⁵	-177
2023	PacifiCorp	Jim Bridger 1 & 2 ²⁰⁶	-354
2025	Idaho Power	Jim Bridger 3 ²⁰⁷	-174
2025	Idaho Power	North Valmy 2 ²⁰⁸	-133
2025	PacifiCorp	Naughton 1 & 2	-357
2025	PacifiCorp	Colstrip 3 & 4	-148
2025	Avista	Colstrip 3 & 4 ²⁰⁹	-222
2026	Idaho Power	Jim Bridger 2 ²¹⁰	-180
2027	PacifiCorp	Dave Johnston 1 – 4	-755
2028	Idaho Power	Jim Bridger 4	-177
2036	PacifiCorp	Huntington 1 & 2	-909
2037	PacifiCorp	Jim Bridger 3 & 4	-702
2039	PacifiCorp	Wyodak	-268

Note: Table 5.3. reports the exit dates and retired generation of coal-fired facilities that provide energy to Idaho and are included in the preferred resource strategy from each utility based upon their most recent IRP Updates.

Table 5.3. shows the coal-fired facilities that are owned by Idaho utilities. This table reflects the exit dates for each of the utilities from the coal units as utilities move away from coal-fired energy generation. Based on state and local policies, as well as market changes, a utility may choose to exit ownership of a coal facility before the facility is retired.

5.3. Microgrids

A microgrid is a group of interconnected loads and distributed energy resources within clearly defined electrical boundaries that acts as a single controllable entity with respect to its relationship with the grid. This means a microgrid can connect and disconnect from the grid to enable it to operate in both grid-connected or island-mode.²¹¹

²⁰⁴ Avista. “2021 Electric IRP.” <https://www.myavista.com/about-us/integrated-resource-planning>; PacifiCorp. “2021 IRP Volume I.” <https://www.pacificorp.com/content/dam/pcorp/documents/en/pacificorp/energy/integrated-resource-plan/2021-irp/Volume%20I%20-%202019.15.2021%20Final.pdf>; and Idaho Power. “2021 Integrated Resource Plan.” https://docs.idahopower.com/pdfs/AboutUs/PlanningforFuture/irp/2021/2021%20IRP_WEB.pdf

²⁰⁵ Idaho Power and PacifiCorp have not developed contractual terms that would be necessary to allow for the potential earlier exit of a Jim Bridger unit by one party, and not both parties. Exit order is to be determined.

²⁰⁶ Jim Bridger Units 1-2, converted to natural gas peakers in 2024.

²⁰⁷ Idaho Power IRP, 2021.

²⁰⁸ Idaho Power is conducting further analysis of North Valmy Unit 2 exit timing. Idaho Power IRP, 2021.

²⁰⁹ Avista has received approval for the 2025 life in Washington but has not received authorization in Idaho to recover all costs through 2027

²¹⁰ Idaho Power and PacifiCorp have not developed contractual terms that would be necessary to allow for the potential earlier exit of a Jim Bridger unit by one party, and not both parties. Exit order is to be determined.

²¹¹ U.S. Department of Energy. “The U.S. Department of Energy’s Microgrid Initiative.” <https://www.energy.gov/sites/prod/files/2016/06/f32/The%20US%20Department%20of%20Energy's%20Microgrid%20Initiative.pdf>

The development of microgrids as an emerging resource provides practical answers to the energy challenges of the 21st century by creating an optimized way to access reliable, clean, and resilient energy through local, interconnected energy systems that incorporate loads, decentralized energy resources, battery storage, and control capabilities.

In conjunction with Idaho Falls Power, the Idaho National Laboratory began studying the benefits of hydropower microgrids in 2016. In April 2021, the entities successfully tested and stabilized the hydropower microgrid.²¹² The successful test means that the hydroelectricity produced by the city's Lower, Older Lower and City hydroelectric plants can provide enough energy to power emergency generators for hospitals, fire departments, police buildings, evacuation centers and other public health facilities when disconnected from the power grid.

5.3.1. Smart Grid

Electric infrastructure in the United States is aging and reaching capacity. Modernizing the grid to make it “smarter” and more resilient through the use of cutting-edge technologies, equipment, and controls that communicate and work together to deliver electricity more reliably and efficiently can greatly reduce the frequency and duration of power outages, reduce storm impacts, and restore service faster when outages occur.

Technologies that not only allow for two-way communication between a utility and its customers but sensing capabilities along transmission lines that respond to needed load in real time describes smart grid technologies. Emerging smart grid technologies could make it possible for consumers to individually balance their energy supply and demand. Allowing consumers to adjust electricity use in response to available supplies and costs could enhance the capacity and flexibility of the power system and may have a significant impact on Idaho energy networks. Smart grid development may facilitate the deployment of electric vehicles and help reduce carbon emissions in the transportation sector. The development of new energy storage technologies will impact both the feasibility of fuel switching in the transportation sector (gas to electric) as well as grid stability through grid-scale energy storage.²¹³

5.4. Electric Vehicles

Electric vehicles (EVs) run on batteries powered by electricity rather than an engine that requires the combustion of fossil fuels. EV adoption is rising especially with improvements in battery performance. The State is working to develop public charging stations at least every 50 miles along major travel corridors to provide EV drivers the confidence to travel throughout the state.

²¹² Idaho Falls Power. “Idaho Falls Power to Conduct Microgrid Test.” <https://www.ifpower.org/about-us/news-updates/article?item=idaho-falls-power-to-conduct-microgrid-test>

²¹³ U.S. Department of Energy: Office of Electrical Delivery and Energy Reliability. “What is the Smart Grid.” https://www.smartgrid.gov/the_smart_grid/smart_grid.html

Figure 5.2. Electric Vehicle Charging Levels²¹⁴

Charging Level	Vehicle Range Added per Charging Time and Power	Supply Power
AC Level 1	4 mi/hour @ 1.4kW	120VAC/20A (12-16A continuous)
	6 mi/hour @ 1.9kW	
AC Level 2	10 mi/hour @ 3.4kW	208/240VAC/20-100A (16-80A continuous)
	20 mi/hour @ 6.6kW	
	60 mi/hour @ 19.2 kW	
DC Fast Charging	24 mi/20minutes @24kW	208/480VAC 3-phase (input current proportional to output power; ~20-400A AC)
	50 mi/20minutes @50kW	
	90 mi/20minutes @90kW	

There are three levels of EV charging. Level 1 chargers are often used to charge EVs overnight via common 120-volt outlets. Level 2 charging stations require a 240-volt outlet which can be installed at residences, businesses, or fleet locations to fully charge an EV in 3-5 hours.²¹⁵ Level 3 direct current fast chargers (DCFC) require a specialized, 480-volt outlet and can provide a full charge after 20-30 minutes. Level 1 and 2 chargers are best suited for private day-to-day use, whereas DCFC are the most popular option for public charging.²¹⁶ As of 2021, Idaho has 104 EV station locations and 262 ports available to the public.²¹⁷

The State of Idaho supports local and regional EV development efforts and offers grants, such as the Electric Vehicle Supply Equipment (EVSE) Program, and technical assistance to deploy publicly available DCFC infrastructure. Additionally, the State participates in regional efforts such as REV West, a partnership between Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, and Wyoming to educate consumers and fleet owners to raise EV awareness, reduce range anxiety, increase EV adoption, and coordinate EV charging locations.

²¹⁴ U.S. Department of Energy. "Costs Associated with Non-Residential Electric Vehicle Supply Equipment."

https://afdc.energy.gov/files/u/publication/evse_cost_report_2015.pdf

²¹⁵ U.S. Department of Energy. "Electric Vehicles: Charging at Home."

<https://www.energy.gov/eere/electricvehicles/charging-home>

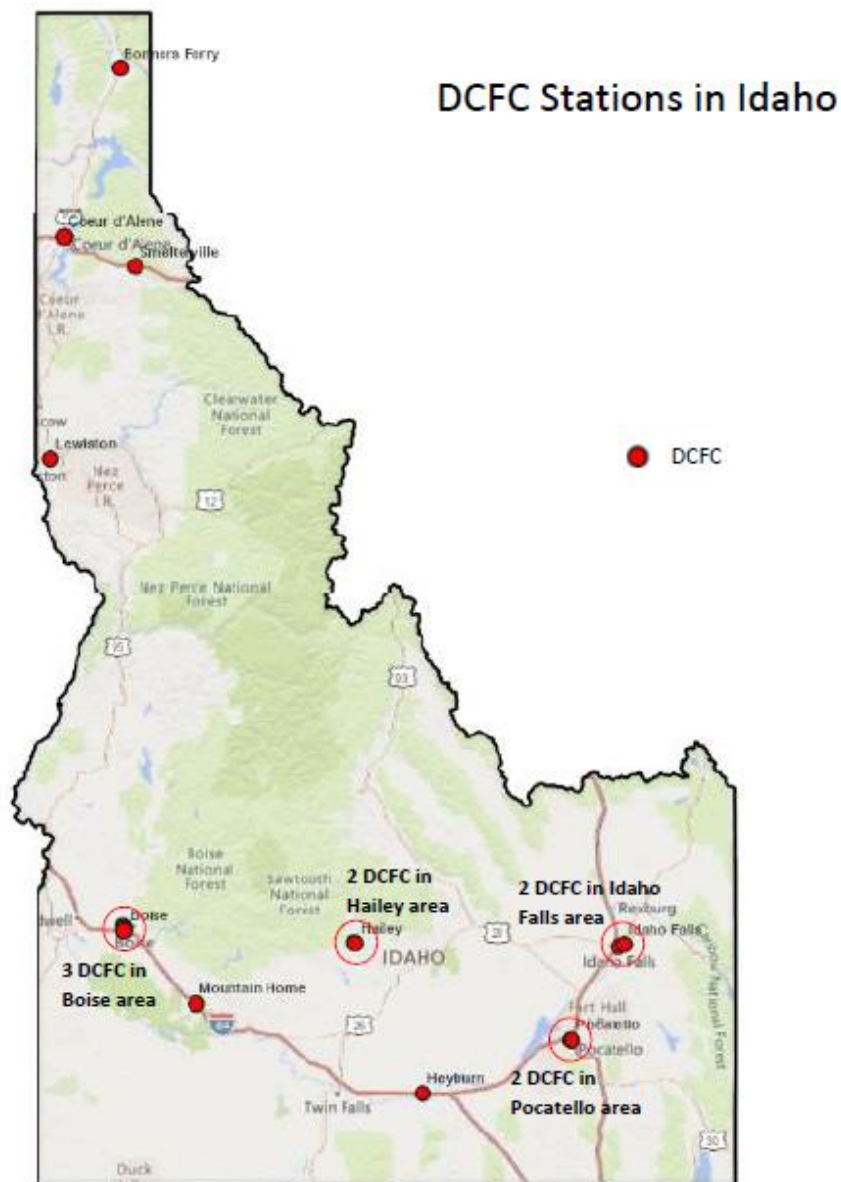
²¹⁶ U.S. Department of Energy. "Electric Vehicles: Vehicle Charging."

<https://energy.gov/eere/electricvehicles/vehicle-charging>

²¹⁷ U.S. Department of Energy. "Electric Vehicle Charging Station Locations Idaho."

https://afdc.energy.gov/fuels/electricity_locations.html#/analyze?fuel=ELEC

Figure 5.3. Electric Vehicle DC Fast Charging Station Locations in Idaho²¹⁸



²¹⁸ U.S. Department of Energy. “Electric Vehicle Charging Station Locations Idaho.” https://afdc.energy.gov/fuels/electricity_locations.html#/analyze?fuel=ELEC

6. Energy Research and Education Entities in Idaho

6.1. Research at Idaho National Laboratory

INL is one of the State's largest employers, and the U.S. Department of Energy's (DOE) nuclear energy research, development, and demonstration laboratory. INL is a leading contributor to a variety of non-nuclear clean energy technologies research on cybersecurity and protecting critical infrastructure.²¹⁹ Within its 890 square miles of research space, INL has numerous unique research facilities and capabilities.

Nuclear Science and Technology: In addition to the Gateway for Accelerated Innovation in Nuclear (GAIN) initiative,²²⁰ which was created to provide technical, regulatory, and financial support to move advanced nuclear reactor technologies toward commercialization, INL was recently named home to the National Reactor Innovation Center (NRIC). NRIC is the next step toward commercialization of advanced nuclear reactors. It provides private sector technology developers access to facilities and expertise within the national laboratory system. Through NRIC, new reactor demonstrations will be able to accelerate technology readiness from proof of concept to proof of operations. This includes demonstration of the first of its kind small modular reactors (SMRs) and microreactors.²²¹

Through its nuclear research program, INL is currently engaging in the development and deployment of three advanced nuclear reactor technologies.

- The NuScale SMR power plant for the Utah Associated Municipal Power Systems (UAMPS) Carbon Free Power Project (CFPP) is currently set for full operation at the INL site by 2030.²²²
- Oklo Power LLC (Oklo) is preparing to license, build, and operate the company's Aurora microreactor design at the INL site. On Feb. 19, 2020, INL announced it will provide Oklo with access to recovered spent nuclear fuel to aid the company in its efforts to develop and demonstrate the Oklo Aurora design.

²¹⁹ Idaho National Laboratory. "INL Research Areas." <https://www.inl.gov/research-programs/>

²²⁰ Gateway for Accelerated Innovation in Nuclear. "What is GAIN?"

<https://gain.inl.gov/SitePages/What%20is%20GAIN.aspx>

²²¹ U.S. Department of Energy "National Reactor Innovation Center Fact Sheet."

https://www.energy.gov/sites/prod/files/2019/08/f65/NRIC_Fact_Sheet.pdf

²²² NuScale Power, LLC. "Fact Sheet - Carbon Free Power Project." <https://newsroom.nuscalepower.com/media-center/media-resources/fact-sheets/default.aspx>

Energy Environment Science and Technology: INL is working to help accelerate cost-effective integration of clean energy sources, including geothermal, wind, bio-based, nuclear and solar power into the grid. Additionally, INL leads research into electric vehicle (EV) charging technologies and the charging habits of EV owners, hoping to discover safer, faster, and more efficient means of dispatching energy on smart grids, charging, and utilizing battery technologies.²²³ Effective charging will enhance EV owner security, while increasing domestic energy independence. INL’s extensive research can help inform decisions on how to most effectively deploy EV charging opportunities.

National and Homeland Security: In addition to the global leading work on cybersecurity and critical infrastructure protection, INL has unparalleled assets such as a wireless test bed and over 111 miles of transmission lines to be utilized for testing real world scenarios by industry, government, and other partners.

INL recently opened two new state-owned world class facilities dedicated to cybersecurity (Cybercore Integration Center) and nuclear modeling and simulation (Collaborative Computing Center). These facilities will significantly enhance the cutting-edge research being done by INL in collaboration with Idaho’s colleges and universities. INL is a prominent resource of energy education and outreach throughout Idaho.

6.2. Center for Advanced Energy Studies

The Center for Advanced Energy Studies (CAES) is a research, education, and innovation consortium that brings together INL, Boise State University, Idaho State University, the University of Idaho, and the University of Wyoming. CAES headquarters is a state-owned, energy-efficient facility located near INL and University Place campus in Idaho Falls. With complimentary capabilities and research programs at each of the participating universities, CAES works to solve regional energy challenges that have national impact.²²⁴ CAES leverages the expertise, facilities, and capabilities of the member organizations to collaboratively address challenges in these focus areas: nuclear energy; energy-water nexus; cybersecurity; advanced manufacturing; innovative energy systems; energy policy; and computing, data and visualization.²²⁵

Based at Boise State University, the Energy Policy Institute is the policy arm of the Center for Advanced Energy Studies (CAES). The Institute is a non-partisan and evidenced-based research and advising center that specializes in energy systems change. It focuses on how to manage energy shifts—planned and unanticipated—in natural, technical, and human systems. The Institute's team works with policymakers, industry, and communities to advance understanding and decisions about clean, safe, and secure energy systems.

²²³ Idaho National Laboratory. “Clean Energy & Transportation.”

<https://at.inl.gov/SitePages/Evaluation%20of%20Conductive%20and%20Wireless%20Charging%20Systems.aspx>

²²⁴ Center for Advanced Energy Studies. “About Us.” <https://caesenergy.org/about-us/>

²²⁵ Center for Advanced Energy Studies. “Core Capabilities.” <https://caesenergy.org/research/core-capabilities/>

6.3. Universities, Colleges, and Technical Training

Many of Idaho's higher education institutions are engaged in educating tomorrow's energy workforce. For example, elective courses are offered in energy efficiency and renewable energy at Boise State University.²²⁶ The courses provide non-science or engineering students with a solid grounding in energy fundamentals, which is helping Boise State educate a knowledgeable generation of energy consumers, policymakers, teachers, and business leaders.

The Micron School of Materials Science and Engineering (MSE) at Boise State University is home to one of the most productive materials science and engineering programs in the northwest. Students and faculty collaborate on funded research in areas such as nanoscale fabrication, shape memory alloys, energy, biomaterials, and materials modeling. MSE is currently investigating a broad range of materials issues in areas such as nuclear fuels, biomaterials, glasses, semiconductors, electronic memories, computational modeling, and magnetic materials.²²⁷

The Department of Biological and Agricultural Engineering at the University of Idaho houses the Biodiesel Fuel Education Program which provides science-based information about biodiesel and assists in the development of educational tools for a national biodiesel outreach program. The program develops and distributes educational materials that support advances in biodiesel infrastructure, technology transfer, fuel quality, fuel safety, and increasing feedstock production.²²⁸

The National Institute for Advanced Transportation Technology at the University of Idaho is a center for transportation research, education, and technology transfer. It is committed to preserving and protecting the environments of the Pacific Northwest. The Institute contributes to the sustainability of the environment through the development of clean vehicles, alternative fuels, efficient traffic control systems, safe transportation systems, sound infrastructure, and the policies that support these systems.²²⁹

Idaho State University offers bachelor's and master's degree programs in Nuclear Science and Engineering and prepares graduates to excel in a wide range of careers associated with nuclear reactors, the nuclear fuel cycle, and other applications of nuclear technology.²³⁰

²²⁶ Boise State University. <https://www.boisestate.edu/>

²²⁷ Boise State University. "Micron School of Materials Science and Engineering." <http://coen.boisestate.edu/mse/>

²²⁸ University of Idaho. "Biodiesel Education." <http://biodieseleducation.org/>

²²⁹ University of Idaho. "National Institute for Advanced Transportation Technology." www.uidaho.edu/engr/research/niatt

²³⁰ Idaho State University. "Programs of Study." <http://coursecat.isu.edu/programsstudy/>

Idaho State University established the Energy Systems Technology and Education Center (ESTEC) in its College of Technology. ESTEC integrates the education and training required for graduates to maintain existing plants. They learn to install and test components in new plants in key areas of technology, including electrical engineering, instrumentation and control, mechanical engineering, wind engineering, instrumentation and automation, nuclear operations, and renewable energy.²³¹

Idaho's community colleges also emphasize the importance of educating the energy workforce of the future. Instructors at the College of Southern Idaho (CSI) in Twin Falls have trained the next-generation energy workforce in renewable energy since 1981 through the Renewable Energy Systems Technology Program.²³² CSI received a \$4.4 million Economic Development Administration federal grant in 2011 to help build the Applied Technology and Innovation Center in Twin Falls. Completed in 2014, the 29,600 square foot energy efficient center houses the college's expanding HVAC, environmental technology, wind energy, and machine technology programs with classrooms, hands-on labs, and administrative offices.²³³

College of Eastern Idaho (CEI) launched its Energy Systems Technology Program in 2010; it provides the first year of this two-year program at the CEI campus. After first-year completion, qualified students enter the second year of the ESTEC program at Idaho State University. The program equips students to become energy systems maintenance technicians with mechanical, electrical, and instrumentation and control skills.²³⁴

The College of Western Idaho (CWI) is looking to the future of managing a diverse energy sector with its Advanced Mechatronics Engineering Technology program. This one-to-two-year program teaches students about electricity, robotics, wireless communication, renewable energy, instrumentation, and computerized control systems.²³⁵

The Northwest Lineman College, based in Meridian, trains lineman apprentices and educates students in construction, maintenance, and operation of the electrical grid. It provides lineman certification for individuals already working in the trade and develops customized training services for power and construction companies worldwide. Founded in 1993, the college educates more trade professionals in the Power Delivery Industry than any other educational institution in the United States, training over 8,000 individuals annually.²³⁶

²³¹ Idaho State University. "College of Technology." <https://www.isu.edu/estec/>

²³² College of Southern Idaho. "Renewable Energy Systems Technology Program." <https://www.csi.edu/programs/renewable-energy-systems-technology/default.aspx>

²³³ U.S. Economic Development Administration. "CSI Applied Technology & Innovation Center." <https://www.eda.gov/success-stories/workforce/stories/college-of-southern-id.htm>

²³⁴ College of Eastern Idaho. "Energy Systems Technician."

<http://www.cei.edu/programs-of-study/trades-industry/energy-systems-technician>, and Idaho State University. "Energy Systems Technology and Education Center." <https://www.isu.edu/estec/>

²³⁵ College of Western Idaho. "Advanced Mechatronics Engineering Technology." <https://cwi.edu/program/advanced-mechatronics-engineering-technology>

²³⁶ Northwest Lineman College. <https://lineman.edu/students-home/campuses/idaho/>

Appendix A: List of Idaho Electric and Natural Gas Utilities

Investor-Owned Utilities

<u>Avista Utilities</u>	800-227-9187
<u>Dominion Energy (formerly Questar)</u>	800-323-5517
<u>Idaho Power Company</u>	800-488-6151
<u>Intermountain Gas</u>	800-548-3679
<u>Rocky Mountain Power</u>	888-221-7070

Municipal Electric Utilities

<u>Albion Light and Water Plant</u>	208-673-5352
<u>Bonners Ferry Light and Water</u>	800-626-4950
<u>Burley Electric Department</u>	208-878-2224
Declo Municipal Electric Department	208-654-2124
<u>Heyburn Electric Department</u>	208-679-8158
<u>Idaho Falls Power</u>	208-612-8280
Minidoka Electric Department	208-531-4101
<u>Plummer Electric Department</u>	208-686-1641
<u>Rupert Electric Department</u>	208-436-9600
<u>Soda Springs Electric Light and Power</u>	208-547-2600
<u>Weiser Electric Department</u>	208-414-1964

Rural Electric Cooperatives

<u>Bonneville Power Administration</u>	800-282-3713
Atlanta Power	208-459-7014
<u>Clearwater Power</u>	888-743-1501
East End Mutual Electric	208-436-9047
<u>Fall River Rural Electric</u>	800-632-5726
Farmers Electric	208-436-6384
<u>Idaho County Light and Power</u>	877-212-0424
<u>Inland Power and Light</u>	800-747-7151
<u>Kootenai Electric Cooperative</u>	800-240-0459
<u>Lost River Electric Cooperative</u>	208-588-3311
<u>Lower Valley Energy</u>	800-882-5875
<u>Northern Lights Incorporated</u>	800-326-9594
<u>Missoula Electric Cooperative</u>	800-352-5200
<u>Raft River Rural Electric</u>	800-342-7732
<u>Riverside Electric Cooperative</u>	208-436-3855
<u>Salmon River Cooperative</u>	208-879-2283
South Side Electric	208-654-2313
<u>United Electric Co-Op Inc.</u>	208-679-2222
<u>Vigilante Electric Cooperative</u>	800-221-8271

Glossary:

Average Megawatt (aMW): An average megawatt is the amount of electricity produced by the continuous production of one megawatt over a period of one year. The term, sometimes also called average annual megawatt, defines power production in megawatt increments over time. Because there are 8,760 hours in a year, an average megawatt is equal to 8,760 megawatt-hours.

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.

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.

Biomass: Plant materials and animal waste used as a feedstock for energy production.

British Thermal Units (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 \approx 125,000 BTUs.

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.

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.

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-Effective: Cost-effectiveness of an energy measure means that the lifecycle energy, capacity, transmission, distribution, and other quantifiable savings to residents and businesses exceed the direct costs of the measure to the utility and participant.

Demand: The amount of power consumers require at a particular time. Demand is synonymous with load. It is 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.

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. The amount of electric energy produced is 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.

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

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

Gigawatt-hour (GWh): 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.

Greenhouse gases (GHG): 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.

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.

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.

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 Resource Plan (IRP): A plan that IOUs 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.

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.

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.

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.

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.

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

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.

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

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 in such a way as to provide reliable transmission of electrical power from multiple generators to multiple load centers.

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, just, 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 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. This is also the use of a utility's transmission and distribution facilities on a common-carrier basis at cost-based rates.

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.

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.

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. It must meet certain ownership, operating and efficiency criteria established by FERC.

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. (*See wheeling*)

Regulatory compact: A traditional covenant between customers in a state and investor-owned utilities (IOUs) in exchange for providing service to all customers in a defined service territory. IOU is given a service area monopoly on service and allowed to earn a limited return set by state regulators. The commission enforces the terms of the regulatory compact. (*See 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 resource: An energy source that is continuously or cyclically renewed by nature, including solar, wind, hydroelectric, geothermal, biomass or similar sources of energy.

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. This does not include consumers residing in temporary accommodations, such as hotels, camps, lodges and clubs.

Retail: Sales covering electrical energy supplied for 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.

Rural electric cooperative: *See Cooperative electric utility.*

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

Smart grid: Smart grid is a concept that is currently undeveloped. Smart grids 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. Consumers will have the choice and flexibility to manage electrical use while minimizing bills. Smart grid could be described 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.

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.

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 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.

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.

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.