Introduction to Energy Resilience

House Committee on Energy and Environment

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OREGON DEPARTMENT OF ENERGY

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Leading Oregon to a safe, equitable, clean, and sustainable energy future.

Our Mission

The Oregon Department of Energy helps Oregonians make informed decisions and maintain a resilient and affordable energy system. We advance solutions to shape an equitable clean energy transition, protect the environment and public health, and responsibly balance energy needs and impacts for current and future generations.

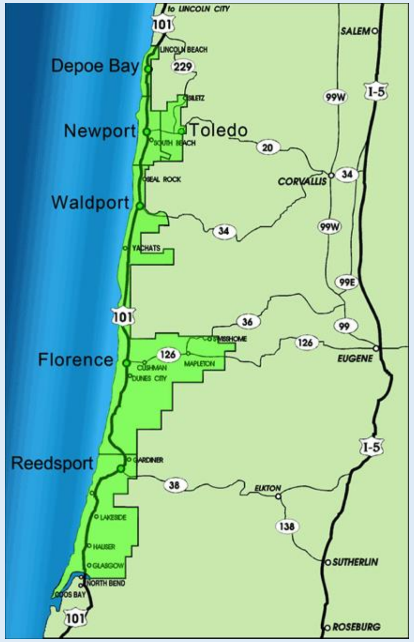
What We Do

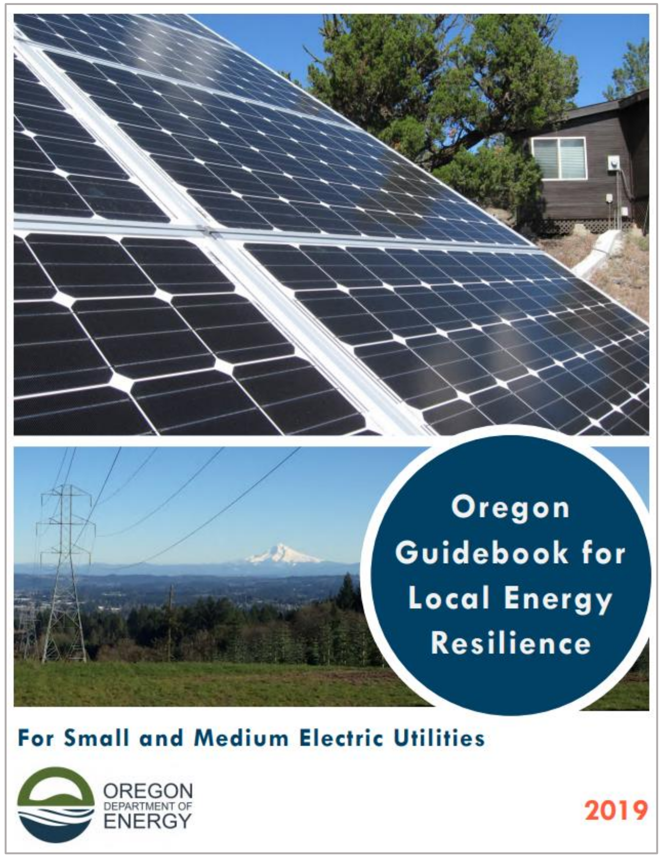
On behalf of Oregonians across the state, the Oregon Department of Energy achieves its mission by providing:

- A Central Repository of Energy Data, Information, and Analysis
- A Venue for Problem-Solving Oregon's Energy Challenges
- Energy Education and Technical Assistance
- Regulation and Oversight
- Energy Programs and Activities

ODOE'S WORK ON RESILIENCE

CENTRAL LINCOLN
A COMMUNITY-OWNED ELECTRIC UTILITY





- Developed as a resource for staff at consumer-owned utilities
- Partnership with Central Lincoln PUD
- Significant stakeholder engagement from 2017-19
- How can we build on growing awareness of threats and changes in energy technology to improve resilience?

Source: Resilience Guidebook

2020 ENERGY REPORT

Goal of the Report

Pursuant to ORS 469.059, provide a comprehensive review of energy resources, policies, trends, and forecasts, and what they mean for Oregon.

Scoping the Report

Shaped by a data-driven process, equity considerations, and input from stakeholders and the public.

Designing the Report

Shorter briefs on a wider variety of energy topics, tear-away style. Themes cross sections for general 101 or technology reviews and deeper-dive policy briefs.

Policy Brief: Evaluating the Resource Adequacy of the Power System

Background

The electric power system is unique, relative to other industry sectors, in that it has little to no capability to store electricity as an end-use fuel. As a result, the electric generation and transmission system must be built to satisfy the largest hourly requirements for electricity—called peak demands—even though consumers use less (oftentimes significantly less) during most hours of the year. This results in an electric generation and delivery system that is, by design, underutilized much of the time, especially when compared to the liquid fuels and natural gas sectors.[1] To evaluate the adequacy of the power system, utilities and grid planners must forecast customer demand for electricity and compare that to the ability of existing resources to meet that demand in real-time. If the capabilities of existing resources might fall short, then new capacity resources will need to be deve… years (or more) depending on the types of resources.

Suggested reading: For more background on Resource Adequacy and why it's important for maintaining the long-term reliability of the power system, see the Energy 101 on Resource Adequacy.

Resource Adequacy (or RA) is the term that grid plan… evaluation of whether adequate generating capacity … over the next several years (typically from one to five …

Resource Adequacy can be evaluated for individual loa… areas within their system. It can also be evaluated for b… regions. In any case, the following are several key techn… of an adequacy evaluation:

Table 1: Resource Adequacy Evaluation: Key Techni…

Demand: How much power will customers require in the future?	○ Energy effic… efficiency sa… ○ Population: … decline? And… ○ Economic g… rate? Will it … ○ Electrificati… adopt electri… furnaces?

[1] Note that **Resource Adequacy** in this context focuses on long-te… future power supplies, whereas the similarly-named **Resource Suf…** the short-term management of existing resources and must be me… time markets. (see Wholesale Electricity Markets Policy Brief for m…

2020 Biennial Energy Report

Energy 101: Resource Adequacy

We consume energy daily: when we charge our phones, flip a light switch, turn up the furnace to heat our homes, or fill up our car at the gas station. In terms of total end-use fuels consumed by Oregonians, 31 percent of the energy comes in the form of liquid transportation fuels (e.g., gasoline and diesel); 42 percent is electricity; and 26 percent is direct use of fuel oil or natural gas (e.g., for home heating or industrial processes).

Storing End-Use Fuels: Gasoline, Natural Gas, and Electricity

Electricity must be generated and delivered across a large transmission and distribution system, just in time to meet consumer demand. This differs significantly from other end-use fuels (and differs from virtually all other commodities and consumer products) that can be produced at an operationally or economically optimal time, and then stored for consumption at a later point in time.

This section refers to "end-use fuels" because of the important differences between primary energy sources and the end-use fuels that consumers actually consume to power their everyday lives. For example, crude oil is a natural resource extracted from the earth. This primary energy source must be refined into gasoline before it can be used in a vehicle. That gasoline, once refined from the original energy source, can be (and is) stored in large volumes as the end-use fuel that Oregonians consume. Similarly, natural gas, once captured and processed for injection into storage tanks or pipelines, is the end-use fuel that Oregonians consume in their homes and businesses.

Electricity is quite different. The primary energy sources used to generate electricity vary considerably – from the gravitational potential energy stored in volumes of water at altitude, to the nuclear potential energy contained within uranium isotopes, to the thermal kinetic energy of solar energy. A wall outlet cannot use that water, uranium, or solar energy until it has been converted into electricity—the end-use fuel.

Think about gasoline. What does it look like? Chances are you are imagining a physical volume of a brownish-colored liquid. You can literally fill a jar on the table in front of you with gasoline or diesel fuel, the two liquid fuels that predominantly power our transportation systems. Liquids are easily stored in large volumes. Think about natural gas or propane. What does it look like? This one is a bit more challenging, but you might imagine filling a balloon in front of you with some volume of natural gas, or a propane tank attached to your grill. Pipeline networks and large tanks can store vast quantities of these gaseous end-use fuels.

Now think about electricity. What does it look like exactly? Where might you store it? You might imagine a standard AA battery, which stores approximately 3 watt-hours (or 0.003 kWh) of energy.[1] The average residential customer in Oregon would need 9,000 AA batteries to power their house for a single day.[i] So while there are ways to store electricity, those storage systems have historically been limited in their ability to efficiently store energy over a long duration or in

[i] In 2018, the average residential customer of Oregon's investor-owned utilities consumed 10,151 kWh of electricity over the course of the entire year, or approximately 27.8 kWh per day. (OPUC Utility Statistics Book)

2020 Biennial Energy Report *Energy 101 – Page 68*

https://energyinfo.oregon.gov/ber

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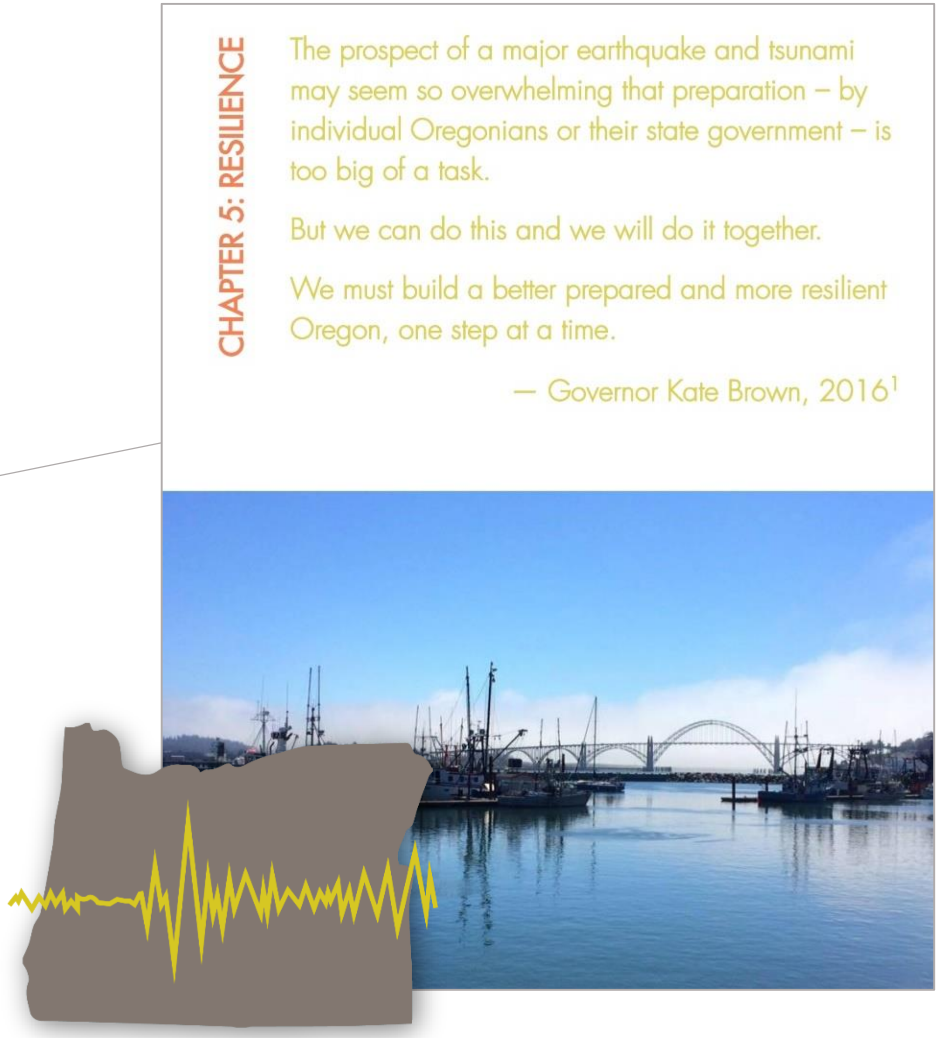
2018 REPORT:
POLICY DEEP DIVE ON RESILIENCE



https://energyinfo.oregon.gov/2018-ber

WHAT IS ENERGY RESILIENCE?

ODOE's Definition: The ability of energy systems, from production through delivery to end-users, to withstand the effects of and restore energy delivery rapidly following non-routine disruptions of severe impact or duration.

- Focused on lower frequency events of high impact
- Emerging field lacking uniform standards or requirements
- Collaboration among energy providers and local communities is key
- No one-size-fits-all solutions, must be responsive to local circumstances
- Prioritize, prioritize, prioritize!

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Source: 2018 Biennial Energy Report, Chapter 5

PRIORITIZE, PRIORITIZE, PRIORITIZE

Community Energy Resilience:

The ability of a specific community to maintain the availability of energy necessary to support the provision of energy-dependent critical public services to the community following non-routine disruptions of severe impact or duration to the state's broader energy systems.

FEMA

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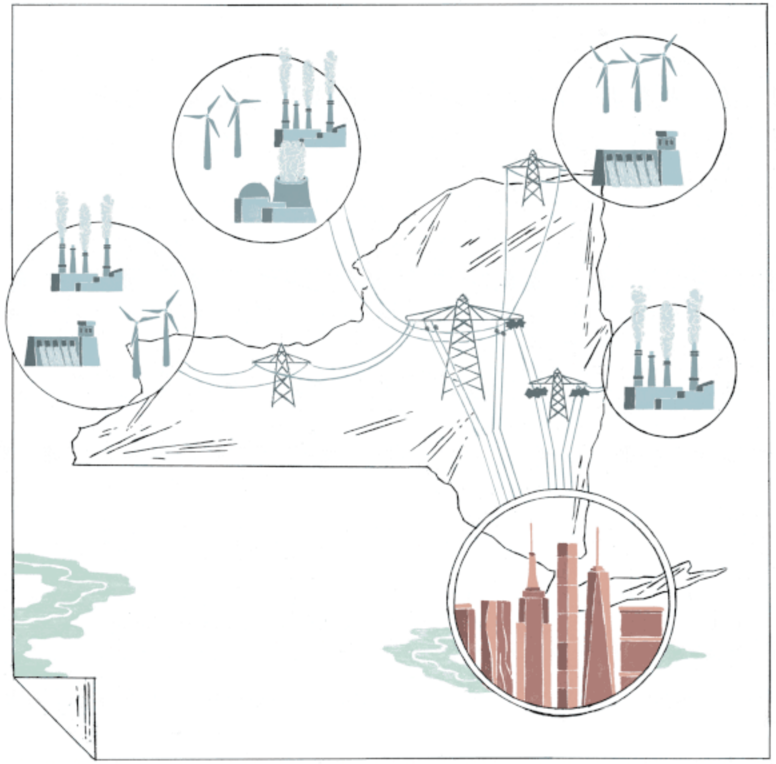
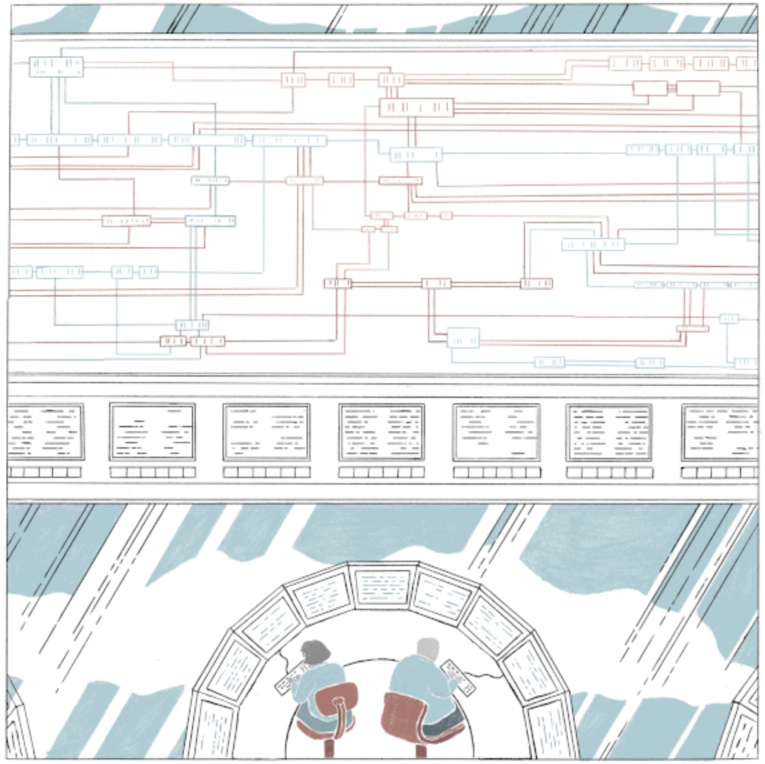
Source: 2018 Biennial Energy Report Chapter 5

WHAT ISN'T ENERGY RESILIENCE?

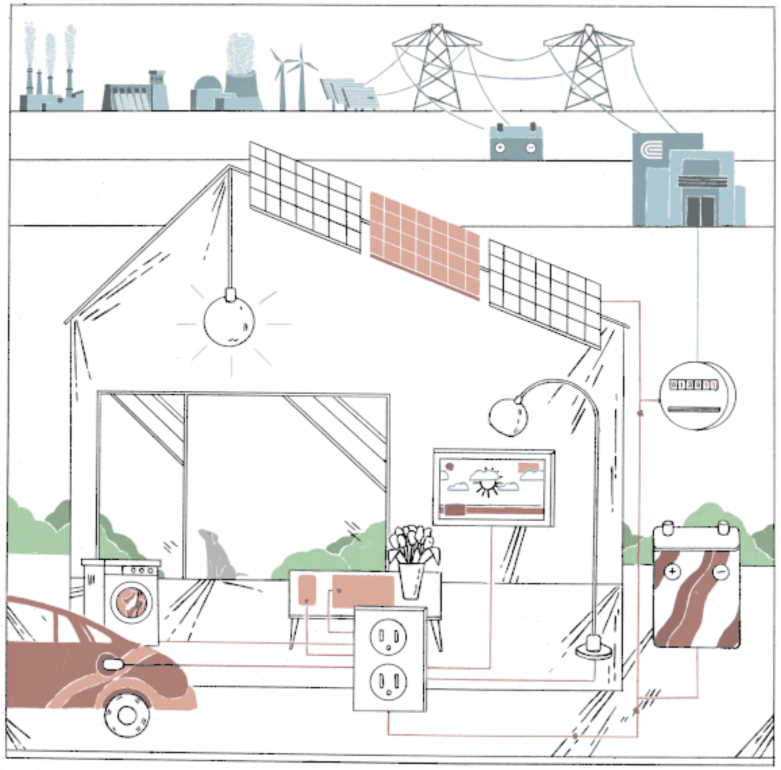
Generated by power plants



Balanced in real-time



And delivered into your home



Source: *How NYC Gets Its Electricity*, NY Times (February 2017)

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WHY ENERGY RESILIENCE?

statesman journal
PART OF THE USA TODAY NETWORK

September 9, 2020 | Wildfires have burned nearly one million acres in Oregon.

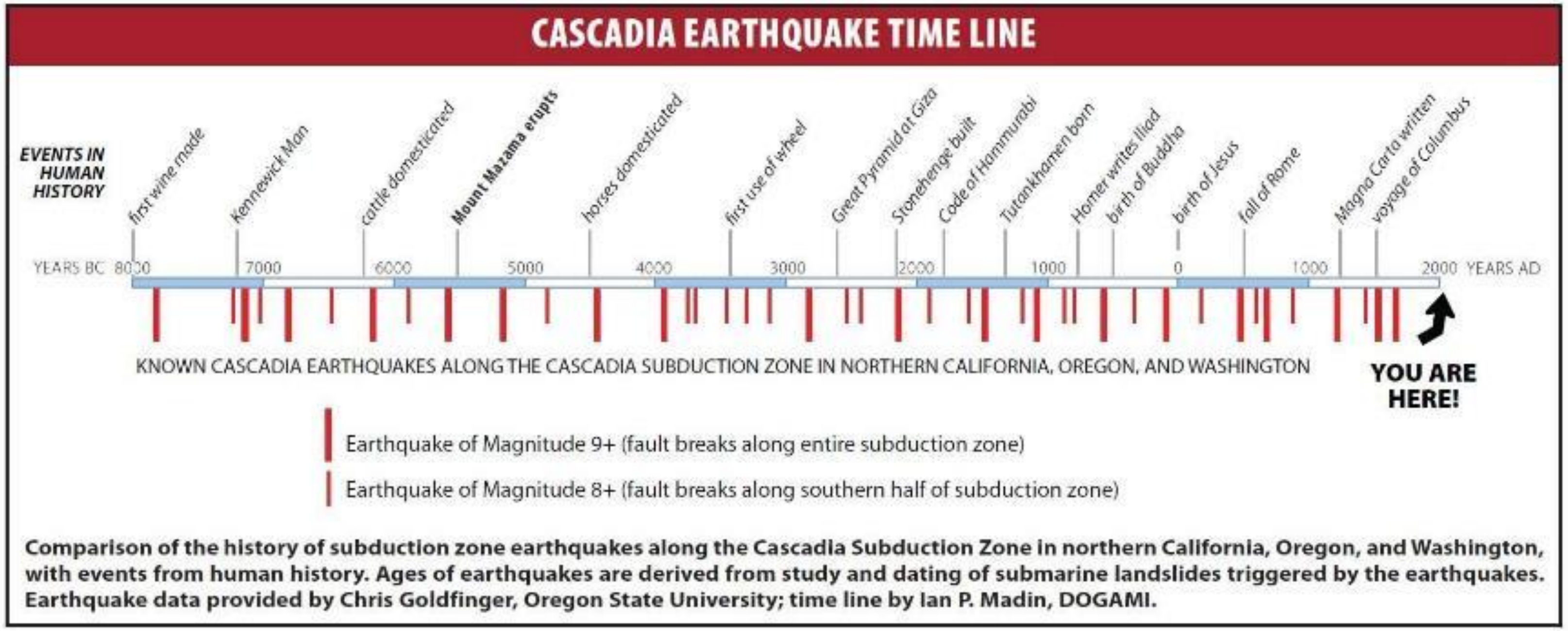
OPB

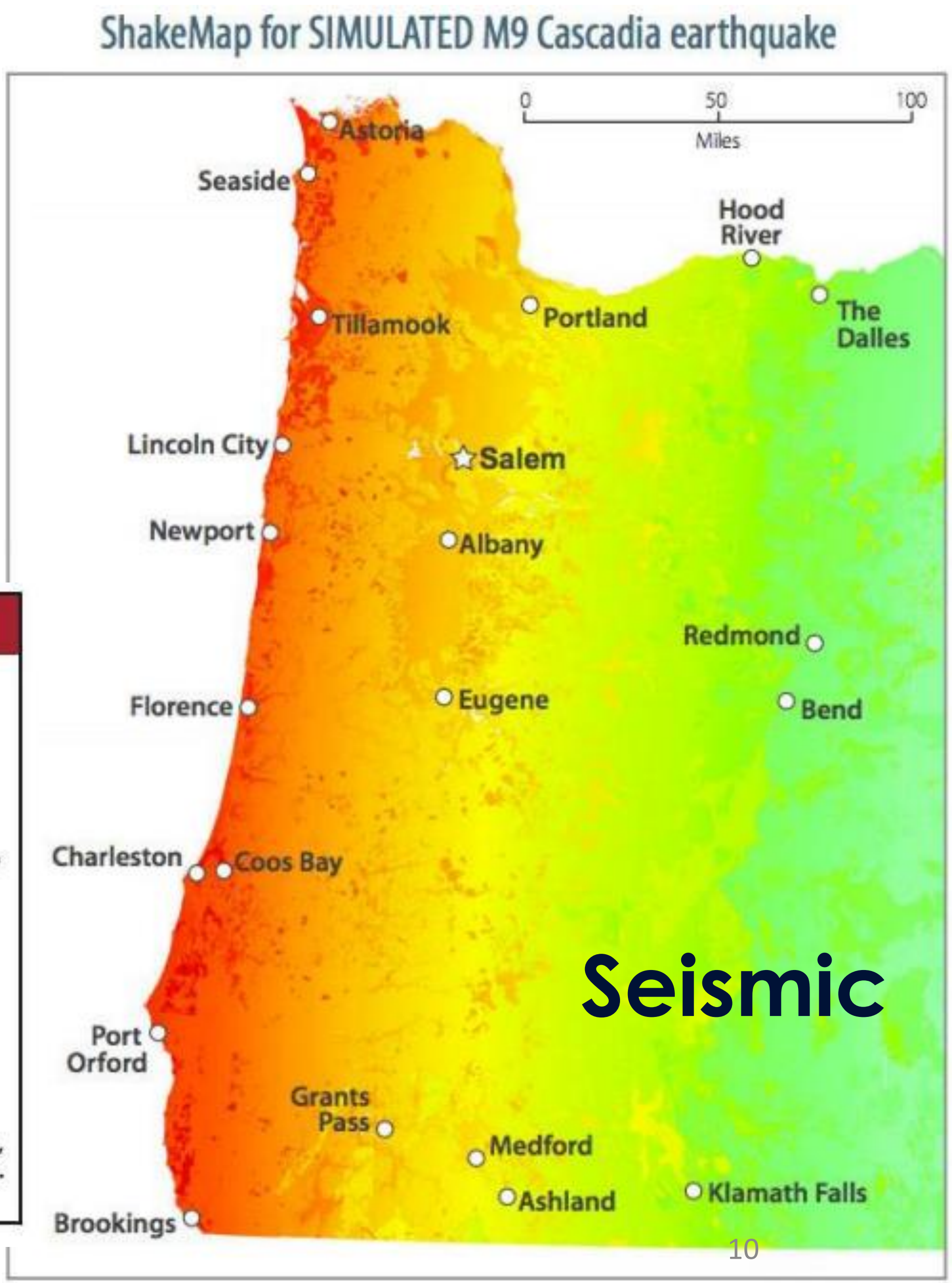
Mar 7, 2019 | When Disaster Struck, This Tiny Oregon Town Was Out On Its Own

“. . .it will take millions of dollars to repair the sewer and water systems for this town [Elkton] of 200 people. And the local utility company, Douglas Electric Cooperative, is looking at about $6 million in damages. Nine days after the storm, about 4,600 of its customers didn’t have electricity. . .”

WHY ENERGY RESILIENCE?

Sep 15, 2016 | Unprepared: Will we be ready for the megaquake in Oregon? (video)

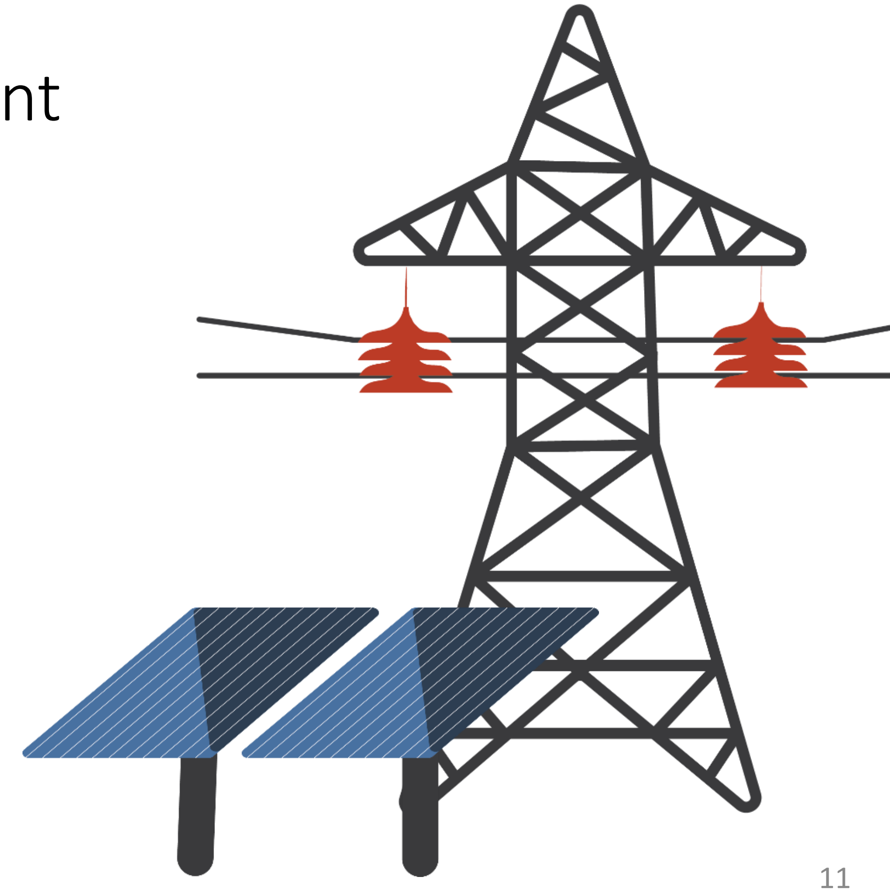




Seismic

WHAT CAN BE DONE?

- Re-locating infrastructure out of high-risk areas
- Hardening infrastructure to make it more resilient
- Developing more local sources of energy



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WHAT IS A MICROGRID?

- Utilizes distributed energy (notably solar + storage) to meet local demand
- Operate independently and "island" from the grid
- Scale can vary
- Can be expensive compared to power from the grid…
- …But can deliver diverse benefits to utility & community, and meet policy goals

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 techn… the spectrum of traditional to innovative, and demonstr… integral to the production and management of our ene…

Electricity generation technologies, such as wind and so… and in many cases are now lower cost than more traditi… technologies may be just around the corner while resea… to make them commercially viable. Tomorrow's energy… generate hydrogen fuel, offshore wind turbines, fuel cel… and emit only water, or carbon capture and sequestrati… capture and store harmful greenhouse gas emissions.

Automated metering infrastructure enables utilities to e… electricity use so that they can optimize their systems a… customers. Electric vehicles, battery storage, and smart… electric utilities to communicate with devices in homes… electricity loads while avoiding investments in expensiv… of Oregon, utilities are already communicating with cus… better manage the grid.

There are trade-offs with these technologies. Some ope… gases or other air pollutants, but there are often emissi… associated with building and transporting them. For exa… manage the waste streams of new technologies when t… Technologies like smart thermostats and rooftop solar… of energy use for consumers, but not all Oregonians ha… significant equity issue that requires deep partnership w… underrepresented communities.

The technologies examined in the following pages are t… of interest to stakeholders that ODOE heard from when… these technologies place Oregon and its communities… sustainable future. They help Oregon meet its climate a… and more efficient fuels and resources. They offer oppo… economy by creating energy-related jobs to maintain o… projects. They can make us more resilient by enabling u… systems when disruptions occur. And beyond these opp… so cool.

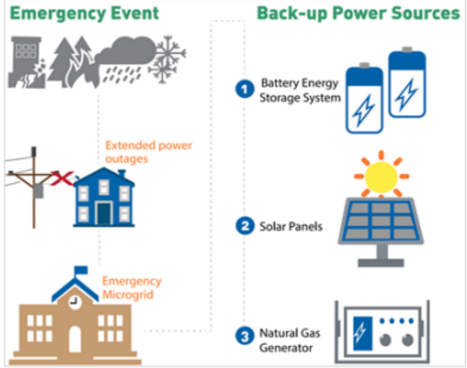
Oregon Department of Energy

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…

Source: 2020 Biennial Energy Report, Technology Reviews, p. 92

CA + WA: DEPLOYING MICROGRID SOLUTIONS

Washington State Department of Commerce

- Clean Energy Fund established in 2013
- Three rounds of funding to date have invested $118M and leveraged $400M+
- Resilient microgrids a focus of recent projects

UTILITY DIVE

California approves PG&E, SDG&E, SCE microgrid tariffs with eye to upcoming fire season

*"…PUC ordered the utilities to create a **Microgrid Incentive Program**, which would fund clean energy microgrids from a $200 million budget for vulnerable communities impacted by grid outages…"*

PUBLIC UTILITIES COMMISSION · EUREKA · STATE OF CALIFORNIA

Source: Washington Clean Energy Fund

Source: California Microgrids, Utility Dive (January 2021)

BUILDING ENERGY-RESILIENT OREGON COMMUNITIES

Engage

- Engage stakeholders to identify the diversity of benefits + need for collaboration

Prioritize

- Comprehensive statewide assessment to identify risks to energy infrastructure
- Develop understanding of unique threats to individual communities
- Center equity considerations to prioritize disadvantaged and high-risk communities

Fund

- Strong and growing federal interest in these types of projects (FEMA, USDOE, etc.)
- Can we develop innovative and sustainable funding arrangements to share the costs across all the beneficiaries of these projects?

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Questions/Comments?

Biennial Energy Report online:
energyinfo.oregon.gov/ber

ODOE's website: www.oregon.gov/energy

Contact us: Adam.Schultz@oregon.gov

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