

Community Resilience **Board Learning Paper**

Prepared by Lizzie Rubado, Jessica Iplikci, Becky Engel
April 2018

Preface

This paper is part of a series that describes a variety of topics identified by Energy Trust of Oregon's Board of Directors as potentially influential to the organization during the time period of its next strategic plan (2020-2024). This series of papers will educate and inform the Board about the potential impact of these topics and enable its Directors to better to assess risk, identify opportunity and guide the direction and goals of Energy Trust.

Remaining current on potentially significant and influential developments in the clean energy industry is critical to the fundamental role of the Board. These topics have been identified because of their potential to influence, impact or otherwise affect Energy Trust's ability to serve the ratepayers of Oregon and Southwest Washington. **These papers should not be interpreted as policy proposals or recommendations for roles in which Energy Trust intends or desires to be directly involved.**

Introduction

Energy efficiency is the cleanest, cheapest and most important resource for the utilities and ratepayers of Oregon, and Energy Trust is the prime organization delivering that resource. Communities face a growing number of stresses that pose risks to their energy systems, including aging infrastructure, natural disasters and severe weather events. To become resilient, many communities will need to develop concrete action plans that identify projects and initiatives tailored to local needs, strengths and vulnerabilities. As these plans are developed, energy efficiency and renewable energy investments are a strategy to enhance the resilience of energy systems in communities.

2017 was a historic year and broke records for the number of extreme weather events that occurred and the damages and costs that resulted.ⁱ According to FEMA, more than 25 million Americans (nearly 8 percent of the U.S. population) were affected by unprecedented disasters.ⁱⁱ Here in Oregon, residents experienced severe snow and ice storms, devastating wildfires and the hottest August on record.



Figure 1. Photo of the Eagle Creek Fire taken from the Washington side of the Bonneville Dam area on Monday, Sept. 4, 2017. (Photo by Tristan Fortsch)

In its 2014 report, the U.S. Global Change Research Program indicated that extreme weather linked to global climate change is already affecting every region of the country and is projected to worsen in the near and long term.ⁱⁱⁱ This increasing frequency and severity of extreme weather and disasters highlights the need for individuals and municipalities to change the way they prepare for and mitigate against climate change and future hazards. Investing in mitigation activities *before* the next disaster or major heatwave is the key to becoming resilient.

Traditional disaster mitigation planning happens at the top (the state level) and trickles down until it finally reaches citizens at the individual level. But new thinking based on experiences with major disasters is driving new thinking about how individuals, cities and states should be making investments in resilience and, more specifically, bolstering “community resilience.”^{iv}

The concept of community resilience is relatively new to emergency preparedness, and there is no generally accepted or operationalized definition of community resilience.^v Despite the lack of a formal definition, there are commonly held ideas about what makes for a resilient community.^{vi} One good summary of these shared ideas comes from the City Club of Portland:

“A resilient community, city or region understands its strengths and vulnerabilities and has developed capabilities to plan for and mitigate the impact of a major earthquake or other disaster, rapidly restore itself to a state of basic well-being, and rebuild to achieve even greater resilience.”^{vii}

The thing that may distinguish *community* resilience from broader definitions of disaster resilience efforts is the explicit focus on the risks, needs and resources specific to a given community. Community resilience also includes a focus on incorporating equity and social justice considerations in preparedness planning and response. From a planning perspective, community resilience planning is a bottom-up, rather than a top-down mode of thinking because priorities are likely to be very different when resilience is approached from the perspective of the impacted community as opposed to the state as a whole.^{viii}

Energy concerns are a vital component of the community resilience equation, because energy powers communities, making modern life possible. Energy efficiency and distributed renewable energy are essential components of any resilience strategy because they aid emergency response and recovery, help with climate change adaptation and mitigation and provide social and economic benefits. They can also help protect communities from the impacts of emerging threats, such as politically motivated cyberattacks on power plants and electric systems.^{ix} Whatever the threat, energy efficiency and distributed renewables help reduce vulnerability to the diverse hazards a community may face and increase the community’s capacity to cope with the damage.

I. State-level Planning

In traditional resilience and hazard mitigation planning, community-level energy resilience mostly has been overlooked. Energy emergency planning at the state level is heavily focused on liquid fuels and petroleum, with some attention given to transmission-level electricity and natural gas. According to several experts interviewed for this paper, the conventional approach to local energy needs post-disaster has been almost totally reliant on generators and an expectation that “the national guard will fly in diesel when we need it.”^x

In Oregon, energy resilience planning at the state level is guided by two central documents: the Oregon State Energy Assurance Plan and the Oregon Resilience Plan.

A. Oregon State Energy Assurance Plan

Every state has an Energy Assurance Plan, which looks at the potential threats to critical energy infrastructure and identifies solutions for reducing risks and minimizing the impact of energy supply interruptions on health and safety. Oregon’s Energy Assurance Plan was updated in 2012 and assesses an array of activities to prevent, prepare for and respond to any “energy emergency,” which is defined as any disruption in fuel or electricity supply that extends over a wide area and lasts more than several hours. Under this definition, the plan looks at resilience in relation to more than severe weather and natural disasters. Energy infrastructure events (such as spikes in demand during peak energy use, unanticipated power plant or refinery shutdowns or transmission system congestion), acts of terrorism and cyber security breaches, political events (oil embargos or war) and even market anomalies (spike in energy prices) are also considered.^{xi}

In Oregon, natural hazard mitigation and emergency response planning for liquid fuels falls under the purview of Oregon Department of Energy, while natural gas and electricity infrastructure and transmission fall to Oregon Public Utility Commission. Each agency has an action plan describing how distribution of energy or restoration of service is prioritized in the event of a disaster and is responsible for executing their plan during

an emergency. During an emergency, Oregon Emergency Management coordinates the work of these agencies and all other public and private organizations providing emergency services. The result is a top-down response that consolidates decision-making and directs the flow of resources through the various agencies and counties to critical services such as law enforcement, fire and medical teams, and then to essential service providers like utilities, telecommunications, public works, sanitation and public transit.

B. The Oregon Resilience Plan

The Oregon Resilience Plan was written to move Oregon beyond emergency preparedness into resilience, with a potential Cascadia earthquake and tsunami as the focal point. Commissioned by the legislature and written by the Oregon Seismic Safety Policy Advisory Commission, the Oregon Resilience Plan is more of a report than a plan.^{xii} It highlights how different regions and communities likely will be impacted during and after an earthquake and paints a serious picture of how long certain communities may be isolated. The main message from the plan is clear, stated in bold as the opening sentence to the executive summary: “very large earthquakes will occur in Oregon’s future, and our state’s infrastructure will remain poorly prepared to meet the threat unless we take action now to start building the necessary resilience.”

Writer Kathryn Schulz pulled material from the Oregon Resilience Plan for “The Really Big One,” her Pulitzer Prize-winning article for *The New Yorker* on seismic risk in the Pacific Northwest.

“Soon after that shaking begins, the electrical grid will fail, likely everywhere west of the Cascades and possibly well beyond,” Schulz describes memorably in her passages describing how a magnitude-9.0 Cascadia subduction zone earthquake might unfold, “If it happens at night, the ensuing catastrophe will unfold in darkness... in the I-5 corridor it will take between one and three months after the earthquake to restore electricity.”^{xiii}

II. Communities at Risk

Disasters do not uniformly affect communities or residents. Risk is a difficult thing to define by a single metric. All communities are at risk from hazards of some kind, but what those hazards are and how they factor into the level of risk depend on a given community's geography, built environment, demographics and social systems.

Understanding how much a community is at risk from various threats is a complex undertaking. The likelihood of the hazards themselves must be weighed with the vulnerabilities of a particular community. Vulnerabilities can include physical infrastructure weaknesses and social and economic factors. Vulnerability to natural hazards is affected by a person's social and economic circumstances in everyday life. People who lack access to resources and information suffer most in a disaster.

As part of Oregon's state-level hazard mitigation planning, which is led by the Oregon Office of Emergency Management, the state has assessed the statewide risk from 11 natural hazards and predicted the impacts that climate change will have on each in the Oregon Natural Hazards Mitigation Plan. In addition to looking at the state as a whole, the plan analyzes eight regions in the state and assesses vulnerability by county. Figure 2 presents the local vulnerability rankings for each of Oregon's 11 hazards by county.

In addition to this statewide assessment, counties and some large cities in Oregon maintain their own hazard mitigation plans which identify their top hazards, vulnerabilities and mitigation priorities. Since they are local plans, the risks and recommended mitigation activities are more reflective of the local community's needs and other community-level planning efforts. For example, Portland's planning process applied an equity lens for the 2016 update to its Mitigation Action Plan to ensure that the process and outcomes benefit Portlanders who are most likely to be impacted by a natural hazard event.^{xiv}

There have been efforts over the years to create a central repository for these local plans and catalogue and track all the actions from these plans. Unfortunately, there is no consistent funding or staff dedicated to the work.^{xv}

County	Coastal Erosion	Tsunami	Drought	Dust Storm	Earthquake	Volcanic	Landslide	Wildfire	Flood	Wind Storm	Winter Storm
Baker			H	M	M	L	M	H	M	H	H
Benton			L		H	L	L	M	M	M	M
Clackamas			L		H	H	L	M	M	L	M
Clatsop	H	H	M		H	M	H	H	H	H	H
Columbia			L		M	M	M	M	H	H	H
Coos	M	H	M		H	M	M	M	H	H	H
Crook			H	L	L	H	L	M	H	M	M
Curry		H			H	H	L	H	H	H	
Deschutes			L		M	H		M	L	L	H
Douglas - central					M		M	H	H	M	H
Douglas - coastal	L	H			H		M	M	M	M	M
Gilliam			H		M	M	M	M	M	L	H
Grant			H		M	H	M	H	H	H	H
Harney			M		L	L	L	H	M	L	M
Hood River			H		M	L	M	M	M	H	H
Jackson			M		H	L	L	M	M	H	H
Jefferson			H		L	H	L	H	M		H
Josephine					H			M	M	H	H
Klamath			M		M	L		L	M		M
Lake			H		H	H	L	M	M	M	H
Lane - central			M		M	M	L	M	H	M	H
Lane - coastal		H			H		M	L	H	H	L
Lincoln		M	L		M	L		M	L	H	
Linn					H	H		M	H	M	H
Malheur			H	L	M	M	M	H	H	M	M
Marion					H	M		M	M	H	H
Morrow				M	H		M	M	H	M	H
Multnomah					H	H	M	M	H	H	H
Polk					H	M		M	H	H	
Sherman			M		L	L	M	M	M	M	M
Tillamook		H	L	L	H	M	H	H	H	H	H
Umatilla			H	H	M			H	M	H	H
Union			M	L	H	L	L	H	H	H	H
Wallowa			H		L	L	L	H	M	M	M
Wasco			H		M	L	M	M	L	H	H
Washington			M		H	H	L	M	H	H	H
Wheeler			H		H	M	H	H	H	M	H
Yamhill			M		H		M	L	H	M	H

Figure 2. Local vulnerability rankings by county, taken from local natural hazard mitigation plans. ^{xvi}

III. Community Resilience Planning

Across Oregon’s vast and active landscape are urban, rural and deeply rural communities. Resources and capabilities to prepare for disasters varies. Community and energy resilience – a major emerging need – starts with developing resources and capabilities at the community level. Threats or hazards will always be part of the picture when it comes to discussing resilience, but many risks and dangers also come from just how well-prepared – or not – communities are when facing a range of threats. Impacts to homes, businesses, and infrastructure, in both the public and private sectors, are serious. Although this paper does not go into assessing impacts, some aspects of community-led and -supported resilience planning are included to illustrate some of the first steps toward resiliency in several communities.

Planning and prioritization factor greatly into resilience – or a community’s ability to be resilient. Planning across a community’s many needs is a great undertaking. Major systems such as energy, water, communications, health care, food security, to name a

few, require substantial planning to secure when disrupted. Access to energy, and electricity in particular, underpins all these critical systems. Following an emergency, there are two challenges that communities face: the time it takes to restore power and, when power is restored, the potential for reliability or capacity issues for a very extended period. Both can compromise recovery by undermining rebuilding and economic activity. On a positive note, communities can become more resilient by utilizing technologies available today.

Planning involves identifying needs and developing various ways to address the needs. From the perspective of urban planners and design professionals, a common phrase used is “design intent.” Utilizing technologies available today, strategies can be developed or applied to various needs to support a resilient design intent, or to maintain functionality when utility-supplied energy is constrained or unavailable. Solar electric systems are an example of a technology that can be enhanced with storage and other advanced technologies to be resilient. Other systems may need to be designed to fail safely or to activate or buffer in certain circumstances. Buildings with robust envelopes and smart controls can be designed to “coast” through fluctuations in available power, or drop non-critical energy loads, enabling the building to be livable or usable even under constrained power scenarios. Therefore, designing with resilience in mind is a way of strengthening existing strategies and technologies currently used today in providing energy efficient solutions and renewable energy solutions in homes and businesses.

IV. A Growing Movement

Natural disasters near and far have focused the attention of Oregonians on the need to create more resilience in our communities. Communities are learning from each other, sharing plans, knowledge and emerging best practices to accelerate this movement toward a more secure and resilient energy future.

Several Oregon communities are leading the way to develop secure, self-sustaining systems. Communities on the forefront of mitigating serious risks to their communities, business and commerce include:

- Central Lincoln PUD, serving Coos, Douglas, Lincoln and Lane counties,
- Eugene Water and Electric Board (EWEB),
- Beaverton School District

For example, Lincoln PUD led community support to relocate a substation out of a tsunami zone and build a new operations center on higher ground. These investments are the result of the community engagement to prioritize energy resilience investments essential to providing power.^{xvii}

Additionally, EWEB and the City of Eugene are exploring locally-sourced power, supported by Oregon State University in a three-year study to explore how to use solar and waste-to-energy systems for generating local energy supplies. EWEB is preparing to provide power in Eugene through a microgrid in the event of an extended outage, which is just part of an overall Eugene community disaster readiness plan. The City of Eugene's community disaster readiness plan considers bolstering essential services such as emergency services, communications, health care and first responders.^{xviii}

Beaverton School District was one of the first districts to develop a plan to upgrade schools to serve as community centers or emergency shelters. Its plan outlines various strategies to address back-up power, renewable generation and water storage. These lessons can be shared among other schools or community buildings planning to serve large populations seeking shelter and services.^{xix}

A. Technologies

The pathway toward community resilience will require long-term planning, prioritization and leadership at the local level to procure technologies. Planning done locally places communities in a lead role when shaping priorities and needs and procuring resources.

As local infrastructure investments are made, resilience can be addressed in ways that bring value over the life of the investments, rather than just during a major event. For example, an investment in solar provides daily savings on power bills but can also be enhanced with advanced energy storage to provide back-up power to the occupants in the event of an emergency, as well as grid services to the utility, such as peak shaving.

An example of how controls can transform existing equipment into more flexible community assets is PGE's Dispatchable Standby Generation program, which puts commercial and industrial customers' standby generators to work when the local region has a critical need for power. In this program, PGE upgrades the customer's control system, installs new switchgear and pays for routine maintenance. In return, the utility can use the generator during non-outage times when there is a need for additional power.

Looking across many communities in Oregon, several types of technologies or renewable fuels can be incorporated for energy resilience, including:

- Biomass, like wood pellets, utilized as a primary fuel for space and water heat;
- Separation of critical and non-critical loads, with responsive controls;
- Solar plus storage to provide electricity to critical loads during outages;
- Electric vehicles as a multi-strategy solution for transportation and storage;
- Microgrids that combine various distributed energy systems and controls;
- Passive systems to allow for passive heating and cooling or ventilation;
- Daylighting to allow electric lighting to power-down or to cut lighting load; and
- Envelope enhancements to help moderate fluctuations with heating and cooling.

Currently, most homes and businesses are unable to disconnect safely from the grid to operate utilizing only on-site power. Microgrid capabilities are emerging as a solution for enabling grid-connected homes, businesses and communities looking to serve energy needs in times of a power outage, and can be developed into community energy resilience planning. Figure 3 illustrates various levels of microgrids.

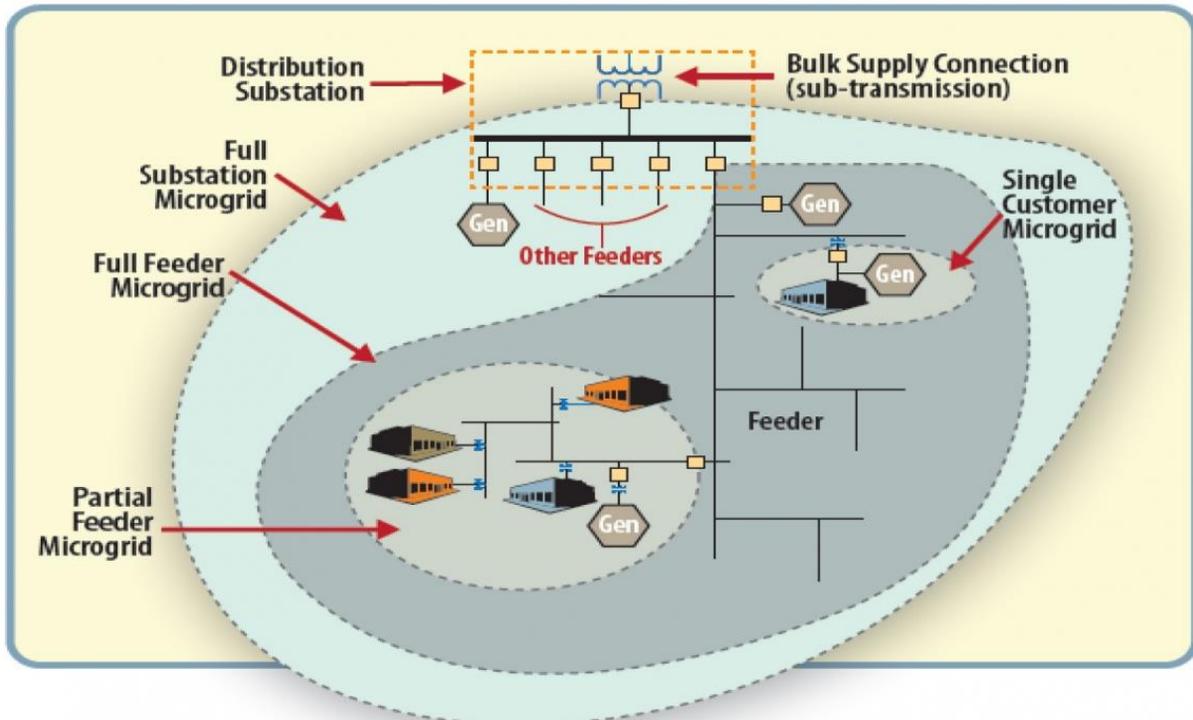


Figure 3. A microgrid is a group of interconnected loads and distributed energy resources that acts as a single controllable entity with respect to the grid. A microgrid can connect and disconnect from the grid to enable it to operate in both grid-connected or island-mode. (Illustration by U.S. DOE)^{xx}

Most of the energy solutions used to create community energy resiliency are commercially available today. Opportunities are in packaging solutions, including smart controls and developing specific messaging and support to deploy these towards resilience. Energy Trust can build on the awareness already created in public and private sectors and help customers adopt *distributed and resilient* energy solutions.

Still relevant today is the 2007 point of view by the chairman of the Oregon Seismic Safety Policy Advisory Commission:

“Without exception, everyone on the West Coast will be assuming more responsibility (public, private, personal), so the better informed and educated people are, the more responsive everyone will be when the need to help each other arises”.^{xxi}

Considerations for Energy Trust

The following are areas of opportunities for consideration by the board.

1. As cities and communities start to lead resilience efforts, or create new positions in government to lead resilience efforts, Energy Trust can engage with city staff leading resilience efforts that incorporate energy resilience planning. To do this more effectively, it may be helpful to **reposition efficiency and renewable energy as a resilience strategy**, with the objective of strengthening cities and communities to incorporate technical aspects of energy resilience.
2. Develop technical information and guidelines for **enhancing solar systems with new capabilities to deliver on-site energy when the grid is unavailable, a function known as “islanding.”** (When the grid is down, most of the more than 12,000 distributed renewable energy systems that Energy Trust has funded will also be down because they lack islanding capability, and therefore unable to provide power to homes and businesses.) Investigate the costs and benefits of retrofitting existing solar electric systems to be capable of islanding.
3. **Target resources**, technologies and strategies for critical community locations to **power the delivery of essential resources** – water, electricity, food, health care, communications, and emergency shelter. Identify priority areas for critical facilities and communities with high needs/risks/vulnerabilities from widespread and prolonged power outages.
4. **Document emerging energy resilience assets** to provide transparency into which communities have plans and critical infrastructure so that gaps in local community infrastructure can be addressed.
5. **Develop public-private partnerships** and support community-based organizations in the delivery of resilience and identification of grant funding opportunities. Set goals at the county or a regional level to have energy resilience plans developed and in place. **Study Japan’s recovery** and

restoration efforts to build local knowledge and capabilities to lead resilience integration across communities, as retrofits and those under construction today.

- 6. Support more advanced-planning efforts and zero-net communities** where large-scale developments can be developed to behave more like a microgrid capable of supporting densely populated areas, mixed-use developments and critical infrastructure commonly part of large-scale developments. **Incorporate renewable energy into water-resource planning** and emergency communication planning to support local emergency responders.

About Energy Trust of Oregon

Energy Trust of Oregon is an independent nonprofit organization dedicated to helping utility customers benefit from saving energy and generating renewable power. Our services, cash incentives and energy solutions have helped participating customers of Portland General Electric, Pacific Power, NW Natural, Cascade Natural Gas and Avista save on energy bills. Our work helps keep energy costs as low as possible, creates jobs and builds a sustainable energy future.

-
- ⁱ (National Oceanic and Atmospheric Administration, 2018)
- ⁱⁱ (Kaniewski, 2018)
- ⁱⁱⁱ (Melillo, 2014)
- ^{iv} (Fritz, 2017)
- ^v (Patel SS, 2017) and (Plough, 2013)
- ^{vi} (Schultz, 2018), (Patel SS, 2017) and (Community & Regional Resilience Institute, 2018)
- ^{vii} (City Club of Portland, 2017)
- ^{viii} (Schultz, 2018)
- ^{ix} (Sanger, 2018)
- ^x (Hall, 2018)
- ^{xi} (Oregon Department of Energy, Oregon Public Utility Commission, 2012)
- ^{xii} (Oregon Seismic Safety Policy Advisory Committee, 2013)
- ^{xiii} (Schulz, 2015)
- ^{xiv} (City of Portland, Portland Bureau of Emergency management, 2016)
- ^{xv} (Joseph Murray, 2018)
- ^{xvi} (State Interagency Hazard Mitigation Team, 2015)
- ^{xvii} (Wray, 2017)
- ^{xviii} (Sayard Schultz, 2016)
- ^{xix} (SEFT Consulting Group, 2015)
- ^{xx} (U.S. Department of Energy, 2018)
- ^{xxi} (The Oregon Resilience Plan – Energy – February 2013)

References

- City Club of Portland. (2017, February 14). Big Steps Before the Big One: How the Portland area can bounce back after a major earthquake. *City Club of Portland Bulletin*.
- City of Portland, Portland Bureau of Emergency management. (2016). *The Mitigation Action Plan*. Portland.
- Community & Regional Resilience Institute. (2018, January 30). *What is Community Resilience?* Retrieved from Community & Regional Resilience Institute website: <http://www.resilientus.org/about-us/what-is-community-resilience/>
- Fritz, A. (2017, September 23). Harvey. Irma. Maria. Why is this hurricane season so bad? *The Washington Post*.
- Hall, J. (2018, January 12). (L. Rubado, Interviewer)
- Joseph Murray, A. P. (2018, February 20). Centralized information about local hazard mitigation plans. (L. Rubado, Interviewer)
- Kaniewski, D. (2018, January 11). *Investing in Mitigation to Build a More Resilient Nation*. Retrieved from FEMA website: <https://www.fema.gov/blog/2018-01-11/investing-mitigation-build-more-resilient-nation>
- Melillo, J. M. (2014). *Climate Change Impacts in the United States: The Third National Climate Assessment*. Washington D.C.: U.S. Global Change Research Program.

-
- National Oceanic and Atmospheric Administration. (2018, January 8). *2017 was 3rd warmest year on record for U.S.* Retrieved from NOAA website: <http://www.noaa.gov/news/2017-was-3rd-warmest-year-on-record-for-us>
- Office of Emergency Management. (2018, February 14). *Regional Hazard Viewer*. Retrieved from Oregon Office of Emergency Management website: http://oregonem.com/hazardsviewer/hazardsViewer_content.html
- Oregon Department of Energy, Oregon Public Utility Commission. (2012). *Oregon State Energy Assurance Plan*. Retrieved from Oregon Department of Energy Website.
- Oregon Seismic Safety Policy Advisory Committee. (2013). *The Oregon Resilience Plan: Reducing Risk and Improving Recovery*. Salem.
- Patel SS, R. M. (2017). What Do We Mean by 'Community Resilience'? A Systematic Literature Review of How It Is Defined in the Literature. *PLOS Currents Disasters*.
- Plough, A. F. (2013). Building Community Disaster Resilience: Perspectives From a Large Urban County Department of Public Health. *American Journal of Public Health*.
- Sanger, N. P. (2018, March 15). *Cyberattacks Put Russian Fingers on the Switch at Power Plants, U.S. Says*. Retrieved from The New York Times: <https://nyti.ms/2Dv2gXY>
- Sayard Schultz, S. S. (2016). *Eugene-Based Electricity Generation: Optimizing Resiliency for Eugene Water and Electric Board*. Eugene: OSU School of Public Policy.
- Schultz, A. (2018, January 2). (L. Rubado, Interviewer)
- Schulz, K. (2015, July 20). The Really Big One. *The New Yorker*.
- SEFT Consulting Group. (2015). *Beaverton School District Resilience Plan*. Beaverton: Beaverton School District.
- State Interagency Hazard Mitigation Team. (2015). *Oregon Natural Hazards Mitigation Plan*. (2014). *The Oregon Resilience Plan*. Salem: Oregon Emergency Management.
- U.S. Department of Energy. (2018, March 9). *The Role of Microgrids in Helping to Advance the Nation's Energy System*. Retrieved from U.S. DOE website: <https://www.energy.gov/oe/activities/technology-development/grid-modernization-and-smart-grid/role-microgrids-helping>
- Wray, R. (2017, May 30). *Newport Hosts NGA Policy Academy Retreat on Local Energy Resiliency*. Retrieved from Oregon Department of Energy website: <https://energyinfo.oregon.gov/2017/05/30/newport-hosts-nga-policy-academy-retreat-on-local-energy-resiliency/>