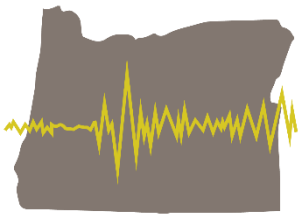
Energy Resilience

Resilience is a term that is often heard across issues of public concern, but what does it mean in the context of energy? Energy resilience refers to the ability of energy systems, from production through delivery to end-users, to withstand and rapidly restore energy delivery following non-routine disruptions of severe impact or duration.[1] [2] These disruptions can be caused by natural hazards and physical or cyber-attacks on energy systems.



Energy Resilience vs. Energy Security

Energy resilience is a subset of energy security. Energy security encompasses efforts to ensure energy supply, affordability, accessibility, reliability, and resilience.[3]

Reliability vs. Resilience:

Reliability is the ability of energy systems to withstand and recover from *typical disruptions*.[2] [4] Typical disruptions could include average winter weather or branches falling on a powerline.

Resilience is the ability to withstand and recover from *nonroutine disruptions of severe impact or duration*. Examples of nonroutine disruptions of severe impact or duration include an ice storm lasting several days or a windstorm producing countywide impacts. Actions that strengthen resilience can also increase reliability.

Energy resilience is pursued from the national to the community level with differing emphases. The federal government's energy resilience efforts put significant focus on increasing collaboration—internationally, across Tribes, states, and territories, and the public and private sectors. Utilities tend to focus on increasing the resilience of larger energy systems and infrastructure. Community-level resilience efforts, in contrast, typically focus on the end-users: ensuring public safety and welfare during nonroutine energy disruptions. This includes ensuring adequately fueled backup power generation and storage to provide energy to critical public service facilities such as hospitals, emergency response centers, and community resilience centers, as well as strengthening household resilience. At the state level, the State of Oregon pursues actions to increase resilience across both larger energy systems and within communities, and facilitates collaboration between all interested parties.

Learn more about backup power in ODOE's 2022 Biennial Energy Report.

Community Resilience Centers

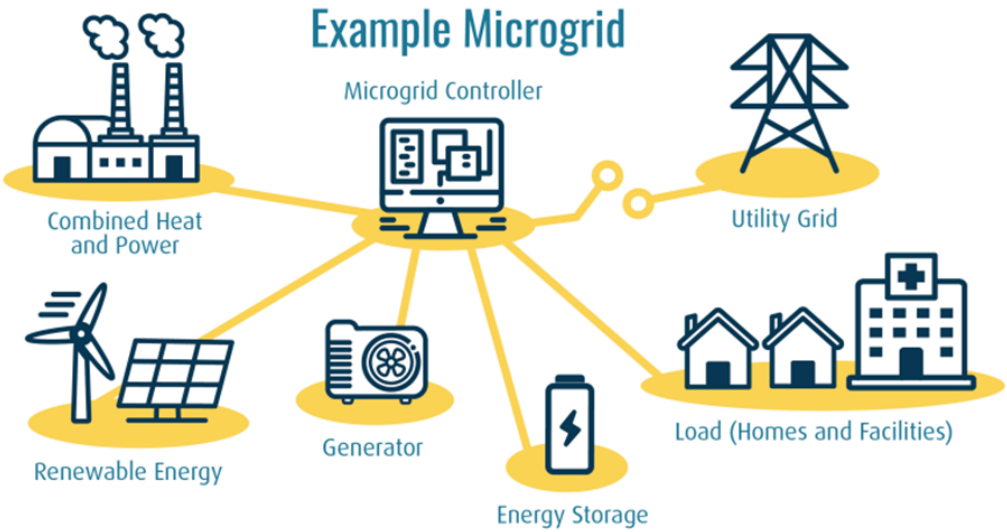
Community resilience centers are gathering places that provide essential services and resources for community members during disruptive events. Specific to energy resilience, these centers provide residents access to essential energy services such as heating and cooling, air filtration, and charging of essential devices like medical equipment or cell phones.

While there are variations in emphases among these different entities, there are two overarching commonalities across their energy resilience efforts:

- Increasing the ability to adapt to changing conditions and prepare for disruptions to reduce impact and speed recovery.
- Elevating equity: ensuring that the needs of those who are most vulnerable to energy disruptions are addressed.

Actions to strengthen energy resilience can occur across larger energy systems or at the community level. Examples of energy resilience actions for larger energy systems, i.e. electricity, liquid fuels, and natural gas, include: upgrading older infrastructure with more durable and resilient equipment; undergrounding power lines to increase their ability to withstand a variety of extreme weather events; using drones to evaluate energy infrastructure to prevent issues via early detection and enable speedier recovery after events; and system segmentation to isolate impacted areas and allow unaffected areas to continue providing energy services (see the Transmission Options 101 in this report). Actions at the community level can look like increasing gasoline, diesel, and aviation fuel storage, installing seismically certified generators, and developing energy generation and storage infrastructure such as microgrids (Figure 1), to support critical public services and/or household resilience. Additionally, actions to increase energy efficiency can support resilience by reducing the energy demand that must be met during energy disruptions.

Figure 1: Example of a Microgrid and Its Components[5]



Why Does Energy Resilience Matter?

Fundamentally, energy resilience matters because access to energy matters. Energy systems are the backbone for essential services such as life safety; heating, cooling, and air filtration; communications and information systems; transportation; production of food and goods; and medical care. These services are important under normal conditions and critical during emergencies.

September 2020 wildfire damage in Detroit, OR.

The need to bolster energy resilience has become more evident in recent years due to an increase in the frequency and severity of threats and disruptions to energy systems. The occurrence and intensity of extreme weather events, such as winter storms or wildfires, has increased in frequency, scale, and duration, with a corresponding effect on energy disruptions (see this report's Climate Change Effects on Energy Systems 101 for more information).[6] [7] Likewise, there has been a rise in public safety power shutoffs, during which utilities preventatively shut off electricity due to increased incidents of high wildfire risk. The incidence of cybersecurity attacks has also increased in recent years, as has the vulnerability of energy systems due to increased use of digital technologies.[8] Finally, a Cascadia Subduction Zone Earthquake poses a threat to Oregon's energy systems of nearly unparalleled severity.[9] Though this threat has long existed, in recent decades there have been increased efforts to raise public awareness and create resilient systems to prepare for the catastrophic earthquake.[10]

Building energy resilience across larger energy systems and in communities is also critical to help ensure equitable protection from energy disruptions. Some groups are more vulnerable to energy disruptions than others, and those disruptions can also compound other vulnerabilities and inequities that groups experience. For instance, energy disruptions during an extreme heat or cold event or a wildfire with unhealthy air quality can pose a greater risk for individuals with certain medical conditions. Similarly, individuals living in areas with significant urban heat island effects,[i] who are more likely to be low-income or People of Color, face elevated risk during extreme heat events;[12] [13] this risk is further amplified during an energy disruption.

During the 2021 heat dome event in Portland, 61 percent of the individuals who lost their lives in Multnomah County were living in an urban heat island area, and the majority did not have working air conditioning.[13] Individuals with lower incomes may have less financial ability to strengthen household resilience via backup power or efficiency measures — and their homes may also have less efficient weatherization and appliances to begin with.[14] Therefore, efforts to: 1) increase larger energy systems' ability to withstand nonroutine disruptions and recover quickly, 2) ensure that critical public services function during disruptions to larger systems, 3) provide access to community resilience locations, and 4) increase household resilience, are vital to helping protect vulnerable populations and reduce inequitable impacts from disruptions. Ensuring equity in energy resilience efforts goes hand in hand with the opportunities the broader clean energy transition offers to rectify past inequities and create a more equitable path moving forward.

[i] Heat islands occur in urban areas where there is a high density of roads and buildings and limited green space, resulting in increased absorption and remittance of heat. Temperatures in urban heat islands are 1–7°F higher than surrounding areas during the day and 2-5°F higher at night.[11]

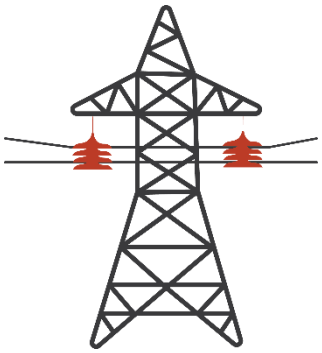
Energy Resilience Efforts

Many organizations, from the federal government to community groups, are working to strengthen energy resilience. While not a comprehensive of all initiatives and efforts, the information below helps illustrate some of the work Tribal Nations, the federal government, the State of Oregon, utilities, and communities are doing to bolster energy resilience. Building partnerships and advancing equity are at the heart of much of this work.

Tribes

Oregon's nine federally recognized Tribes are engaged in planning and project development to bolster energy resilience. For instance, in 2022, the Confederated Tribes of the Umatilla Indian Reservation completed a Strategic Energy Plan.[15] Increasing household resilience through renewable energy generation and energy efficiency is a central component of the plan. The Coquille Indian Tribe is in the process of developing a Resilience Management Plan, which will include an Energy Assessment and strategies that explore potential renewable energy options as a pathway to supporting the Tribe in becoming energy sovereign.[16]

In terms of project development, the Confederated Tribes of Coos, Lower Umpqua and Siuslaw Indians are developing a solar and battery storage system to provide backup power to Tribal buildings during outages, with support from the Oregon Department of Energy's Community Renewable Energy Grant Program.[17] In 2023, the Confederated Tribes of Warm Springs, in partnership with Portland General Electric, received a $250 million grant from the U.S. Department of Energy's Grid Resilience and Innovation Partnerships Program to expand and increase the resilience of the Bethel Round Butte Transmission Line, which is a critical piece of Oregon's electricity infrastructure.[18] The Confederated Tribes of Warm Springs, the Cow Creek Band of Umpqua Tribe of Indians, Coquille Indian Tribe, Burns Paiute Tribe, and Confederated Tribes of the Umatilla Indian Reservation have received U.S. DOE Grid Resilience State and Tribal Formula grants.[19] The Tribes will award funds from these grants to eligible entities for grid resilience improvements.



Federal Government

Federal efforts include programs to support energy resilience planning and project implementation, such as funding for state energy security plan development and the Grid Resilience State and Tribal Formula Grant, Grid Resilience and Innovation Partnerships, Home Efficiency Rebate, Home Electrification and Appliance Rebate, and Energy Efficiency and Conservation Block Grant programs. These federal grant programs fall under the Justice 40 Initiative, which specifies that 40 percent of federal grant investments flow to federally recognized Tribes, including Alaska Native Villages, and to disadvantaged communities that are identified using the Climate & Economic Justice Screening tool. The federal government also invests in research, training, and tool development to support energy resilience efforts nationally as well as for Tribes, states, and territories— such as the Department of Energy's recent investment of $45 million to develop new tools to address cybersecurity threats.[20] The federal government fosters opportunities for collaboration across Tribes, states, territories, and the public and private sectors through the Electricity Subsector Coordinating Council and the Oil and

Natural Gas Subsector Coordinating Council, in addition to supporting the work of groups such as the National Association of State Energy Officials and the National Association of Regulatory Utility Commissioners.

State of Oregon

Learn more about the Oregon Energy Security Plan on ODOE's website.

The State of Oregon is engaged in a variety of efforts to increase energy resilience. ODOE has developed the Oregon Energy Security Plan, which includes a risk assessment of the state's liquid fuels, natural gas, and electricity systems, and mitigation measures to address risks and increase resilience. ODOE is also developing the Oregon Energy Strategy, which will present pathways to achieve the state's energy goals, including bolstering resilience. The Oregon Department of Environmental Quality is administering the Fuel Tanks Seismic Stability Program, which evaluates the earthquake vulnerability of large-capacity oil and fuel storage and distribution facilities in Lane, Multnomah, and Columbia counties and requires the facilities to develop plans to minimize risk of damage to employees, surrounding communities, and the environment. The Oregon Public Utility Commission oversees all utilities in Oregon in matters of safety and in recent years has increased focus on energy resilience such as convening utilities and interested parties to learn from disruptive events, with a particular focus on wildfire mitigation. As the economic regulator of the state's investor-owned electric and natural gas utilities, OPUC ensures that the investor-owned utilities have enough resources to implement resilience measures such as vegetation management and hardening of infrastructure.

The State of Oregon also has a variety of grant programs that support energy resilience. The Oregon Department of Energy is currently administering several of the aforementioned federal grant programs: Grid Resilience, Solar for All, Home Energy Rebates, and Energy Efficiency and Conservation Block Grants. ODOE also runs several state-created grant programs that support energy resilience projects and planning: the Community Renewable Energy Grant Program, Oregon Solar + Storage Rebate Program, and the County Energy Resilience Program. The Oregon Department of Human Services is administering a Resilience Hubs and Networks grant program that supports the development of community resilience centers. The Oregon Department of Emergency Management administers several state and federally funded grant programs that have co-benefits for energy resilience, such as the Emergency Management Performance Grant Program, State Preparedness and Incident Response Equipment Grant Program, Hazard Mitigation Grant Program, Building Resilient Infrastructure and Communities, and State and Local Cybersecurity Grant Programs.

For a more in-depth discussion of Oregon's resilience actions taken in recent years and planned for the future, see sections 10 and 11 of the Oregon Energy Security Plan.

Utilities

Utility actions to strengthen resilience include vegetation management, reconductoring, asset replacement, undergrounding equipment, installing smart grid technologies, and developing or supporting energy resilience projects like microgrids. For instance, in 2020 Portland General Electric partnered with the City of Beaverton to help design a robust backup power system for its Public Safety Center that houses its emergency management and police departments.[21] The backup power

system includes a generator, solar energy production, and a battery storage system and can support the building throughout prolonged power outages. Utilities also help educate their customers about household resilience and some provide funding opportunities to help support these actions. For example, the Eugene Water & Electric Board offers its residential and commercial customers the Backup Power Program, which offers zero to low-interest loans for backup power systems like generators or battery storage.[22] Pacific Power offers a rebate program that supports the purchase of backup power systems for customers in their Medical Certificate Program, who face vulnerabilities to loss of power due to their medical conditions.[23]

Cities, Counties, and Other Organizations

Cities, counties, and community organizations are also engaged in planning, project implementation, and education for energy resilience. For example, Hood River and Wallowa counties have developed countywide energy plans with energy resilience components.[24] [25] These counties are also pursuing efforts to build priority resilience projects, such as local microgrids and solar generation and storage, and both counties have utilized ODOE's Community Renewable Energy Grant Program to complete detailed project implementation planning.[17] With the launch of ODOE's County Energy Resilience Program in spring 2024, there will soon be more county energy resilience plans in place across the state. Partnerships among local government entities, local community organizations, and other organizations such as economic development districts and statewide energy-focused nonprofits — for example, Sustainable Northwest and Energy Trust of Oregon, among others — are critical to helping communities achieve their energy resilience goals.

Williams & Russell Project

The Williams & Russell Project, under development in Northeast Portland's Albina neighborhood, centers equity and energy resilience. The development site was formerly the commercial center of the Black community in Albina from the 1940s-1960s, but was condemned in the 1970s and purchased by Legacy Hospital as part of Portland's urban renewal program.[26] The project seeks to restore and reclaim the lot as a vibrant part of the neighborhood; the development will provide 85 affordable apartment units, 20 homes for purchase, and a 30,000 square foot Black business hub, with commercial and office space for Black-owned businesses and community organizations. The building will feature energy efficient construction, solar panels, and energy storage — ensuring resilience during energy disruptions — in addition to other sustainable features.[27] Partners involved in the project include: the Williams and Russell CDC, Prosper Portland, Portland Community Reinvestment Initiatives, Adre, Legacy Health Services, Portland Housing Bureau, the City of Portland, and Energy Trust of Oregon, among others.[27] [28]

Together these efforts are paving the way to increase the resilience of Oregon's energy infrastructure and communities. Moving forward, these entities will continue to put plans, programs, and projects in place to bolster energy resilience while continuing to adapt to the changing landscape of energy in Oregon.

References

1. House Bill 2021, 07/19/2021, 81st Oregon Legislative Assembly 2021 Regular Session (2021). https://olis.oregonlegislature.gov/liz/2021R1/Downloads/MeasureDocument/HB2021

2. Oregon Department of Energy. (2019). *Oregon Guidebook for Local Energy Resilience*. Oregon Department of Energy. https://www.oregon.gov/energy/safety-resiliency/Documents/Oregon-Resilience-Guidebook-COUs.pdf

3. Oregon Department of Energy. (2024). *Oregon Energy Security Plan*. Oregon Department of Energy. https://www.oregon.gov/energy/safety-resiliency/Documents/2024-Oregon-Energy-Security-Plan.pdf

4. T.J. Galloway Sr. (2018, July 31). *Advancing Reliability and Resilience of the Grid*. FERC Reliability Technical Conference. https://www.ferc.gov/sites/default/files/2020-08/Galloway-North-American-Transmission-Forum.pdf

5. National Association of State Energy Officials. (n.d.). *Microgrids State Working Group*. National Association of State Energy Officials. Retrieved August 28, 2024, from https://www.naseo.org/issues/electricity/microgrids

6. Do, V., McBrien, H., Flores, N., Northrop, A., Schlegelmilch, J., Kiang, M., & Casey, J. (2023). Spatiotemporal distribution of power outages with climate events and social vulnerability in the USA. *Nature Communications*, *14*. https://doi.org/10.1038/s41467-023-38084-6

7. U.S. Department of Energy Grid Deployment Office. (2023, November 8). Keeping the Lights On in Our Neighborhoods During Power Outages. *GDO Blogs*. https://www.energy.gov/gdo/articles/keeping-lights-our-neighborhoods-during-power-outages

8. IEA. (2023, August 1). Cybersecurity-is the power system lagging behind? *News and Commentaries*. https://www.iea.org/commentaries/cybersecurity-is-the-power-system-lagging-behind

9. Oregon Department of Energy. (n.d.). *Cascadia Event*. Oregon Department of Energy. Retrieved July 16, 2024, from https://energyinfo.oregon.gov/cascadia-event

10. Oregon Seismic Safety Policy Advisory Commission. (2013). *The Oregon Resilience Plan*. https://www.oregon.gov/oem/Documents/Oregon_Resilience_Plan_Final.pdf

11. U.S. Environmental Protection Agency. (n.d.). *Heat Island Effect*. United States Environmental Protection Agency. Retrieved August 9, 2024, from https://www.epa.gov/heatislands

12. Voelkel, J., Hellman, D., Sakuma, R., & Shandas, V. (2018). Assessing Vulnerability to Urban Heat: A Study of Disproportionate Heat Exposure and Access to Refuge by Socio-Demographic Status in Portland, Oregon. *International Journal of Environmental Research and Public Health*, *15*(4). https://doi.org/10.3390/ijerph15040640

13. U.S. Environmental Protection Agency. (2023, August 3). *Heat Islands and Equity*. United States Environmental Protection Agency. https://www.epa.gov/heatislands/heat-islands-and-equity

14. U.S. Environmental Protection Agency. (2018). *Energy Efficiency in Affordable Housing A Guide to Developing and Implementing Greenhouse Gas Reduction Programs*. U.S. Environmental Protection Agency. https://www.epa.gov/sites/default/files/2018-07/documents/final_affordablehousingguide_06262018_508.pdf

15. Confederated Tribes of the Umatilla Indian Reservation. (2022). *Strategic Energy Plan*. https://ctuir.org/media/iudazpyv/draft-ctuir_strategic-energy-plan.pdf

16. Coquille Indian Tribe. (2024, June 4). *RFP-Resilience Management Plan*. Coquille Indian Tribe. https://www.coquilletribe.org/rfp-resilience-management-plan/

17. Oregon Department of Energy. (n.d.). *Community Renewable Energy Grant Program*. Oregon Department of Energy. Retrieved August 9, 2024, from https://www.oregon.gov/energy/Incentives/Pages/CREP.aspx

18. KTVZ News Sources. (2023, December 7). New Warm Springs, PGE partnership brings $250 million federal investment for transmission line expansion. *KTVZ News Channel 21*. https://ktvz.com/news/warm-springs/2023/12/01/new-warm-springs-pge-partnership-brings-250-million-federal-investment-for-transmission-line-expansion/

19. Grid Deployment Office. (n.d.). *Grid Resilience State and Tribal Formula Grant Awards*. Energy.Gov. Retrieved August 21, 2024, from https://www.energy.gov/gdo/grid-resilience-state-and-tribal-formula-grant-awards

20. U.S. Department of Energy. (2024, February 26). DOE Announces $45 Million to Protect Americans From Cyber Threats and Improve Cybersecurity in America's Energy Sector. *Newsroom*. https://www.energy.gov/articles/doe-announces-45-million-protect-americans-cyber-threats-and-improve-cybersecurity

21. City of Beaverton. (n.d.). *Public Safety Center*. Beaverton Police Department. https://www.beavertonpolice.org/publicsafetycenter

22. Eugene Water and Electric Board. (n.d.). *Backup Power Program*. EWEB. Retrieved August 9, 2024, from https://www.eweb.org/rebates-and-savings/residential-incentives-rebates-loans-and-conservation/backup-power-program

23. Pacific Power. (n.d.). *Backup Electric Power*. Pacific Power. Retrieved August 9, 2024, from https://www.pacificpower.net/outages-safety/storm-emergency-preparedness/backup-generators.html

24. Hood River County. (2018). *Hood River County Energy Plan*. http://hrccd.hoodrivercounty.gov/images/uploads/documents/Hood-River-Energy-Plan_6-18-18.pdf

25. Wallowa County. (2023). *Wallowa County's Energy Future A Community-wide Energy Plan*. https://static1.squarespace.com/static/5f7381666ab2e75b02d77f6d/t/65b0564796bfac2282d693ee/1706055247854/WC+CESP+011024.pdf

26. Prosper Portland. (n.d.). *Williams & Russell Project*. Prosper Portland. Retrieved July 16, 2024, from https://prosperportland.us/portfolio-items/the-hill-block-n-russell-and-williams-collaboration/

27. Adre. (2024, June 13). *The Williams & Russell Project District Systems for Equity-Centered Development*. https://www.energytrust.org/wp-content/uploads/2024/05/District-Systems-for-Equity-Centered-Development.pdf

28. Adre. (n.d.). *Williams & Russell Project*. Adre. Retrieved July 16, 2024, from https://www.adre.dev/development/williamsandrussell