



# RENEWABLE ENERGY IN THE PACIFIC NORTHWEST

Renewable energy comes from natural sources that are continually and sustainably replenished such as the sun, the flow of water, or other natural processes. By utilizing multiple resources, we can increase our renewable energy options, lessen our dependence on fossil fuels, and achieve even greater reductions in greenhouse gas emissions, while utilizing local resources, reducing air pollution, and building strong rural economies.



Washington leads the nation in electricity generation from renewable resources, mostly hydropower. The Grand Coulee Dam on the Columbia River is the largest hydropower producer in the United States and provides abundant and inexpensive electricity to the region.



More than two-thirds of the net electricity generated in Oregon is produced from renewable resources, including hydropower. Oregon has the capacity to produce 3,150 megawatts of electricity from wind farms, enough to power 695,000 homes.



In Idaho, solar technologies are used to generate electricity at remote homes, farms, and other facilities where extending power lines can be cost prohibitive. Wind energy production is growing in Idaho. In 2104, wind provided 18% of the state's net energy generation.

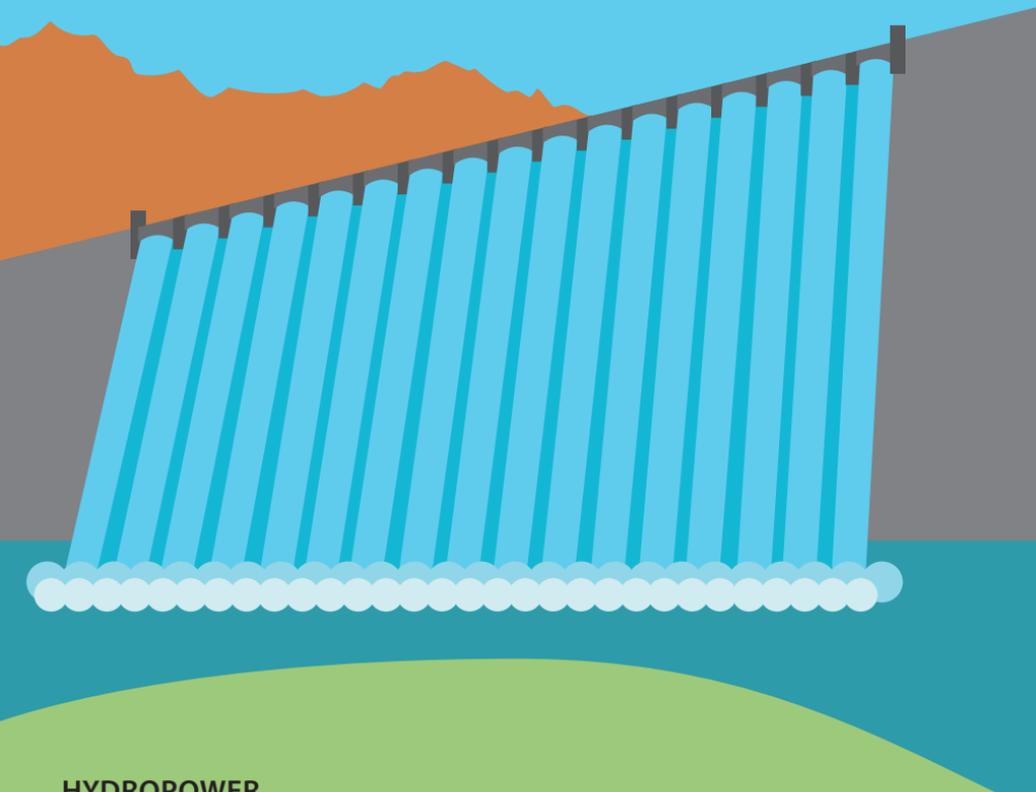


\* Percentage of energy consumed from renewable sources out of total energy consumed from all sources such as electricity, transportation fuels, natural gas, biomass, and others.



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## HYDROPOWER

Hydroelectric power is energy that is captured from the flow of water. Hydroelectric facilities use water to power machinery or generate electricity. In the Pacific Northwest, most of our electricity is created at dams placed in the path of rivers.

To create energy, the water stored behind the dam will flow through an intake to turn the blades of a turbine, which spins a generator to produce electricity. The generated electricity is then transferred over electric lines to power homes, factories, and businesses.

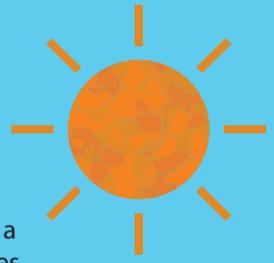
## IS HYDROPOWER RENEWABLE?

While water is renewable, rivers themselves are not, which means hydropower does not always fit into the renewable energy category. Water is renewable because it is continually replenished through the water cycle. Rivers are not renewable because once a river is dammed its course and its ecosystems are disrupted, which can have unintended environmental consequences.

There are different opinions on the renewability of hydropower in Washington and Oregon where renewable electricity use is mandated through each state's Renewable Portfolio Standard (RPS). Washington's RPS excludes new and existing hydropower projects where water is diverted or impounded. Oregon considers "small hydro" projects to be renewable. Both states count efficiency upgrades at existing facilities towards RPS goals. Another reason these western states exclude hydropower from RPS mandates is to encourage diversity in their renewable energy mix.

## SOLAR

Energy from the sun can be captured and used to generate electricity or heat. Solar energy is generated using two different types of equipment. Photovoltaic (PV) technologies will directly convert solar energy into electricity. In contrast, solar thermal units generate electricity by heating water to produce steam that turns a turbine to generate electricity. Solar thermal technologies are also used to directly heat buildings and water.



## WIND ENERGY

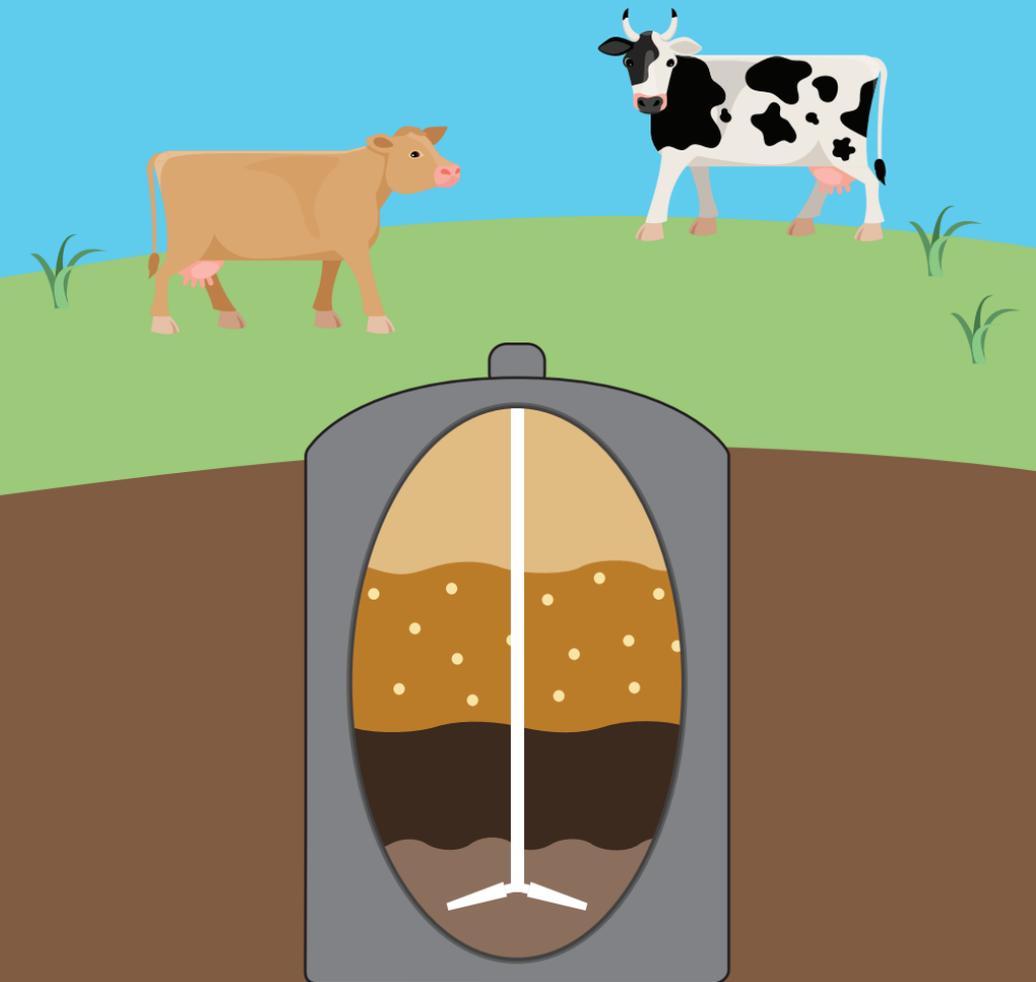
Wind turbines convert the energy of wind to electricity. Wind turbines harness wind energy with two or three propeller-like blades that are mounted on a tower to take advantage of faster, less turbulent wind that is found several hundred feet above the ground. The blades spin a rotor to generate electricity.

A single, small-wind system can produce enough electricity to power a home, farm, or small business. Larger systems of multiple wind turbines, called a wind farm, contribute energy to electric utilities through a main power grid.

## ANAEROBIC DIGESTION

Anaerobic digestion is a form of biomass energy that produces renewable energy when microorganisms convert organic matter, such as animal manure, food processing wastes, and sewage sludge, into methane-rich biogas.

The biogas is collected and used onsite to generate heat and power or it is processed into renewable natural gas and sold. The remaining solids can be reused as animal bedding, and the remaining liquids can be used a nutrient-rich fertilizer product.





## **BIOMASS ENERGY**

Biomass is organic material that comes from plants and animals including wood, agricultural crops, and organic waste products. Biomass is essentially stored solar energy that can be converted to electricity, fuel, or heat. For example, biomass energy is used when we burn wood to heat our homes or convert used cooking oil into biodiesel to fuel our trucks and tractors.

## **BIOFUELS**

Biofuels, such as ethanol and biodiesel, are available in the PNW as a transportation fuel. Ethanol and biodiesel are made from biomass and are typically blended with gasoline and diesel fuels at low blends. Most of the ethanol available in the PNW is produced in Midwestern states from corn or at PNW facilities that also use Midwest-grown corn as their primary feedstock. Other facilities in the PNW produce biodiesel using oil from canola harvested in the PNW and Canada or from used cooking oil collected from restaurants.

# PNW ENERGY FOR THE FUTURE

## GEOTHERMAL POWER

Utility-scale geothermal power is harnessed by capturing heat radiating up from within the Earth. The heat warms rocks and the water trapped within the rocks. Wells drilled into the earth draw out the hot water, which can be used directly to heat homes and buildings. In addition, steam produced from the very hot water can drive turbines to generate electricity. Although a few geothermal facilities are operational in the PNW, further explorations and research into the potential of geothermal sources is continuing.

## WAVE AND TIDAL ENERGY

The power of waves and tides can be captured by buoys, turbines, and other technologies and converted into renewable electric power. The development of ocean energy technologies is still in the demonstration stage, but there is potential for it to become a leading source of renewable energy in the future.



## HYDROGEN FUEL CELLS

Hydrogen fuel cells produce electricity by combining hydrogen and oxygen atoms. This combination results in an electrical current. Hydrogen fuel cells are currently used as a backup energy supply and the technology is being researched as a means to power our transportation, including cars, trucks, buses, and marine vessels.

## DROP-IN BIOFUELS

Drop-in fuels include renewable gasoline, diesel, and jet fuel that are chemically identical to fossil fuels currently in use. Cellulosic drop-in biofuels are made from the inedible parts of plant material. In the Pacific Northwest, researchers are investigating poplar trees, grown as a dedicated energy crop, and forestry waste, such as the treetops and branches left behind from logging operations, as feedstocks for these renewable fuels.