Energy 101

Just about everything involves energy. It's part of our daily lives – from driving our cars and heating our homes to turning on our computers and firing up the grill after a long day.

This section builds the foundation of the energy story: how energy is produced, used, and transformed. These Energy 101s were developed for people new to energy or specific energy topics, along with those looking for a resource to help tell the story of how energy systems affect their work and interests. Energy policy is complex and, without being armed with technical information and understanding, it is sometimes difficult to be part of the conversations.

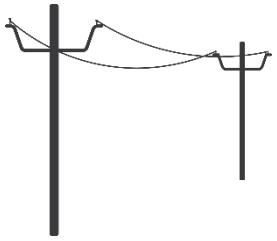
101s this year touch on a variety of topics. We look at important emerging topics like firm power and how utilities keep the lights on, what happens to solar and wind technologies when they reach the end of their useful lives, and how federal policy changes affect Oregon's energy and climate work. We also provide primers on community benefits frameworks, Oregon electric utilities, energy facility siting and permitting, and industrial symbiosis. In the 2026 report we introduce legislative briefs, which provide an overview of energy-related bills from the 2025 session that are anticipated to inform bills in future sessions.

Energy is intertwined in everything that Oregonians do – from powering vehicles to supporting our livelihoods and economy, to electricity and fuels that serve as the backbone for industry and businesses. Energy affordability, access to energy, and the effects of energy choices on communities and individuals also affect Oregonians and Oregon's economy. Everyone should have the opportunity to engage in energy choices, whether it's options to reduce energy use and costs for homes, businesses, and industry, or how we meet the challenge of transitioning our energy systems to cleaner, more renewable resources while minimizing negative outcomes for Oregonians. We hope these 101s continue to build foundational knowledge so readers can make informed choices about the energy resources, uses, and investments that can change our work, lives, and communities.

TABLE OF CONTENTS

206 Oregon Electric Utilities
213 Community Benefits Frameworks
218 Energy Facility Siting and Permitting
231 Reliability, Firm Power, and Keeping the Lights On
243 Industrial Symbiosis
248 Solar Panel and Wind Turbine Recycling
263 Effects of Federal Changes on State Energy and Climate Activities
287 SB 1526 Legislative Brief (FORGE Act)
291 SB 1582 Legislative Brief (Virtual Power Plants)

Oregon Electric Utilities



This article provides information about electric utilities in Oregon, including some key differences between types of utilities. It also discusses electric utility histories and governance structures.

Electric utilities provide electricity to Oregonians within their exclusive service territories. They procure or generate electricity, maintain and operate local distribution grids, and bill customers to pay for services. Some utilities also plan for and operate pieces of the transmission system.[i] Utilities are central players in implementing energy regulations and policies. They also have an important role ensuring system reliability and affordability.

Types of Electric Utilities

Broadly speaking, there are two types of electric utilities in Oregon: investor-owned and consumer-owned. Investor-owned utilities are for-profit corporations with shareholders. Private boards govern IOUs and the Oregon Public Utility Commission regulates them. The OPUC is an independent state agency with a three-member commission appointed by the Governor. They "ensure Oregon utility customers have access to safe, reliable and high-quality utility services at just and reasonable rates. This is done through robust and thorough analysis and independent decision-making conducted in an open and fair process."[12] OPUC approves IOUs' resource and investment decisions, rate schedules,[12] and other regulatory filings such as wildfire mitigation plans.

Consumer-owned utilities are not-for-profit entities. Locally elected boards or city councils govern and regulate COUs. COUs include municipal utilities, people's utility districts, and electric cooperatives. These are often referred to as munis, PUDs, and co-ops. There are differences between the various types of COUs in Oregon. Municipal utilities are owned and operated by city governments. PUDs are special purpose local government organizations and are not restricted by municipal boundaries. Electric cooperatives are independent, not-for-profit businesses owned by their consumer members.[18] [19] Oregon's Tribal co-op, the Umpqua Indian Utility Cooperative, is organized under Tribal sovereignty.[20] However, some features are common to all Oregon COUs, including: 1) COUs are operated on a non-profit basis; 2) are not subject to OPUC oversight on core utility decisions such as planning, procurement, and ratemaking; 3) COUs are democratically accountable to their customers or members; and 4) COUs are "preference customers" entitled to first access rights to power generated by BPA.

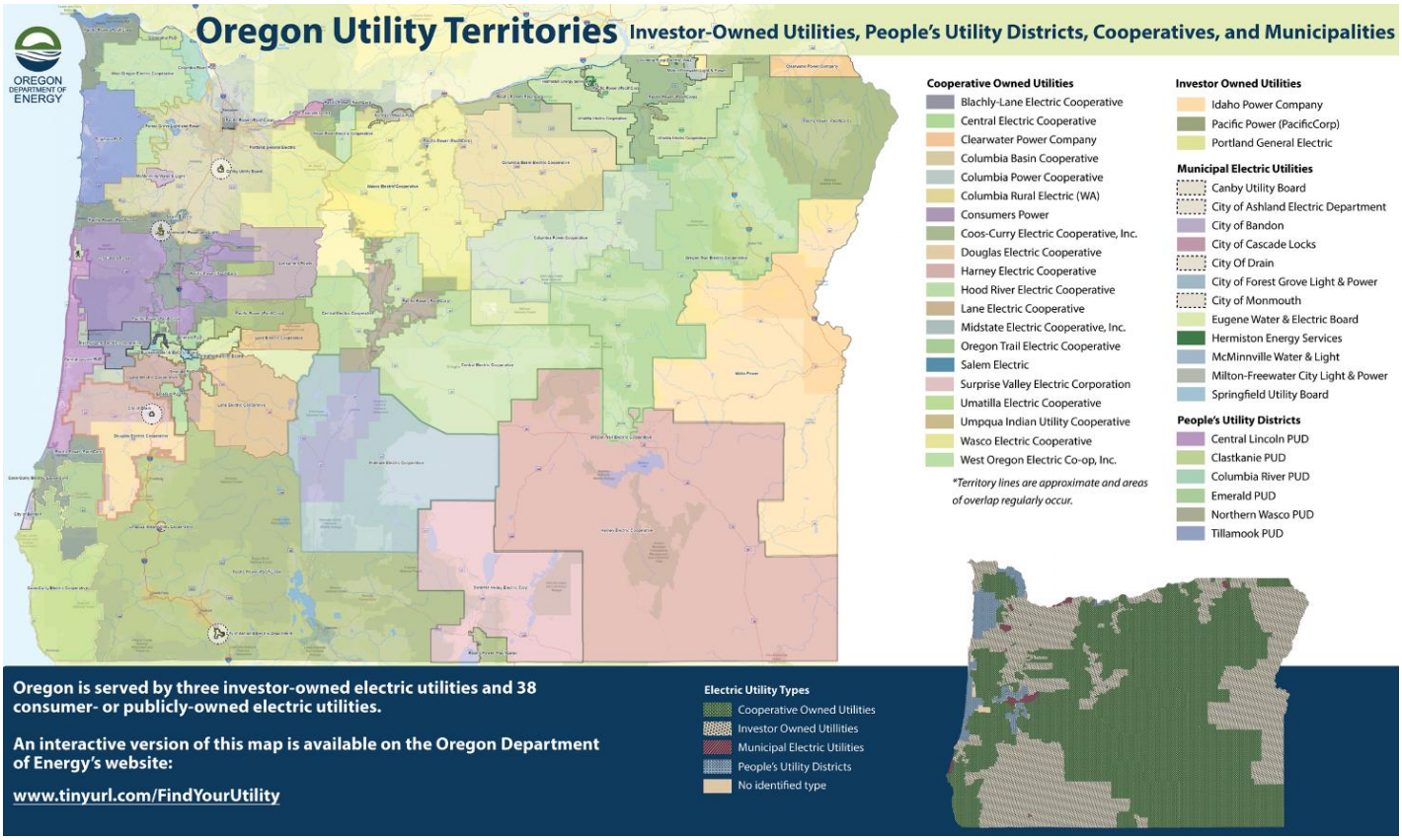
Oregon Utilities by the Numbers

As of the date of this report, three electric IOUs – Portland General Electric, PacifiCorp, and Idaho Power – operate in Oregon. Oregon also has 38 electric COUs, including 19 cooperatives, a Tribally owned cooperative, 12 municipal-owned utilities, and six People's Utility Districts. As of 2025, IOUs served 1,611,554 Oregon customers (74.3 percent of Oregonians) and accounted for 56.2 percent of

[i] Transmission refers to the movement of large volumes of high-voltage electricity across long distances, and is distinct from electrical distribution, which refers to the movement of lower voltage electricity shorter distances. Refer to Energy 101: Electricity Transmission for more on this subject.

Oregon electricity sales. Excluding the Umpqua Indian Utility Cooperative,[ii] COUs served ,558,573 customers (25.7 percent of Oregonians) and accounted for 39.1 percent of electricity sales – with electric service suppliers accounting for 4.7 percent of electricity sales to 62 customers.[5] ODOE provides a map of utility service territories online: Find Your Utility.

Figure 1: Electric Utility Service Territories in Oregon[6]



Shifting Service Territories

Electricity service territory was an especially active topic in Oregon in 2026. Idaho Power and Oregon Trail Electric Cooperative entered into agreements for OTEC to purchase and transfer ownership of those assets all of Idaho Power's Oregon service territory, and both utilities have filed with the OPUC to have the transaction approved. Idaho Power explained that the sale is intended to avoid complexities of operating in multiple jurisdictions, given that its Oregon territories represent a small portion of their business.[7] PacifiCorp announced and then cancelled non-binding negotiations to sell some distribution assets to OTEC in Wallowa County.[8] [9] Citing differing state policies across its six-state operations, PacifiCorp is also proposing to sell its Washington service area and certain Washington-based generation assets to Portland General Electric. PacifiCorp and PGE have filed with the OPUC to have the transfer approved by March 1, 2027.[10] Altogether, these developments reflect a shifting electric utility landscape and, in the case of the OTEC acquisitions, an expansion of COU service territories in Oregon.

[ii] Data for UIUC are not included in OPUC's Utility Statistics Book; based on DEQ GHG Reporting data for 2024, UIUC sold 23,172 MWh of electricity, or 0.00037% of the electricity sold in the state.[4]

Electric Utility History

Oregon's electric utilities have their roots in municipal and investor-owned utilities founded in the late 1880s. Through the 1920s, cities and investors formed municipal and private utilities in some areas across the state — particularly in urban areas. The expansion of electric service was accompanied by legislation to regulate utilities. The Oregon Public Utility Act of 1911, modeled on a similar 1907 Wisconsin statute, defined public utilities to include entities that delivered heat, light, or power. The 1911 Act authorized the Railroad Commission of Oregon to regulate non-municipal utilities. The 1911 Act included many features of the "regulatory compact" of today — in exchange for the opportunity for profits and monopoly rights within a service territory, the Act required IOUs to provide adequate and safe service to all customers at reasonable rates, and to submit to oversight from a state commission on ratemaking, service reliability, safety, and transparency.[11] Today, the Oregon Public Utility Commission oversees regulation of investor-owned electric utilities in Oregon.

In the 1930s, the state and federal government took action to expand the availability of electricity in rural areas. Oregon adopted a 1930 amendment to Oregon's Constitution for the establishment of people's utility districts[13] — governmental entities that can provide electric service beyond municipal boundaries. Congress passed the Rural Electrification Act of 1936 to provide low-interest financing and other support for rural electric cooperatives.[14] In the same year, Congress formed the Bonneville Power Administration. Congress required that BPA sell hydroelectric power on a preferential basis to rural customers and public entities.[15] These developments led to the formation of many of Oregon's PUD and cooperative COUs in the 1930s and '40s, and expansion of rural electrical service.[16] In 2001, the Cow Creek Band of Umpqua Tribe of Indians established the Umpqua Indian Utility Cooperative, the first formal Tribally owned electric co-op in the Northwest.[17]

Electric utilities often operate as monopoly electricity suppliers in their territories. This practice is based on the treatment of utilities as natural monopolies and has origins in the late 1800s and early 1900s. A natural monopoly is a type of business where high up-front investment costs make competition between companies inefficient.[1] As an example, imagine multiple utilities constructing and maintaining electricity lines to the same households and neighborhoods. This situation would be costly for consumers and offset advantages from the entities' competition. To avoid this outcome, Oregon law generally protects utilities' monopoly provision of electricity within geographical areas designated as their exclusive service territory. In turn, these utilities are subject to regulation to mitigate potential harm from monopoly power.



Lineworkers on a utility pole, circa 1953. Photo courtesy of Portland General Electric and Oregon Historical Society.

However, utilities' monopoly power over the electricity sector has decreased in several ways over time. The federal Public Utility Regulatory Policies Act of 1978 requires utilities to buy output from qualifying small renewable generators and cogeneration facilities at a utility's "avoided cost" rate.[iii] This policy is designed to support a fair and open market for independent electricity producers.[2] The OPUC has imposed procurement requirements to support competitive bidding for some IOU investments. Oregon created a direct access program in 1999. This program allows non-residential customers in IOU territories (typically large industrial users) to contract for power from third-party energy service providers.[3] Additionally, advancements in wind and solar — which are characterized by greater variability based on geography and weather conditions than electricity from conventional power plants — and other factors are making regional markets for electricity generation more important.[iv] While utilities' monopoly over generation has decreased, they retain monopolies on electricity distribution in their service territories.

Utility governance structures and regulatory oversight address the monopolistic power of electric utilities and the public interest in electricity. This is accomplished by the regulation of IOUs by the OPUC and through appointed or directly-elected COU governing boards. Because of the role played by OPUC and COU governing bodies in managing electric utilities' monopoly characteristics, public policy serves an important role in grid planning, operations, security, and affordability.

BPA and Preference Customers

The Bonneville Power Administration is a nonprofit federal power marketing administration created to market electric power from the Bonneville Dam on the Columbia River and to construct facilities necessary to transmit that power. BPA now markets electricity from all 31 federal hydroelectric facilities in the Pacific Northwest, known as the Federal Columbia River Power System, as well as one non-federal nuclear plant and several small non-federal resources. BPA also owns most of the region's high voltage transmission system.[21] [22]

Consistent with federal policies promoting widespread access to electricity service, federal law requires BPA to give preference to public entities and rural customers when BPA markets electric power.[23] Many COUs purchase all of their electricity from BPA, which is among the least expensive electricity in the country.[24] BPA retains its role in providing electricity to COUs as preference customers. BPA also provides benefits from the federal hydro system to rural and residential customers within IOU service territories through the Residential Exchange Program established by the Northwest Power Act of 1980.[25]

Electric System Management and Regulation

To deliver power to customers - and ensure there is enough of it — utilities plan and procure resources. These processes differ across utilities. In planning, IOUs develop integrated resource plans

[iii] The avoided cost rate is intended to represent the incremental cost to the electric utility of electric energy or capacity which, but for the purchase from the QF, the utility would have to generate itself or purchase from another source. For more information, refer to Energy 101: Public Utility Regulatory Policies Act of 1978 (PURPA).

[iv] For more information on electricity markets, refer to Energy 101: Electricity Day-Ahead Markets (2024).

(IRPs) as part of their regulated process. Some COUs also have formal planning processes and COUs enter into long-term contracts with BPA to procure power. In cases of COUs that procure all or most of their power from BPA, this contracting may cover their planning needs. In addition to utility-level planning, the Northwest Power and Conservation Council produces regional Power Plans. BPA is required to act in accordance with the regional Power Plan, and this plan informs utility actions across the region.

Resource procurement and ratemaking are further processes that OPUC oversees for IOUs and boards or city councils review for COUs. Resource procurement is the investment by utilities in generating and other infrastructure. The utility planning efforts described above guide resource procurement decisions. Utilities set rates for electricity that aim to recover the costs of resource procurement and utility operations from ratepayers. This ratemaking process establishes the price that Oregonians pay for electricity. The OPUC is presently investigating a multiyear ratemaking framework to provide more long-term, stable ratemaking for Oregon IOUs.

Beyond the core utility roles of planning, procurement, and ratemaking, Oregon policy regulates utility action in a few areas. Notably, HB 2021 (2021) provides clean energy targets applicable to the state's large IOUs and electric service suppliers. These targets require these entities to reduce their greenhouse gas emissions by 100 percent by 2040. Since 2007, Oregon's Renewable Portfolio Standard has promoted the use of new renewable resources like wind and solar over fossil fuel resources like coal and natural gas. It applies to both IOUs and COUs. The RPS requires each utility to obtain at least 5 percent of the electricity they provide to Oregonians from qualifying renewable resources. In 2026, utilities that historically have supplied over 3 percent of all electricity sales in Oregon must obtain at least 25 percent of their electricity from qualifying sources. The obligation of large IOUs increases to 50 percent by 2040. OPUC oversees IOU compliance obligations under the RPS while COU governing bodies oversee COU compliance with the RPS.

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Developing Community Benefit Frameworks to Support Clean Energy Goals



Community Benefits Frameworks, Plans, and Agreements are all slightly different in their approach. While each seeks to address the needs of host communities, they vary in their legal structures and implementation. In a report developed for the Oregon Department of Energy by Oregon State University capstone students, Community Benefits Frameworks[1] are described as:

> *A set of guidelines to use that sets the stage for plans or agreements at the project level. An umbrella term describing a range of commitments, less formal funds, and payments that a developer may provide to a community (Bingham[2] et al., 2025).*

A community benefits agreement differs from a plan or framework because it is a formal, legally binding contract negotiated between a developer and a community entity, such as a community-based coalition or municipal government (Bingham et al., 2025).[1]

Oregon State University developed the report "Community Benefits for Energy Projects in Oregon" for the Oregon Department of Energy as a landscape review to help the Department determine next steps from a recommended action in the Oregon Energy Strategy:

> *Develop a community benefits framework at the Oregon Department of Energy that can be used as appropriate across the agency to address outreach and engagement, workforce needs, prioritizing environmental justice communities, and equitable practices.*[3]
>
> Federal uncertainty highlights the need for a formalized state community benefits framework that provides meaningful involvement with Environmental Justice communities as defined in HB 4077.[4] [5] Community Benefits Plans were required in many Federal Inflation Reduction Act and Infrastructure Investment and Jobs Act grant-funded programs. Changes in federal policy [have] result[ed] in community benefits plans no longer being required or funded by the federal government.
>
> A community benefits framework would provide a foundation to continue supporting and funding community benefits through the state for energy-related programs and projects. It would provide an opportunity for ODOE-administered projects and programs to learn more about community needs and interests, and could direct benefits by utilizing metrics to develop an implementation plan. It could serve as a starting point for broader consideration of how to incorporate community benefits considerations in programs across the state. ODOE commits to applying the energy strategy's Equity and Justice Framework in developing and implementing the community benefits framework.[6]

ODOE maintains the importance of supporting communities who are disproportionately affected by climate change, communities with limited infrastructure, and rural and coastal communities in the clean energy transition. These groups can be supported and prioritized by using a community benefits approach.

It is important to know that Tribal Benefit Agreements have also been utilized in project development but are outside of the scope of this 101. TBAs differ in significant ways from Community Benefit Agreements (CBAs) by recognizing Tribes as sovereign nations, acknowledging the history and

contemporary contexts of how Tribal sovereigns exist in the U.S., and providing a broader scope for negotiation given the sovereign authority of Tribal nations.[7]

Oregon State University Capstone

ODOE collaborated with Oregon State University capstone students to better understand the landscape of community benefits. OSU and ODOE developed two questions to research:

1. What types of community benefits are currently being provided by clean energy projects and programs in Oregon, and what do these suggest about host community expectations?
2. What approaches have federal and state agencies outside of Oregon used to develop community benefits frameworks for clean energy development, and how do these frameworks vary in their design features and development processes?

OSU determined that a combination of case study analyses and interviews would best address these overarching questions. Students anticipated that the case studies methods would give high-level findings about processes and design, and the interviews would provide complementary details regarding community and developer experiences.[1]

Key Takeaways

Oregon State University's final report names five findings and five recommendations for ODOE to consider when developing a community benefits framework for clean energy development projects.

Findings

1. Frameworks range between standardization and flexibility: There were no standardized approaches to community benefits frameworks across jurisdictions (e.g., mandatory versus voluntary approaches, project size thresholds, participation requirements).
2. Communication and engagement matter: Early and sustained communication can help clarify expectations, build trust, and create opportunities for community input. However, the presence of engagement requirements does not necessarily result in meaningful participation.
3. Community capacity shapes participation: Some communities may lack the legal or technical expertise and political power needed to engage effectively in negotiating and implementing community benefits.
4. Accountability and oversight remain underdeveloped: While some jurisdictions employ or recommend accountability mechanisms, many frameworks lack clear enforcement authority and long-term monitoring responsibilities.
5. Economic and workforce benefits emerged as common priorities: Jurisdictions varied in the benefits recommended, though economic development and workforce and contracting equity emerged as the most common priorities across jurisdictions.

Recommendations

1. Balance standards and flexibility: Establish a baseline set of requirements for community benefits while maintaining sufficient flexibility to allow communities to shape benefits according to local needs and circumstances.

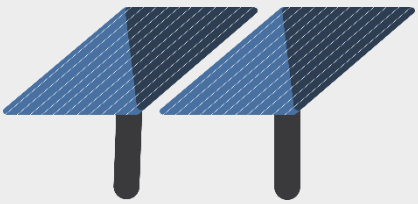
2. Require early and sustained engagement about community benefits: Set minimum requirements and expectations for how developers engage host communities.
3. Provide legal and technical assistance to communities: Create a funding or support mechanism to provide legal and technical assistance to communities negotiating benefits.
4. Strengthen accountability and oversight: Require an accountability and oversight process that includes community members in an oversight capacity.
5. Require a community needs assessment: Require a community needs assessment process prior to community benefits implementation.[1]

Community Benefit Considerations and Clean Energy Deployment

Governor Kotek issued Executive Order 25-29[8] in November 2025, focusing on reducing greenhouse gas emissions and advancing Oregon's clean energy future. Among other directives, the EO directed agencies to look at opportunities to accelerate deployment of clean electricity and transmission infrastructure. Agency responses to this directive identify the potential of including community benefits frameworks, plans, and agreements as a way to encourage meaningful engagement in siting processes and encourage benefits directly to the communities who are most affected by the clean energy transition.

For example, ODOE was directed to "evaluate and recommend actions to update siting and permitting processes to facilitate deployment of renewable energy, energy storage, and grid infrastructure needed to deliver reliable and affordable clean energy to Oregon consumers" (2.c.).[8] The report addresses this by noting, "Division staff will work with ODOE's Communications and Strategic Engagement Team staff to establish practices that could be employed during the NOI stage to better make people aware of the proposed project and encourage their review and comments."[9]

Benefits of Early Engagement



In November 2024, what would be the state's largest solar farm was approved on nearly 10,000 acres of active farmland in Morrow County. With almost 4 million solar panels that can produce up to 1,200 megawatts of power, there are potential negative economic impacts to the local economy with so many acres being removed from production. In addition to other state and local requirements, solar projects that propose to remove more than 12 acres of high-value farmland from production must also meet the requirements of a State Land Use Goal Exception. Specifically, they must justify multiple valid reasons for removing high value farmland from production, which is protected by Land Use Goal 3 (Agriculture Lands). The company seeking a site certificate to build the project, Pine Gate Renewables, collaborated with the community and local government to address the effects on the surrounding dryland wheat producers caused by the removal of nearly 10,000 acres from the local agricultural economy over the stated 40-year life of the facility. This was calculated at $1,179 per acre for a total of $11.08 million. The establishment of an agricultural mitigation fund in the amount of $11.08 million was one of the reasons accepted by EFSC to justify an exception to Goal 3. The fund will be administered by the county and is designed to support projects that improve the long-term viability and resilience of Morrow

County's wheat farms and supporting organizations.[10] Projects will be selected by a nine-person advisory committee of local agricultural interests and two members selected by EFSC to represent statewide or regional interests.

ODOE was also directed[8] to develop a framework for strategic transmission siting. A recommendation in this report is:

> **Framework[11] for community benefits.** The Oregon Energy Strategy recommends developing a community benefits framework at the Oregon Department of Energy that could inform how to incorporate community benefits in energy-related projects across the state. The first step in developing this framework has been undertaken in collaboration with Oregon State University. OSU conducted a case study analysis of eight jurisdictions outside of Oregon, five Oregon case studies, and conducted twelve interviews to map best practices in implementing community benefits frameworks, plans, and agreements. A future step could be to develop a model framework that could be utilized and adapted as needed to support communities in negotiating benefits around transmission development.

The Department of Land Conservation and Development was directed to develop a framework to accelerate energy deployment through Oregon's land use planning.[8] DLCD recommended normalizing community benefit conversations (2.h.)[12] noting:

> "Community benefit conversations should include all cities, rural communities, rural neighborhoods and properties, and Tribes that stand to be [affected]. Community benefits should provide mutual uplift. Having all the right entities in the discussion is the only way to ensure that everyone is heard and everyone's issues are addressed."

Conclusion

Currently, ODOE does not have a formally adopted community benefits framework, though the agency will continue to move forward in developing one per the Oregon Energy Strategy's Cross Cutting Action 12. As the state continues to explore ways to reduce barriers to and accelerate clean energy deployment, it will need to consider how to include community benefits frameworks, plans, and agreements utilizing best practices and examples from across the country.

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Energy Facility Siting and Permitting in Oregon



Siting means choosing where to put something, like a building or a project. It involves picking an optimal spot based on a number of considerations, going through applicable review and public engagement processes, and getting the needed permissions and rights for construction. This process ensures that the chosen location is suitable for the intended use and considers factors like the effects on the environment, Tribal Resources, nearby properties, land use and resource needs, accessibility, and post-approval regulatory compliance.

State Energy Facility Siting Overview

Oregon Energy Facility Siting Council

The Oregon Energy Facility Siting Council plays a central role in reviewing and approving many energy facilities in Oregon, including electricity generation, transmission, and natural gas pipelines. The Council's role is to ensure developers meet state laws and rules governing the siting of energy facilities. These regulations help ensure the state meets its energy needs while also protecting natural resources, Tribal and community interests, and public health. The framework used today was established in 1975, when the Oregon Legislature created EFSC and the Oregon Department of Energy.[1] EFSC is a separate government body from the department, composed of seven volunteer members who serve up to two four-year terms. Members are appointed by the Governor and confirmed by the state Senate.

EFSC has final decision-making authority over whether to authorize an energy facility that falls within state jurisdiction. The Oregon Department of Energy's Siting Division provides staff support to EFSC by coordinating review of proposed large energy facilities—conducting regulatory, technical, and environmental analyses, facilitating public and agency engagement, and advising on compliance with Oregon's siting standards.

Jurisdiction

Not all energy facilities fall within state jurisdiction. Depending on size and type, certain projects may instead be regulated at the federal level (for example, hydroelectric dams or liquefied natural gas terminals) or the county level. Many renewable energy projects fall within EFSC jurisdiction when they exceed statutory thresholds set in Oregon law, while others remain under local control or cross between federal and state jurisdiction. This means that energy development in Oregon can span several layers of governmental authority, and jurisdiction can vary significantly from project to project.

The centralized EFSC and Energy Facility Siting Division system was designed to bring consistency, transparency, and efficiency to decisions about where large-scale energy facilities can be built and how they should operate over time. At its core, Oregon's siting system ensures that major energy projects undergo a coordinated, statewide review, replacing what would otherwise be a patchwork of local and state permitting processes.

Federal and local jurisdiction can intersect with state jurisdiction. While these reviews can happen in tandem, this requires significant planning and coordination by the developer, and can affect the Siting

division's review and overall EFSC timeline. To date, these multijurisdictional reviews have only occurred on transmission line projects.

Many proposed renewable energy projects are not required to be reviewed by EFSC and are instead reviewed at the local government level. However, for these projects, ORS 469.320(8)(a) authorizes developers to opt in to EFSC or local governments to defer jurisdiction to EFSC. Opting in to the EFSC process may be advantageous for projects that span county boundaries, involve multiple local approvals, or benefit from the predictability of a single statewide review structure. To date, no developers have opted in to EFSC, and no local governments have deferred regulatory authority to EFSC.

EFSC Site Certificates

When EFSC issues a site certificate, it is a binding agreement authorizing a developer to construct and operate a facility under defined statutes, rules, and conditions. To receive a site certificate, a developer must demonstrate that the proposed facility meets Oregon's siting standards, which include requirements related to environmental protection, land use, public safety, and other resource considerations.

The siting process is deliberately thorough. Proposed projects are reviewed not only for their location and design, but also for how they will minimize, avoid, or mitigate potential negative outcomes. ODOE staff conduct the technical review and provide recommendations, while EFSC makes final decisions in public, quasi-judicial meetings. This structure helps ensure that decisions are based on a clear evidentiary record and that Tribal governments, members of the public, and local, state, and federal partners have meaningful opportunities to participate.

Over time, EFSC has reviewed a wide variety of energy facilities, including wind, solar, geothermal, hydro, natural gas, coal, and nuclear electrical generation, high-voltage transmission lines, pipelines, nuclear research reactors, and energy storage technologies. As Oregon's energy landscape continues to change, so too does the siting program. Recent applications increasingly incorporate battery storage, hybrid renewable systems,[i] and large transmission corridors needed to integrate new clean energy resources into the grid.

Tribal Coordination

To facilitate stronger Tribal government review of EFSC applications, the process includes providing notification letters to Tribal governments at the same time as applicable state agencies. The review processes also include cost reimbursement agreements to support time of Tribal staff.

Compliance

Beyond initial approval, EFSC also oversees ongoing compliance. Certificate holders are responsible for constructing, operating, and ultimately decommissioning facilities in accordance with their site certificate conditions, while ODOE staff monitor performance, conduct inspections, and review

[i] Hybrid renewable systems incorporate more than one type of renewable energy resource at one facility, such as the Nolin Hills Wind Power Project and the Biglow Canyon Wind Farm, which are approved for solar and wind electricity generation as well as battery storage.

amendment requests. This long-term oversight ensures that facilities continue to meet state standards throughout their operational life.

Today, Oregon's siting system is an important tool for balancing the state's need for clean, reliable, and affordable energy with its responsibility to protect communities and natural resources. The process provides predictability for developers, transparency for the public, and accountability throughout the lifetime of energy projects, supporting a statewide energy transition grounded in environmental stewardship and public trust.

Executive Order 25-29 Report on Siting and Permitting Large-Scale Electricity Infrastructure



Executive Order 25-29 directs Oregon agencies to streamline siting and permitting processes for clean energy projects, energy storage, and transmission infrastructure.[2] In response, the Oregon Department of Energy's Energy Facility Siting Division evaluated its statutory authorities, rules, and practices to identify opportunities for greater efficiency while maintaining strong protections for public health, communities, and natural resources.

ODOE conducted a comprehensive assessment of Oregon's major energy permitting pathways to identify what already works well, what streamlining efforts are already underway or planned for, and where additional opportunities exist to increase efficiency. The report included an evaluation of statutory requirements, administrative rules, agency practices, and recent project experiences to inform near-term streamlining opportunities and longer-term strategic improvements across state, local, and federal interfaces.

Oregon's centralized siting process provides several foundational efficiencies that help minimize the amount of time it takes to site a facility, including:

- A single statewide review for large energy facilities
- Established, uniform siting standards
- Consolidated public processes
- Coordinated technical reviews across multiple agencies

These elements can create clarity and predictability relative to many states with decentralized systems.

Despite structural strengths, there are several reasons that can increase the time and effort to move projects through siting and permitting:

- Incomplete application submittals
- Increasingly complex projects, especially hybrid and multi-component clean energy systems
- Insufficient early Tribal outreach and coordination by the project proponent, where early and consistent engagement can ensure Tribes have the opportunity to have a say in how best to protect their resources

- Increase in controversy and public opposition that extend timelines and require significant staff and legal resources
- Multi-jurisdictional reviews involving federal agencies, with specific timelines, requirements, and stage gates
- Insufficient staffing capacity across agencies as the volume and complexity of projects has grown
- A thorough process that requires an applicant to demonstrate compliance with standards and includes enough evidence to withstand legal challenges

ODOE's Siting Division is already taking steps to improve efficiency and transparency, including:

- Strengthening relationships, protocols, and requiring project proponents to seek earlier engagement with Tribes
- Updating rules to clarify requirements and reduce procedural ambiguity
- Expanding public engagement tools, including improved notices and virtual participation that aim to make it easier for the public to follow and participate in proceedings
- Adopting digital tools for filings, GIS analysis, and workflow management that will facilitate faster internal processes

These improvements provide measurable benefits today and support more substantial reforms ahead.

The report identifies additional actions that could meaningfully streamline processes, but may require statutory and rule changes and would require additional resources, and/or funding:

- Modernizing contested case procedures to reduce delay while ensuring fairness
- Leveraging artificial intelligence and automation to support document review, data processing, and analysis
- Increasing staffing within the ODOE Siting Division and reviewing agencies to address workload constraints
- Evaluating opportunities for more parallel or concurrent reviews across Tribal governments, agencies, and jurisdictions
- Strengthening interagency coordination on state jurisdictional reviews through shared schedules, joint guidance, and clearer expectations

Further information on past, current, and future streamlining ideas can be found in the report.

How is Jurisdiction Determined?

Determining which government entity has authority over a proposed energy facility is a foundational early step in the siting and permitting process. Jurisdiction is shaped by several factors, including the type and size of the facility, land ownership, and the defined authorities of Tribal, state, local, and federal governments. This can lead to significant project complexity, so understanding these distinctions helps applicants, communities, and agencies anticipate the appropriate review pathway(s) and coordinate across multiple permitting processes when needed.

Table 1: Renewable Energy Project Primary Permitting Jurisdictional Thresholds

Renewable Energy Type	County[ii]	County with HB 2329[3]	EFSC	Oregon Water Resources Commission	Oregon Department of State Lands	Federal Government
Solar Photovoltaic *High Value Farmland*	< = 100 acres	> 100 acres & < = 240 acres	> 240 acres	N/A	N/A	N/A
Solar PV *Arable Farmland*	< = 100 acres	> 100 acres & < = 1,280 acres	> 2,560 acres (4 sq. miles)	N/A	N/A	N/A
Solar PV *Other Land*	< = 320 acres	> 320 acres & < = 1,920 acres	> 3840 acres (6 sq. miles)	N/A	N/A	N/A
Onshore Wind	N/A	< = 100 Average MW Capacity	> 100 Average* MW Capacity or > 300 Peak or Nameplate** MW Capacity	N/A	N/A	N/A
Geothermal	N/A	< = 55.5 MW	> 55.5 MW	N/A	N/A	N/A
Biomass	< 6 BBTU/day	N/A	> 6 BBTU/day	N/A	N/A	N/A
Offshore (wind and wave)	N/A	N/A	N/A	N/A	< = 3 Miles Offshore	> 3 Miles & < = 200 Offshore (BOEM)
Battery Storage	All projects	N/A	N/A	N/A	N/A	N/A
Hydroelectric	N/A	N/A	N/A	Projects in waters of the state. Oregon licensing process is done in coordination with FERC[4] both	N/A	Projects in waters of the U.S. (FERC)

[ii] ORS 469.320(8)(a) allows for developers to opt in to state jurisdiction or local governments to defer to state jurisdiction for wind, solar, battery energy storage and associated transmission lines.

				> and < 100 THP[5]		
Pumped Hydroelectric	N/A	N/A	N/A	Oregon licensing process is done in coordination with FERC	N/A	All projects (FERC)

*"Average" equals the peak or nameplate capacity divided by the amount listed in ORS 469.300(4).
**"Peak or Nameplate" equals the manufacturer maximum rated capacity of all combined wind turbines.

The type and size of a facility are the basis for determining projects that are subject to Energy Facility Siting Council jurisdiction. Oregon Revised Statute 469.300 defines the types of facilities that fall within EFSC jurisdiction and establishes thresholds that determine when a facility must obtain a site certificate before construction or operation.[6] When a project meets or exceeds EFSC thresholds, the Council becomes the primary permitting authority for the state. Thresholds apply to a range of project types, including thermal power plants, high-voltage transmission lines, natural gas pipelines, wind and solar energy facilities above certain capacities, geothermal developments, and nuclear projects. As indicated in the tables below, the legislature periodically updates these thresholds.

Table 2: Solar Photovoltaic Power Generation Facility State Jurisdictional Threshold Changes Over Time

Agricultural Capability	Pre-2013	After 2013 HB 2820[7]	After 2019 HB 2329	After 2023 HB 3179[8]
High Value Farmland	>100 Acres	>100 Acres	>160 Acres	>240 Acres
Predominantly cultivated land	>100 Acres	>100 Acres	>1,280 Acres (2 square miles)	>2,560 Acres (4 square miles)
Other land	>100 Acres	>320 Acres	>1,920 Acres (3 square miles)	>3,840 Acres (6 square miles)

Table 3: Wind Power Generation Facility State Jurisdictional Threshold Changes Over Time

Capacity	Pre-2019	After 2019 HB 2329	After 2025 HB 3874
Average MW Capacity	35	50	100
Peak or Nameplate MW Capacity	105	150	300
# of Turbines based on 2.5 MW Nameplate Capacity and 500 feet in height	42	60	120

Table 4: Geothermal Generation Facility State Jurisdictional Threshold Changes

Capacity	Pre-2019	After 2019 HB 2329
Average MW	35	50
Peak or Nameplate MW	38.85	55.5

Certain facilities may qualify for statutory exemptions from EFSC review, often based on design characteristics or efficiency standards. Exemptions change the permitting pathway but do not remove a project's obligation to comply with other applicable state and local laws. Recent rulemaking clarified exemption criteria, ensuring they are applied consistently while maintaining alignment with Oregon's energy and environmental goals. With passage of HB 4031 in 2026, developers of solar, wind, marine, and geothermal projects of any size can elect to have their projects reviewed at the county level until Dec. 31, 2028 if their project meets certain federal tax credit eligibility requirements.[9]

County Jurisdiction

If a proposed energy facility does not meet EFSC thresholds, primary permitting authority typically rests with the county where the project is located. Counties evaluate land use compatibility under local zoning ordinances and comprehensive plans that are consistent with Oregon's statewide land use planning goals and apply any local conditional use requirements. This approach allows smaller or less complex projects, such as distributed renewable energy facilities or transmission segments below jurisdictional thresholds, to be reviewed under a local framework tailored to community needs and resource considerations. This approach can lead to differences in siting processes between counties because of varied land use requirements and local ordinances.

ORS 469.320(8)(a) allows for developers to opt in to state jurisdiction or local governments to defer to state jurisdiction for wind, solar, battery energy storage and associated transmission lines.

Counties also play a critical role in all EFSC proceedings because they provide important data and expertise. EFSC relies on local land use information and ordinances to inform their decisions. County governing bodies serve as Special Advisory Groups for EFSC, providing recommendations and context related to local planning and community impacts throughout the siting process. Counties are compensated for their time and efforts through cost reimbursement agreements.

Land Ownership

Land ownership also affects which Tribal governments, federal, state, or local government agencies hold jurisdiction over siting and permitting requirements. Oregon's mix of Tribal, private, state, and federal lands shapes which authorities are involved in siting decisions and which processes apply.

- **Tribal trust and reservation lands** are subject to Tribal and federal authority. Oregon's nine federally recognized Tribes are sovereign governments, and the state does not have jurisdiction over any proposed energy facilities on these lands. Coordination for proposed projects near Tribal lands requires engagement early in the process to identify and protect cultural and natural resources.
- **Private lands** serve as the location for most EFSC-jurisdictional renewable energy and transmission projects.
- **State lands** may involve additional coordination with agencies authorized to manage the property, such as the Department of State Lands.
- **Federal lands** introduce federal permitting requirements, even when a project is otherwise consistent with state siting provisions.

What's that Acronym?

In siting processes, many of the entities and regulations are commonly referred to by their acronym.

EFSC: Energy Facility Siting Council

FERC: Federal Energy Regulatory Commission

LCDC: Land Conservation and Development Commission

NEPA: National Environmental Policy Act

CATEX: Categorical Exclusion Determination

EA/FONSI: Environmental Assessment/Finding of No Significant Impact

EIS: Environmental Impact Statement

BLM: Bureau of Land Management

USFS: U.S. Forest Service

More acronyms: EFSC-Acronyms-and-Abbreviations.pdf

Some types of energy facilities fall within exclusive or shared federal jurisdiction. In these cases, state authority may be limited or preempted. Federal jurisdiction commonly arises in the following situations:

- Interstate natural gas pipelines and certain hydroelectric projects, which are regulated by the Federal Energy Regulatory Commission (FERC).
- Transmission lines or renewable energy projects located on federal lands, which require federal environmental review under the National Environmental Policy Act (NEPA) and permitting from agencies such as the Bureau of Land Management (BLM) or the U.S. Forest Service. If these meet or exceed EFSC's statutory thresholds, they are also state jurisdictional.
- Facilities owned or operated by federal power authorities, such as the Bonneville Power Administration.

Where federal jurisdiction applies, Tribal governments and state and local governments may participate as cooperating agencies or issue supporting permits in the federal agency decision-making process. When multiple jurisdictions are involved, applicants must navigate

multi-layered review pathways. Thoughtful coordination among agencies can help reduce confusion and shorten approval timelines.

Siting Steps at County, State, and Federal Levels

County and state siting approval processes are similar in their purpose and goals. Decisions must be based solely on evidence submitted for the record and provide opportunities for public review and comment. EFSC members or county officials work to ensure that applicants meet certain requirements and adhere to the law. In general, as long as all applicable requirements are met, applicants receive permits.

Most utility-scale projects are proposed on lands zoned for agricultural use, which requires a conditional use review as part of the siting approval process. The Land Conservation and Development Commission (LCDC) establishes the base review requirements that must be applied. These include an exception to Statewide Planning Goal 3 (Agricultural Land) for solar projects that exceed specific acreage thresholds, which applies to both state and county jurisdictional projects.

Counties must meet state laws when approving energy projects. The processes by which they consider these approvals are determined by the Land Conservation and Development Commission's procedural and substantive requirements, in addition to any locally adopted substantive requirements. Further information on the county process and comparison of county review vs. EFSC review can be found in ODOE's Report on Siting and Permitting Large-Scale Electricity Infrastructure.

The EFSC process is a consolidated and uniform pathway for energy projects that is inclusive of all state agency permitting processes.

Major Phases in the EFSC Review Process

- **Notice of Intent:** an applicant gives notice that they plan on submitting an application for approval to build an energy facility.
  - **Public Comment Period and Public Informational Meeting:** Notice is provided to adjacent property owners and anyone signed up to receive project notices. The notice establishes a comment period and one or more information meetings scheduled in the vicinity of the proposed facility. These meetings serve to provide the public with general information about the facilities, including potential impacts to communities and resources as well as their opportunities to participate in the review process.
  - **Project Order:** ODOE prepares a project order establishing all state and local standards or criteria that must be met in the application.
- **Application:**
  - Developer submits application, including all information requirements as outlined in the Project Order.



- **Completeness Review:** ODOE conducts a completeness review of all application materials and requests additional materials as needed until application is deemed complete and ready for the next phase. Once an application is complete, ODOE provides public notice of its availability and holds one or more public information meetings in the vicinity of the project to help prepare them for the Draft Proposed Order step.
- **Draft Proposed Order:** ODOE creates a draft order for site certificate based on its assessment of the complete application. The order includes the assessment of the application, including findings of fact and how those facts do or do not meet the statutory and rule requirements for a facility, as well as conditions for each phase of the facility that the certificate must abide by.
    - Comment periods are provided for public input on the complete application and Draft Proposed Order. This provides an opportunity for the public to comment on the DPO within the context of siting statues and rules. Commenters who provide applicable comments at this phase are then eligible to participate at the contested case phase.
- **Proposed Order:** ODOE revises the Draft Proposed Order based on EFSC's discussion and deliberations, including input from the public to create a final proposed order for EFSC to consider.
- **Contested Case Proceeding:** A contested case provides an opportunity for those who properly raised an issue during the public comment period to challenge ODOE's recommendations to EFSC.
- **Final Order and Possible Site Certificate:** ODOE prepares a final order for EFSC to consider, and EFSC decides if an application will receive a site certificate.
- **Next Steps:**
    - Preconstruction: If a facility is granted a site certificate, the next step it enters into is preconstruction. At this phase, a project finalizes build plans, works to obtain any additional permits needed, and finalizes mitigation and revegetation plans among other tasks. The certificate holder works closely with siting staff to ensure that all preconstruction conditions are met before moving into the construction phase.
    - Construction: At this phase, a certificate holder has met all their preconstruction conditions and has received a verification of completion from ODOE. This allows the certificate holder to move into construction. This phase is closely monitored by ODOE to ensure certificate holders adhere to all construction conditions of their site certificate and includes monthly inspections and semi-annual reports.
    - Operations: Once a facility has completed all construction activities, it moves into operations. Operational facilities have a set of certificate conditions that must be met,

What are Contested Cases?

Contested cases are designed to have a third-party hearing officer further evaluate specific issues from ODOE's recommendation to EFSC. While it plays an important role in ensuring appropriate compliance, and further establishes the record on those issues that could be appealed to the Oregon Supreme Court, it adds additional time to the process.

To participate in a contested case a person or group must make an applicable comment during the open comment period at the Draft Proposed Order phase. Applicable comments are ones that are clearly tied to siting statute and rules and demonstrate how an application is not meeting a specific statute or rule.

and ODOE siting staff monitor the facility through site inspections, annual reporting from the certificate holder, and incident reporting from the certificate holder.

- Retirement: At the end of the life of a facility, it will move into the retirement phase. At this phase, a project must formally submit a retirement plan to EFSC for approval. This plan should outline how the facility will be decommissioned safely and render the space back to the usable condition it was in prior to the facility being built.

Federal Siting

When a federal agency develops a proposal to take a major federal action, such as move toward a siting approval, the law requires the applicants conduct a National Environmental Policy Act assessment. The environmental review under NEPA can involve three different levels of analysis: [10]

- **Categorical Exclusion (CATEX)** applies to routine actions that are in a predefined category of projects that have already been analyzed and that "normally do not significantly affect the quality of the human environment." A CATEX determination would exclude the need for additional NEPA analysis.
- **Environmental Assessment (EA)** is used to determine if a project could potentially have significant impacts and could result in a Finding of No Significant Impact (FONSI), which would preclude the need for a full Environmental Impact Statement or the project transition to an EIS.
- **Environmental Impact Statement (EIS)** is a comprehensive, detailed study mandatory for major federal actions that are known or expected to significantly affect the quality of the human environment. Some complex projects conduct this type of analysis without an EA ahead of time. An EIS provides an assessment on the specific potential effects and examines alternatives that would mitigate those negative effects.

Further information on Federal review steps can be found in ODOE's Report on Siting and Permitting Large-Scale Electricity Infrastructure.

Compliance

State of Oregon

ODOE's Siting Division is funded and authorized to ensure that all facilities remain in compliance with site certificate conditions throughout their entire lifecycle.[6] This includes oversight pursuant to ORS 469.310,[iii] which establishes the policy that energy projects, as defined, must be constructed and operated "in a manner consistent with protection of the public health and safety and in compliance with the energy policy and air, water, solid waste, land use and other environmental protection policies of this state."[6]

ODOE's Siting division works with certificate holders to review certificate conditions at each phase of project:

- Preconstruction
- Construction
- Operations

[iii] Oregon Revised Statutes

- Retirement/Decommissioning
- Incidents
- Violations
- Requests for Inspection

At each phase, division staff review conditions and confirm with the certificate holder that they are in compliance. If any condition is out of compliance, the Siting Division works with the certificate holder to come into compliance with the condition.

Further information about each phase can be found in the Report on Siting and Permitting Large Scale Electricity Infrastructure.

For projects authorized at the county level, counties are not explicitly obligated to ensure compliance with land use decisions. Ongoing compliance monitoring requires that counties have sufficient staffing and resources to undertake consistent, proactive compliance activities; most counties where utility scale energy facilities are constructed do not have sufficient resources.

Federal Level Compliance

The actions, terms, and conditions stated in the Record of Decision are enforceable by federal agencies and private parties. The ROD can be used to compel compliance with or execution of mitigation, monitoring, and enforcement measures identified therein.[11] Once the ROD has been issued, the Lead Agency Official for the NEPA review remains responsible for overseeing and demonstrating compliance with the ROD and all applicable requirements.

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Reliability, Firm Power, and Keeping the Lights On



We live in a time of rapid change in the electricity landscape. More extreme weather is becoming the norm. Large electricity users, including data centers, are significantly increasing electricity demand. Electricity networks are nearing their limits, requiring upgrades and expansion. Electrification, coal retirements, and a shift to clean resources are all changing how energy is used and generated. These rapid changes are creating concerns over electricity reliability or the ability to "keep the lights on." This has become a region-wide concern that affects Oregon as part of a broader interconnected regional electricity system.

Electricity system reliability refers to whether there is enough power to meet demand across all hours of the year. It this context, every resource has its strengths and limitations. Power planners need to understand the amount of power that can be available, with a high degree of certainty, to meet electricity demand every hour of the year. In the Northwest, the most difficult challenge lies in meeting demand during a prolonged cold or heat event that coincides with a low hydro year. As technologies evolve and the electricity system diversifies, it is important to consider not just how individual technologies operate, but how a portfolio of resources can supply electricity reliably.

Resource Adequacy, Firm Power, and Resource Sufficiency

The job of electricity system planners and operators is to make sure the system is ready to meet daily fluctuations in electricity demand, seasonal differences, and high stress events. This requires operating the electricity system in real time while planning over different time horizons (hours, days, months, years).

This is because the electricity system is dynamic, constantly adjusting to shifts in human behavior, economic activity, industrial processes, and changing weather. For example, on weekdays, household power demand rises as people wake up and start their days. It flattens as many people leave home for school and work — and it rises again in the late afternoon and evening, settling at a lower level while people sleep. Weekends look different. Industrial demand has a different daily and weekly profile, depending on the industry. Throughout the year, there is also variability. Fall and spring tend to have relatively mild temperatures and lower heating or cooling needs, while winter and summer experience more extreme highs and lows. Weather can also fluctuate from year to year, and extreme weather years can challenge electricity systems.

In system planning, the concept of "resource adequacy" refers to "having enough resources to provide electric service under a range of conditions or scenarios with a sufficient degree of reliability."[1] This means sizing the system for when electricity demand is expected to reach record highs, or peaks, while accounting for uncertainty in generation such as unplanned generator outages and variability in renewable generation.

Ensuring resources are available to generate enough electricity during critical periods is key. This is where sufficient and firm power comes in.[i] Firm power is defined as: "Power or power-producing

[i] This article focuses on firm power, as opposed to firm *loads* or firm *energy requirements*, which are detailed in the Northwest Power Planning and Conservation Act. Discussion of firm transfer capacity on transmission lines is also out of scope.

capacity, intended to be available at all times during the period covered by a guaranteed commitment to deliver, even under adverse conditions."[2] For many decades, the power system relied almost exclusively on firm technologies, such as natural gas, nuclear, geothermal, coal, and hydro. With an evolving resource mix that includes variable renewable resources, battery storage, virtual power plants, and other technologies, a key consideration for system planning is how to account for the contribution of each resource to system needs, and to identify the least-cost portfolio of resources that can work together to meet electricity needs reliably and in line with state policies.

An Evolving Electricity Mix

The resources that produce electricity in the region have evolved as technologies have advanced. Figure 1 is taken from the 2005 Northwest Regional Power and Conservation Plan. It provides a snapshot of resources powering the Northwest over time. In 1960, hydropower supplied virtually all the region's needs. Twenty years later, the resource mix included coal, hydro, natural gas, and nuclear. By then, the hydroelectric system was no longer sufficient to meet regional load growth. By 2003, more coal, natural gas plants, wind, and other resources were added to the mix.

Figure 1: Changing Pacific Northwest Sources Electricity Generation in the Northwest, 1960-2003[3]

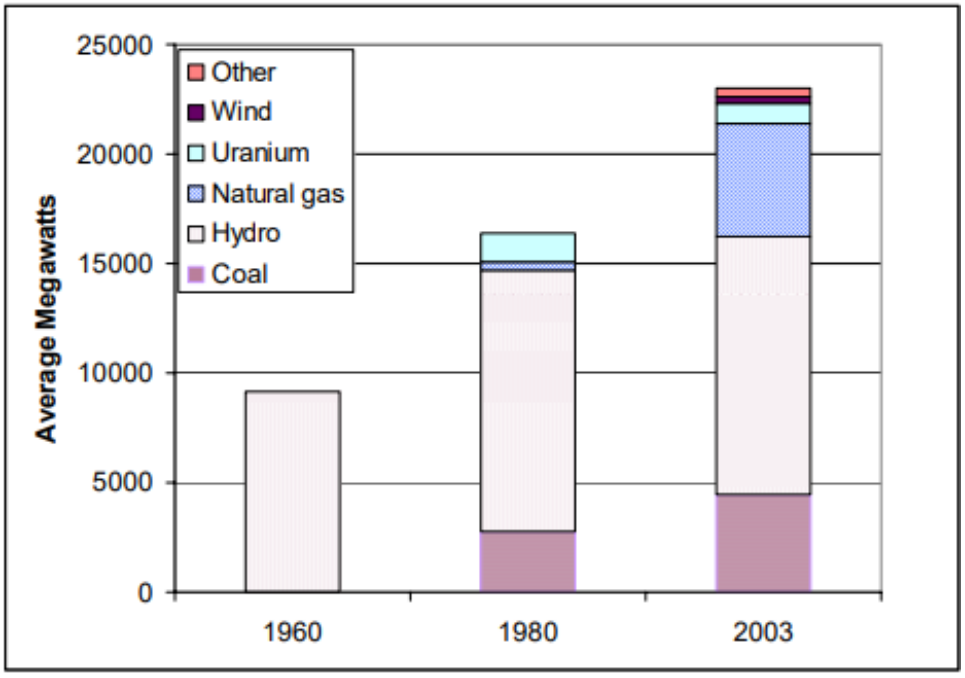
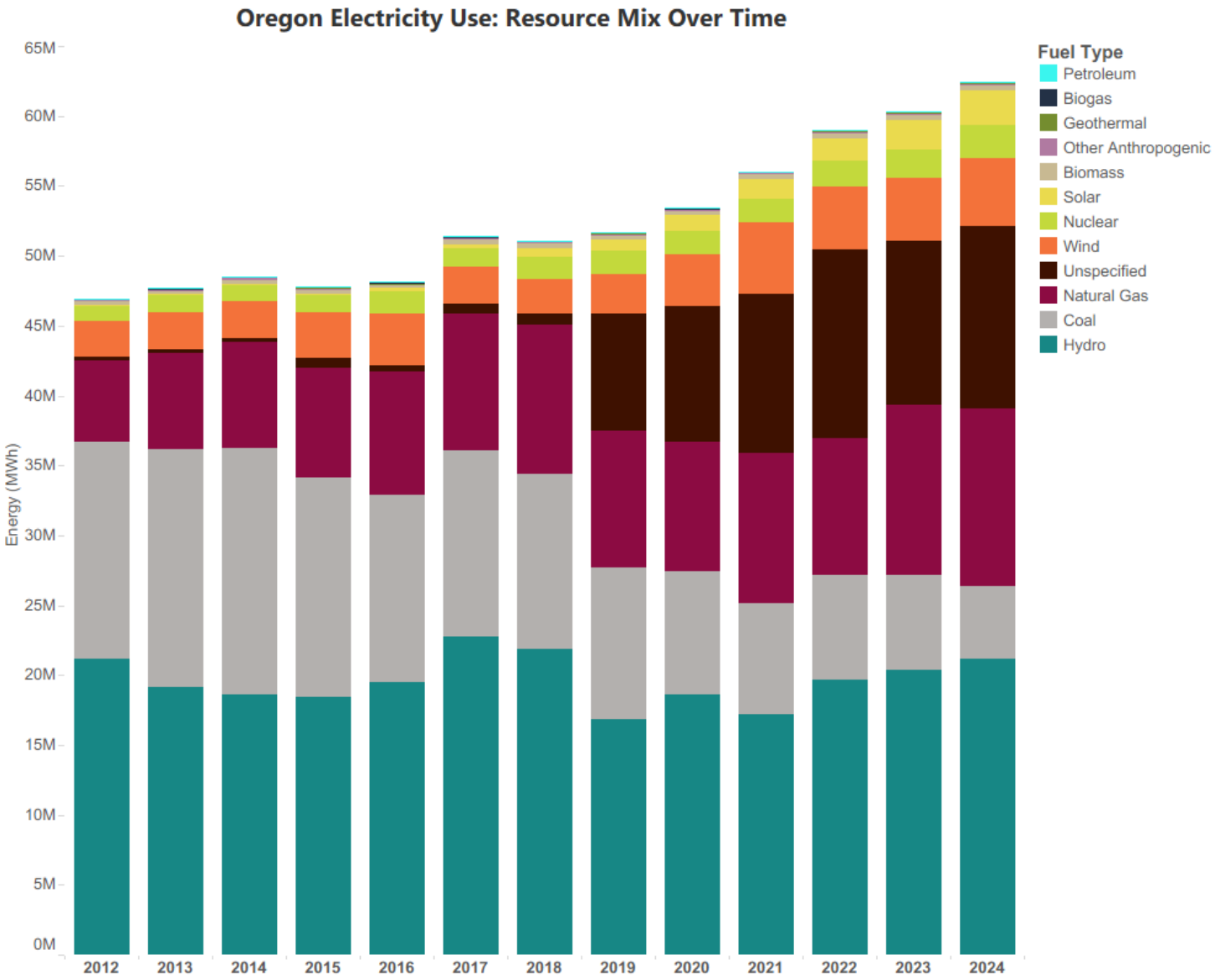


Figure 2 provides a closer look at how the electricity resource mix in Oregon has evolved in recent years. From 2012-2024, many Pacific Northwest states established policies that drove a shift in resources. Wind, solar, and natural gas power production increased, while coal power decreased. Hydropower production in Oregon and the Northwest fluctuates each year based on snowpack and precipitation, meaning the same system of dams can produce different amounts of electricity depending on water conditions.

Figure 2: Oregon's Electricity Resource Mix, 2015 - 2024[4]



An accounting change is responsible for the increase in "unspecified" power in 2019.[ii] Unspecified power is electricity purchased from the market where the specific source is not identified. It may come from a mix of resources across the West, including hydro, gas, coal, wind, and solar. Market transactions have been increasing over the past several years and are expected to further grow with the establishment of electricity day-ahead markets in the West.[iii] This is important, because electricity markets provide an efficient way to take advantage of resources located outside of Oregon – like solar power produced in the southwest and wind in states located to the East – and to export power from

[ii] ODOE does not have access to the data necessary to produce the resource mix for market purchases but is looking into options on how to report this information in the future.

[iii] Extended Day Ahead Market and Markets+.

Oregon when it is abundant. Natural gas and coal resources from outside the region also help meet demand, especially at times when the grid is stressed.[iv]

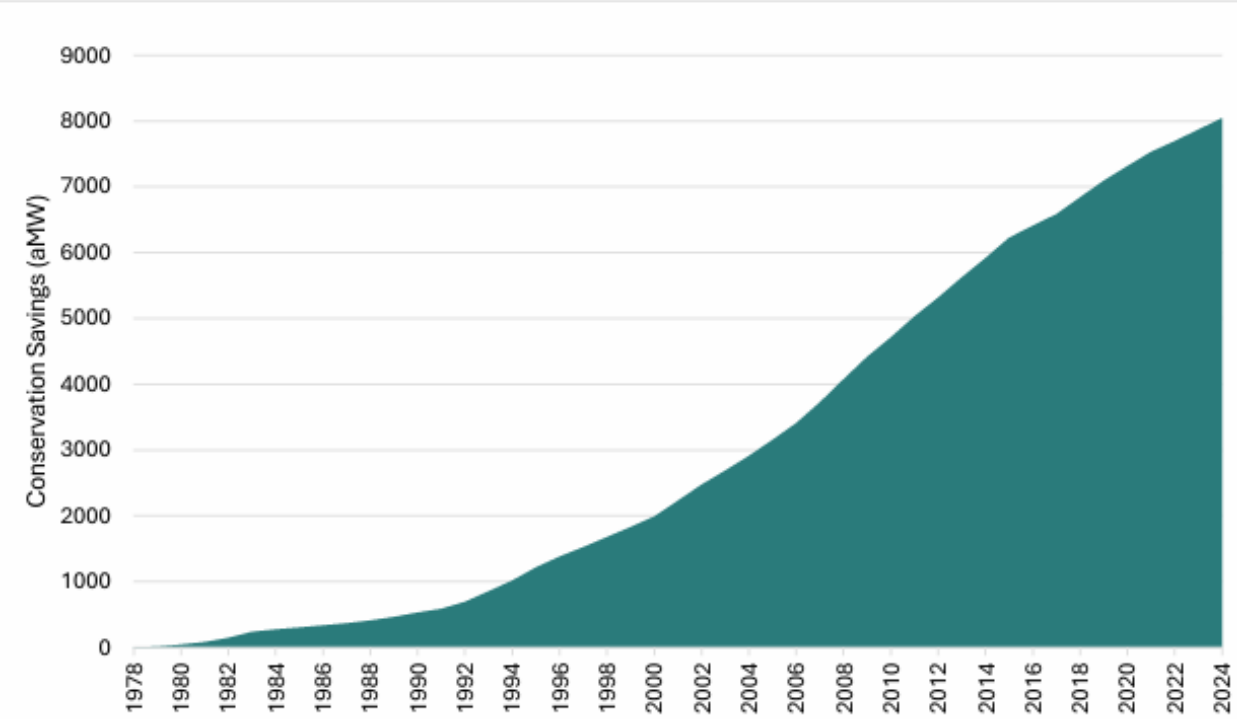
As these images illustrate, Oregon and the region have transitioned to a more diverse system over time. Regional forecasts are showing continued diversification with increasing shares of variable[v] renewable resources and batteries, driven by economics and state clean energy policies.

Distributed Resources

The portfolio of resources that can meet energy needs goes beyond utility-scale electricity generators. It also includes technologies and measures that can take place at community or building level. Reducing energy consumption (energy efficiency or conservation), shifting energy consumption in time (demand flexibility), and generating and storing power locally (such as through rooftop solar PV and batteries) are all examples of distributed resources. These resources can be deployed individually or bundled into virtual power plants, described further in this document.

Since the 1980s, energy efficiency or conservation has been recognized as a top priority to meet resource needs in the Northwest. The Northwest Power Act defines conservation as "any reduction in electric power consumption as a result of increases in the efficiency of energy use, production, or distribution."[5] Over the past 45 years, energy efficiency has reduced regional demand for electricity by more than 8 GW of power, more than 6.5 times the generating capacity of the Bonneville Dam.[6 7]

Figure 3: Northwest Conservation Savings Since 1978[8]



[iv] Under Senate Bill 1547, Oregon's investor-owned utilities must eliminate all coal-generated power from electricity sales to their customers in Oregon.

[v] Variable renewable resources are technologies whose electricity production levels vary – go up or down – with the availability of naturally occurring resources. Examples are wind and solar power.

Another important area of opportunity is shifting electricity consumption in time, often referred to as demand response or demand-side flexibility.[vi] Demand response is not a new concept. In Oregon and around the world, utilities have contracted with large electricity users to reduce operations when called on. This generally has occurred during rare instances of critically high peak demand or system stress.[9] More recently, smaller electricity users are also shifting their energy use. For example, price signals are encouraging customers to shift electricity use away from higher-cost peak periods to lower-cost off peak periods, or participating in active demand response or "virtual power plant" programs.

These programs deploy existing devices flexibly, and coordinate distributed resources such as rooftop solar PV panels, batteries, and other standby generation.[vii] A virtual power plant can orchestrate all of these resources in configurations that support power system reliability. For example, as of 2026, PGE operates a VPP portfolio that contains a mix of flexible load, solar, battery, and dispatchable standby generation across more than 230,000 participating customers. PGE has called on these resources hundreds of times over the past year, including during regional peak events.[10] PGE's 2023 IRP sets an aspirational goal to grow its VPP capacity to 25 percent of historic peak demand.[11]

Defining Reliability and Firmness for Critical Periods

The idea of "firmness" can be thought of as a guarantee of availability regardless of weather or economic conditions. If you make firm plans, it means that you've agreed with others to meet at a certain place and time to do something together and participate through the whole activity. Similarly, ensuring reliable, firm power requires planning to determine – with a high degree of certainty – which resources can be relied upon to be available, at a designated place, to reliably generate electricity for a duration of time.

Each resource has strengths and limitations in this regard. System planners have tools to help ensure that they can determine which resources they can count on, at what level, when, and for how long. The following is a summary of common challenges that different resources face.

Table 1. Common challenges and approaches for different resources

Resource	Common Challenge	How This is Addressed
Hydropower*	Snowpack can vary greatly year-to-year and between seasons; rain and other weather can also affect hydro availability.	Planning is conducted using a historical low water year, so that even in a low hydro year, reliability can be maintained.

[vi] Note that demand-side flexibility is often characterized as a broader concept than demand response, and reflects the many ways in which demand shifting can support power system needs such as peak demand, frequency regulation, and integrating variable renewable resources.

[vii] Dispatchable standby generation refers to customer-owned backup generators.

Natural gas	Natural gas generators can face fuel supply and delivery risks.	Historical data on forced outages, seasonal operational constraints, fuel supply challenges, and other issues affecting operations are accounted for in estimating plant availability.
Nuclear power	There is a need for periodic maintenance and refueling.	Historical performance and forced outage data are accounted for in estimating plant availability.
Geothermal	The heat of a geothermal source declines over time (steam field degradation) and there is a need for periodic maintenance.	Historical performance and forced outage data are accounted for in estimating plant availability, and power output is derated to account for steam field degradation.
Variable renewable resources (solar, wind)	Solar and wind power generate more or less electricity depending on how strongly the sun is shining and the wind is blowing.	Seasonal and hourly performance data are used to calculate the contribution these resources can be expected to make during critical events. Data can be calculated in geographic clusters to account for different climates and local needs.
Demand response	Incentives and technologies must be aligned to generate consistent and predictable responses in energy consumption.	Price signals, direct load control, and customer notifications are examples of tools used to generate reliable results. As with power plants, historical performance during tests and events are used to demonstrate the amount of demand reduction that can be counted on. Demand response might be bundled into different products demonstrating the ability to shift a certain amount of load, for a certain duration, with a certain frequency.
Batteries (Battery Energy Storage Systems or BESS)	Battery capacity and recharge times limit how and how long batteries can effectively operate.	The contribution of batteries to reliability is primarily determined by how long and how frequently they can discharge during periods of system need. They are often combined with other resources (including other batteries or variable renewable resources) or strategically located on the electricity system to provide more durable reliability support.

*Storage hydropower is the single largest firm resource in the Pacific Northwest.

While Table 1 addresses each resource separately, it is important to design a system where resources work together. Particularly as Oregon and much of the region transitions away from fossil resources and towards more variable renewables, the challenge is not substituting capacity 1:1, but rather investing in a resource portfolio with the capabilities needed to meet reliability needs.

How are Resource Contributions Measured?

There is no single methodology or metric used across the U.S. to measure the contribution of different resources to critical hours. However, a commonly used indicator is Effective Load Carrying Capability (ELCC). This is a measure of how a resource's expected performance during critical hours compares to what a "perfect resource" would provide.

For example, a solar facility might have a nameplate (or maximum) capacity of 100 MW, which it can generate at noon on a sunny, summer day. But it may only be able to provide 30 MW of power during other times, such as a critical summer peak period in the early evening. In that case, its ELCC would be 30 percent. So if planners are trying to ensure that there are enough resources to meet early evening peaks in July, they know that solar can be relied on to provide 30 MW to support that need.

The ELCC may also fall with increasing amounts of installed solar capacity. This is because ELCC is not just a measure of predicted performance, but of the potential of a resource to contribute to reliability needs. If the grid becomes saturated with solar, for example, adding more solar power will have diminishing returns in meeting resource adequacy needs. In this case, its ELCC will be reduced.

The ELCC of resources can range from very low to very high and differ across seasons. The Western Resource Adequacy Program[viii] has published a range of preliminary ELCCs for solar in the Northwest across winter and summer months.[12,13] The highest ELCC in the WRAP sub-region that covers Oregon is 78.5 percent in June, and the lowest is near-zero in November. This makes sense when considering the difference in how much sun the region sees in

Measuring Firmness: The Western Resource Adequacy Program

Starting in 2019, numerous utilities from across the West launched an effort to understand the resource adequacy problem in the region and identify possible solutions. The effort resulted in a region-wide approach for evaluating and addressing resource adequacy to support reliable electricity delivery. Participants in the program must demonstrate that they have enough resources to meet their share of regional capacity needs for the upcoming season – winter or summer. If they fall short, they have time to secure more resources in time for the season. The program includes an operational component allowing participants to pool and share resources during tight grid operating conditions.

In Oregon, Clatskanie PUD is a member of WRAP, along with BPA who serves utilities throughout Oregon and the region.

[viii] The Western Resource Adequacy Program is an initiative of the Western Power Pool to bring utilities together to support resource adequacy across the West.

winter versus summer.[ix] The ELCC is higher when solar is combined with batteries, because together solar and batteries can produce more power to support system needs.

Another example comes from PJM, an electricity market in the Midwest and Mid-Atlantic. PJM publishes ELCC ratings for resources participating in its three-year forward market, which is part of how the region plans ahead. Some of the highest ELCC values in that region for their 2027/2028 forward auction are for nuclear power (95 percent), demand response resources (92 percent), and diesel generators (92 percent).[14] [15] [x]

In the Pacific Northwest, the greatest risks that system planners need to prepare for are low hydro years combined with either a multi-day winter cold snap or summer heat dome. The winter event is particularly challenging because in winter, solar output is limited and there is a risk that there may also be low wind generation.

Average vs. Peak Loads

While the power system is built for critical periods, it operates at much lower levels most of the time. This means it is important to consider a mix of resources that can provide power day-to-day, and those that can provide predictable power from time-to-time. The difference between average and peak loads can be significant. In 2025, the Pacific Northwest had a winter peak of 35,700 MW,[16] while annual demand for the past few years has been around 22,000 average MW. That means that the system, on average, runs at a little over 60 percent of its peak need.

Example: the 2024 Cold Snap

In January 2024, the Northwest power system experienced a critical period demonstrating the challenge of securing resource adequacy during a low hydro year when temperatures dropped over several days. While people might best remember outages on the distribution system due to ice accumulation, the broader system faced its own challenge of maintaining adequate resources to meet high demand combined with energy shortfalls. During this window, several utilities across the region were operating under emergency protocols.[17] [18] [xi]

This example is useful to help understand the idea of firmness and resource adequacy. The graphic below shows the role that hydropower, natural gas, imported electricity, coal, wind, and solar played in meeting resource needs across the four northwestern states over the week of January 11 – January 17, 2024. Note that the resource mix in Oregon is different across utilities, and that this image does

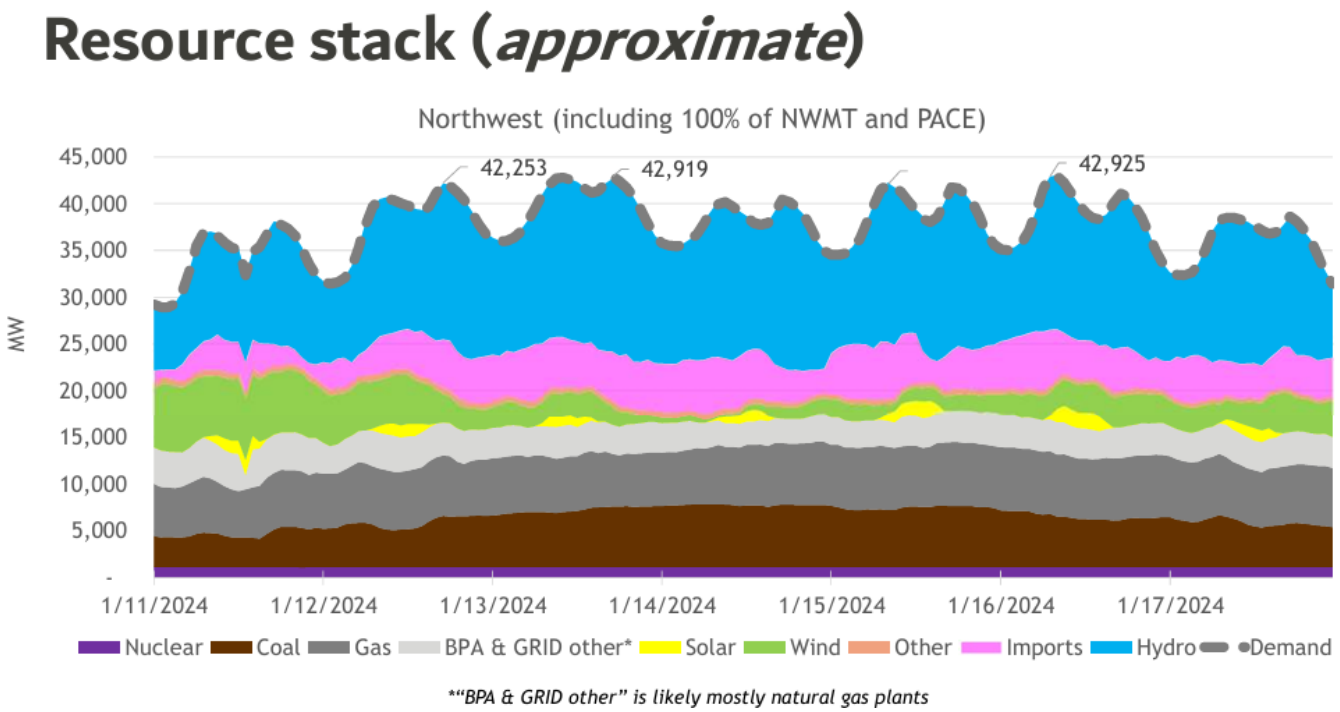
[ix] WRAP does not use a single definition of "firmness." Instead, it uses a resource accreditation framework that assigns each resource a Qualified Capacity Contribution (QCC)—the amount of dependable capacity that resource contributes toward meeting reliability requirements. QCC is calculated differently depending on the resource type.

[x] Note that diesel generators tend to be deployed rarely, and only during critical times on the power system. While they generate harmful air emissions, they can be turned on and off quickly and run for prolonged periods of time if needed.

[xi] The RC West Reliability Coordinator placed four entities on some level of emergency alert: Energy Emergency Alert Watch (EEA Watch), an EEA 1 (all resources in use or committed, energy deficiencies 1 expected), or an EEA 3 (balancing area is at risk of not meeting firm load and maintaining contingency reserves and is preparing for potential rotating power outages).

not represent the resource mix of any individual utility.[19] However, these resources all contributed to meeting Oregon's electricity needs over that week as part of an interconnected system.

Figure 4: Approximation of Northwest Power Generation Around the January 2024 Cold Snap[20]



While these were the resources providing power during this critical week, there was more to the story. Several other dynamics were occurring on the power system:

- The Northwest was a net importer of an average of 4,900 MW per hour during the five days from January 12 – January 16, 2024 across the AC intertie, one of the big transmission lines linking Oregon with California.[18] At the same time another key transmission line, the DC intertie from California to Oregon, was down for maintenance. This intertie has a transfer capability of 3,100 MW south to north. California and the desert Southwest had available capacity that could have been exported to Oregon had the intertie been available.[20]
- Demand response programs were deployed in several utility service territories and are not reflected here. While the region has historically relied on hydropower for flexibility, demand response can help capture the flexibility opportunity of temporarily reducing loads to reduce pressure on the power system.[21] One well-documented example is the Alberta Independent System Operator, who during the January cold snap sent an emergency alert to their customers to limit electricity use to essential needs only. Within three minutes, the system load dropped by approximately 170 MW.[22]
- An unexpected outage at the Jackson Prairie Natural Gas Storage Facility in Lewis County, WA created energy supply constraints on January 13, adding to reliability concerns over this critical period.[20] The loss of a compressor station in Canada further limited supply for a time.[23] Coordination between the natural gas and electricity sector is increasingly important to maintain reliability, highlighting the growing interdependence between them, particularly during critical periods.

- The hydropower system was managed flexibly, dispatching hydropower during the day as demand increased and relying on imported power at night to conserve water in reservoirs for the next day's peak period. Operations at the lower Columbia dams created additional storage, allowing upstream generation to increase without exceeding prescribed flows and producing hundreds of additional megawatts. Coordinated releases from Canadian reservoirs provided further support.[10]

As this example shows, resources in Oregon, the Northwest, and the broader region work together towards meeting reliability needs. Different generation technologies, transmission lines, and distributed resources all play a role in maintaining reliability. As a hydro-dependent region, the Northwest must plan for low hydro years, while seeking a complementary portfolio of resources to deliver needed electricity at all times.

Conclusion

The electricity landscape is rapidly changing. There is a need to build new resources to supply steeply rising electricity demand, respond to extreme weather events, and to meet Oregon's clean energy goals. It is important to consider the full portfolio of resources that can meet the state's policy objectives reliably and at least cost. The Oregon Energy Strategy finds that the least cost path builds on existing resources, including hydro and natural gas, incorporates low carbon generating technologies like wind, solar, and batteries, and mobilizes demand-side resources including energy efficiency, and demand flexibility.[24] Emerging technologies like enhanced geothermal and long duration storage can also play an important role, as they mature over time. Imported energy plays an important role, and allows Oregon to take advantage of abundant resources in the Southwest and Intermountain West. System planners have the tools to calculate the contribution of these resources to the most critical system needs, and how these resources can work together to maintain reliability throughout the year.

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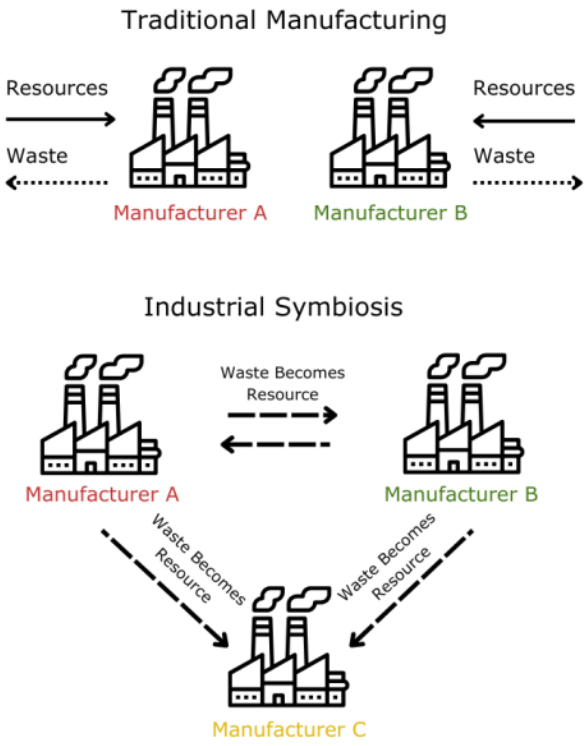
Industrial Symbiosis

Industrial symbiosis is emerging as an opportunity within the broader circular economy framework to reduce energy consumption, enhance resource efficiency, and strengthen local and regional economies. As Oregon advances climate and economic development goals, industrial symbiosis offers a practical pathway to support economic competitiveness and the state's energy goals. While industrial symbiosis can be applied to many different sectors and waste streams, this 101 will focus specifically on the energy-related implications.

Industrial Symbiosis and Circular Economies

A circular economy is an economic system designed to minimize waste and keep materials in use by reusing, repairing, and recycling rather than discarding. Unlike a traditional linear economy, where goods are produced, used, and discarded, a circular approach reduces the need for new raw materials and the energy required to produce them. This approach lowers overall energy use through processes that reduce extraction and manufacturing, recover waste heat and biogas, and encourage shared resource infrastructure as energy and water systems.

Figure 1: Comparison of Inputs and Outputs for Traditional v. Industrial Symbiosis



Industrial symbiosis is one of the most practical ways circular economy principles show up in a real-world industrial setting. Industrial symbiosis is the practice of harvesting waste streams (typically energy, water, or materials) from one industry to be repurposed as a valuable resource for another industry.[1] The increase in industrialization has led to an increase in greenhouse gases, resulting in adverse consequences for the environment and human health.[2] Industrial symbiosis is one way that Oregon can continue to grow in a way that allows for the reduction of greenhouse gases without jeopardizing its economic growth.

Typically, industrial symbiosis projects happen when businesses within industrial areas, ports, or business parks are located close enough to share physical "waste" streams. Common types of exchanges include:

- Waste heat from one facility supplying heat or steam to another
- Byproducts or waste materials becoming input for nearby businesses
- Water treatment systems capturing biogas to generate power for the grid

Examples of industrial symbiosis exist throughout the world. One of the most well-known is the Kalundborg Symbiosis in Denmark, where businesses and public utilities exchange energy, water,

steam, and materials through an elaborate integrated network. Kalundborg Symbiosis was the world's first network like this, developed in 1972, and is now estimated to be saving businesses and utilities in the network over 24 million euros, and reducing over 635,000 tons of carbon dioxide and 100 gigawatt hours of energy per year (Per Møller, Kalundborg Symbiosis, Personal Communication, [September 23], 2025).

There are emerging examples of industrial symbiosis in the Pacific Northwest. In Washington, Chomp[i] on Vashon Island is delivering renewable natural gas to a local food manufacturing plant and capturing waste heat from the facility to manufacture certified organic dry fertilizer.[3] In Oregon, the Port of Morrow is engaging in the beginning stages of industrial symbiosis with feasibility planning being completed, with support from the Oregon Legislature and industry partners, like Lamb Weston, Oregon Potato Company, and Boardman Foods.[4]



Impact Bioenergy (now Chomp) in Washington State, featuring a renewable natural gas balloon[3]

Benefits

Industrial symbiosis offers a wide range of benefits, including fewer primary materials used, a reduction in CO2 and other greenhouse gas emissions, energy and water savings, and economic growth. For businesses, it can reduce both energy and operating costs by improving operational efficiency and lowering long-term costs. By sharing energy, water, and material resources, industry can minimize their reliance on volatile markets and potentially limit exposure to supply chain disruption. Participation in an industrial symbiosis network could also open access to infrastructure that would be too expensive for a single company to build or maintain on its own. In addition, recovering value from byproducts that previously required disposal can create new revenue streams and reduce waste. These combined benefits help businesses become more resilient and competitive, especially in sectors with energy-intensive operations, such as food processing or manufacturing.

Communities have the potential to experience gains when industries collaborate through symbiosis, as these networks naturally encourage economic vitality, reduce pollution, and make efficient use of existing infrastructure. For urban communities, symbiosis can lead to more efficient land use, lower

[i] Impact Bioenergy was rebranded as Chomp in 2023.

emissions, and job creation in high-paying, in-demand sectors, like green energy, green building design, and sustainable manufacturing. For rural communities, the potential advantages can be even more pronounced. Rural regions, particularly in Oregon, often rely on a small number of large employers, like agricultural processors, timber mills, fisheries, or manufacturing plants. Industrial symbiosis can help stabilize these anchor industries through cost savings and shared services and make communities more attractive for new business investment.

At a systems scale, industrial symbiosis can help reduce total energy demand and make energy use more efficient. By capturing and reusing waste heat or developing biogas, symbiosis networks reduce the need for new or peak energy generation. Symbiosis has the potential to enhance grid stability because shared infrastructure, district loops, or co-located renewable energy projects can smooth out variability and decrease reliance on fossil fuel systems. In rural areas, where grid constraints or reliability concerns are common, these shared systems can be particularly valuable.

Barriers

Key barriers to adoption of industrial symbiosis projects can be categorized into five main themes: cost, technology, knowledge, geography, and regulatory uncertainty.

Cost

High upfront costs remain one of the most significant challenges to expanding industrial symbiosis in Oregon. Many symbiosis projects require upfront capital investments in shared infrastructure, such as heat recovery systems, pipelines, and upgrades to treatment facilities and other processing equipment that exceed what individual businesses can finance on their own.[5] Even when long-term cost savings are clear, the payback period can be too long for smaller or cash-constrained businesses, especially in communities with limited access to financing tools (like rural or historically marginalized communities). Without stable funding programs, grants, or incentives, communities and firms often struggle to move past the concept stage into full implementation. This makes sustained public funding or private investment and predictable financing mechanisms essential for implementation of industrial symbiosis systems statewide.

Technology

Sites participating in industrial symbiosis often require specialized equipment, processes, and technical expertise. For example: capturing and sharing waste heat, shared steam loops, or biomass processing, along with engineering expertise to develop and integrate the new systems and processes into processes and existing infrastructure. Aging infrastructure may not be compatible with the needed modern technologies without substantial retrofits. Small and rural communities often lack technical staff or the funding to hire consultants to conduct feasibility studies. Without technical assistance and feasibility studies, projects struggle to move beyond planning.

Knowledge

One of most commonly cited barriers to industrial symbiosis is a lack of understanding or awareness of the concept.[6] Most businesses are unfamiliar with the concept, unsure about how to identify resource-sharing opportunities, or concerned about privacy and sharing of proprietary information with local competitors. Communities may not know how to evaluate waste streams or structure

agreements that protect public and private interests. Building knowledge through study tours, case studies in the region, and technical facilitation would help partners see practical opportunities.

Geography

Geography is incredibly important in determining whether symbiosis is feasible, especially in a state a large as Oregon. Industrial symbiosis is easier to achieve in dense corridors where businesses are located close together, allowing for a short distance transport of heat, water, or materials. This is why industrial symbiosis is best suited for initial implementation at locations like industrial parks and ports. (Thomas Helsgaun, GreenLab, Personal Communication, [September 25, 2025]

Regulatory Uncertainty



Regulatory uncertainty is another major obstacle, particularly around permitting for wastewater reuse, air emissions, and bioproduct transports.[7] Businesses often express concerns around navigating overlapping federal, state, and local requirements, which can create delays and increase project costs. Clarifying regulations, improving permitting consistency, and creating guidance for symbiosis exchanges can significantly reduce these barriers and build alignment from potential industry partners.

Oregon Policies

With the passage of House Bill 4086 in 2026, the state expanded its policy framework around industrial symbiosis by directing Business Oregon to develop a statewide Industrial Symbiosis Roadmap by May 2027. The Roadmap is required to identify and describe industrial symbiosis opportunities throughout Oregon, examine best practices and emerging technologies, analyze barriers to adoption such as infrastructure gaps or permitting constraints, and recommend key performance indicators to track statewide progress. This is the most comprehensive policy effort Oregon has taken to date on industrial symbiosis.

The Legislature's directive has shifted and expanded Business Oregon's work by formalizing its role as a convener and technical facilitator for industrial symbiosis projects. In addition to developing the roadmap, the agency is funding targeted technical assistance to four early-stage efforts: COR Healthy Communities (Portland), Clatsop County, Klamath Falls Community, and the Port of Morrow. Collectively, this policy and the programmatic changes position Business Oregon as a central hub for advancing voluntary industrial symbiosis initiatives, while also helping local communities and businesses build practical pathways toward shared economic and environmental benefits. Business Oregon also applied for and received a U.S. Department of Energy grant to support industrial symbiosis pilot projects; however, the grant award is under further review by the federal government.

Conclusion

Industrial symbiosis represents a practical and scalable strategy for advancing Oregon's economic, environmental, and energy objectives simultaneously. By linking businesses through shared resource systems and transforming waste streams into inputs, industrial symbiosis can reduce energy consumption, strengthen local resilience and create new opportunities in rural and urban economies. As Oregon continues to pursue its climate and economic development goals, these integrated

approaches offer a pathway to support industry growth while lowering emissions and reducing long-term infrastructure and operating costs.

Oregon's recent legislative action signals a commitment to exploring expanded opportunities statewide. The development of a comprehensive Industrial Symbiosis Roadmap paired with technical assistance to early pilot communities positions the state to help communities move from isolated projects to coordinated systems-level strategies. With growing interest from industry, communities, and now the Legislature, Oregon is poised to build a more circular, efficient, and resilient industrial economy that supports local prosperity and long-term goals.

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Solar Panel and Wind Turbine Recycling

Lower operating costs and policies supporting clean energy development are driving large-scale solar and wind generation developments in Oregon.[1] With this expansion, there are questions about what happens to these technologies when they reach the end of their useful lives.

All forms of energy production require the extraction of raw materials and generate waste streams. Waste from energy production generally falls into two categories. The first includes emissions produced during fuel combustion, which can contain pollutants such as greenhouse gases, fine particulate matter, carbon monoxide, and nitrogen oxides. These waste streams can contribute to climate change, air and water pollution, and can degrade human health.[2] The second includes waste related to infrastructure materials used throughout the lifecycle of the technology, including raw material extraction, manufacturing of energy-generation technologies, operational and maintenance activities (excluding fuels), and end-of-life disposal. This waste can contribute substantially to landfill volumes and without proper management, may affect land and water quality.

While wind and solar technologies do not generate combustion waste, they are consumables that will need to be replaced over the lifetime of a generation facility. This is comparable to hydroelectric, coal, nuclear, and natural gas facilities, which also need to replace turbines and other mechanical components as the equipment wears out.

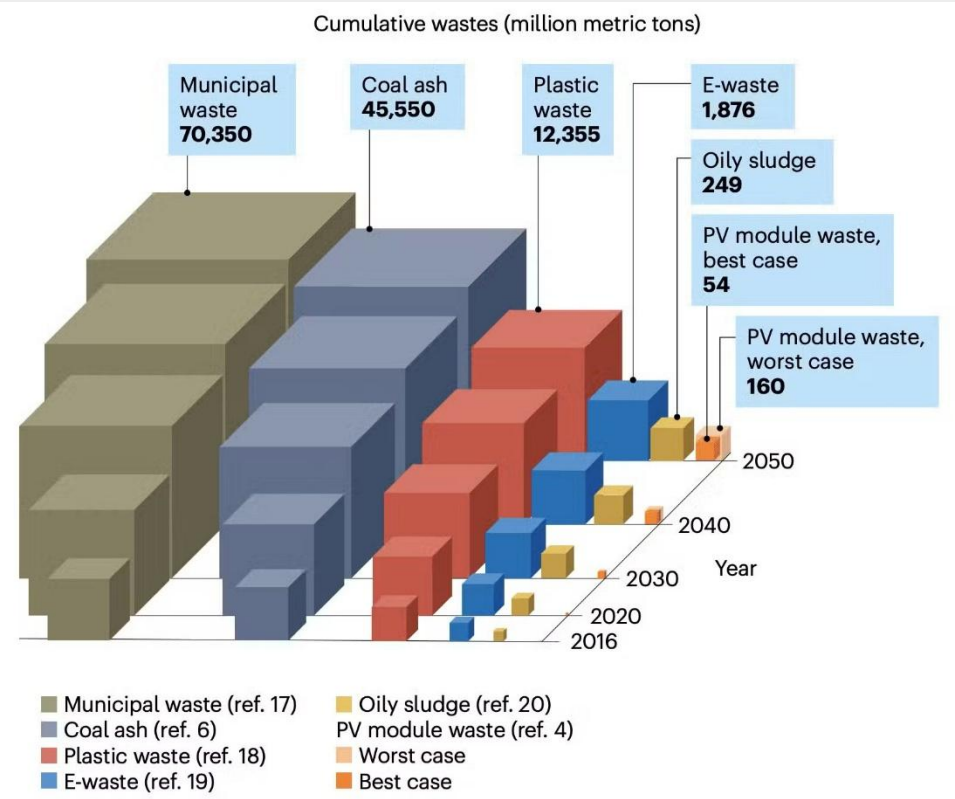
As with other energy technologies, there are opportunities to recycle or repurpose waste streams generated by wind turbines and solar panels. Although waste is produced across all components of these facilities — including roads, fencing, transmission lines, collector systems, substations, inverters, and transformers — this section focuses specifically on the waste associated with wind turbine blades and solar panels.

Waste Production

Wind turbine blades and solar panels can become waste when they reach the end of their useful lives, but waste from electricity generation is not exclusive to these technologies. For example, coal generation, which was the predominant type of electricity generation in the U.S. from 1950 to 2015, produces large amounts of waste from mining and processing as well as combustion at the generating site.[3]

In 2015, coal plant byproducts made up the second-largest waste stream in the United States after household waste, producing roughly 89 kilograms of waste for every megawatt-hour of electricity generated.[4] While it's important to find ways to reduce all waste streams, it's also important to bear in mind the relative size and toxicity when prioritizing waste reduction efforts.

Figure 1: Cumulative Waste Produced per Year by Waste Producer Type[5]



Solar and Wind Development Trends

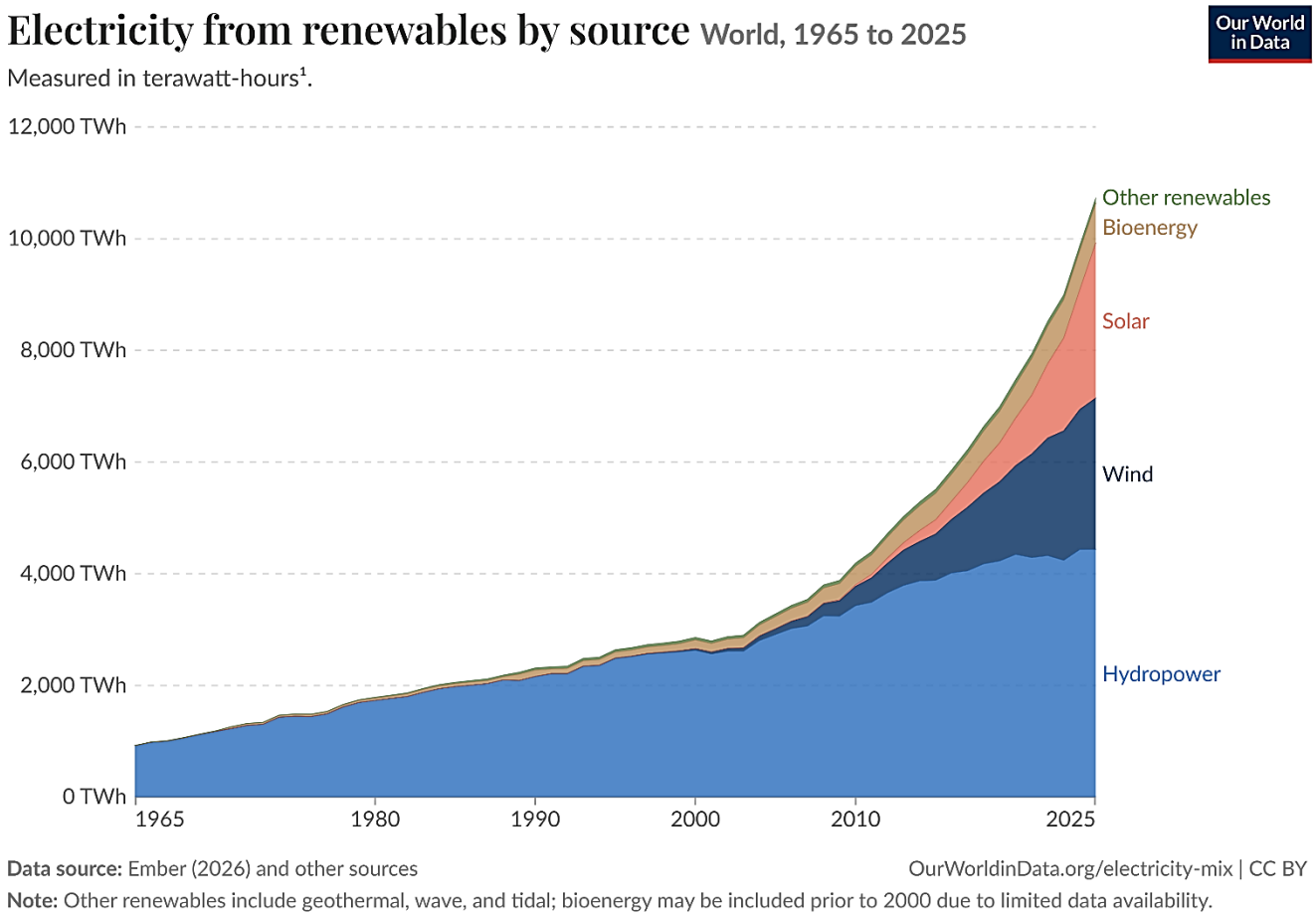
The rapid expansion of renewable energy is reshaping Oregon's electricity system, driven by policy mandates, growing customer demand for clean power, and declining technology costs. As the impacts of climate change intensify, energy providers are increasingly shifting toward renewable electricity. This transition is motivated by several factors:

(1) The declining cost of renewable technologies—solar is now often the least-cost option for adding new generation, and renewable energy technologies overall are typically more cost-effective and faster to deploy than traditional facilities.[6] As a result, global wind and solar generation has expanded rapidly, increasing from 378.20 terawatt-hours in 2010 to 5,491.78 TWh in 2025.[7]

(2) State policies such as Oregon House Bill 2021 (2021), which directs the state's large investor-owned utilities (IOUs) and electricity service suppliers (ESSs) to decarbonize their retail electricity sales by 2040,[8] and the state's Renewable Portfolio Standard.[9]

(3) Strong customer demand for clean energy, reflected in high voluntary renewable energy program enrollment by PGE and Pacific Power customers.[10]

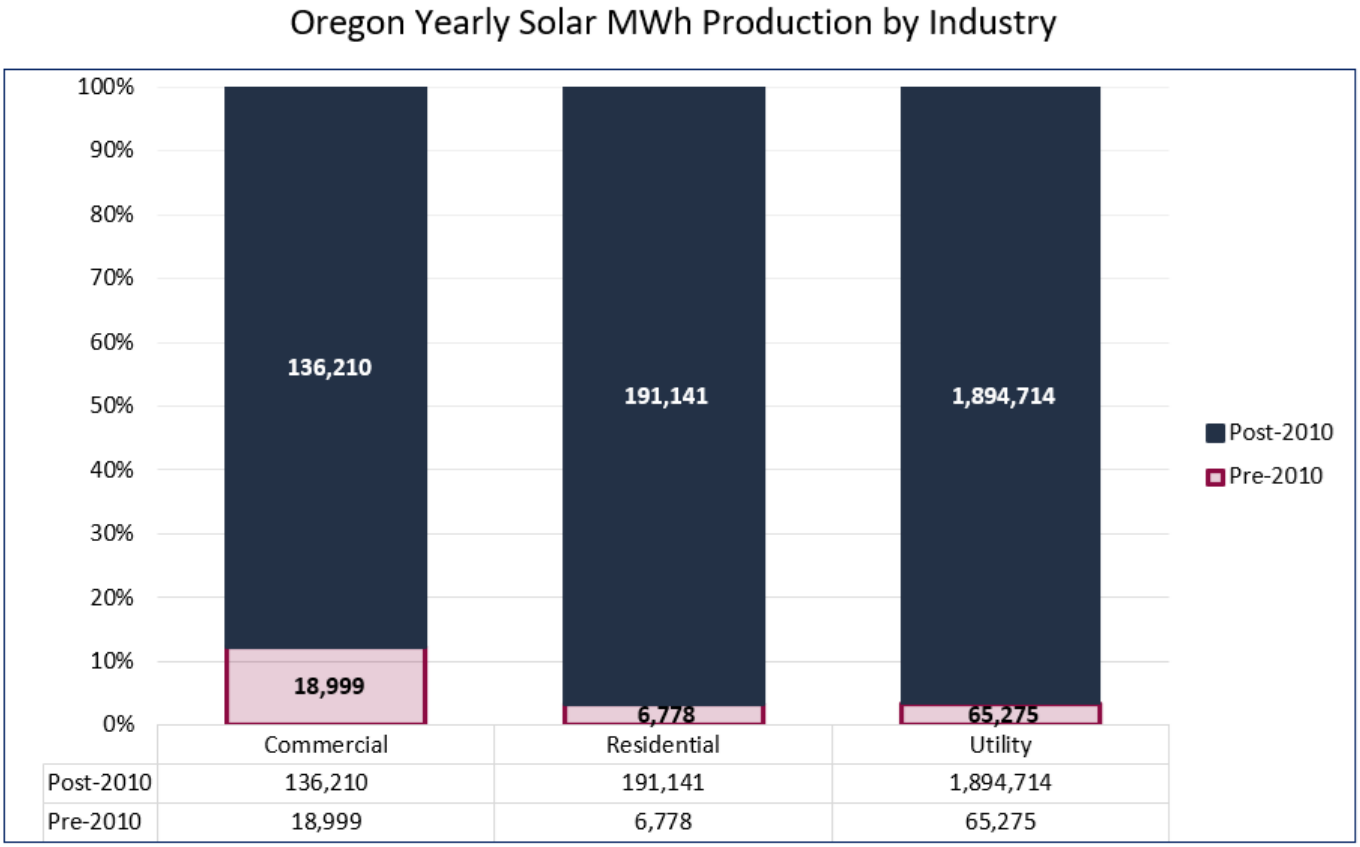
Figure 2: Renewable Electricity Generation Worldwide by Year[11]



1. Watt-hour A watt-hour is the energy one watt of power delivers for one hour. Since one watt equals one joule per second, a watt-hour equals 3600 joules of energy.
Metric prefixes are used for multiples of the unit, usually:
- kilowatt-hours (kWh), or a thousand watt-hours;
- Megawatt-hours (MWh), or a million watt-hours;
- Gigawatt-hours (GWh), or a billion watt-hours;
- Terawatt-hours (TWh), or a trillion watt-hours.

In Oregon, solar generation rose from 6,400 MWh in 2012 to 2,001,400 MWh in 2024. Wind generation increased from 6.3 million MWh in 2012 to 9.5 million MWh in 2024.[12] The International Renewable Energy Agency estimates that more than 90 percent of solar modules installed before 2010 will reach end-of-life within the next decade.[13] Oregon has approximately 24 MW of solar installations that were installed before 2010.[14]

Figure 3: Oregon Solar Production by Year[15]



	Commercial	Residential	Utility
Post-2010	136,210	191,141	1,894,714
Pre-2010	18,999	6,778	65,275

By contrast, wind turbines may not follow a comparable end-of-life timeline. Although no utility-scale wind or solar projects in the state have yet reached the end of their operational life, ongoing repowering and routine maintenance activities continue to generate waste streams.

For example, according to its application for a site certificate, the permitted 1,200-MW Sunstone Solar Facility is expected to generate a substantial amount of replacement materials over its lifespan. When constructed, this facility is expected to include approximately 3,937,536 solar modules. Each year, an estimated 5,118 solar modules would be replaced, resulting in roughly 204,720 modules requiring on-site storage over the life of the facility. These routine module replacements are projected to produce about 550 cubic yards of waste per month or a total of 198,000 cubic yards throughout the facility's anticipated 30-year operational period.[16] That amount of waste would fill approximately 6,600 standard 30-yard roll-off dumpsters.

Oregon currently has 50 utility-scale wind farms with a combined operating capacity of 4,181 MW.[17] Modern wind turbines generate an estimated 10 to 15 tons of blade waste per megawatt over their operational lifespan.[18] Recycling or repurposing blades from existing wind farms as they are decommissioned or repowered could divert a cumulative total of between 41,810 and 62,715 tons of waste from landfills. According to one estimate, the cumulative end-of-life wind turbine blade waste in the United States is projected to exceed 2.2 million tons by 2050.[19]

Repowering an energy facility involves retrofitting, upgrading, or replacing components such as solar panels or turbine blades and nacelles to more modern and efficient equipment. This process can extend the facility's operational lifespan and enhance its overall energy generation capacity. To date, at least six wind facilities, or portions of wind facilities in Oregon, have been repowered — extending their operational life and increasing their generating capacity.

Solar and Wind Technology Components and Recycling Options

Effective planning for end-of-life management of solar and wind technologies requires detailed insight into their component materials, the limitations of existing recycling pathways, and the advancement of new recovery methods that can keep valuable resources in use across the renewable energy sector. Over the past century, the ability to harness energy from natural resources has advanced significantly, supported by innovations in composite materials and manufacturing that have made renewable energy technologies more cost-effective and widely deployed. Continued progress in material recovery strengthens the potential for industrial symbiosis across the energy and manufacturing sectors and supports the broader development of circular economies, where waste streams from one industry can be used by other industries. Learn more in the Industrial Symbiosis Energy 101.

Wind turbines rely on a mix of recyclable steel, composite materials, and valuable critical minerals, but their blades remain the primary recycling challenge due to their complex construction and large size. Modern wind turbine blades are composed of steel, glass fibers, carbon fibers, basalt fibers, and various polymers.[20] Other key materials used in the steel and generator components include critical minerals such as neodymium, dysprosium, praseodymium, electrical steel, nickel, and cobalt.[21] Many of these critical minerals can be extracted from recycling generator magnets, transformers, and structural components. The gearbox and shaft are typically made of recyclable steel, while the blades—constructed from glass and carbon fiber thermosets, which are polymers that permanently harden when cured and cannot be remelted—pose greater recycling challenges due to their permanent curing process and large size, which complicates removal and transport.

Figure 4: Diagram of Geared Wind Turbine[21]

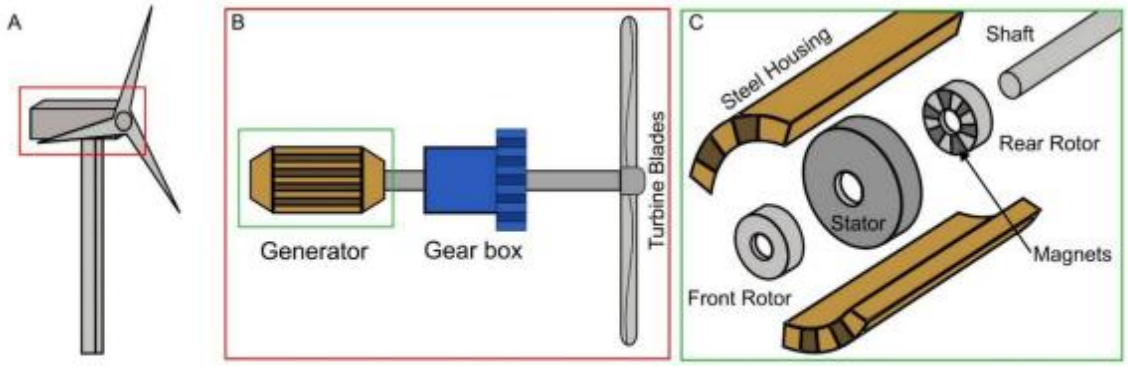


Figure 12. Structure of a typical wind turbine generator including A) wind turbine, B) drivetrain interior, and C) generator parts. *Figure by Willey Kemp, ORNL.*

Turbines of the Past

While wind turbines have been around since the 7th century, the first electricity-generating turbine was built in 1887 by electrical engineer James Blyth to power his holiday home in Scotland. This turbine was comprised of cloth sails on a wooden frame.[22] At the time, locals considered Blyth to be eccentric, and the technology was not widely adopted. In 1980, the first large-scale utility wind turbines were installed in California, beginning the era of modern wind turbines supporting the electric grid.[23]



Recycling Logistics

Wind turbine recycling presents substantial logistical challenges. The size of turbine blades and the limited number of facilities capable of processing their composite polymers require energy producers to plan carefully for end-of-life management. Landfill disposal costs range from $60 to $150 per ton, while recycling blades for use in cement production typically ranges from $80 and $200 per ton.[24]

Wind turbine blades are engineered to withstand harsh environmental conditions for decades, making them suitable for repurposing in outdoor applications. Around the world, companies are converting decommissioned blades into architectural elements, benches, playground structures, and other durable installations. While these repurposed products can be practical and long-lasting, the market for them remains limited.[21]





Shredded turbine blade fibers can be used to enhance the strength of concrete. The material must be processed through multiple shredding cycles to achieve a fine, uniform product, which reduces the need for traditional reinforcement materials and helps lower construction time, cost, and overall material use. Companies such as REGEN Fiber are developing improved processing methods to produce cleaner, higher-quality fibers.

In 2022, Oregon completed its largest wind turbine repowering project at the Shepherds Flat facility. More than 900 blades were removed, sectioned, compressed, and transported — by rail and truck — to a processing facility in Missouri. There, the blades were repeatedly shredded until the resulting material met the specifications needed for use as concrete reinforcement.[25]







Learn more:

SCAN OR CLICK

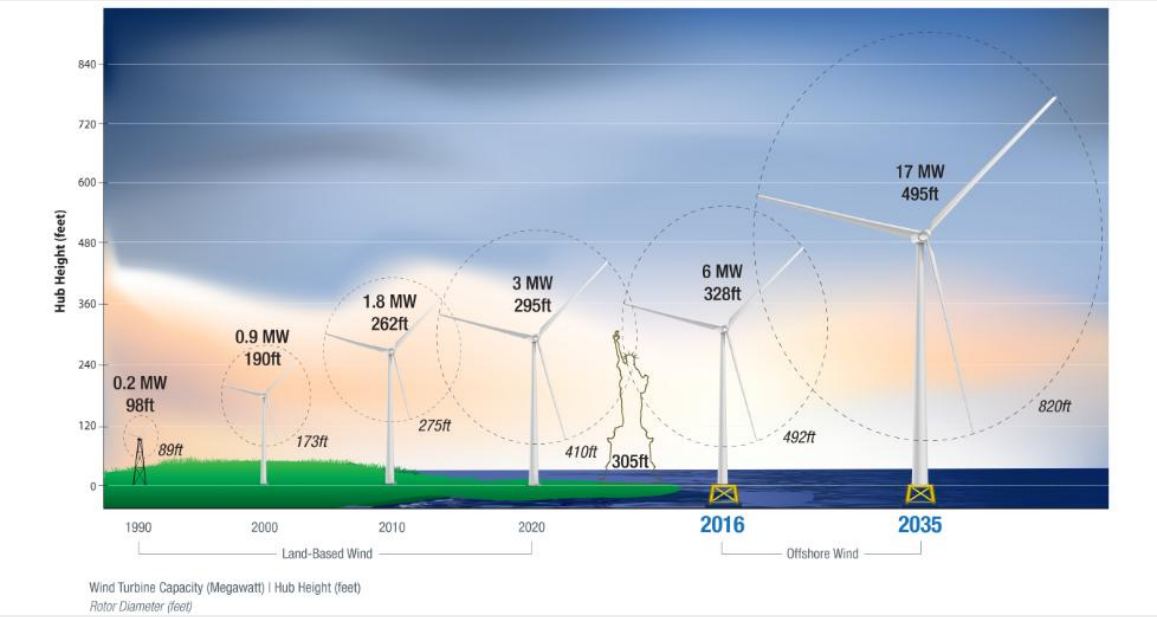
Spotlight: Offshore Wind

Offshore wind turbines are designed to withstand stronger and more consistent wind conditions than onshore turbines. While the overall recycling process is similar for both types, offshore projects introduce additional logistical considerations. Offshore rotor diameters – the full span of the circle covered by the blades – can reach nearly 500 feet, compared to typical onshore diameters of 190 to 300 feet.[26] Although these larger blades support higher energy production, they also create significant challenges for end-of-life management and recycling.

Blade removal in offshore environments requires specialized marine vessels and can only be performed under suitable weather conditions. Once retrieved, blades must be cut into smaller sections to enable transport and further processing. As a result, offshore blade recycling involves more complex handling and processing methods due to the larger scale of components and the additional logistical challenges not present in onshore installations.

While there are no current offshore wind installations on the west coast, HB 4080 (2024) directed the Department of Land Conservation and Development to develop an Offshore Wind Roadmap to develop standards for future offshore wind projects.

Figure 5: Typical Size of Wind Turbine by Capacity and Location[26]



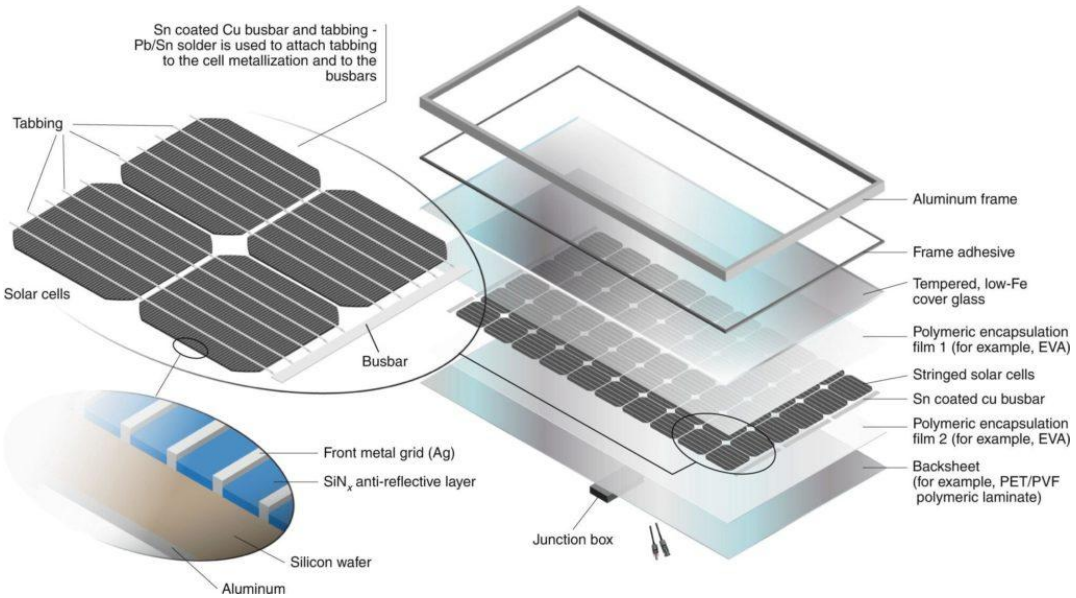
Solar Beginnings



People have been using passive solar design to heat homes, grow crops, and tell time for centuries. While the power of the sun has been studied and revered for generations, the full power to utilize it as an energy source at scale is relatively new. The photovoltaic effect was first demonstrated in 1839 by Edmond Becquerel, then a 19-year-old working in his father's laboratory. Although the phenomenon was recognized by scientists, it remained largely a scientific curiosity until 1954, when Bell Telephone Laboratories developed the first single-crystal silicon solar cell. This early "solar battery" was designed to power telephone repeaters as an alternative to expensive conventional batteries. While the technology was not yet economical for large-scale production, it marked the beginning of serious research into solar electricity.[27] These early solar cells are still capable of producing power, demonstrating the longevity of solar technology.[28]

Solar panels contain valuable materials that are difficult to separate and recover, making current recycling processes costly and labor-intensive. Modern solar panels are typically composed of glass sheets layered over specialized photovoltaic cells mounted within aluminum frames. These cells contain silicon and various critical minerals.[29] Because the cells are bonded to the glass during manufacturing, they can be difficult to separate during recycling, complicating material recovery. Solar panels also contain valuable minerals such as silver, cadmium, tellurium, copper, gallium, and indium.[30] Most of these materials are currently obtained through mining that occurs primarily outside the United States, which means they often need to be imported and can carry significant environmental and financial costs. Improving domestic recovery of these minerals could create significant economic opportunities and support job growth within the United States. However, each panel requires manual disassembly for recycling, and in many cases, the cost of this process exceeds the market value of the materials recovered.

Figure 6: Diagram of Photovoltaic Module Components[31]



Solar panels must be processed at specialized recycling centers that are capable of isolating the different component materials.[31] Electronics, wiring, aluminum frames, and sealants are removed before the glass and photovoltaic cells can be separated. Glass removal is essential, and it must be handled carefully because contamination from other panel materials significantly reduces its potential for reuse. To detach the glass from the ethylene-vinyl layers, recyclers apply heat to the tempered glass. Once separated, materials can be crushed for recovery. Recycled glass can be used to manufacture new glass products or for industrial applications such as sandblasting. Heat and chemical processes can be applied to the encapsulating polymers to extract silicon, silver, copper, aluminum, and other minerals. Recovery of critical minerals reduces dependence on mining and mineral imports.

The cost to recycle solar panels is a major barrier to widespread recycling. Current market constraints and data limitations contribute to uncertainty regarding the economic feasibility of recycling solar components. Recycling a solar panel currently costs between $20 and $30, while the recovered materials are valued at only $3 to $12. In comparison, landfill disposal costs range from $1 to $5 per panel.[32] Additionally, many local recycling facilities do not accept solar panels, making it difficult for homeowners and small businesses to locate appropriate disposal options. In many cases, individuals must coordinate panel collection through a solar installer.

The growing volume of end-of-life solar panels, combined with the high value of the critical minerals they contain, is creating a market opportunity for advanced recycling solutions in Oregon and beyond. A study by Rystad Energy estimates that the solar panel recycling market could reach $2.7 billion by 2030.[33] In Oregon, however, this market is still emerging. As more panels reach end-of-life, demand for recycling services is expected to increase. The high environmental and economic costs of mining critical minerals used in solar panels further underscore the importance of recovering existing materials.[34]

Advancements in recycling technologies, infrastructure, and policy are beginning to reduce barriers to recycling. Reuse remains the most cost-effective and resource-efficient disposal method, particularly when components remain functional for their original purpose. When facilities repower or upgrade to higher-efficiency panels, older panels often retain significant remaining service life and may be sold on the secondary market for residential use at lower cost. Solar technology continues to improve; whereas panels installed around 2010 typically produce 250–300 W, modern panels now exceed 400 W. For large solar facilities, this increase in output can be substantial, creating a strong incentive to upgrade to more efficient panels even before the existing ones reach the end of their life.

Figure 7: Recoverable Materials in Solar Photovoltaic Panels[35] [36]

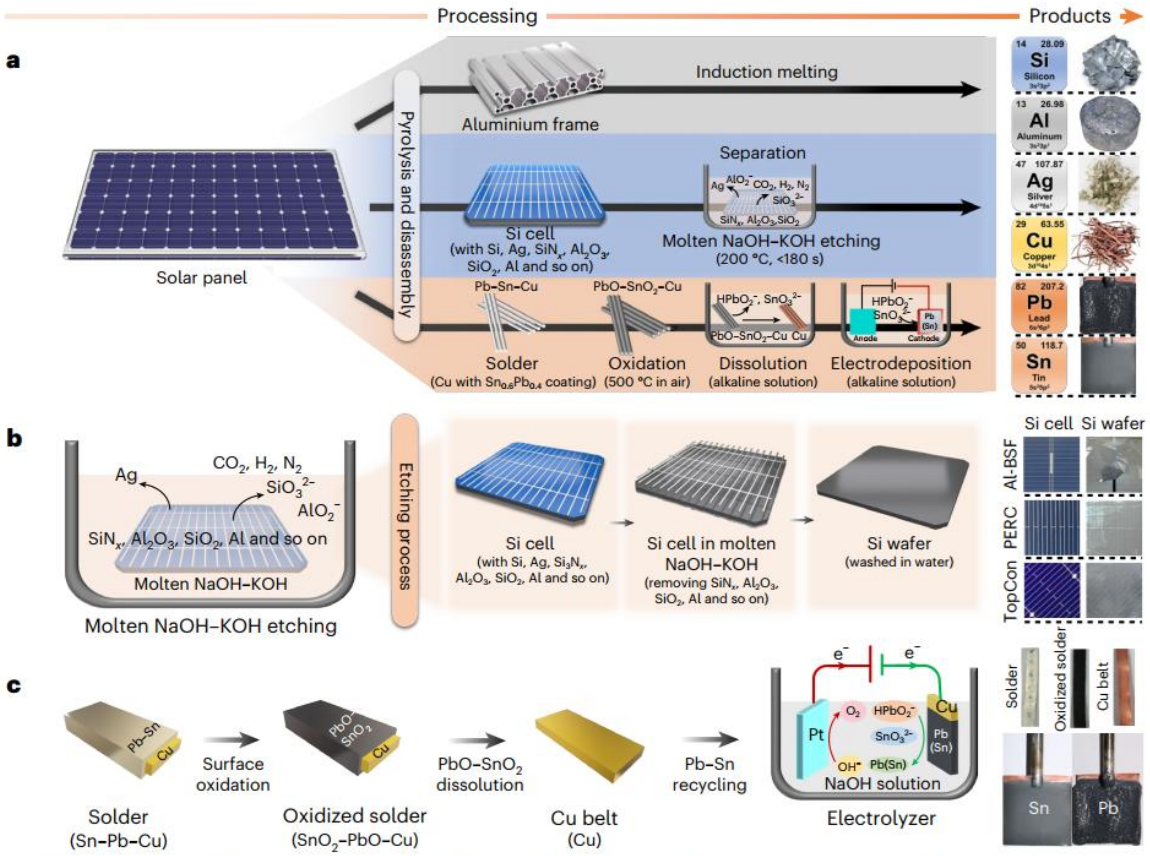


Fig. 1 | Schematic diagram of the recycling of an EoL PV panel and the recycled products. a, Flow chart showing the recycling of EoL PV panels including the initial dismantling process, the induction melting of Al frames and glass, the salt-etching process, and the recycling of solders; the pictures on the right are the recycled products. **b**, Schematic of the salt-etching process in molten NaOH–KOH. **c**, The recycling of solders including the oxidation, the alkali leaching and the electrodeposition.

Supporting Policies

Current state statutes do not explicitly mandate recycling for solar or wind components, though policy tools exist to help manage end-of-life materials. Oregon administrative rule 345-022-0120 requires energy facilities to demonstrate reasonable efforts to minimize waste to receive a site certificate from the Energy Facility Siting Council, although the Council has discretion in applying that requirement on wind and solar facilities. In addition, policies that classify solar panels as hazardous waste help divert them from standard landfill streams, making it easier for waste management facilities to identify and redirect old panels to recycling or repurposing programs. This approach aligns with emerging federal efforts such as the EPA's proposed universal waste regulations under the Resource Conservation and Recovery Act, or RCRA, for streamlining the collection, transport, and recycling of solar panels, whether they are classified as hazardous or not.[37]

The efficacy of policies governing the disposal of wind and solar resources at the end of their lives are in the earliest stages of being tested. Decommissioning requirements vary significantly across states, and some states have not adopted such requirements at all. As more renewable energy facilities undergo repowering, as sites eventually reach decommissioning, and as recycling technologies and

markets continue to evolve, existing policies may need to be revised or new policies developed to address emerging real-world conditions.[38]

Solar and Wind Recycling Future

Although cost and logistical challenges persist, ongoing research is driving the development of improved recycling methods, including processes that recover clean fibers and significantly expand the value and potential uses of recycled blade materials.

Companies such as Carbon Rivers are pioneering techniques to separate glass fibers from decommissioned wind turbine blades, which typically contain about 50 percent glass fiber.[39] Traditional recycling methods often yield materials suitable only for low-value applications, such as cement fillers.



Photo courtesy: Carbon Rivers

Advancements in blade manufacturing are also expected to simplify recycling. Current research indicates that blades made with dynamic thermosets can achieve performance levels comparable to traditional thermosets.[40] Dynamic thermosets allow resins and carbon fibers to be separated under heat or pressure, enabling fiber recovery. In contrast, traditional thermosets form permanent bonds between resins and fibers, limiting the ability to recover high-quality materials and restricting their reuse.

Similar progress is being made in solar panel recycling technologies. Historically, recycling has been more expensive than the value of the recovered materials. Enhanced recovery techniques — such as vacuum distillation, microwave-assisted processes, green chemical solutions, and hybrid systems — enable more efficient extraction of silicon and high-value metals.[41] Improved recycling can also help buffer supply shortages, reduce geographic dependence, decrease environmental and social impacts from mining, and support more stable access to raw materials. As demand for these minerals continues to grow, recycling and recovery from solar panels can reduce exposure to price volatility, geopolitical risks, and bottlenecks. Encouraging circular mineral use is a strategic consideration for sustaining long-term supply chain resilience.[42]

Material reuse in manufacturing also supports a more circular solar industry. For example, SOLARCYCLE and Arizona State University have partnered to develop solar panels using specialized recycled glass.[43] Recovered glass from decommissioned panels typically cannot be incorporated into new solar panels due to contamination, such as embedded silicon particles and antimony residues, which prevents it from meeting the purity standards required for photovoltaic manufacturing.[44] The SOLARCYCLE process allows glass from decommissioned panels to be repurposed into new panels, contributing to a more sustainable product lifecycle.

Ongoing updates to photovoltaic standards are significantly improving panel durability, ensuring that systems can better withstand weather exposure, mechanical stress, and long-term degradation. These enhanced durability requirements extend the operational lifespan of solar panels, reducing the likelihood of premature failures and lowering the volume of panels entering the waste stream. By keeping panels in service longer, these standards also reduce the overall cost per kilowatt-hour over

the system's lifetime and help minimize environmental impacts associated with manufacturing, transport, and end-of-life management.[45]

Conclusion

Managing end-of-life materials from solar panels and wind turbines is a complex and evolving challenge. However, continued advancements in recycling technologies and manufacturing practices are steadily reducing costs and lowering barriers to recycling and repurposing these waste streams. These efforts hold significant potential to divert large volumes of material from landfills, particularly as Oregon's solar and wind sectors continue to expand.

Recovering critical minerals domestically, from both solar panels and wind turbine components, reduces the environmental and economic impacts associated with mining, lowers emissions from long-distance transport, and helps retain more value within local and national markets. As recycling technologies improve and markets mature, the ability to reclaim materials such as steel, aluminum, copper, silicon, glass, and rare earth elements will strengthen the resilience of renewable energy supply chains.

Together, investments in improved recycling processes, durable product design, and supportive policy mechanisms can enhance the environmental and economic sustainability of solar and wind energy systems. These actions position Oregon to capture the long-term benefits of a circular renewable energy economy while minimizing the waste generated by its growing clean energy infrastructure.

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Effects of Federal Changes on State Energy and Climate Activities



Almost since its inception in 1975, the Oregon Department of Energy and other state agencies have partnered with the federal government to implement energy and climate policies, projects, and programs. From federal support for Oregon to participate in Hanford Nuclear Site cleanup issues to formula funding through the longtime State Energy Program, ODOE's partnership with the federal government has helped Oregon make progress on its energy, environmental, and climate goals.[i]

In addition to long-term funding for specific activities and programs, Oregon has also benefitted from significant one-time investments, such as the 2009 American Recovery and Reinvestment Act.[1] ARRA was a nearly $800 billion economic stimulus package designed to help the U.S. recover from the Great Recession. ARRA allocated more than $4.2 billion in economic assistance to Oregon, including $55.9 million to ODOE for energy projects and programs.

Congress also passed two major pieces of legislation related to investments in energy and climate in 2021 and 2022: the Infrastructure Investment and Jobs Act[2] and the Inflation Reduction Act.[3] Since their passage, ODOE secured over $275 million in formula and competitive grants[ii] from the laws, supporting energy projects around grid resilience, energy efficiency, renewable energy, workforce training, and more. As a state, Oregon was awarded even more funds related to climate and energy that did not go through ODOE: for example, Oregon is a member of the Pacific Northwest Hydrogen Association, which was awarded $1 billion to support clean hydrogen projects in Oregon, Washington, and Montana.

Upon the U.S. presidential transition on January 20, 2025, the administration began pulling back federal energy and climate policies and funding. On inauguration day, Executive Order 14154 *Unleashing American Energy* rolled back previously established policies and programs related to energy, including support for electric vehicles and vehicle emissions standards, regulations for energy efficient appliances and equipment, National Environmental Policy Act requirements, and others.[4] The Executive Order also temporarily froze disbursement of funds provided by the Inflation Reduction Act and Infrastructure Investment and Jobs Act that targeted climate change and clean energy initiatives. In July 2025, H.R.1, sometimes referred to as the One Big Beautiful Bill Act, eliminated some renewable energy tax incentives that had been enacted as part of the Inflation Reduction Act of 2022.[5] IRA tax credits, including clean vehicle credits, clean electricity investment credits, and residential clean energy tax credits, were set to expire in 2032; H.R.1 terminated the credits in 2025 and 2026 instead.

Further actions in 2025 and into 2026 have canceled funding and programs, and created uncertainty among state energy offices, businesses, and communities, including in Oregon. It is likely that additional federal actions throughout the remainder of the administration's term will make more changes to energy and climate policies, projects, and programs. Outlined here are some effects of federal changes identified by OODE as of the date of this report.

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[i] Learn more about ODOE's history of federal funding: https://energyinfo.oregon.gov/blog/2025/6/23/odoe-at-50-history-of-federal-funding

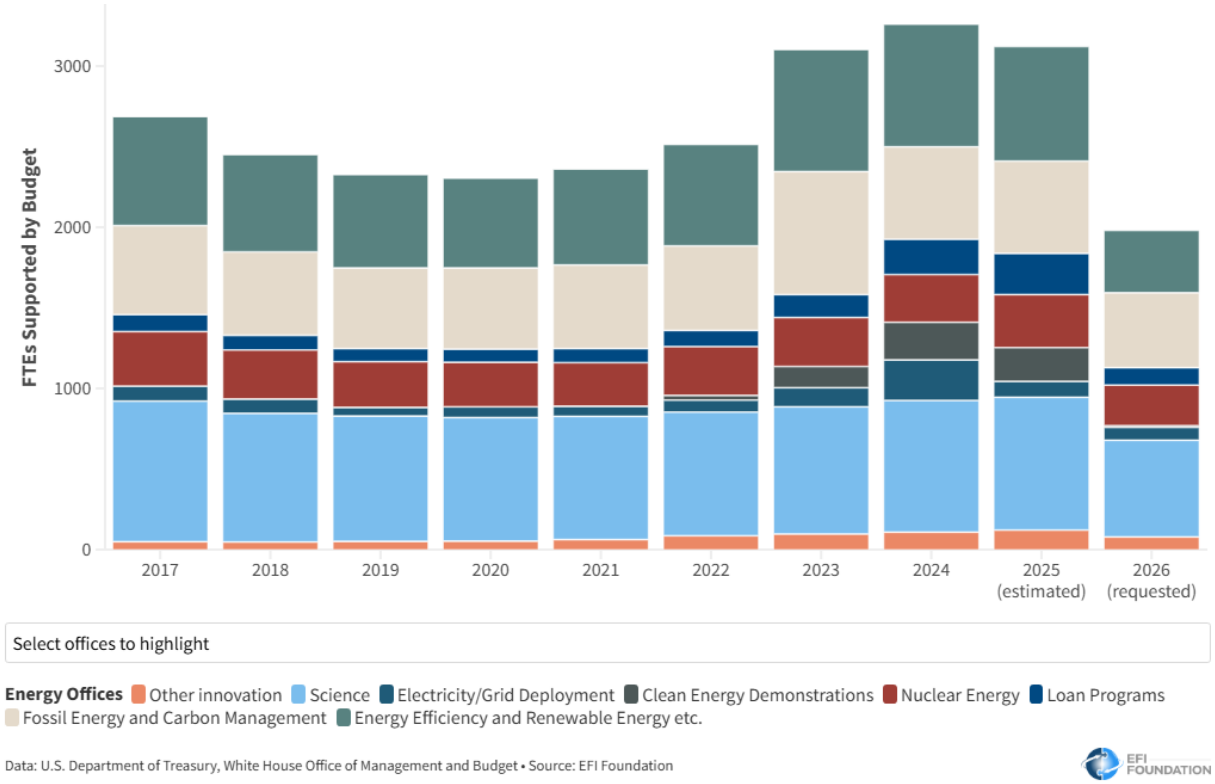
[ii] Formula grants are distributed automatically based on a preset standard (such as population). Competitive grants are awarded based on an evaluation against specific criteria and other applicants.

Changes in Clean Energy and Climate Policies at the Federal Level

Federal Staffing and Leadership

The U.S. Office of Personnel Management, which is the chief human resources agency for the federal government, reports that the number of federal employees has been reduced by more than 270,000 since January 20, 2025.[6] The number of U.S. Department of Energy staff has reduced by nearly 3,000, while the U.S. Environmental Protection Agency has reduced by more than 2,000 in that same time period. State energy offices, including the Oregon Department of Energy, have experienced slower response times from federal partners following the reduction in staff. ODOE used to meet with the U.S. DOE Office of Community Engagement regional partner monthly to discuss outreach and engagement strategies, but the office was closed in November 2025.[7] The U.S. Energy Information Administration, which is responsible for publishing important reports and energy data, announced delays in releasing some of its reports, including its International Energy Outlook and annual marketing report on uranium.[8]

Figure 1: Staffing Trends in U.S. DOE Science and Energy Innovation Programs[9]



The Bonneville Power Administration and the U.S. DOE Office of Environmental Management are two examples of programs where staffing shortages are of particular interest to Oregon. BPA is responsible for delivering electricity throughout the Pacific Northwest, including operating 15,000 miles of high voltage transmission lines that move power from the federal Columbia River hydropower dam system. Early in 2025, and although it is funded by ratepayers in the northwest, BPA was one of the many federal agencies facing staffing cuts. Staff being cut were involved in engineering, power distribution, and line work as well as modeling and resource planning. By spring of 2025, more than 400 BPA employees had been laid off, had rescinded job offers, accepted buyouts,

or retired early, causing Oregon's senators and former BPA administrators to warn of power outages and public health and safety risks.[10] Some of those workers were offered their jobs back,[11] and at a Congressional hearing in May 2025, Energy Secretary Chris Wright indicated that U.S. DOE would not pursue additional staffing cuts at BPA.[12]

According to a 2026 report by the U.S. Government Accountability Office, the Office of Environmental Management had a vacancy rate of 45 percent at the end of FY 2025. The GAO reported that almost half of the vacancies were in "mission-critical positions" such as nuclear safety specialists and staff involved in treating radioactive waste and addressing contaminated buildings, soil, and groundwater.[13] The Office of Environmental Management is responsible for addressing the environmental legacy of nuclear waste production and sites across the country like Hanford in Washington state just north of Oregon's border. Oregon has a significant interest in ensuring the safe and timely cleanup of Hanford, which sits on the Columbia River. Radioactive and chemical contamination pose a threat to Oregon's farmland and fisheries, and staff at the Office of Environmental Management are important partners to the states of Oregon and Washington.

Climate Change

The current federal administration has taken several actions to roll back policies and efforts to fight climate change and reduce greenhouse gas emissions. As policies and programs have been rescinded or reduced, some federal agencies also received instructions from leadership to avoid certain words or phrases, such as "climate change," "emissions," and "sustainable," in public messaging and on websites, this also extends to any mention of disparately impacted populations including environmental justice and similar terms.[14]

In 2009, after the Supreme Court's ruling in Massachusetts v. EPA, the U.S. Environmental Protection Agency found that greenhouse gas emissions pose a threat to public health and wellbeing.[15] Known as the "Endangerment Finding," it established a legal basis for regulating emissions under the Clean Air Act. A contributing finding also noted that new motor vehicles, specifically, release the harmful greenhouse gas emissions that threaten public health. In February 2026, the U.S. EPA formally rescinded the Endangerment Finding, which also rescinded its regulation of vehicle and other sector emissions.[16] Shortly after the announcement, a group of states, including Oregon,[17] and a coalition of environmental and health groups filed a lawsuit against the U.S. EPA for its action, which remains active in the D.C. Circuit Court.[18]

As described in formal comments submitted to U.S. EPA by the Oregon Department of Environmental Quality, "Rescinding the Endangerment Finding and associated federal standards would have serious and far-reaching consequences for Oregon."[19] In addition to increasing health risks and climate-related hazards, DEQ pointed out that the action could undermine Oregon's clean energy transition. By creating consistency across markets and enabling long-term planning by manufacturers and utilities, federal rules reduce the costs associated with delivering cleaner technologies. Without federal standards, "Oregon would be left with a patchwork of state-level policies that cannot achieve the same extent of reductions in emissions."

In 2015, the United States joined 194 international parties in entering the Paris Agreement, which commits countries to reduce emissions, reassess and strengthen commitments over time, and provide financial support to developing countries to mitigate and adapt to climate change.[20] The U.S.'s

involvement with the Paris Agreement has changed through the most recent three administrations, withdrawing from the Agreement in 2020, rejoining in 2021, and withdrawing once again in January 2026.[21]

Fossil-fuel generated electricity, such as from coal and natural gas, is a significant contributor to greenhouse gas emissions and air pollution. In 2022, the electricity sector accounted for 24 percent of U.S. greenhouse gas emissions.[22] In 2023, over half of the national greenhouse gas emissions from electricity generation came from natural gas-powered electricity, and over 46 percent from coal.[23]

Figure 2: National Greenhouse Gas Emissions from Electricity Generation (2023)[23]



Coal use has been declining in the U.S. since its peak in 2007, with consumption dropping 64 percent by 2024.[24] In the energy sector, the drop in consumption is largely due to climate-related policies and technology and cost improvements for other resources, such as wind and solar. In April 2025, Executive Order 14241 was amended to designate coal as a "mineral," which effectively allows for expedited permitting for coal-fired power plants, providing financial incentives for coal production, and increasing coal mining on federal land.[25] This was one of multiple actions by the administration that encouraged the production and use of coal, which also included reducing pollution controls on coal-burning power plants and directing the Pentagon to buy more coal-powered electricity. An analysis by the New York Times found that harmful mercury emissions from coal-fired power plants increased by around 9 percent in 2025.[26]

While Oregon's only coal plant shut down in 2020, Oregon utilities can still buy coal-generated power on the regional market until 2030; coal made up about 8.3 percent of Oregon's electricity mix in 2024.[23] Federal action increasing the availability of this resource in the west and lowering its cost could result in higher greenhouse gas emissions per kilowatt hour in Oregon.

In April 2026, the U.S. EPA published a final rule to reduce regulations for oil and gas operators, including lifting some restrictions on vent gas flaring and changing some requirements for monitoring that flaring. The EPA argued the actions would save the oil and natural gas industry about $208 million per year,[27] but the actions would also increase the amount of methane emissions associated with natural gas use. As noted above, natural gas accounts for over half the greenhouse gas emissions from electricity generation. Natural gas is used to generate more than 20 percent of the electricity Oregonians use.[23]

Energy Facilities

In addition to lifting regulatory restrictions meant to curb greenhouse gas emissions from coal-powered energy generation, the federal administration has also taken action to keep coal plants open that were scheduled to close, citing the increasing energy demand in the U.S., including for data centers. Secretary of Energy Chris Wright issued an order in March 2026 to keep a unit of the

Centralia Generating Station coal plant in Washington operating; it had been scheduled to shut down in 2025.[28] This order followed others issued in December 2025 to keep coal plants in Indiana and Colorado operational.

In April 2026, following the March 2026 order, TransAlta, which operates the Centralia Generating Station, filed a request with the Federal Energy Regulatory Commission noting it would cost $19 million to keep the facility operating.[29] The company indicated that the fixed costs would be split equally between BPA and the California Independent System Operator, which are likely to pass costs along to consumers in the northwest. The company also reported that fixed costs will add up to about $8.2 million every 90 days.[29] In June 2026, the U.S. DOE extended the emergency order to keep the Centralia plant operational until September 12.[30]

At the same time coal plants were ordered to continue, the Interior Department stopped construction of five offshore wind projects on the East Coast in December 2025, citing unspecified national security risks.[31] Critics noted that keeping coal plants open to meet energy demand while canceling construction of new resources was contradictory.[32] Vineyard Wind I, the first utility-scale offshore wind facility in the U.S., was already partly operational at the time of the Interior Department's announcement. In January 2026, a federal judge ruled that construction and operation at the facility could continue.[33] Three other halted projects were also allowed to resume construction following preliminary injunctions issued by federal judges.

The Interior Department's action followed a Presidential Memorandum in January 2025 that withdrew the Outer Continental Shelf from wind energy leasing in its entirety, effectively stopping any new offshore wind projects in the U.S.[34] This included wind energy areas identified off the southern Oregon coast. The administration is offering payouts to energy companies that agree to cancel their offshore wind projects that are already under development. As of May 2026, the payouts offered total nearly $2 billion in taxpayer dollars.[35] While there are no wind facilities off of Oregon's shores today, Oregon has strong resources off its coast and potential for offshore wind projects in the future.[36] However, without federal funding for research and pilot projects, offshore wind generation will likely be further delayed.

Federal actions have also affected onshore wind facilities. In May 2026, the Associated Press reported that the American Clean Power Industry Association accused the Pentagon of delaying development of more than 250 onshore wind facilities across the U.S. by stalling national security reviews.[37] Typically, proposed wind facilities are reviewed by the Federal Aviation Administration to ensure facilities wouldn't interfere with radar systems or military and other aviation needs – oftentimes, this includes ensuring tall wind turbines are built with lights on the top so they can easily be seen at night. Without approval from the FAA, wind facility construction will be delayed or halted.

Oregon Renewable Energy Siting Assessment

The Oregon Renewable Energy Siting Assessment (ORESA) project was published in 2022 as an educational resource for users to explore data and information on renewable energy development in Oregon. The ORESA project goals were to develop baseline data and gather stakeholder perspectives to create a collection of information to support Tribes, communities,

policy makers, energy developers, and government agencies interested in potential projects or renewable energy policies.

A Mapping and Reporting Tool includes data on renewable energy, military training areas, economic development, land use, natural and cultural resources, and other important considerations. Users can interact with and browse spatial data, create site-specific reports to support early coordination on potential projects, and review additional information such as regulatory process maps, reports, and tools that are not reflected in the spatial data.

The ORESA project was funded through a $1.1 million U.S. Department of Defense Office of Local Defense Community Cooperation grant awarded to the Oregon Department of Energy, working with the Department of Land Conservation and Development and Oregon State University's Institute for Natural Resources.

https://www.oregon.gov/energy/energy-oregon/Pages/ORESA.aspx

Not all clean energy facilities have been negatively affected by recent federal action. Nuclear power, which produces no greenhouse gas emissions during electricity generation, has seen growing interest across the U.S. and across federal administrations. In May 2025, Executive Order 14302 was issued to "expedite and promote the production and operation of nuclear energy."[38] The EO aims to accelerate nuclear production by increasing capacity at existing reactors, constructing new large reactors, and providing federal loans and guarantees to spur construction.

The federal administration is also considering reducing safety and public health regulations for nuclear power plants. For example, in early 2026, U.S. DOE proposed including advanced nuclear reactors on its National Environmental Policy Act 'categorical exclusion' list, which is typically used for routine government actions where very little environmental impact is expected.[39] In addition, Executive Order 14300 (2025) mandated that the Nuclear Regulatory commission establish an expedited pathway for nuclear reactor designs previously tested by the U.S. Department of Energy or the U.S. Department of Defense, and NRC issued a proposed rule on April 2, 2026. ODOE submitted comments to the NRC expressing concern that this action could erode the statutory separation between U.S. DOE's "nuclear promotion" activities and NRC's nuclear safety obligation.[40]

Oregon's only nuclear plant, Trojan, closed in 1993,[41] and current state law makes it difficult to gain approval and build a new nuclear facility in Oregon. In 1980, Oregon voters passed Measure 7, under which the state cannot permit new reactors until there is a permanent federal nuclear waste repository and even then, a specific facility would have to be approved by voters.[42] Nuclear technology continues to evolve, as does interest by some Oregon leaders who have introduced recent legislation to further study advanced nuclear technologies, such as small modular reactors, as a carbon-free resource for the state. As Oregon decision-makers re-examine the state's nuclear policies, reducing public health and safety regulations at the federal level may increase Oregonians' concerns about the technology.

Transportation

Transportation accounts for about 35 percent of Oregon's greenhouse gas emissions by sector, primarily from petroleum fuel products.[43] Transportation-related programs and policies that increase

fuel efficiency and reduce greenhouse gas emissions are essential to meeting Oregon's climate goals. Federal corporate average fuel economy, or CAFE, standards have been an important tool in improving the average fuel economy of vehicles.[44] First enacted by Congress in 1975, CAFE standards regulate how far vehicles travel on a gallon of fuel for light-duty vehicles and for medium- and heavy-duty vehicles.

CAFE standards offer consumers vital information about fuel efficiency and fuel economy, including regulating miles-per-gallon ratings on new vehicle information stickers. In 2024, the National Highway Traffic Safety Administration estimated that fuel efficiency standards for model years 2027-2031 would save Americans over $23 billion in fuel costs.[45] Over time, CAFE standards require that vehicles sold by manufacturers get more fuel efficient over model years. The standards also set rules for manufacturers that don't meet those requirements, including potential fines or credit purchases from other manufacturers that over-perform on efficiency.

As part of H.R.1, associated fines for manufacturers not meeting the standards were eliminated.[5] In December 2025, The U.S. Department of Transportation announced an initiative to roll back CAFE standards,[46] and the NHTSA began a rulemaking process to reset standards for model years 2022-2031. In its draft Environmental Impact Statement for the proposed rulemaking, the NHTSA notes that rolling back standards from the 2024 update would reduce efficiency by about 13 to 17 MPG by model year 2031.[47] Further, fuel consumption, fuel costs, and air pollution would increase by rolling back the standards. For a typical driver, this would increase annual gasoline use by roughly 250-400 gallons, adding approximately $1,200-$1,900 per year in fuel costs at current Oregon gasoline prices.

California adopted the Advanced Clean Trucks regulation in 2020 and the Advanced Clean Cars II regulation in 2022 to increase sales of zero-emission light-, medium-, and heavy-duty vehicles.[48] Oregon followed California when the Environmental Quality Commission adopted both regulations in 2022.[49] In 2024, the U.S. Environmental Protection Agency granted California waivers to enforce these standards.[50] In June 2025, however, Congress voted to overturn the waivers through the Congressional Review Act by passing H.J. Res. 87 and 88.[51] [52] California, Oregon, and a coalition of other states are challenging these actions in court. The resulting regulatory uncertainty may affect automobile manufacturers' long-term investment decisions related to zero-emission technologies.

As discussed below, transportation policies and programs have also been affected by federal funding changes, such as the end of a tax credit for purchasing electric vehicles and EV chargers earlier than planned, as well as delaying funding for the National Electric Vehicle Infrastructure program that funds fast EV chargers along freeways nationwide, including in Oregon.[53]

Federal greenhouse gas emissions standards are foundational to Oregon's policies and programs that reduce emissions from transportation, such as Advanced Clean Cars II and Advanced Clean Trucks rules noted above. Weakening GHG regulations at the federal level potentially undermines Oregon programs while putting additional pressure on them to deliver reductions.

Energy Efficiency

In the Oregon Energy Strategy, published in November 2025, *energy efficiency* is identified as one of the five least-cost pathways for Oregon to reach its energy and climate policy objectives.[54] Energy efficiency means getting the same level of service (heating, cooling, comfort, transportation) using

less energy. The least expensive energy is the energy that is not needed in the first place. Reducing energy use through efficiency saves households and businesses money, reduces the burden on all ratepayers, and lowers the costs of transitioning the economy to clean energy. Strong policies and programs have supported increasing energy efficiency over the years, such as setting minimum appliance standards and providing incentives to ensure households with low incomes can access newer energy efficient technologies.

In early 2025, the U.S. Department of Energy announced its intent to roll back energy efficiency programs, as well as eliminate its office focused on energy efficiency.[55] This included regulations for appliance standards, which set minimum efficiency requirements that appliance manufacturers need to meet for equipment. In 2026, the Appliance Standards Awareness Project reported that without the national efficiency standards in place, an American household would have paid about $6,000 more on its utility bills over the last decade.[56] Further, businesses would have spent $330 billion more on utility bills over the last decade, and electricity use would have been 14 percent higher in 2025 nationwide without the standards.

Oregon has a history of leading on energy efficiency standards for appliances and other products. While some efficiency standards have been set at the federal level in the past, there are some products that do not yet have a national standard but would benefit from a state standard to achieve meaningful energy and water savings. Oregon established its first energy efficiency standards for 11 product categories in 2005, followed by six in 2007, three in 2013, and nine new and two updated standards in 2021.[57] Examples of appliances and equipment the state has identified for efficiency standards in the past include water coolers, televisions, computers and computer monitors, faucets and shower heads, and others. Often, federal standards are later modeled after standards first enacted at the state level. Thirteen of Oregon's previous standards have since been preempted by the federal government, meaning that a national standard has been adopted and applies to those products and that all states, including Oregon, cannot establish a different standard.

In addition to energy efficiency policy changes, administration actions have also reduced funding and incentive programs that support efficiency, as discussed below.

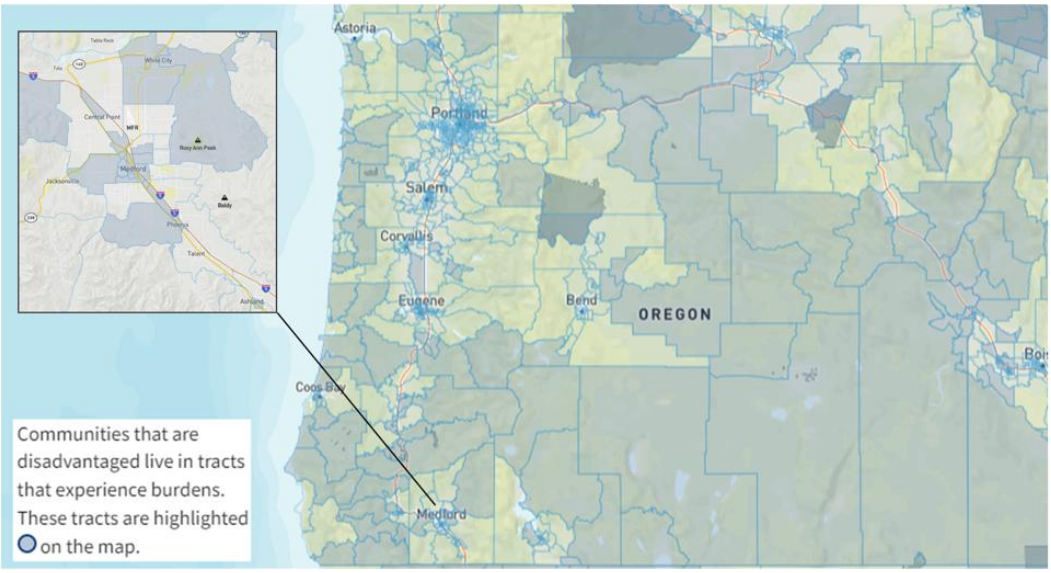
Equity

One of the most significant differences between past and current administrations is the approach to diversity, equity, and inclusion in federal programs and services. Executive Order 13985, *Advancing Racial Equity and Support for Underserved Communities Through the Federal Government*, was issued in January 2021 with a focus on making federal program and funding decisions that advance equal opportunity.[58] Later that month, Executive Order 14008 established the Justice40 Initiative, which created a goal that 40 percent of overall benefits from certain federal investments should flow to disadvantaged communities.[59] The order listed investments in clean energy, energy efficiency, clean transit, training and workforce development, and other efforts as examples.

Later in 2021, Congress passed the Infrastructure Investment and Jobs Act,[2] followed by the Inflation Reduction Act in 2022.[3] As noted above, the Oregon Department of Energy secured over $275 million in formula and competitive grants from the laws, supporting energy projects around grid resilience, energy efficiency, renewable energy, workforce training, and more. Both laws included Justice40 requirements, so awarded entities were to ensure at least 40 percent of the benefits flow to

disadvantaged communities. To aid in identifying disadvantaged communities, the White House made a Climate and Economic Justice Screening Tool available, which identified census tracts that defined the characteristics of a disadvantaged community.[60]

Figure 3: Snapshot of Climate and Economic Justice Screening Tool for Oregon (2024)[60] [iii]



Oregon, including ODOE, focused significant efforts on ensuring awarded grants were meeting Justice40 goals. However, in January 2025, Executive Order 14151 terminated all "diversity, equity, inclusion, and accessibility mandates, policies, program, preferences, and activities in the Federal Government."[61] This included rescinding the Justice40 Initiative for federally funded programs, removing an important tool for addressing past and potential future harms to those who are most affected by climate change.

While the federal government is no longer focusing on ensuring equitable access to government programs and benefits, the State of Oregon remains committed to advancing racial and environmental justice. In 2022, the Oregon Legislature passed House Bill 4077, which established the Environmental Justice Council.[62] The Council advises the Governor and state natural resource agencies on environmental justice issues. HB 4077 also directed the Council to develop an environmental justice mapping tool (due December 31, 2027) to provide information about environmental justice issues in the state to guide agencies as they develop policy and make funding and program decisions. Like other state agencies, ODOE regularly participates in Council meetings and continues to follow state guidance and laws to ensure its programs are equitable across Oregon communities who are disproportionately affected by environmental harms.

Changes in Clean Energy and Climate Funding at the Federal Level

Federal Funding Freezes

As discussed above, ODOE secured over $275 million in formula and competitive grants from the 2021 Infrastructure Investment and Jobs Act and the 2022 Inflation Reduction Act. As a state, Oregon

[iii] The original Climate and Economic Justice Screening Tool website was removed by the federal government in 2025. The Climate Program Portal created an archived version for the public to access.

secured even more funding, including as part of a $1 billion consortium to create a clean hydrogen hub in the Pacific Northwest. Table 1 shows the awards to Oregon from IIJA and IRA, as well as the current status of each.

Table 1: IIJA and IRA Awards to ODOE (Status as of October 1, 2026)

Grant Name	Status	State of Oregon Award Amount	Federal Act
Grid Resilience	Awarded	$50 million	IIJA
Infrastructure Investment and Jobs Act – State Energy Program	Awarded	$5.6 million	IIJA
Energy Efficiency Conservation Block Grant	Awarded	$1.9 million	IIJA
Home Energy Rebates – Retrofit (HOMES)	Awarded	$56 million	IRA
Home Energy Rebates – Electrification (HEAR)	Awarded	$56 million	IRA
Climate Pollution Reduction Grants – Planning Funds	Awarded	$3 million	IRA
Climate Pollution Reduction Grants – Implementation Funds	Awarded	$197 million	IRA
Energy Auditor Training – Competitive	Selected but Paused	$1.7 million	IIJA
Latest and Zero Energy Building Codes – Formula	Selected but Paused	$6.5 million	IRA
Training for Residential Contractors – Formula	Selected but Paused	$2 million	IRA
Solar for All	Program Canceled by U.S. DOE; Under litigation.	$86.6 million	IRA
Training for Residential Energy Contractors – Competitive	Project Canceled by U.S. DOE but reinstated	N/A	IRA
Resilient and Efficient Codes Implementation (ASHRAE)	Project Canceled by U.S. DOE	N/A	IIJA

Resilient and Efficient Codes Implementation (Earth Advantage)	Project Canceled by U.S. DOE; reinstatement in process after litigation	N/A	IIJA
Hydrogen Hub	Project Canceled by U.S. DOE; Under litigation	Up to $1 billion (as part of a consortium)	IIJA

The federal administration change in 2025 created significant uncertainty about federal funding and programs. On January 27, 2025, the federal Office of Management and Budget issued a memo pausing federal grants, loans, and other financial assistance programs until agencies could review programs and activities to ensure they were consistent with the president's policies and requirements, including Executive Order 14151 that focused on ending equity efforts.[63] The memo stated: "Federal agencies must temporarily pause all activities related to obligation or disbursement of all Federal financial assistance, and other relevant agency activities that may be implicated by the executive orders, including, but not limited to, financial assistance for foreign aid, nongovernmental organizations, DEI, woke gender ideology, and the green new deal." Lawsuits challenging the memo quickly followed[64] and on January 28, a U.S. District Court issued an administrative stay on implementing the memo.[65] The Office of Management and Budget then rescinded the memo but the White House Press Secretary Karoline Leavitt issued a statement clarifying that the funding freeze would continue.

The announced funding freeze had a significant effect on Oregon and the nation, as important programs such as Medicaid and childcare programs were at risk, in addition to energy- and climate-related programs. The freeze announcement lacked clarity about what programs or funding were affected, so the state, including the Oregon Department of Energy, was unsure which programs were truly frozen from further work. Other programs, including those supporting code development and workforce, received "conditional awards" but conditions were never communicated, and the statuses remain in limbo at the time of this report.

While the early days of uncertainty and funding freezes gained more clarity over time, some federal energy programs and projects have been outright canceled, while others continue to experience delays.

Program Funding Cancelations

Solar for All



In May 2024, ODOE Director Janine Benner joined federal and local partners to celebrate Oregon's nearly $87 million Solar for All award.

In April 2024, the U.S. Environmental Protection Agency announced that Oregon would receive an $86.6 million Solar for All grant to support renewable energy adoption for low-income Oregonians.[66] The Oregon Solar for All Coalition – which includes the Oregon Department of Energy, Energy Trust of Oregon, and Bonneville Environmental Foundation – applied for the highly competitive funding in fall 2023. The Solar for All program was originally designed to advance equity, environmental, and energy justice priorities in support of federal Justice40 Initiative goals to deliver benefits to disadvantaged communities. Awarded programs would reduce greenhouse gas emissions and other air pollutants, deliver the benefits of solar energy to low-income and disadvantaged communities across the nation, and mobilize financing and private capital to stimulate additional projects that reduce emissions.

Oregon's program aimed to serve about 8,000 households with low incomes – saving households over $83 million – and program funding would provide financial and technical assistance to support solar installations for homes with little to no upfront cost; solar on multifamily buildings with benefits for low-income residents; development of community solar projects; and workforce development activities.

Oregon's Solar for All Programs and Funding

- Solar installations at single-family households with little to no upfront customer cost | Oregon Department of Energy | $29 million
- Multifamily buildings that provide tangible benefits to low-income residents | Oregon Department of Energy | $10.86 million
- Financial and technical assistance to develop community solar projects under the Oregon Community Solar Program | Energy Trust of Oregon | $15 million
- Financial and technical assistance to develop Consumer-owned Utility Territory Community Solar projects | Bonneville Environmental Foundation | $11 million
- Workforce development activities | Oregon Department of Energy | $2.87 million

On August 7, 2025, the Oregon Department of Energy received a letter from the U.S. Environmental Protection Agency stating that the EPA was canceling all Solar for All program funding, including

Oregon's award.[67] ODOE first learned of the cancelation when EPA Administrator Lee Zeldin made an announcement on social media.[68]

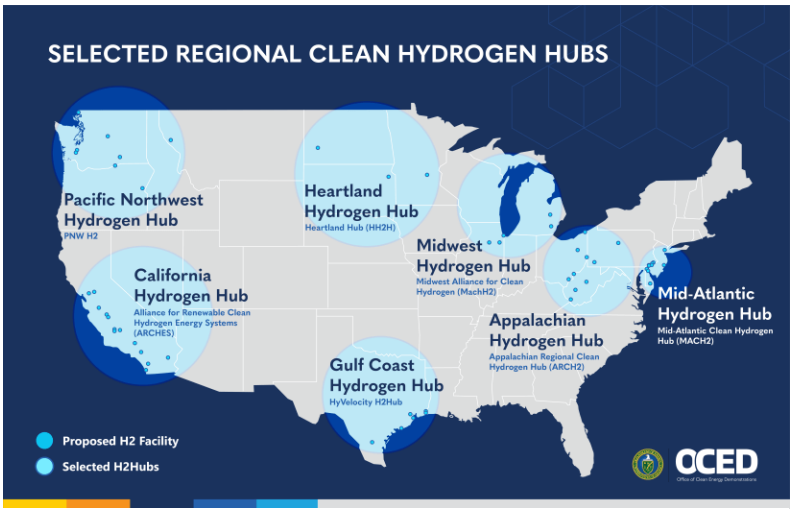
On September 5, 2025 the Oregon Department of Energy sent a letter to the U.S. EPA regarding the wrongful termination of the grant. In the letter, ODOE requested to formally initiate an administrative dispute with the goal that EPA return the obligated funds to Oregon.[69] The following month, on October 16, 2025, Oregon Attorney General Dan Rayfield announced Oregon was joining 23 other Solar for All awardees in a lawsuit against the EPA for illegally ending the $7 billion Solar for All program.[70] The lawsuit was filed in the U.S. Court of Federal Claims to recover damages for EPA's unlawful breach of the grant agreements that were already fully executed and the funding obligated under the program.

In September 2026, a federal judge ruled that the Solar For All program was illegally terminated, noting that Congress had clearly indicated that funds that were already obligated should have continued to be administered by the U.S. EPA.[71] As of October 1, 2026, it is unclear what this means for the program going forward or Oregon's award.

Without the Solar for All funding, Oregon has limited capacity to support solar installations on Oregon homes.[iv] Solar not only helps households lower their energy costs, it can also help the overall electric grid by reducing demand on the system, and minimizes potential greenhouse gas emissions from other energy resources that make up Oregon's electricity mix.

Pacific Northwest Hydrogen Hub

In October 2023, the U.S. Department of Energy announced it had selected the Pacific Northwest Hydrogen Association's PNWH2 Hub as one of the regional clean hydrogen hubs funded through the 2021 Infrastructure Investment and Jobs Act.[72] The Pacific Northwest Hydrogen Association is a multi-state nonprofit coalition of public and private partners spanning Oregon, Washington, and Montana, including the Oregon Department of Energy, and was selected to receive up to $1 billion to support the clean hydrogen hub.



Seven regional hydrogen hubs were announced in October 2023, including the Pacific Northwest Hydrogen Hub. (U.S. DOE Office of Clean Energy)

The PNWH2 Hub proposed to leverage the northwest's abundant clean power, including hydropower, as well as innovative local companies ready to help support a clean hydrogen economy. The hub would focus on decarbonizing hard-to-electrify sectors, such as heavy-duty vehicles, long-duration energy storage, agriculture and

[iv] The Oregon Department of Energy's Solar + Storage Rebate Program, which launched in 2020, ran out of state funding in mid-2024. Through administrative savings and canceled projects from previous funding rounds, ODOE was able to temporarily reopen the program in June 2026 with $1.1 million available to support new solar and storage projects. The funding was reserved within 10 minutes, and no additional funding has been allocated to continue the program.

industry, and ports. In addition to bolstering a clean hydrogen economy, projects funded by the hub were expected to create or support more than 10,000 jobs in the region.[73] This focus and attention on hydrogen was consistent with the low-carbon fuels pathway in the Oregon Energy Strategy, which acknowledges the important role that fuels play in Oregon's energy sector and the need to replace existing fuels with low-carbon alternatives like hydrogen to meet our climate goals.

On October 1, 2025, the U.S. Department of Energy announced it was canceling over $7.5 billion in funding for energy projects across the country (more on these project cancelations below).[74] Among the canceled projects: the Pacific Northwest Hydrogen Hub and the California Hydrogen Hub.

Losing a $1 billion investment in the region was a significant blow not only for jobs and the economy, but also for the potential greenhouse gas reductions that would come with clean hydrogen. The Pacific Northwest Hydrogen Hub remains active to continue clean hydrogen efforts and submitted an appeal to the U.S. DOE to reinstate the funding.[75] As of October 1, 2026, funding remains canceled.

Other Funding Cancelations

Resilient and Efficient Codes Implementation

The 2021 Infrastructure Investment and Jobs Act included competitive funding opportunities for Resilient and Efficient Codes Implementation programs, which support advancing energy efficiency in building codes that "save money for American homes and businesses, reduce greenhouse gas emissions, and encourage more resilient buildings."[76] Nonprofit Earth Advantage was awarded $2.9 million to support such energy efficient code efforts, including examining pathways to support the adoption of Building Performance Standards in Oregon. On a national scale, ODOE was also part of a team, led by ASHRAE and in partnership with other states, to develop energy code training materials to support workforce development and building official education. Both of these Resilient and Efficient Codes Implementation programs were canceled alongside many other U.S. DOE energy projects in October 2025,[74] though the project led by Earth Advantage was reinstated in June 2026.

The Oregon Energy Strategy identified energy efficiency as a key pathway to advance Oregon's energy objectives and highlighted the importance of building codes as a tool to improve efficiency in existing buildings. Unfortunately, the state can no longer count on federal funding to support and strengthen workforce development and help advance efficiency and resilience in existing buildings.

Building Resilience Infrastructure and Communities

The Federal Emergency Management Agency's Building Resilience Infrastructure and Communities, or BRIC, grant program provides funding to communities across the nation for "pre-disaster mitigation funding" to strengthen community resilience. The 2021 Infrastructure Investment and Jobs Act appropriated about $882 million in BRIC funding, and FEMA began awarding funds to projects around the country, including in Oregon. However, FEMA announced in April 2025 it was ending the program and did not distribute the funding.[77]

In July 2025, several states, including Oregon, filed a lawsuit to restore the funding for fiscal years 2020 through 2023. The lawsuits prevailed, and in March 2026 FEMA announced the program was reopening.[78] A letter from FEMA to the Oregon Department of Emergency Management in March outlined some of the potential projects that could have millions of dollars in funding restored, including projects for seismic retrofitting, battery and microgrids, backup generators, and hazard

mitigation plan updates.[78] For example, in Lane County, a $1.5 million grant was awarded to support the Blachly Lane Amy Hill Overhead to Underground project to place 1.75 miles of overhead powerlines underground.[79] Undergrounding power lines can improve grid resilience and reliability by protecting infrastructure from possible environmental hazards, such as wind or ice storms.

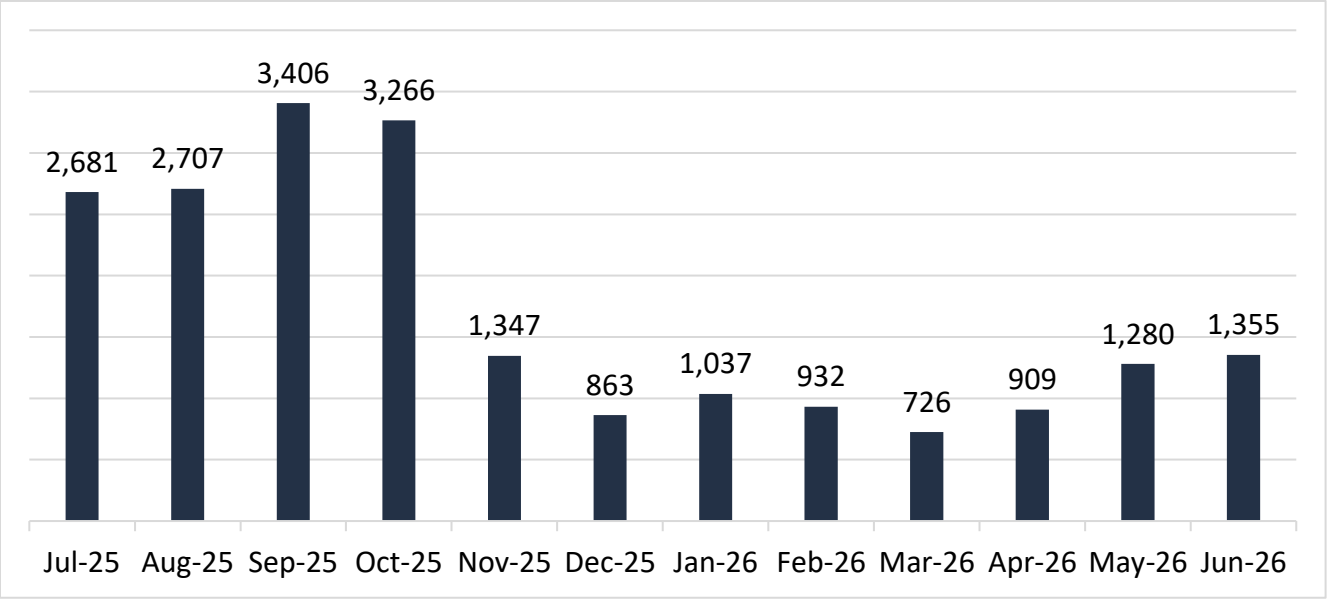
Tax Credit Cancelations

Tax credit programs have long been a tool for helping households, businesses, and energy developers invest in renewable energy, energy efficiency, and other energy technologies that save energy and reduce greenhouse gas emissions. The 2022 Inflation Reduction Act created new energy tax credits and expanded existing tax credits to further encourage technology adoption, such as solar, electric vehicles, efficient heat pumps, and other equipment.[80] For example, through the IRA, Energy Efficient Home Improvement Credits and Residential Clean Energy Property Credits were extended to 2033 and 2034, respectively. The U.S. Department of Treasury announced that more than 3.4 million households took advantage of about $8.4 billion in tax credits for clean energy and energy efficiency improvements in their homes in 2023.[81]

H.R.1 in 2025, also known as the "One Big Beautiful Bill Act," repealed much of the IRA's tax credit extensions.[82] For households taking advantage of the Energy Efficient Home Improvement Credit or the Residential Clean Energy Credit, H.R.1 changed the eligibility date for claiming tax credits to projects completed by December 31, 2025.

H.R.1 repealed electric vehicle tax credits as of September 30, 2025, including $7,500 for new EVs, $4,000 for used EVs, and $7,500 for light-duty and $40,000 for heavy-duty commercial clean vehicles. An Alternative Fuel Vehicle Refueling Property Credit, which subsidized up to 30 percent of the cost of installing refueling equipment for alternative fuel vehicles (including charging infrastructure), had been extended by the IRA to 2032 and increased the maximum business credit to $100,000. H.R.1 terminated the tax credit for projects installed after June 2026. In Oregon, the number of light-duty electric vehicle registrations was growing month-to-month but saw a steep decline immediately after the September 30 federal tax credit expiration.

Figure 4: Monthly Light-Duty Electric Vehicle Registrations in Oregon (Oregon DMV)



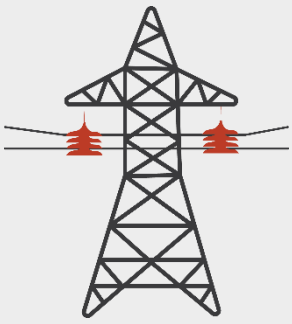
Businesses and contractors were also affected by H.R.1 changes. A Credit for Construction of Energy-Efficient New Homes had been extended to 2032 and offered tax credits to contractors who built and sold new energy-efficient homes; H.R.1 ended the credit as of June 30, 2026. An Energy Efficient Commercial Buildings Deduction allowed businesses to deduct purchase and installation costs for energy-efficient equipment more quickly than regular tax rules; H.R.1 also ended that deduction as of June 30, 2026.[82]

The IRA also established or expanded tax credits for clean energy production and energy efficiency. Previous tax credits for renewable energy generation were set to expire, so the IRA established a Clean Electricity Production Tax Credit with a base credit of 0.3 cents per kilowatt hour and a Clean Electricity Investment Tax Credit with a base credit of 6 percent of qualified investments for energy facilities producing renewable and clean power in 2025 and beyond.[3] The tax credits were designed to spur clean energy development across the country, lowering costs and helping to reduce greenhouse gas emissions in the energy sector. H.R.1 restricted both tax credits. Qualifying wind and solar facilities must begin construction before July 6, 2026 or begin producing electricity before January 1, 2028; other facilities are required to begin construction before 2033.[83]

Clean energy developers, including those in Oregon, have used tax credit programs to make their projects more feasible. The changes in H.R.1 meant that Oregon developers may have to meet accelerated timelines for energy facilities if they want to take advantage of the tax credit program(s). In response to the timeline change, Governor Kotek issued Executive Order 25-25 in October 2025 to accelerate wind and solar energy development in advance of the federal clean energy tax credits ending.[84] The order directed executive branch agencies, including the Oregon Department of Energy, to take actions to "accelerate and prioritize siting and permitting reviews, approvals, and processes necessary to expedite the permitting and development of solar and wind energy projects in Oregon that seek to qualify for federal clean energy tax credits." It also directed ODOE and the Energy Facility Siting Council to consult with developers to identify process changes within statutory authority that could help projects meet the federal tax credit deadline. ODOE and EFSC conducted outreach in late 2025 and early 2026 and have been working with developers to facilitate meeting the tax credit deadlines.

Executive Order 25-29: Accelerating Clean Energy Projects and Infrastructure

In addition to Executive Order 25-25, Governor Kotek also issued EO 25-29[85] in 2025 on reducing greenhouse gas emissions and advancing Oregon's clean energy future. The EO directed state agencies to "prioritize implementation of the Oregon Energy Strategy pathways," including getting clean energy projects built.



In September 2026, the Oregon Department of Energy submitted three major deliverables required under Governor Kotek's Executive Order 25-29: a report on Siting and Permitting Large-Scale Electricity Infrastructure, a report on Reducing Barriers to Clean Energy Deployment, and a Proposed Framework for Strategic Transmission Siting. Together, these reports and proposed framework address the issue of how to accelerate the pace at which clean energy projects and associated transmission infrastructure are permitted, built, and brought online in Oregon. These efforts will ultimately

support access to the energy needed for Oregon homes and businesses to continue to grow and thrive.

As articulated in the Oregon Energy Strategy and amplified in the executive order, demand for electricity is rising far faster than in recent history, driven by new data centers along with electrification, industrial growth, and climate change-driven reliability challenges. At the same time, many state-approved clean energy projects are struggling to move into construction because local and federal permitting processes are stressed, interconnection timelines and costs are increasing, supply chains are constrained, and the transmission system has become a limiting factor for nearly every major project. EO 25-29 asked agencies to diagnose these challenges and propose a coordinated, proactive state response. Alongside the Department of Land Conservation and Development's report, Accelerating Clean Energy Deployment Through Oregon's Land Use Planning Framework, ODOE's documents fulfill that directive and recommend concrete steps the state can take today to help meet this challenge.

Each document addresses a different stage of project development, but they collectively outline a roadmap to support EO 25-29's directive to "get clean energy projects built" and advance key elements of the Oregon Energy Strategy. The Oregon Department of Energy stands ready to act as quickly as we can on these recommendations, working in concert with leadership, other natural resource agencies, Tribes, state and local governments, developers, the public, and the legislature to continue balancing energy needs and impacts for current and future generations.

https://energystrategy.oregon.gov/implementing-the-strategy

Investor-owned electric utilities in Oregon have also expressed concerns about how the eliminated tax credits will affect efforts to transition to clean electricity – and meet the 100 percent clean electricity target outlined in HB 2021. In its 2025 Clean Energy Plan, PacifiCorp states "H.R. 1 would phase out and repeal these tax credits for new resources. If passed, all solar, wind, storage, and clean hydrogen facilities would no longer receive either production or investment tax credits if they are unable to achieve COD within the timelines being debated in Congress. This would have a material implication on the costs to comply with Oregon policies, including HB 2021 and the elimination of coal resources by 2030."[86] Portland General Electric states in its Integrated Resource Plan 2025 update, "Essential federal tax credits have been targeted for elimination by US Congress – could increase renewable costs by at least 30-50% or more."[87]

Project Cancelations

On October 1, 2025, the U.S. Department of Energy announced it was terminating 321 financial awards totaling nearly $8 billion that would have supported 223 energy projects and programs across the country, including in Oregon. In its announcement, U.S. DOE claimed the projects "did not adequately advance the nation's energy needs, were not economically viable, and would not provide a positive return on investment of taxpayer dollars."[88]

Reaction to the announcement was swift, with critics pointing out that the terminated projects were located in Democratic-run states.[89] Oregon was estimated to lose about $405 million in federal grants tied to energy and climate action; the awards were for 13 organizations across the state.[90] Portland

General Electric had three grants totaling over $60 million; other organizations were set to lose grants between $1-30 million. As noted above, the Pacific Northwest Hydrogen Association's $1 billion award was also terminated. The largest grant in Oregon was $250 million to develop a regional transmission project connecting areas east and west of the Cascade Mountains awarded to Warm Springs Power Enterprises, an enterprise wholly owned by the Confederated Tribes of the Warm Springs. Although initially listed as terminated, following review by the current Administration, the grant was allowed to move forward and continues to be honored.[91]

Portland General Electric was the prime awardee for three grants terminated in the U.S. DOE announcement, totaling over $60 million. U.S. DOE communicated that it would like to reinstate PGE's financial assistance for one of those grants, and PGE is evaluating the benefits and risks of reinstating the grant for approximately $45 million in total funding.

Several states and coalitions sued the U.S. DOE after the announcement in an effort to restore the billions in grants. In January 2026, a federal judge ruled that the administration violated the Fifth Amendment in canceling the grants because the cancelations were based on whether the projects were located in "blue" states.[92] While that particular lawsuit didn't cover all of the $8 billion in grants, a second lawsuit was filed in March 2026.[93]

In April 2026, the U.S. DOE announced it would "retain or modify" billions of dollars in grants that had been previously terminated or under scrutiny, including many of the projects canceled in October 2025.[94] Among the retained or modified awards are many Oregon-based awards, including for the Warm Springs Tribe, Portland General Electric, PacifiCorp, universities, nonprofits, and businesses;[95] [96] however, uncertainty remains around the status of the projects on the "retain or modify" list.

Conclusion

Oregon has been a leader in promoting clean energy and efficiency since the 1970s and became the first state to set a price on carbon in 1997.[v] Through setting standards, establishing foundational policies, and distributing funding, the federal government has been an important partner to the state. Federal policies and priorities naturally fluctuate with changes in administration over time. In recent years, changes to policy, programs, and funding have been particularly drastic, and have increased regulatory uncertainty and removed tools that Oregon jurisdictions, businesses, and households use to support progress on clean energy and climate change that prioritizes reducing barriers and increasing benefits to environmental justice and climate-affected communities.

In 2023, the Oregon Department of Energy undertook a modeling effort to assess Oregon's progress towards meeting the state's greenhouse gas reduction goals; ODOE found that the state had the program and policy infrastructure in place to meet its 2035 goal. In late 2025, ODOE updated the forecast, taking into consideration changes to the energy landscape – including increasing electricity demand as well as changes at the federal level. The updated forecast found that Oregon is no longer positioned to meet its 2035 greenhouse gas reduction goals. It's clear that if Oregon is going to close the gap between the projected emissions levels and where the state wants to be in 2035 and 2050,

[v] Learn more about Oregon's carbon standard: https://secure.sos.state.or.us/oard/viewSingleRule.action?ruleVrsnRsn=323651

Oregon is going to have to step up with its own measures and, at least in the short term, will have little assistance from the federal government. Not only does this present a challenge to emissions reduction efforts, the reduction in federal funding will also increase the cost of these efforts for Oregonians.

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Fund for Oregon Resilience, Growth, and Energy (FORGE) Act: An Analysis of SB 1526 (2026)

Senate Bill 1526 (2026) would have taken the initial steps toward establishing an institution to provide funding tools for energy projects, similar to institutions in many other states. SB 1526 was introduced by the Senate Energy and Environment Committee and led by Senator Janeen Sollman. It was drafted by a work group brought together by Senator Sollman and passed out of committee with bipartisan support. However, the bill did not move out of the Ways and Means Committee prior to the adjournment of session.

Key Takeaways

- Many states have programs or institutions that provide low-cost loans and other financing mechanisms to support clean energy projects.
- SB 1526 proposed taking first steps toward establishing an entity in Oregon for the purpose of financing clean energy and resilience projects.
- While the bill came from a work group process and passed its initial policy committee with bipartisan support, it did not pass out of budget committee.

Background and Context

The Oregon Energy Strategy found that "a stable source of financing is critical to support the pace and scale of investment required to both reduce greenhouse gas emissions and enhance resilience to climate impacts." In 26 states, a clean energy fund provides such a funding source, sometimes part of a state agency and sometimes not.[1] Model programs include the Massachusetts Community Climate Bank, which is part of the state's housing agency, and the Connecticut Green Bank, which is described as a quasi-public agency.[2] [3]

Oregon has had clean energy loan programs in the past but currently lacks a program with the necessary scale and focus to meet state and local clean energy goals. Subsequently, legislators have introduced bills that would have created new energy-focused financing mechanisms, including cap and invest legislation (e.g., HB 2020 from 2019) and clean energy fund concepts.[4] In recent years, a work group had been meeting, most recently convened by Senator Sollman, and the legislature held informational hearings on the topic.[5]

Legislation Overview

SB 1526 would have directed ODOE to apply for funding from the Environmental Restoration Council to carry out initial work toward creating a nonprofit entity to finance clean energy and resilience projects in the state.

Given the budget dynamics facing the state during the 2026 legislative session, supporters of this concept developed a creative funding mechanism to get a new program started. A settlement with Monsanto had yielded $698 million, which was used to establish the Oregon Environmental Restoration Fund.[6] [7] The bill directed ODOE to apply to the Environmental Restoration Fund or other

sources for the funding required to carry out the elements of SB 1526. If the agency did not receive an award from that application, no further work would be done.

If ODOE were to secure sufficient funding, which was listed as at least $2 million in the bill, then the agency would recruit and convene an eight-member founding board, including the Director of the State Department of Energy, the Director of the Oregon Business Development Department or the director's designee, the Director of the Housing and Community Services Department or the director's designee, four members who represent nongovernmental organizations, and one member who represents a labor organization. The bill laid out other criteria for board members to ensure diversity and expertise across its membership.

The board, once appointed, would have been directed to form a nonprofit to facilitate the financing of clean energy and resilience projects. The bill also required an annual report from the new nonprofit to the Legislature. Once the nonprofit entity was established, Business Oregon and ODOE would have been required to work with the entity to support its work, with all agencies required to assist.

Perspectives and Outcomes

Supporters of SB 1526 included associations representing contractors, clean energy and environmental organizations, local governments, and climate advocates. In testimony, these supporters focused on the potential for economic development should the FORGE Act be established. For example, the Oregon Environmental Council and Climate Solutions put in joint testimony citing the success of clean energy funds in other states, pointing out that since launching in 2011, the Connecticut Green Bank has helped create more than 30,500 jobs, lowered energy costs for more than 8,500 businesses and 69,000 households, and generated an investment leverage ratio of $6.70 for every dollar spent.[8] [9] Several associations representing contractors submitted testimony in support, citing potential job creation and other economic growth, including the Northwest Native Chamber, Oregon Solar and Storage Industries Association, Building Potential, and more.[10–12] Another perspective raised by the Nature Conservancy pointed out that "Oregon has no shortage of plans, strategies, programs, and policies…that point to strategies and recommendations on what and where we need to invest; yet we often don't have enough funds to do the work."[13]

Opponents of the bill, or more commonly those who were neutral on the bill but had concerns, included members of the public, a think tank, and representatives of Oregon's consumer-owned utilities. These parties raised several potential issues with the legislation. While the bill specifically targeted the use of settlement funds from the Monsanto lawsuit, there were concerns that taxpayers may end up funding the work. A county commissioner pointed out that the existence of many different possible sources of funding created a burden on local governments as they would have to apply to each source and understand varying requirements.[14] Associations representing Oregon's consumer-owned utilities made specific requests for changes to and clarifications of the bill language.[15]

Even though the bill did not impose costs on the General Fund, it did not move out of the Ways and Means Committee and ultimately did not pass.

Conclusion

While SB 1526 was not successful in the 2026 session, the bipartisan support it received demonstrates that there is interest in financing tools that can support a variety of project types across energy, resilience, and restoration. Similar legislation in future legislative sessions seems likely.

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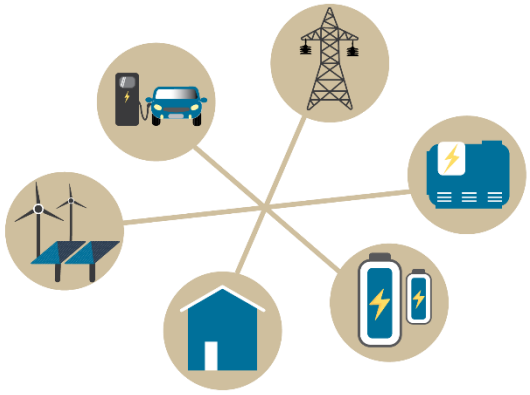
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Expanding Virtual Power Plants: An Analysis of SB 1582 (2026)

Senate Bill 1582 was proposed in the 2026 Legislative Session and would have required utilities to expand their virtual power plant programs and partner with third-party aggregators[i] to increase the pace at which virtual power plants are developed in Oregon. A similar bill, HB 3609, was introduced in 2025. SB 1582 was championed by Senator Courtney Neron Misslin; Representatives Mark Gamba, Sarah Finger McDonald, Dick Andersen, and Sue Rieke Smith also served as chief sponsors. The bill had a public hearing in the Senate Energy & Environment Committee but did not receive a vote to move out of committee.

Background and Context

Virtual power plants provide services to the grid by aggregating, coordinating, and utilizing distributed energy resources like smart appliances, grid interactive buildings, rooftop solar, battery storage systems, and electric vehicles. Utilities can use these customer- or utility-owned resources to provide power and better manage grid operations during periods of peak demand. This could provide financial benefit to customers for the use of their resources while also benefitting ratepayers.



Virtual power plants are currently legal in Oregon and are developed by utilities, which work with third parties including device manufacturers, installers, and aggregators, to enroll customers and operate these resources. Portland General Electric's VPP includes approximately 230,000 participating customers and roughly 600 megawatts of capacity.

Legislation Overview

SB 1582 would have changed how Oregon's investor-owned utilities develop virtual power plant programs, referred to as distributed power plant programs in the bill. Participating customers with batteries, load control devices such as smart thermostats, and electric vehicles would be offered payment, for five years or longer, to provide grid services to the utility. These services include reducing peak load, providing renewable energy for peak demand, deferring transmission and distribution system costs, and providing voltage support, emergency services, or any other services approved by the Oregon Public Utility Commission.

The legislation would also have required investor-owned utilities to offer standard, open access terms for customers or outside entities, to provide grid services. An aggregator is an entity that enrolls and coordinates multiple customer-owned energy resources so they can be operated together as a single resource; both utilities and third parties – such as contractors or manufacturers – can perform this function.[1] Under the bill, they would have been able to receive and manage all contracted program payments and customer participation, including customer compensation and incentives. As part of

[i] An aggregator is an entity that enrolls and coordinates multiple customer-owned energy resources so they can be operated together as a single resource. Both utilities and third parties can function as an aggregator.

VPP operations, the contracting utilities would have been allowed to communicate with and control customer devices but would also have been responsible for the costs of any necessary metering device upgrades. SB 1582 would have allowed utilities to provide a higher level of upfront payments for low- and moderate-income customers participating in a VPP program. Utility costs incurred in the program could have been recoverable through rates.

The bill directed the Oregon Public Utility Commission to review and approve or modify distributed power plant programs submitted by utilities, as well as to develop utility procurement targets and incentives for each five-year period of program operations. Utilities would have been required to report on progress toward procurement targets on an annual basis.

Perspectives and Outcomes

Supporters of SB 1582 included solar contractors and advocates, climate advocacy groups, and members of the public. They focused on various aspects of virtual power plants and their benefits. A one-pager for the bill submitted by 18 organizations mentioned that the policy change could save ratepayers money, make the grid more resilient and efficient, and help Oregon meet its energy and climate goals.[2] Other supporters, such as Columbia Riverkeeper, focused on how more virtual power plants and distributed resources would avoid the need to build larger, more expensive electricity generation projects.[3]

Opponents of SB 1582 included utilities and large industrial energy consumers. For example, Portland General Electric raised concerns about specific design elements of the bill, including provisions limiting the Public Utility Commission's review authority.[4] They also expressed concerns about workload at the OPUC, which is implementing several bills passed in 2025, and about paying more than the value the resource delivers. The Alliance of Western Energy Consumers was concerned that the bill would raise rates for large employers and also felt that the process behind this concept was too rushed for short session to allow for an analysis of cost impacts.[5]

SB 1582 was also expected to have a fiscal impact on the Public Utility Commission. While agency costs to implement new bills are to be expected, with limited resources available to lawmakers in 2026, very few bills with a cost could be passed within the budgetary constraints.

Conclusion

While SB 1582 did not pass, there is continuing interest in virtual power plants. This legislative concept or something similar may be seen in future legislative sessions, and work on virtual power plants by Oregon utilities is expected to continue.

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