

Treasure Valley Electric Plan – Community Advisory Committee

Power Plant Briefing Paper

What is a Power Plant and why are they necessary?

A power plant is used to generate electrical power. It uses some form of energy, such as falling water, coal or natural gas, to turn a generator that makes electricity.

Some power plants do not use a generator to make electricity. For example, a solar cell can directly convert the energy from the sun into electrical energy without needing to turn a generator. However, at the present time these power plants are comparatively small and expensive.

What are the different types of power plants and how do they operate?

- Hydro – A hydroelectric plant converts falling or flowing water into electrical energy. The falling water is used to turn a generator, thus making electricity.
- Coal – A coal-fired power plant uses the energy released from burning coal to make steam that is used to turn an electrical generator
- Natural Gas – In general, there are three types of natural gas fired power plants:
 1. Natural Gas/Steam – A natural gas/steam power plant uses the energy released from burning natural gas to make steam that is used to turn an electrical generator. Very similar to a coal-fired power plant.
 2. Simple Cycle Combustion Turbine – A simple cycle combustion turbine power plant is similar technology to a jet engine used on an airliner. On an airliner, the turbine engine is used to create thrust to push the airliner through the sky. For electrical generation, that thrust is used to rotate an electrical generator.
 3. Combined Cycle Combustion Turbine – A combined cycle combustion turbine power plant takes the excess heat from a simple cycle combustion turbine power plant and uses it to create steam that then turns another electrical generator. This type of power plant can be very efficient.
- Wind – A wind turbine uses the energy of wind blowing across its blades to turn a generator
- Nuclear – A nuclear power plant operates similarly to a coal or natural gas-fired power plant except that it uses the heat generated by nuclear fission to make steam which is used to turn a turbine generator
- Diesel – A diesel power plant uses an internal combustion diesel fueled engine to turn an electrical generator
- Geothermal – A geothermal power plant uses the energy contained in steam or hot water heated by the earth to turn a steam turbine generator

How many and what types of power plants does Idaho Power own and operate?

Idaho Power owns and operates hydroelectric, simple cycle combustion turbine and diesel generating plants. It has interests in three coal-fired power plants operated by other owners.

The breakdown is as follows:

- 17 hydroelectric plants with a total capacity of over 1,988,000 kW. Not all the plants can operate at their maximum capacity at the same time. There are many factors that control how much a hydroelectric plant can generate at one time. The level of the water in the reservoir and the level of water in downstream reservoirs can limit the output.
- Three coal-fired plants with a total capacity of over 1,022,000 kW.
- Two combustion turbine plants with a total capacity of 260,000 kW. These two plants are used for peaking purposes, meaning they primarily generate during the summer when system loads are highest and the cost of power on the market is also high.
- One diesel plant with a total capacity of 5,500 kW. This plant is used only for emergency purposes in the Salmon area. Idaho Power did operate these diesels to sell into the market during the summer of 2001 when the market in the entire western United States made them profitable. This was a unique situation. Normally the cost of power from these diesel engines is too high to make them economical for use on the Idaho Power system or to sell into the market.

Does the amount of power these plants generate meet the electrical needs of the Treasure Valley? If not, how are the additional needs met?

If Idaho Power were to assign all the output from these plants to the Treasure Valley, they would meet the valley's electrical needs. However, Idaho Power's generation is built and paid for by rates paid by all Idaho Power customers and the output belongs to the entire system.

During peak periods (summer afternoons and cold winter mornings), this generation is generally not adequate to serve all of Idaho Power's needs. At these times, power must be purchased on the market and shipped in via high voltage transmission lines connected to surrounding utilities.

Idaho Power constantly monitors market prices and transmission availability in determining whether it is better to purchase electricity on the market or to build more generation.

How will Idaho Power continue to meet the needs of the Treasure Valley?

As the valley continues to grow, the need for new generation will also grow, given that Idaho Power's access to the market is constrained by transmission adequacy. Idaho Power already uses most of its transmission capacity during peak periods so it either has to build more transmission or more generation.

Currently, it is generally more cost effective to build new generation than to build more transmission to interconnect with our neighbors. Idaho Power's Integrated Resource Plan (IRP) determines the number of new plants needed. The IRP evaluates load growth vs. supply adequacy on a sliding 10-year basis.

What are the advantages and disadvantages of having a power plant close to end users?

Transmission lines incur energy losses when transmitting power. Idaho Power loses 11 to 12 percent of the energy generated at the Hells Canyon complex before it ever gets to your home. For every 100 MW generated at Hells Canyon, only 88 MW gets down to the end users.

By building the power plant closer to the load, these line losses are greatly reduced.

An argument can be made that the burden of hosting a power plant should be placed on those using the power, not those living in under-populated areas.

Which kind of power plant is the easiest to live with in an urban community?

It depends on individual perspectives. Those who value clean air would be against coal generation located in their community. Those who value natural scenery would be against a large wind farm located on a hillside. Those who value natural river flows would be against large hydro facilities on rivers.

If generation is located in the Treasure Valley, how many transmission lines can Idaho Power avoid building?

500 kV

The 500 kV lines are used to deliver energy from generators to load, so if the generators are co-located with the load, the lines are unnecessary.

Locating generation within the Treasure Valley can reduce the number of 500 kV lines coming to the valley. However, it would take significant generation located in the Treasure Valley to completely do away with the need for an individual 500 kV transmission line.

345 kV

Like the 500 kV lines, locating generation within the Treasure Valley can reduce the

number of 345 kV lines, if those lines are used to deliver energy from generators to load.

If the lines are used as part of an intra-valley transmission network, locally sited generation would do very little to reduce the need for the transmission.

230 kV

Locally sited generation will not reduce the number of 230 kV transmission lines in the Treasure Valley. 230 kV transmission will likely be part of an intra-valley transmission network that will be used to delivery energy between hub substations.

This transmission will be needed whether the valley has locally sited generation or not.

How would Idaho Power’s system reliability be influenced by generation in the Treasure Valley?

Generally, reliability would be improved if generation were located in the Treasure Valley.

Some of the power outages experienced by customers in the Treasure Valley are caused by electrical faults on the long, high-voltage transmission lines that are used to deliver energy from distant generation to the Treasure Valley.

If you reduce the length of these lines, you reduce the likelihood of damage occurring to the lines.

What type(s) of generation are possible in the Treasure Valley?

Natural gas, coal and nuclear power plants are all “possible” in the Treasure Valley. However, the only type of power plant that could likely find public and regulatory acceptance would be a natural gas-fired power plant.

A combined-cycle combustion turbine power plant could be sited for base-load needs and a simple cycle combustion turbine power plant could be sited for peaking needs.

What are the advantages of generation in the Treasure Valley?

- Efficiency – Line losses are fewer with shorter transmission
- Save money – Transmission costs are reduced if generation is large enough
- Economic advantage – Tax base, employment
- Reliability – If enough generation is located in the Treasure Valley, reliability would improve

What are the disadvantages of generation in the Treasure Valley?

- Visual impact
- Environmental fears – air and water quality, noise
- Siting difficulty – lack of available land

Are power plants safe? What are the environmental advantages and disadvantages of each?

There are dangers inherent with anything that generates electricity, namely electrical shock. The following are other possible safety concerns:

- Hydro – The primary danger from a hydroelectric plant is the varying flows that exit the turbines. A boater or fisherman downstream from a dam must be aware that outputs from hydro-turbines can vary depending on electrical load and water levels will vary in response.

Hydroelectric power is a renewable resource. While it has a high capital or initial cost, the cost of the energy from the water is very low. Large hydro projects are seen by many environmentalists as endangering the lives of the fish that rely on rivers to spawn in. Others see the hydro projects as degrading to riverbanks because they change the natural flow of the river.

- Coal – The main negative aspect of a coal-fired power plant is the air pollution it creates when burning the coal. These plants emit carbon monoxide, carbon dioxide, sulfur oxides and nitrogen oxides. In addition, many coal plants emit varying levels of mercury. Idaho Power is regulated for sulfur oxides.
- Diesel – Carbon monoxide, sulfur dioxide, nitrogen oxide and particulates are the most recognized form of pollution from diesel engines.
- Gas – Natural gas fired power plants emit carbon dioxide and nitrogen oxides. Pollution control equipment acts to greatly limit the amounts of these pollutants emitted to the air.
- Wind – There are no known dangers to people created by wind turbine generation facilities. Some complain about visual and audible nuisance.

The most recognized environmental disadvantage to wind power is its detrimental effect on birds, particularly raptors.

- Nuclear – The most recognized direct danger from a nuclear power plant is nuclear meltdown. If a nuclear power plant loses the cooling necessary to control the nuclear reaction, the fuel can become hot enough to melt through its containment and can create a large steam explosion with resulting nuclear contamination. Nuclear power plants are designed with this in mind and have multiple safeguards against it. Another danger is radiation from the nuclear waste generated by the plant.

Are there other options?

Yes, solar power and fuel cells.

Solar – There are two methods for generating electricity from the sun:

1. Solar thermal – This form of solar power uses large solar concentrators (mirrors) to focus the sun's energy on a liquid medium such as water to create steam to turn

a turbine generator

2. Photovoltaic – This form of solar power directly converts the sun’s energy to electricity without the need for making steam to turn a turbine

Fuel Cells – A fuel cell is an electro-chemical device that converts hydrogen directly into electricity without the need for making steam to turn a turbine. There are many different types of fuel cells but in the end they all work similar to a battery that is continually recharged.

Because of the extreme costs associated with both solar and fuel cells, Idaho Power doesn’t use either of these types of resources for generating electricity at present. Idaho Power continuously monitors various technologies to determine if they make economic sense to include in our generation mix.

What is the cost difference to build and maintain power plants?

- Hydro – Major hydro facilities are very expensive to build. However, they have the advantage of low operating costs because their fuel is essentially free. Significant additional expenses are attached to a hydro facility due to the requirements to perform environmental remediation and provide recreational opportunities as part of our licensing agreements with federal and state governments.
- Coal – Like hydro, a coal plant is expensive to build and their main advantage is in the cost of the fuel. Coal is a low-cost alternative over the long run.
- Gas – Natural gas fired combustion turbine power plants cost the least to build. Their major disadvantage is the cost of the fuel. Natural gas prices are high and extremely volatile so this type of power plant is used only for peaking on the Idaho Power system.
- Wind – Wind turbine power plants are currently expensive to build, though their costs are coming down. Their operating costs are low because their energy is free.
- Nuclear – Nuclear power plants are by far the most expensive to build. Their advantage is the cost of fuel is low, so long-term costs can be lower than most. There are significant additional expenses associated with nuclear power plants for waste remediation.

Which lasts longest before needing replacement?

Hydro power plants tend to last longer than any other type of power plant due to the extreme engineering that must go into damming a river. During the life of a hydro power plant, the generators will be upgraded and even replaced once or twice.

Wind turbines seem to last the shortest amount of time, though that is changing as technology improves.

What is Idaho Power's portfolio of long-term energy plans according to the Integrated Resource Plan?

The portfolio selected in the 2004 Integrated Resource Plan will increase Idaho Power's power supply capacity by almost 940 MW over the next 10 years:

- 76 MW Demand Response Programs (DSM)
- 48 MW Energy Efficiency Programs (DSM)
- 350 MW Wind-Powered Generation
- 100 MW Geothermal-Powered Generation
- 48 MW Combined Heat and Power at Customer Facilities
- 88 MW Simple-Cycle Natural Gas Fired Combustion Turbines
- 62 MW Combustion Turbine, Distributed Generation or Market Purchases
- 500 MW Coal-Fired Generation

Is Idaho Power considering owning a nuclear power plant?

No. Idaho Power's Integrated Resource Plan does not call for building a nuclear power plant at this time. Every two years, this is reconsidered.

Does Idaho Power plan to build new coal or gas plants in the near future?

Yes. Idaho Power's 2004 Integrated Resource Plan calls for the construction of a new coal-fired power plant and additional combustion turbine peakers within the next 10 years.

What is Idaho Power's long term plans to produce "green" power? Is hydro "green"?

In Idaho Power's 2004 Integrated Resource Plan, the chosen generation portfolio to be built in the next 10 years includes quite a bit of renewable energy:

- 350 MW of wind
- 100 MW of geothermal
- 48 MW of combined heat and power at customer facilities

Idaho Power believes that its hydro projects are all renewable energy sources and are thus "green" power. Idaho Power undertakes many activities to mitigate any environmental damage these projects might cause.

How much power does Idaho Power purchase from outside sources?

The quantity of power Idaho Power purchases on the market depends on the season and climate. In 2004, the sixth consecutive year of drought, Idaho Power purchased 18

percent of its energy needs on the market.

During non-drought years, Idaho Power's hydroelectric system can produce more energy and thus market purchases will be lower.

**What is Idaho Power's agreement with Fossil Gulch to purchase its power?
What is the typical MW output of Fossil Gulch?**

Fossil Gulch is designated as a Qualified Facility under the Public Utility Regulatory Policy Act (PURPA) and Idaho Power is required to purchase its output at rates determined by the Idaho Public Utilities Commission.

If Fossil Gulch is generating power and transmission is available (not out of commission due to repair), Idaho Power must take its output.

Fossil Gulch has a maximum output of a little over 10 MW. Depending on wind speed this can vary all the way to zero. At this point, not enough operating data is available to determine what an average output would be.

Why didn't Idaho Power develop the Lucky Peak power plant?

At the time Lucky Peak was developed, Idaho Power had a surplus energy supply and did not need the capacity. This project was developed by local irrigation districts and is operated by Seattle City Light. Idaho Power often purchases this power during the summer.

Does Idaho Power use the power generated at Anderson Ranch dam?

Anderson Ranch dam belongs to the federal government. Bonneville Power Administration customers in southern Idaho generally use the power produced.

If this power were put on the market, Idaho Power would purchase it if the price were low enough to either offset Idaho Power's generating costs or if it were cheaper than market prices during times Idaho Power was purchasing from the market.