2020 BIENNIAL ENERGY REPORT

Submitted to the

OREGON LEGISLATURE

by the

OREGON DEPARTMENT OF ENERGY

November 2020

OREGON DEPARTMENT OF ENERGY

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Published November 1, 2020

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Executive Summary

In 2017, the Oregon Department of Energy, recognizing that the energy world has changed dramatically since the 1970s, introduced House Bill 2343 to the Legislature. The bill charged the department with developing a new Biennial Energy Report to inform local, state, regional, and federal energy policy development and energy planning and investments. The report – based on analysis of data and information collected and compiled by the Oregon Department of Energy – provides a comprehensive review of energy resources, policies, trends, and forecasts, and what they mean for Oregon.

What You Can Expect to See in the 2020 Biennial Energy Report

The 2020 report takes a different approach than the inaugural 2018 Biennial Energy Report, which provided deep policy dives on a handful of important energy topics — including climate change, renewable energy, transportation, energy resilience, energy efficiency, and consumer protection. This 2020 report follows recommendations by energy stakeholders to provide shorter briefs on a wider array of energy topics — from energy in the agriculture sector to what's next for alternative fuels to the effects of the COVID-19 pandemic on energy, and more.

Many sections show that Oregon is on a path toward transitioning to a cleaner, low carbon future. Data and examples included in the report illustrate sustained investments in energy efficiency, affordability, renewable energy, and resource conservation. These efforts have positioned Oregon to successfully tackle today's energy challenges, which are driven by growing adoption from consumers for cleaner energy, economic innovation, and emerging technologies.

The report begins by looking at **Energy by the Numbers**—detailed information on Oregon's overall and sector-based energy use, energy production and generation, energy expenditures, and the strategies Oregon has employed to meet growing energy needs. New in 2020 is an energy flow diagram, illustrating energy production and imports to eventual end-use.

Next up is a **Timeline of Energy History in Oregon,** starting with the Missoula Floods that formed our state and ending with 2020's latest events — including the closure of Oregon's only coal power plant and new actions to tackle climate change.

The **Energy 101** section aims to help readers understand the first part of the energy story: how energy is produced, used, and transformed. Information is meant to provide a foundation for those new to energy and those who are already steeped in the sector.

The **Resource and Technology Reviews** section highlights 23 energy resources and technologies — they cover the spectrum of tradition to innovative, from renewable resources to emerging technologies like microgrids and power-to-gas. The topics covered are prevalent in Oregon or of interest to ODOE's various stakeholders. Many of the technologies offer opportunities to invest in Oregon's economy by creating energy-related jobs, including those focused on restoring our energy systems when disruptions occur.

The final section includes more detailed **Policy Briefs** that cover decarbonization, the transition of the electric grid, innovation in the natural gas system, cleaner transportation options, and the built environment and Oregon's communities. The primary purpose of the report — and these policy briefs — is to inform energy policy development, energy planning and energy investments, and to identify opportunities to further Oregon's energy policies.

The Biennial Energy Report wraps up with a new summary of the process used to develop the report and **closing thoughts** on what's next. ODOE will kick off discussions in 2021 and reach out to hear new voices on recommendations for energy policy in Oregon over the next two years — and beyond.

The Biennial Energy Report may be found in its entirety at

https://energyinfo.oregon.gov/ber

or

www.oregon.gov/energy/Data-and-Reports/Pages/Reports-to-the-Legislature.aspx

The Department of Energy welcomes your comments and questions. Please contact our agency at askenergy@oregon.gov.

TECHNOLOGY REVIEWS

Rapid advancements in technology have responded to and pioneered changes in our state and across the world.

Often these resources and technologies are critical to the function of our society while also helping us work better and faster. Sometimes they also enable us to adapt — the onset of a global pandemic in 2020 has now made virtual meetings commonplace and changed how Oregonians conduct business. The resources and technologies presented in this section cover the spectrum of traditional to innovative, and demonstrate the breadth of technology that is integral to the production and management of our energy system.

Electricity generation technologies, such as wind and solar, are becoming more widely used and in many cases are now lower cost than more traditional technologies. And some newer technologies may be just around the corner while researchers, scientists, and businesses work to make them commercially viable. Tomorrow's energy resources may include electrolyzers to generate hydrogen fuel, offshore wind turbines, fuel cell electric vehicles that run on hydrogen and emit only water, or carbon capture and sequestration technologies that help industries capture and store harmful greenhouse gas emissions.

Automated metering infrastructure enables utilities to evaluate real-time data on customer electricity use so that they can optimize their systems and provide better value to their customers. Electric vehicles, battery storage, and smart appliances create opportunities for electric utilities to communicate with devices in homes and businesses to better balance new electricity loads while avoiding investments in expensive electricity generation. In some areas of Oregon, utilities are already communicating with customers and their smart devices to help better manage the grid.

There are trade-offs with these technologies. Some operate without emitting greenhouse gases or other air pollutants, but there are often emissions and environmental impacts associated with building and transporting them. For example, how do we plan for and manage the waste streams of new technologies when they reach the end of their useful life? Technologies like smart thermostats and rooftop solar can reduce energy costs or the effects of energy use for consumers, but not all Oregonians have access to these technologies — a significant equity issue that requires deep partnership with currently and historically underrepresented communities.

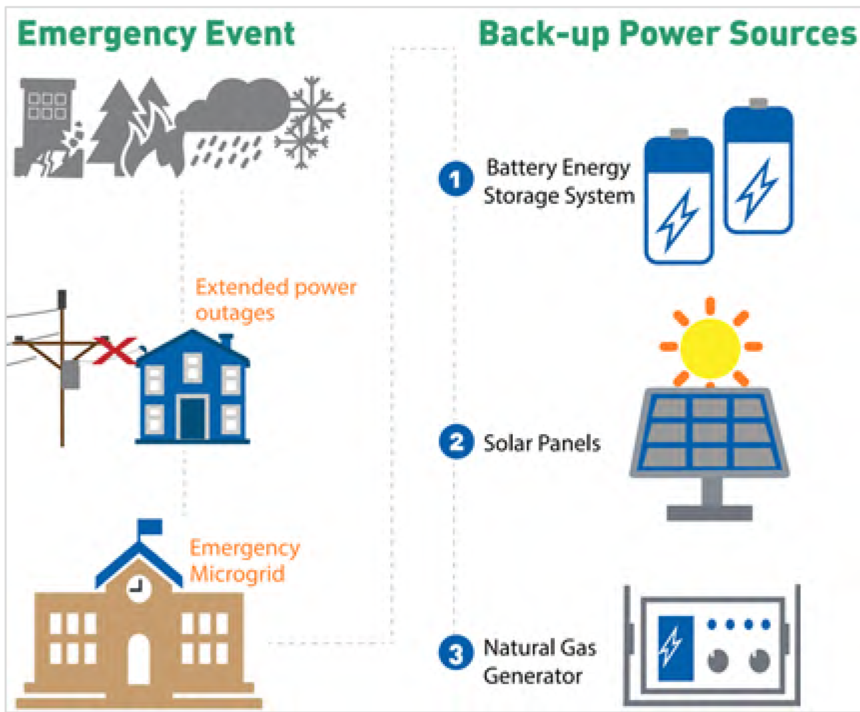
The technologies examined in the following pages are those that are prevalent in Oregon and of interest to stakeholders that ODOE heard from when putting together this report. Many of these technologies place Oregon and its communities on the forefront of a cleaner, more sustainable future. They help Oregon meet its climate and energy goals by enabling cleaner and more efficient fuels and resources. They offer opportunities to invest in Oregon's economy by creating energy-related jobs to maintain our energy system and develop new projects. They can make us more resilient by enabling us to maintain or restore our energy systems when disruptions occur. And beyond these opportunities and benefits — they are just so cool.

Technology Review: Resilient Microgrids

A microgrid is a group of interconnected end-use loads (ranging in size from a single home or building to an entire campus or even a city) and distributed energy resources (DERs) that act as a single controllable entity with respect to the larger electric grid. The key distinguishing characteristic of a microgrid is its ability to connect and disconnect from that larger grid so that it can operate either as a grid-connected resource or in island-mode to deliver power only to local loads.[1]

A wide range of energy technologies can be used to power a microgrid, and additional benefits can often be achieved by combining complementary technologies (e.g., pairing solar with an existing generator to prolong a limited supply of stored on-site fuel). The most common systems incorporate diesel or propane generators, though increasingly solar and battery storage systems are used.[2] Installation costs for these systems can vary widely depending on overall size, technologies used, the efficiency of the building(s) involved, and whether the system is designed to power all regular loads or only the most critical loads when operating in island-mode.[3] Figure 1 is adapted from a process flow diagram of a microgrid deployed by the Eugene Water and Electric Board to provide back-up power and to power a groundwater well during an emergency event.

Figure 1: Microgrid Process Flow (adapted from EWEB)[4]



Trends and Potential in Oregon

Microgrids in Oregon are employed in a wide range of situations today and most often rely on diesel or propane generators to provide emergency back-up power in case of a grid outage. These types of systems are especially common with certain types of commercial and industrial customers. Meanwhile, rapid declines in the cost for solar and battery storage systems have led to an emerging interest in the deployment of microgrid systems based on these technologies, particularly at facilities that provide critical lifeline services to communities. Notable recent deployments in the state include EWEB's project at Howard Elementary School in Eugene[5] and PGE's project at the Beaverton Public Safety Center.[6] [7] These types of microgrid projects can provide carbon-free power to support the continued delivery of critical lifeline services while avoiding the need to rely on imported liquid fuels or emit carbon.

Learn more about energy storage in fellow Technology Reviews.

Opportunities

Historically, many back-up generators have been installed by commercial and industrial customers that are uniquely sensitive to *any* potential disruption of power supply from the grid. Hospitals are one of the more common examples, where a routine two-hour grid outage caused by a severe storm could have significant adverse consequences for high-risk patients or sensitive medical equipment. Meanwhile, many advanced industrial processes (e.g., semiconductor manufacturing) are also susceptible to substantial adverse consequences resulting from even a minor grid outage. The following have been identified as the primary key benefits that microgrids can deliver:

- **Increased Power Reliability:** The traditional use for microgrids, usually utilizing diesel or propane generators, has been to provide increased power reliability for certain customers.[8]
- **Community Resilience:** Solar plus storage microgrid systems can provide significant community resilience benefits by supplying ongoing local power to critical community lifeline services during long-duration grid outages caused by high-impact, low-frequency events such as major seismic events, catastrophic wildfires, or cyberattacks.[i]
- **Local Clean Energy:** Solar-based microgrid systems can also help commercial and industrial customers[9] or communities to meet policy objectives around local renewable energy targets, carbon reductions, or green jobs.

Technology Barriers

While propane and diesel generator-based microgrids have been in use for many decades, and solar based systems have emerged in recent years, there remain significant barriers to the deployment of microgrid systems to achieve the benefits identified above. The following are the primary barriers to the deployment of microgrid systems:

- **Grid Reliability:** Most utility customers already enjoy an incredibly high level of power reliability from standard utility service (typically reliable power is provided 99.99 percent of the time) at a comparatively low cost, and therefore the added reliability provided by microgrids may not be necessary or warrant the added cost in many cases.[10]
- **Cost:** Depending on the size of the microgrid system needed, up-front capital costs can still present a major barrier to deployment even as solar and storage costs decline. The National Renewable Energy Laboratory estimates the range of costs to be $2 to $4 million per megawatt of installed capacity for a typical industrial or community microgrid system. Actual costs vary widely depending on the size of a project (from several kW to tens of MW) and the type(s) of technology included (diesel generators, solar, battery storage, etc.).[11]
- **Valuation Framework:** There is a lack of a standardized valuation framework (e.g., through market mechanisms or a standard tariff or contract) to value the benefits that microgrids can provide to maintain grid stability, shift electricity usage, and deliver community resilience.[12] [13]

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[i] For a more in-depth exploration of community energy resilience and the contribution that microgrids can provide, see the Oregon Guidebook for Local Energy Resilience.

Valuation of these benefits could help to offset costs.

Non-Energy Implications

Microgrids can support continued delivery of critical public services following a major event like an earthquake.

Microgrids can have significant non-energy implications for Oregonians. For example, these systems can deliver community resilience benefits, as discussed above, to support system redundancy and the continued delivery of critical public services following a major event like an earthquake. These systems can also have environmental implications, including avoiding land use impacts by locating renewables on or in existing structures instead of on undisturbed land, or avoiding constituent air pollutants by displacing fossil generation.

The deployment of microgrid projects can require significant up-front capital investments for generators, solar panels, battery systems, and microgrid controllers. As with many other technology-driven advancements in the energy sector, these up-front costs can result in inequitable access to the benefits provided by these systems.

Military Contributions to Energy Resilience

The Department of Defense must ensure energy resilience that supports mission assurance on our military installations. On March 16, 2016, DOD issued an energy resilience policy to address the risk of energy disruptions on military installations, and to require remedial actions to remove unacceptable energy resilience risks.[14] The policy requires installation commanders and mission operators to plan and have the capability to ensure available, reliable, and quality power to continuously accomplish DOD missions from military installations and facilities.

The Oregon Military Department (OMD) is developing a statewide energy resiliency plan as directed by Department of Defense Instruction 4170.11, Installation Energy Management. OMD established mission-based priorities for energy and water sustainability and resilience at the outset of the program, and desired a streamlined and cost-effective approach to sustainability and resilience. OMD will closely coordinate its sustainability and resilience initiatives, streamlining multiple program requirements to gain efficiency. The department will systematically improve sustainability and resilience at its facilities and installations located throughout the state. The plan focuses on elements in five performance areas: energy, water, solid waste, hazardous waste, and other sustainability practices.

An energy resiliency plan has been written for Camp Rilea Training Site and the Clatsop County Emergency Operations Center.

Emergency Operations Center, Building 7022

This Energy Resiliency Plan addresses emergency planning requirements specific to Camp Rilea energy system(s).[15] This plan addresses the electrical system, water system, wastewater system, and natural gas system. This plan satisfies the requirement to develop and maintain a preparedness plan contained in DoD Policy 92-1, "Department of Defense Energy Security Policy."[16] The Camp Rilea ERP has been completed and fulfills nearly all the requirements of the IEWP guidance which was released during the course of the project. Furthermore, in 2012, Camp Rilea became the first military installation to achieve Net Zero water. Today, Camp Rilea continues to implement strategies to achieve Net Zero energy and Net Zero waste.

OMD is now better equipped to achieve its goals by integrating, for example, sustainability and infrastructure resiliency goals and standardizing emergency energy and water equipment and systems for OMD armories. The various measures being implemented will result in significant cost and energy savings.

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