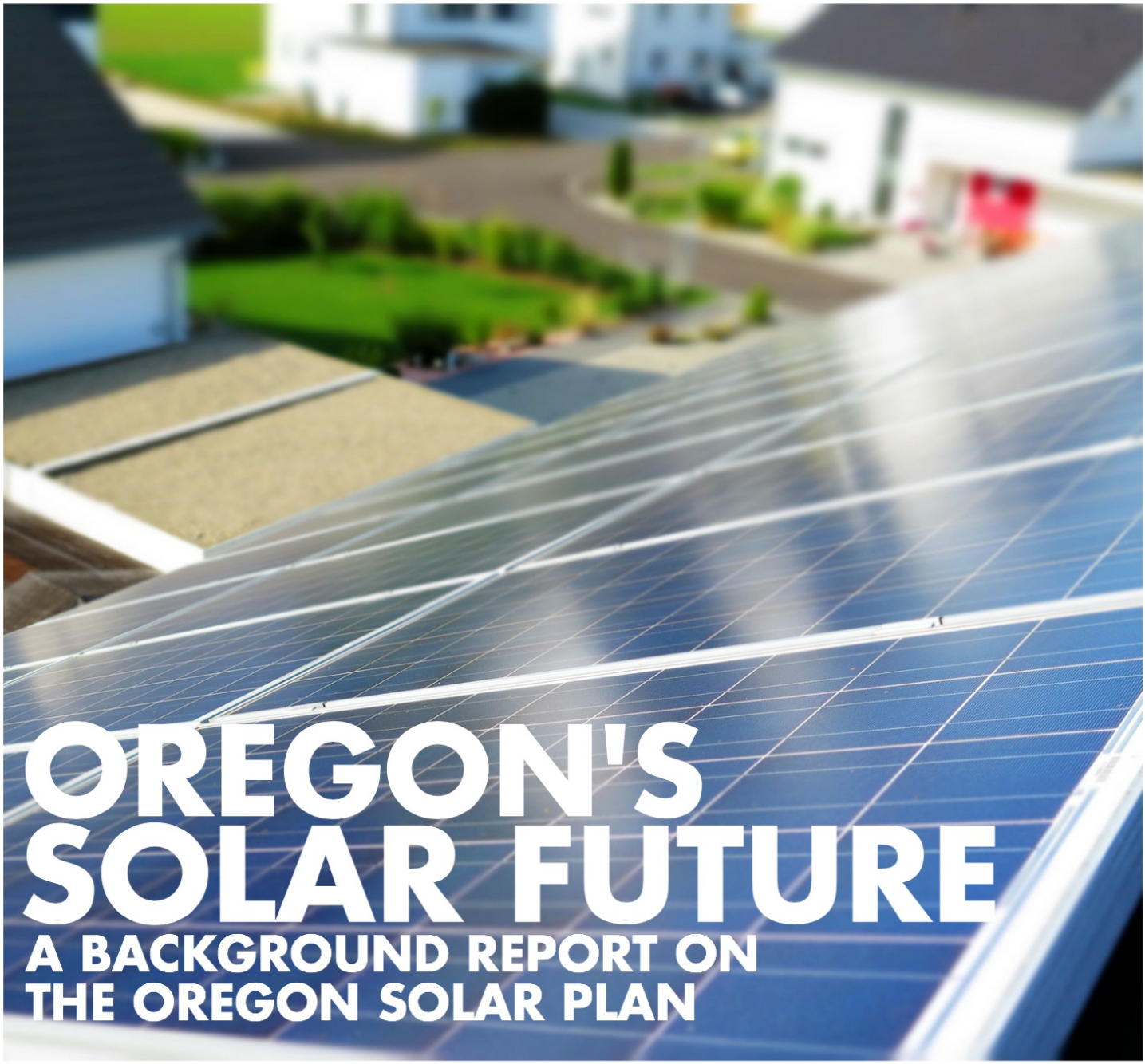

OREGON'S SOLAR FUTURE

A BACKGROUND REPORT ON THE OREGON SOLAR PLAN

PREPARED BY THE GREEN ENERGY INSTITUTE FOR THE OREGON SOLAR ENERGY INDUSTRIES ASSOCIATION

APRIL 2017

OSEIA
Oregon Solar Energy Industries Association

GREEN ENERGY INSTITUTE
AT LEWIS & CLARK LAW SCHOOL

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OSEIA
Oregon Solar Energy Industries Association

THE OREGON SOLAR INDUSTRIES ASSOCIATION

OSEIA is a trade association founded in 1981 to promote clean, renewable, solar technologies. OSEIA works with industry leaders, academic scholars, legislators, government, and non-profit agencies to advocate for solar technologies and raise awareness of its potential to help secure an affordable, reliable, and clean energy future.

For more information, please visit **oseia.org**

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THE OREGON SOLAR PLAN

In the very near future, thriving communities will share a common commitment: to harness and use energy from the sun. These communities will have robust solar industries that support local economic growth and provide local job opportunities. These communities will have resilient energy systems and stable electricity costs. They will breathe clean air and drink clean water. And they will be equitable.

Oregon is home to diverse communities with their own unique challenges and opportunities. Yet in each of these communities, from the smallest town to the largest city, solar energy has the potential to improve the quality of life. Though it currently provides less than one percent of Oregon's electricity, solar is already making life better for thousands of Oregonians. In order to enjoy all the benefits that solar energy can provide, Oregon must develop strategies to grow its solar industry and advance solar development in the state.

In 2016, the Oregon Solar Energy Industries Association (OSEIA) enlisted the technical expertise of the Green Energy Institute to work with a wide variety of industry stakeholders and craft a blueprint for Oregon's solar energy future. That blueprint, the Oregon Solar Plan, seeks to support the energy transition by showing where Oregon can be in ten years in terms of solar deployment and offers strategies for how to get there. **By the end of 2027, Oregon can get 10 percent of its total electricity from solar energy.** The Oregon Solar Plan outlines the current status of Oregon's solar energy, proposes targets for deploying solar energy in Oregon over the next decade, and provides a pathway to deploy solar to reach these targets in 10 years.

This background report to the Oregon Solar Plan provides a more detailed assessment of the findings and strategies presented in the Plan. First, Part I explains why shifts within the electricity sector are forcing Oregon to determine what the state's energy system should look like in the future and why solar energy should be an essential component of Oregon's future energy mix. Next, Part II provides an overview of the current status of solar energy in Oregon and briefly describes how the state got to where it is today. Part III then introduces ambitious yet achievable targets for deploying solar capacity in Oregon over the next 10 years. Finally, Part IV outlines strategies that will enable Oregon to reach these solar targets by 2027.

"The way that you change the future is you change the story that people tell themselves about the future that they will live in.... If you can change that story, people will actually make different decisions."

Brian David Johnson, Arizona State University Center for Science and Imagination

The Oregon Solar Plan is available for download at www.OSEIA.org

I. WHY OREGON NEEDS A SOLAR PLAN

Today, nearly 50 percent of the electricity consumed in Oregon is produced from fossil fuels, and solar energy provides less than one percent of the state's electricity. However, the state is in the process of transitioning away from polluting energy sources. By 2030, Oregon's utilities are required to eliminate coal from their retail electricity mixes. By 2040, Oregon's two largest utilities are required to obtain 50 percent of their retail electricity from renewable sources.[1] Oregon also has a goal to reduce greenhouse gas emissions by 75 percent below 1990 levels by 2050.[2] To achieve these objectives, the state must strengthen its energy supply by transitioning to clean, sustainable, renewable sources of energy. Solar energy already provides numerous benefits for Oregon, and it will be a key component of the state's future mix. Oregon's solar industry is poised to help the state achieve its climate and energy goals by dramatically increasing solar deployment in Oregon over the next decade. The policy decisions Oregon makes today will have substantial implications for future in-state solar development, and the state needs a comprehensive strategy for growing its solar industry and increasing its solar deployment over the next decade. The Oregon Solar Plan aims to support Oregon's efforts to achieve its climate and energy goals by showing where the state can be in 10 years and offering strategies for how it can get there.

A. THE ENERGY TRANSITION

The U.S. energy system, which has operated in the same general manner for more than a century, is in the midst of a transformation. Advances in renewable energy technology and a growing awareness of the detrimental impacts associated with the combustion of fossil fuels have spurred a fundamental shift in how we produce and use electricity. The ongoing energy transition in the United States is currently characterized by a shift away from coal-fired electricity generation in favor of electricity produced from clean, renewable resources. In addition, the availability of distributed energy resources (and soon, energy storage systems) is beginning to reduce reliance on large, centralized power plants. The energy transition is altering the way we think about electricity. This includes how electricity is produced and managed and how we plan for future energy demands. In addition, states are beginning to question whether the traditional utility business model can adapt to serve the nation's evolving energy needs.

The energy transition is underway in Oregon, and Oregonians now have an opportunity to choose what they wants their future energy system to look like and how quickly they want to get there. At the same time, Oregon's electric utilities have the potential to support or impede the state's efforts to build a modern, sustainable energy system. Utilities that aim to participate in the state's transforming energy sector over the long-term will need to adapt their business models and support Oregon's efforts to modernize its grid. Utilities that are unwilling to adapt and change their way of thinking and operating are going to hold Oregon back in the short-term, but they will then be ill-equipped to meet the state's energy needs in future decades. But it is ultimately up to Oregonians to decide when and how the energy transition occurs and where they want their energy to come from over the next fifty years. Oregon must then develop an effective policy framework to help facilitate its energy transition. Unfortunately, the state cannot afford to wait to formulate a long-term energy strategy; it is highly likely that over the next few years, federal policy support for renewables will decrease substantially, resulting in a dramatic reduction in renewable energy deployment across the country. Oregon must ensure that it has effective policy mechanisms in place to help its renewable energy industries weather the loss of important federal policies, such as the Investment Tax Credit.[3]

B. SOLAR ENERGY IS GOOD FOR OREGON

Solar energy will be an essential component of Oregon's clean, sustainable energy system of the future. The state's solar industry is poised to help the state achieve its long-term energy goals and demands. Solar energy is a clean, sustainable, renewable energy resource that offers substantial energy, environmental, economic, and social benefits for Oregonians. Though solar energy currently provides less than one percent of Oregon's electricity, the solar industry is already providing significant benefits to the state by fueling local economic development, creating jobs, and promoting energy independence in Oregon.

SOLAR ENERGY BENEFITS OREGON'S ELECTRICITY SYSTEM

- Solar energy offsets the need to purchase or produce electricity from fossil fuel-fired power plants, which mitigates fuel cost risks for utilities and ratepayers and reduces the need to operate expensive peaking plants, particularly during hot summer days.[4]
- Rooftop solar helps reduce congestion and strain on local grid networks and reduces the need for additional grid infrastructure.[5] By reducing demand on the grid network, solar energy reduces the amount of electricity lost during transmission, further reducing costs for utilities and ratepayers.[6]
- Solar energy can reduce the need for additional generating resources,[7] helping reduce costs for utilities and ratepayers.
- Strategically located solar facilities help reduce the need for new transmission and can help free up capacity on existing transmission lines.
- Solar energy mitigates risks associated with fuel price volatility and environmental compliance costs.[8]
- Distributed solar generation helps decentralize power production, which holds promise for increasing resiliency and reliability of the power grid if deployed in conjunction with resiliency-enabling technologies and practices, such as grid-tied battery-backed energy storage and advanced inverters that enable solar panels to transmit power during grid outages or disturbances.[9]

SOLAR ENERGY BENEFITS PEOPLE AND COMMUNITIES

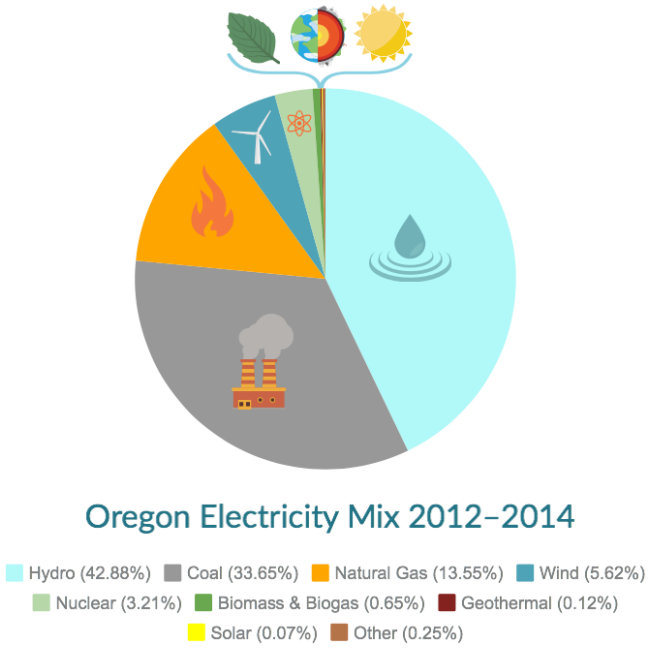
- Solar energy provides **environmental and health benefits** by reducing air and water pollution and contributing to the state's efforts to reduce greenhouse gas emissions and achieve Oregon's climate goals.
- Solar energy provides **economic benefits** by supporting development in local economies. When Oregon buys coal- or gas-based electricity, we are paying to import fossil fuels produced in other states. When Oregon buys solar energy, we are paying for homegrown electricity, which means that solar benefits a larger percentage of Oregon's population than fossil fuel generating resources. Solar energy also reduces long-term energy costs and provides rate stability for homes and businesses, helping to foster economic growth at the local and state levels. Solar development also attracts investment and increases income tax revenue within the state.
- Solar energy **benefits Oregon's communities** by creating jobs in local communities. As Oregon's solar deployment increases, the state's solar industry expands, creating new jobs for electrical workers, material handlers, and technicians. And solar jobs are not limited to the installation sector—the industry supports jobs in a variety of fields, such as engineering and consulting, for example. Strategically sited solar facilities also have the potential to indirectly support job creation and economic growth in non-solar industries by opening up capacity within the existing transmission system, which can enable the system to serve additional commercial and industrial customers.[10]
- **Oregonians support solar energy**. A 2014 poll found that 82 percent of Oregonians support renewable energy, including wind and solar, and 78 percent of respondents believe that renewable energy incentives help create jobs in the state.[11]

SOLAR ENERGY IS ECONOMICAL

- Solar energy is increasingly **economical and affordable**. The costs of solar technologies have dropped significantly in recent years—average installed system prices for solar photovoltaic (PV) systems have dropped 66 percent since 2010.[12] In 2009, solar PV cost $7.50 per watt on average; in 2016, average costs dropped to around $2.00 per watt.[13]
- Solar costs have dropped at a far faster rate than utility analysts had projected.[14] Of all the energy technologies assessed in PGE's 2016 Integrated Resource Plan, the utility expects solar costs to drop the most in the next two decades.[15]
- Solar energy is now cost competitive with fossil fuels, and has the potential to become the cheapest electricity source on the planet in the next 10 years.[16]

C. THE BENEFITS OF SOLAR LEADERSHIP

Over the past decade, Oregon has made great strides in deploying solar energy and growing its solar industry. In the early 2000s, Oregon emerged as an early leader in solar development. In 2008, Oregon was ranked ninth in the nation in terms of cumulative solar PV capacity, per-capita solar PV capacity, and solar PV capacity installed in 2008.[17] Oregon remained a top-ten state in per capita solar PV capacity for a few more years, ranking ninth in per-capita solar PV capacity in 2009 and tenth in 2010.[18] In 2010, Oregon was the top-ranked state in the country for solar manufacturing.[19] These successes were achieved through hard work, substantial investments of capital, time, and energy, and ambitious state policies that enabled Oregon to become an early leader in clean energy.



Data from the Oregon Dept. of Energy

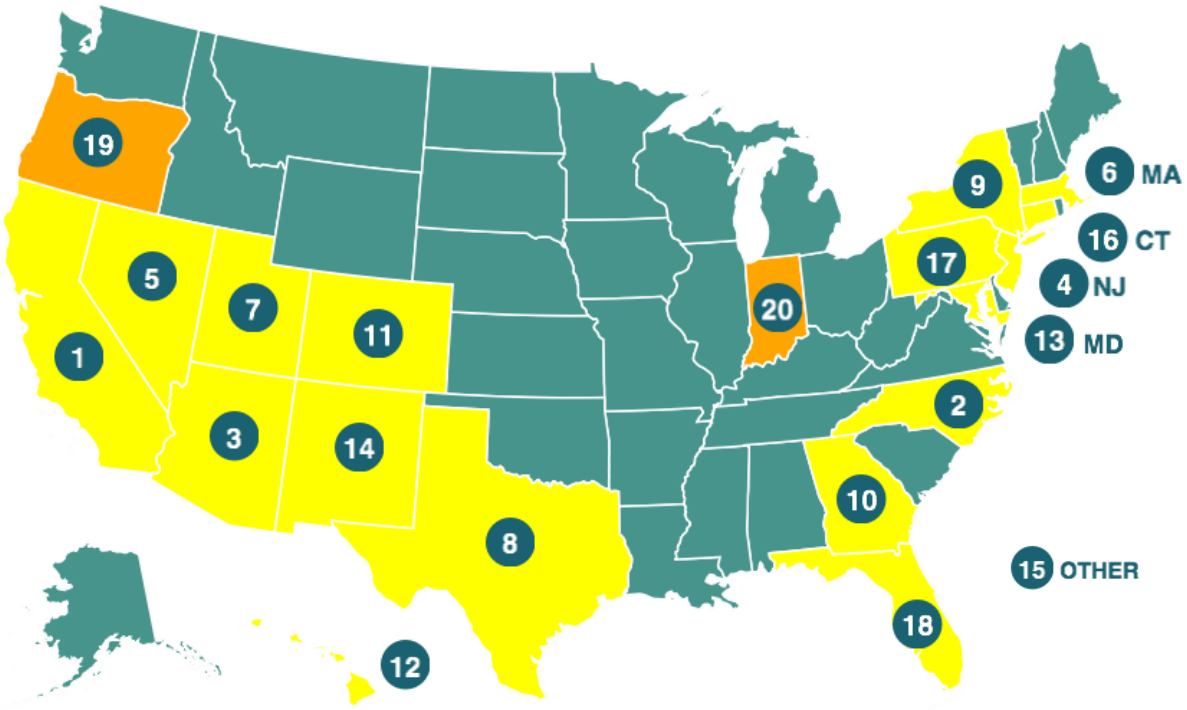
But over time, Oregon's status as a solar leader has waned. As other states began to follow Oregon's example and enact strong solar policies, Oregon chose to repeal some of its most effective incentive programs. By 2015, with 129 megawatts (MW) of total installed solar capacity, Oregon had fallen to the middle of the pack in terms of solar deployment.[20] As a result, many of the state's solar industries struggled with uncertainty over the state's continued commitment to the solar market, and other states began to capitalize off the economic, environmental, and social benefits that Oregon had formerly enjoyed.

Though utility-scale solar development in Oregon surged in 2016, Oregon's policies may not ensure sustained growth for solar development moving forward. Between 2008 and 2015, Oregon installed 25 MW of utility-scale solar capacity; between January 1 and September 30, 2016, the state installed 88 MW of utility-scale capacity, and was on track to install more than 100 MW of utility-scale capacity by the end of the year.[21] As a result of this deployment, Oregon is currently ranked 19th in total state solar PV installations.[22] However, rooftop installations did not experience the same surge in deployment in recent years, and utility-scale development was largely motivated by federal policies over which Oregon has little to no control. Oregon's young yet growing solar industry is still highly vulnerable

to negative policy shifts, and the state needs to reaffirm its commitment to support and grow Oregon's solar sector. To do so, the state must first maintain policies that currently support solar development in Oregon and then adopt or revise policies as needed to eliminate persistent barriers to solar deployment. The state and the solar industry must also work together to grow Oregon's solar workforce, coordinate and simplify land use and energy siting policies, and mitigate technical barriers to solar deployment within the state.

Solar leadership provides significant benefits to states and their citizens, and Oregon should work to regain its status as a solar leader. The leading solar states are in the process of building resilient, sustainable energy systems that will protect consumers from rising energy costs and produce clean, reliable energy for current and future generations. As a solar leader, Oregon could ensure that its residents enjoy the benefits of solar energy in the near-term and position its solar industry to participate in the national solar economy. Solar leadership creates jobs, attracts investment, and promotes a clean and healthy environment. By allowing other states to build significant leads in solar deployment and industry development, Oregon has lost many of the advantages that solar leadership provides. Oregon should work to regain its status as a solar leader by adopting ambitious yet achievable solar deployment targets and supporting policies and programs that advance solar development within the state. The Oregon Solar Plan aims to assist Oregon in reestablishing itself as a solar leader by identifying key strategies for growing the solar industry and increasing deployment within the state.

TOP 20 STATES IN TOTAL INSTALLED SOLAR CAPACITY, DECEMBER 2016



State rankings from GTM Research, U.S. Solar Market Insight, Q4 2016.

II. SOLAR ENERGY IN OREGON TODAY

Oregon is home to a diverse array of solar-related industries that provide jobs for thousands of Oregonians. A variety of state and federal policies have helped Oregon's solar industry grow over the years, and several key policies continue to support solar development within the state. However, Oregon's solar policy support has been inconstant over the past decade, which has resulted in short-term boom and bust cycles of solar development. As a result, Oregon currently ranks 19th in the nation in total solar capacity, and less than one percent of the state's electricity comes from solar energy.

A. OREGON'S SOLAR CAPACITY

As of December 2016, **Oregon has deployed approximately 264 MW_{dc} of solar PV capacity**.[23] This includes 54 MW of residential solar, 55 MW of commercial solar, and 155 MW of utility-scale solar capacity. On average, 1 MW of solar PV powers approximately 115 Oregon homes, which means that **Oregon's 264 MW of solar capacity currently generates enough electricity to power more than 30,000 homes**.[24] Oregon is also projected to deploy 400 MW of utility-scale capacity in 2017,[25] which would enable the state to generate enough solar electricity to power more than 76,000 homes, or 4 percent of Oregon's households.[26]

OREGON'S SOLAR PHOTOVOLTAIC CAPACITY, 2007—2016

FIG. 1 Cumulative PV Capacity

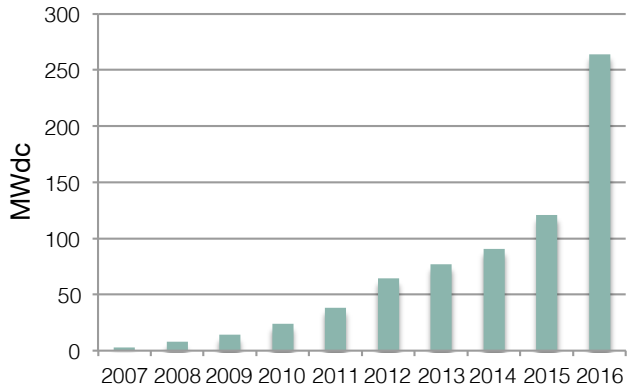
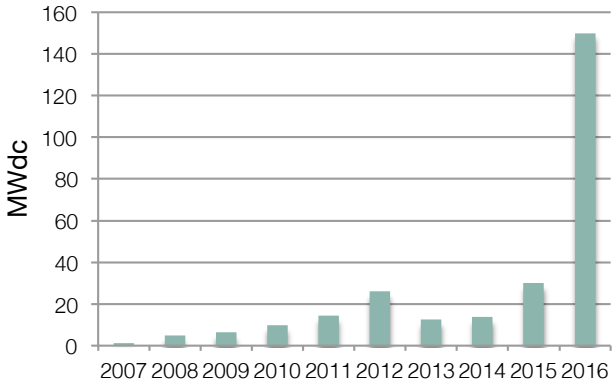


FIG. 2 Annual PV Capacity Additions



PV Capacity data the U.S. Energy Information Admin., the Interstate Renewable Energy Council, and the Energy Trust of Oregon. 2016 capacity data from Greentech Media and the Solar Energy Industries Association.

B. OREGON'S SOLAR WORKFORCE

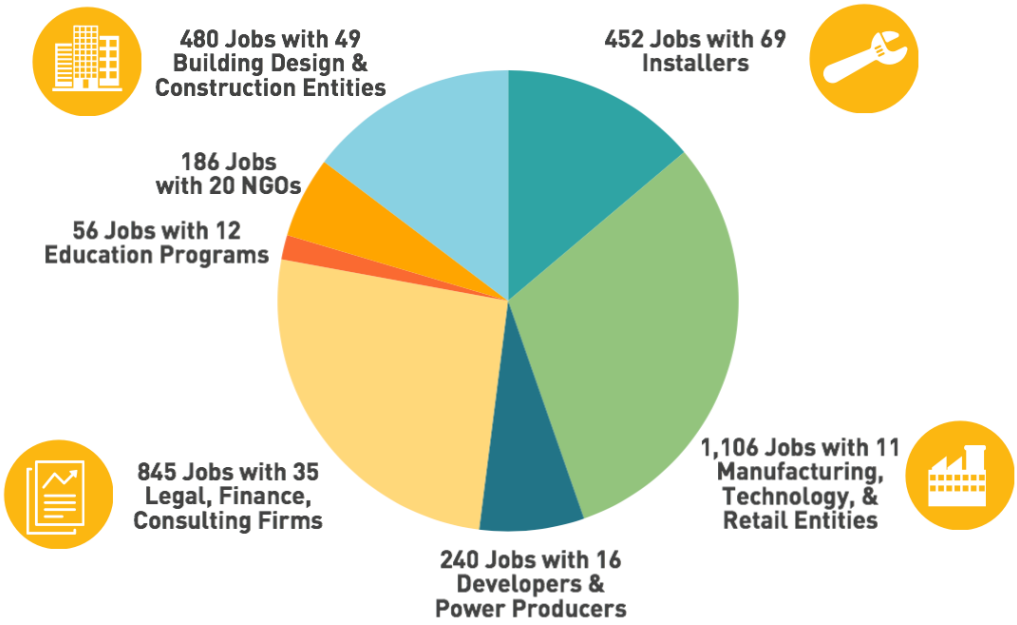
The state's solar industry currently supports a workforce of more than 4,500 Oregonians.[27] According to the Solar Foundation, Oregon's solar workforce grew by 50 percent between 2015 and 2016.[28] Oregon is currently ranked 13th in the nation in total solar jobs and 11th in the nation for per-capita solar jobs.[29]

An estimated 200 public and private businesses and organizations participate in Oregon's solar economy. In addition to supporting growing solar development and installation industries, Oregon is home to a wide variety of solar industry participants, including engineering and architectural firms, technology developers, and educational and training organizations. Oregon is also home to a robust solar manufacturing industry; in 2015, the state was ranked fifth in the nation for solar manufacturing.[30] Because many solar panels and other components built in Oregon are exported out-of-state, the solar manufacturing sector is more insulated from fluctuations in in-state development than other industries.

These industries provide thousands of jobs for Oregon residents. Oregon's solar installation industry employs hundreds of electricians, technicians, apprentices, and general laborers. Oregon's solar manufacturing industry employs more than a thousand workers. In total, the diversity that makes up the solar sector provides career opportunities for thousands of workers in a wide variety of fields, from engineers and architects to business professionals and consultants to educators and community advocates.

Oregon also works to train the solar workforce of tomorrow. For example, the NECA-IBEW Local 48 Electrical Apprenticeship Training Program provides on-the-job training in addition to classroom instruction at its Electrical Training Center.[31] Oregon Institute of Technology offers degrees in renewable energy engineering, which train students to design, develop, and implement a variety of renewable energy technologies, including solar PV.[32] Clackamas Community College's Renewable Energy Technologies program trains students to install and design PV systems.[33] And researchers with the Oregon Process Innovation Center for Sustainable Solar Cell Manufacturing at Oregon State University work to develop innovative advanced solar PV technologies.[34]

FIG. 3 OREGON'S SOLAR WORKFORCE COMPOSITION, 2016[35]



Data from the Green Energy Institute (2016).

C. STATE AND FEDERAL SOLAR POLICIES

A wide variety of local, state, and federal policies support solar development in Oregon. In many cases, multiple policies support individual solar projects. In general, policies that have remained consistent over time have had the greatest impact on solar development in the state, because they have provided a predictable regulatory foundation to support industry growth. Temporary or inconsistent policies have contributed to short-term increases in deployment, but have had minimal impact on long-term development rates. The policies that have been most effective in advancing solar deployment in Oregon are described briefly below. Descriptions of Oregon's current and former solar policies are included in Appendix A.

TBL. 1 KEY SOLAR POLICIES IN OREGON

Policy	State/Federal	Status	Beneficiaries
Net Metering	State	Active	Homes and Businesses
Residential Energy Tax Credit (RETC)	State	Set to expire in 2017	Homeowners
Energy Trust of Oregon Incentives	State	Active	PGE and PacifiCorp customers
Property Tax Exemption	State	Set to Expire in 2018	Property owners
Federal Investment Tax Credit	Federal	Phases down 2019 to 2022	Homes, businesses, and developers
PURPA	Federal	Active	Independent power producers

KEY STATE POLICIES

Net Metering

In Oregon, homes and businesses may generate and consume solar energy produced from onsite solar PV systems. Oregon's net metering policy allows homes and businesses to offset their retail electricity purchases with solar energy produced from onsite solar PV systems.[36] Net metering customers use "bidirectional" electricity meters that run forwards when customers purchase electricity from the grid and run backwards when customers generate solar energy. Net metering is one of Oregon's most essential solar policies because it effectively enables citizens to produce energy for their own consumption by offsetting their retail electricity purchases. Approximately 102 MW of distributed solar PV capacity is currently net metered in Oregon.[37]

Residential Energy Tax Credit

Oregon's Residential Energy Tax Credit (RETC) offers tax credits of up to $6,000 for residential installations of "alternative energy devices," including solar PV.[38] The RETC currently provides $1.30 per watt of installed PV capacity and cannot exceed 50 percent of a system's total installed costs.[39] The RETC is the only solar incentive available to residences statewide and is a significant driver of residential rooftop installations in the state. Though the RETC is available for multiple alternative energy technologies, it is crucial for solar PV. The RETC program has supported the installation of more than 40 MW of solar PV capacity in Oregon.[40]

Energy Trust of Oregon Cash Incentives

PGE and Pacific Power customers are eligible to receive one-time cash incentives for solar PV installations. Energy Trust of Oregon (ETO) incentive values vary by utility and system type and size. Residential customers are currently eligible to receive cash rebates up to $4,000 per home,[41] and commercial customers are eligible to receive rebates up to $135,000 per business.[42] ETO cash incentives are funded through public purpose charges paid by PGE and Pacific Power customers and thus are only available for those utilities' customers. Public purpose expenditures are only authorized to fund the "above-market costs of new renewable energy resources;"[43] ETO incentive rates therefore decrease over time as solar PV costs decline. ETO cash incentives have supported the installation of more than 83 MW of solar PV capacity in Oregon.[44]

Property Tax Policies

Under Oregon's Alternative Energy Systems exemption, increases in property values resulting from the installation of onsite "alternative energy systems,"[45] including solar PV systems, are exempt from the property's assessed value for property tax purposes.[46] More than 5,700 alternative energy projects have received property tax exemptions under this program.[47] The property tax exemption is scheduled to expire in 2018. Through Oregon's Renewable Energy Development Zone program, solar projects in designated counties may qualify for property tax exemptions for periods of three to five years.[48] Oregon also allows solar project owners to enter into a "fee in lieu of property taxes" agreement with local counties. Under this agreement, the project owner agrees to pay the county $7,000 per megawatt of installed solar capacity on an annual basis for a period up to 20 years.[49] Because the property tax exemption for alternative energy systems only applies to solar arrays that offset onsite electricity use, the payment in lieu of property taxes program helps reduce soft costs for utility-scale solar installations that do not offset onsite electricity use.

Renewable Portfolio Standard

Oregon's Renewable Portfolio Standard (RPS) mandates that 50 percent of the retail electricity sold by the state's large electric utilities must come from renewable energy sources by 2040.[50] The utilities demonstrate compliance with the RPS by surrendering Renewable Energy Credits (RECs) that are issued for each megawatt-hour of electricity produced by a qualifying renewable resource. Oregon's RPS helps create a foundation for solar growth in Oregon by stimulating utility demand for renewable energy.

KEY FEDERAL RENEWABLE ENERGY POLICIES

Federal Investment Tax Credit

The federal Investment Tax Credit (ITC) offers a tax credit of up to 30 percent of total project costs for eligible solar projects that commence construction prior to December 31, 2019. In 2020, the ITC phases down to 26 percent, then phases down to 22 percent in 2021. In 2022, the ITC will phase down to 10 percent of project costs. Commercial solar projects that commence construction after 2022 are still eligible for a 10 percent ITC, but the credit is scheduled to expire for residential solar projects at the end of 2022.[51]

Public Utility Regulatory Policies Act (PURPA)

The federal government enacted PURPA in 1978 to support independent electricity production from "qualifying facilities" (QFs), which include small renewable energy producers. [52] PURPA directs utilities to 1) purchase electricity from these QFs, 2) connect the QFs to the electricity grid, and 3) compensate QFs for electricity purchases at rates that do not exceed the utilities' own avoided costs.[53] Under PURPA, Oregon's investor-owned electric utilities must enter into contracts to purchase output from qualifying solar energy producers at the utilities' avoided cost rates.

D. HOW OREGON COMPARES ON A NATIONAL LEVEL

Oregon is currently ranked 19th in total solar PV installed capacity.[54] While many of the top solar capacity states are located in the sunny Southwest, Oregon still lags behind many states in the Northeast with much weaker solar radiation.[55] Oregon is a solar-friendly state in the sense that it has enacted a series of policies to incentivize solar development in the state. However, Oregon is not a leader in terms of deployed solar capacity, and solar energy provides a much smaller percentage of the state's electricity than it does in the leading solar states.

Despite its solar capacity ranking, Oregon has grown a relatively large solar workforce, in large part due to growth within the state's solar manufacturing sector following the expansion of the now-expired Business Energy Tax Credit program in 2007.[56] Utility-scale solar development picked up in Oregon in 2016, which led Oregon's installed capacity ranking to rise from 21st in 2015 to 19th in 2016,[57] and caused Oregon's solar workforce to grow to more than 4,500 workers by the end of 2016.[58]

TBL. 2 STATE SOLAR COMPARISONS, 2016

State	Solar Capacity (MW)[59]	Solar Rank[60]	Solar Workforce[61]	Population (millions)	% Electricity from Solar[62]
California	18,296	1	100,050	38.8	10%
North Carolina	3,012	2	7,112	10	1.5%
Nevada	2,191	4	8,371	2.8	4.8%
New Jersey	2,003	5	6,056	9	2.6%
Massachusetts	1,487	7	14,583	6.7	4.2%
Oregon	264	19	4,509	4	0.2%
Vermont	168	24	1,767	0.6	5.8%



All images by the National Renewable Energy Laboratory

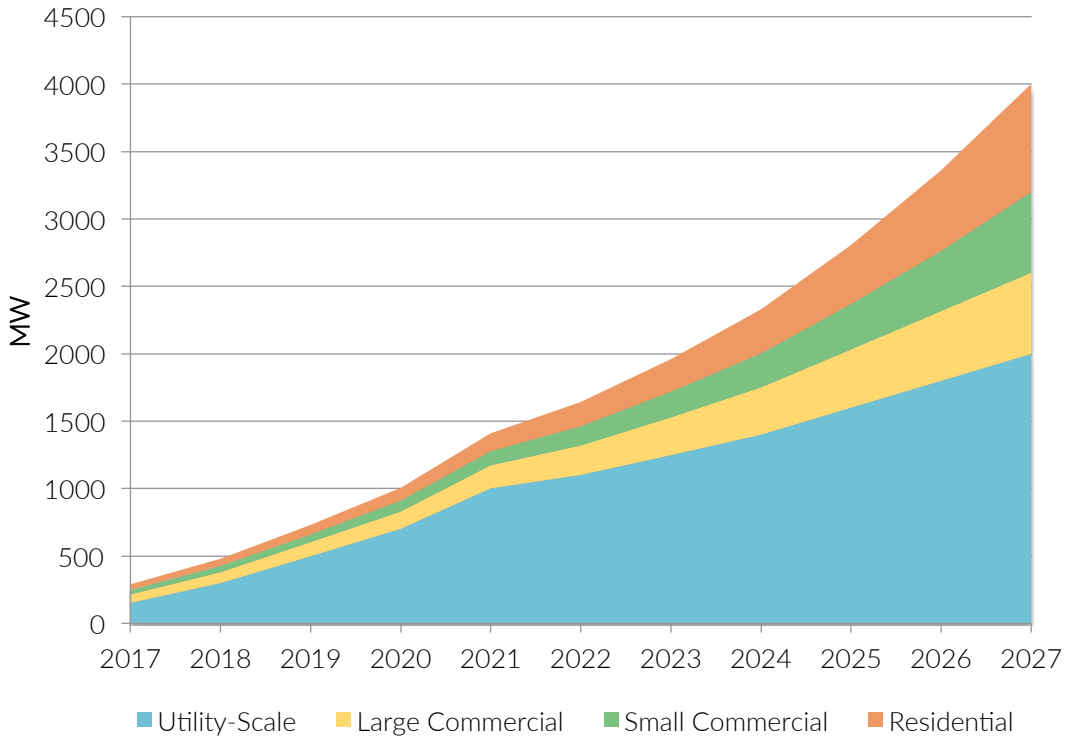
III. 10 PERCENT SOLAR ENERGY IN 10 YEARS

Oregon can feasibly install enough solar capacity to produce 10 percent of its electricity by 2027.[69] Oregon can reach this generation target by installing 4 gigawatts (GW) of solar capacity over the next 10 years, including 600 MW of residential, 600 MW of small commercial, 800 MW of large commercial, and 2,000 MW of utility-scale PV capacity. This solar capacity would generate approximately 6,000,000 megawatt-hours of electricity a year, **enough electricity to meet the needs of approximately 500,000 homes—30 percent of Oregon's households—by 2027.**[70] This deployment will attract private investment to local economies and help stabilize Oregon's electricity costs.

TBL. 3 TARGET 2027 PV CAPACITY

System Type	MW Capacity	Est. Annual Output (MWh)
Residential[63]	600	765,000[64]
Small Commercial[65]	600	765,000
Large Commercial[66]	800	1,020,000
Utility-Scale[67]	2,000	3,500,000[68]
Total	4,000	6,050,000

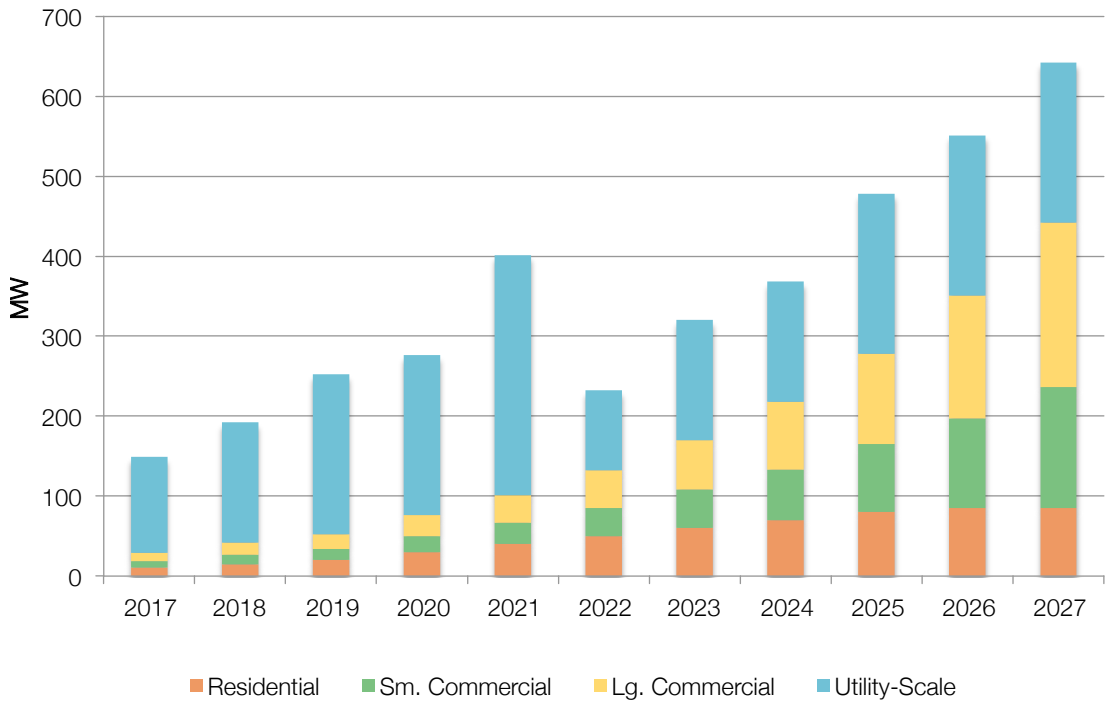
FIG. 4 PROJECTED CUMULATIVE SOLAR CAPACITY, 2017–2027



This rate of deployment reflects a compound annual growth rate of 27 percent for all system classes. The projected rate of deployment is lowest for residential sector, which has a 22 percent compound annual growth rate, and highest for the commercial sector, which has a 31 percent annual growth rate.[71] But the rate of deployment is projected to fluctuate slightly over time in response to federal policy shifts.

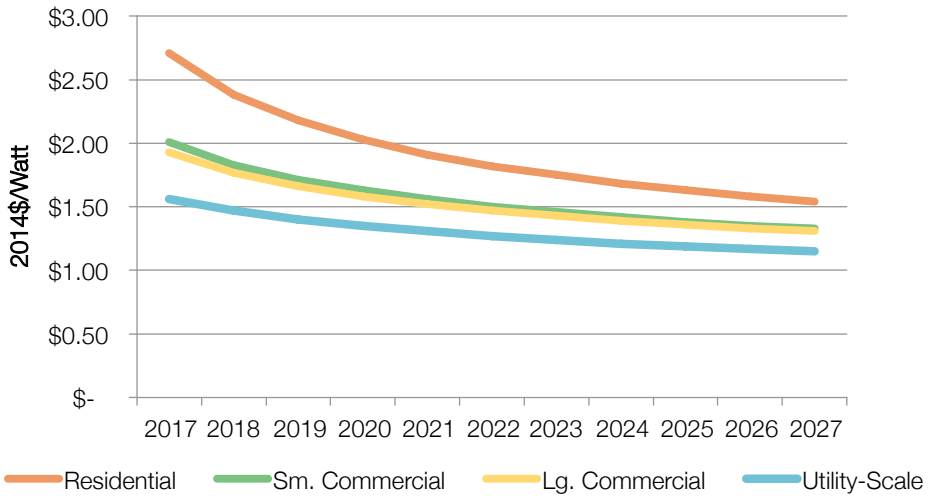
Utility-scale solar installations will likely represent the bulk of Oregon's solar deployment between 2017 and 2021, due to the phase-down of the federal ITC. After a surge in deployment in 2021 to take advantage of the 22 percent ITC, utility-scale deployment may experience a lag in 2022, when the ITC drops to 10 percent for utility-scale and commercial installations. To prevent comparable reductions in deployment in the residential and commercial solar sectors, policymakers should ensure that state policies are in place to reduce the impact of the reduction in federal tax subsidies.

FIG. 5 PROJECTED ANNUAL SOLAR CAPACITY ADDITIONS (NON-CUMULATIVE)



As Oregon's solar deployment increases over time, the private investment in solar will become more cost-effective as costs per watt continue to decline over the next decade. Solar PV costs have dropped dramatically over the past decade, from approximately $7.50 per watt in 2009 to around $2.00 per watt in 2016.[72] As illustrated in figure 6, solar PV costs are projected to decline even further over the coming decade.[73] Solar costs tend to decline as solar deployment increases, so Oregon may experience even steeper cost declines as installation rates increase. However, if solar installation rates slow or stall in Oregon, solar costs may not decline as quickly as projected. Costs will also vary depending on the sizes of the various systems installed.

FIG. 6 PROJECTED SOLAR PV COST DECLINES, 2017–2027



Projected cost declines for solar PV in 2014 dollars from Black & Veatch market research report prepared for PGE.[74]

OREGON CAN SUCCESSFULLY DEPLOY AND INTEGRATE 4 GW OF SOLAR BY 2027

Oregon has the technical, economic, and market potential to deploy 4 GW of solar capacity by 2027. According to utility estimates, PGE's and PacifiCorp's combined Oregon service territories have the technical potential to deploy more than 66 GW of solar PV.[75] In 2012, Environment Oregon estimated that Oregon's solar market could feasibly install 3 GW of solar by 2025.[76] In 2016, the Solar Energy Industries Association projected that Oregon will deploy 1.5 GW of solar capacity by 2022.[77] As Oregon's solar industry continues to grow over the coming years, these earlier projections may prove to underestimate Oregon's solar deployment potential. Indeed, Oregon installed three times as much solar capacity in 2016 as it installed in 2015, and in 2017 the state is expected to install four times the capacity it installed in 2016.[78] Oregon's near-term solar installation targets are well within the current deployment rates achieved by other states. In 2015, California deployed 100 times as much solar capacity as Oregon overall and 10 times as much solar capacity on a per-capita basis. Massachusetts has added more than 200 MW of solar capacity annually since 2013.[79] In the first two quarters of 2016, North Carolina and Utah each installed approximately as much solar capacity as Oregon has installed in total,[80] and Utah installed an additional 746 MW of solar capacity between July and September of 2016.[81]

Oregon can feasibly integrate enough solar generation onto the grid to meet 10 percent of Oregon's retail electricity demand. Analyses by the National Renewable Energy Laboratory (NREL) have concluded that states have the technical capability to integrate large levels of variable renewable energy onto the grid. NREL's *Renewable Energy Futures Study* concluded that renewable energy could feasibly provide 80 percent of the nation's electricity by 2050 while maintaining grid reliability,[82] and NREL's *Western Wind and Solar Integration Study* determined that the western interconnection could reliably integrate up to 35 percent wind and solar energy onto the grid in 2017.[83] Solar already provides more than 10 percent of California's total electricity generation, and the state continues to deploy thousands of megawatts of new solar capacity each year.[84] Thus, obtaining 10 percent of Oregon's electricity from solar energy by 2027 is a feasible, achievable target that will create numerous energy, environmental, economic, and social benefits for Oregonians.

BENEFITS OF REACHING SOLAR TARGETS

- **Modernizing Oregon's Electricity System:** By installing 4 GW of solar energy, Oregon will help increase the resiliency of its energy system, offset the need for new fossil fuel-fired generating resources and associated infrastructure, reduce impacts from rising fuel costs, and reduce wear and tear on existing generating and transmission resources. In addition, Oregon will modernize its grid infrastructure to create a more flexible and reliable energy system.
- **Increasing Private Investment in Oregon's Solar Industry:** In 2015, more than $70 million of private capital was invested in solar energy installations in Oregon. Under the Oregon Solar Plan's targets, Oregon's solar industry could attract between $5 billion and $8 billion in private investments between 2017 and 2027.[85] This market growth would support high-paying jobs for Oregonians and generate revenue for local communities.
- **Reducing Greenhouse Gas Emissions:** By generating 10 percent of its electricity from solar, Oregon could reduce its annual greenhouse gas emissions by 1.8 million metric tons of CO_2 in 2027—the equivalent of taking 380,000 cars off the road or planting 46,000,000 trees.[86]
- **Creating High-Paying Jobs for Oregonians:** Oregon's solar industry supports local jobs in local communities, and developing 4 GW of solar PV could create up to 8,000 new jobs in the installation and electrical sectors alone. Increased solar deployment at sustainable growth rates would create additional jobs in solar component manufacturing and other industry sectors as well. On average, solar-related job-years (i.e. one year of full-time employment) could increase by 14 percent a year between 2017 and 2027.[87]
- **Equitably Increase Access to Solar Energy:** With the enactment of Oregon's community solar program in 2016, the state has the opportunity to equitably increase access to solar energy in local communities. With an effective regulatory framework in place to build a viable community solar market, Oregonians in low-income communities will be able to share in the economic and environmental benefits of solar energy.

IV. A BLUEPRINT FOR OREGON'S SOLAR FUTURE

Oregon's existing renewable energy policies provide a regulatory foundation for the state's solar industry, and it is essential that Oregon retain existing policies that effectively support solar development in the state. Oregon's legal and regulatory framework also contains policy gaps that currently impede certain types of solar development in the state. To meet the Oregon Solar Plan's deployment targets, the state and the solar industry must work together to meet five overarching goals:

1. **Ensure that the payback period for rooftop and distributed PV systems remains under 10 years**
2. **Grow the solar workforce and stabilize existing jobs within the solar industry**
3. **Reduce solar soft costs while supporting and maintaining living wages for solar workforce**
4. **Reduce or eliminate persistent barriers to market entry or participation**
5. **Develop a solar policy framework for Oregon to sustain a stable solar industry**

To achieve these goals, Oregon must continue to implement existing policies that support solar development and adopt new policies to address barriers to solar development within the state. In addition, Oregon must work to expand its solar workforce and address siting and transmission constraints that may impede solar deployment over the next decade. Finally, Oregon's policymakers must make a commitment to strong solar governance to provide regulatory certainty and promote stability within Oregon's solar industry and enable the state to reestablish its position as a solar leader.

A. KEEP POLICIES THAT WORK

Oregon's solar industry benefits from the certainty and predictability associated with stable renewable energy policies. A series of state policies currently support Oregon's residential solar sector, including the **RETC**, the **public purpose charge** for PGE and PacifiCorp ratepayers administered through ETO cash incentives, and **net metering**. Oregon's commercial solar sector also benefits from net metering and ETO cash incentives. Oregon's utility-scale solar sector currently benefits from Oregon's **property tax exemption** for solar facilities and the state's implementation of **PURPA**. The loss of any one of these programs would have serious implications for Oregon's solar industry. These impacts would be compounded by the phase-down and expiration of federal renewable energy subsidies. The federal ITC currently supports residential, commercial, and utility-scale solar development in Oregon, and the phase-down of this program will likely have a dramatic impact on solar development in the state. Therefore, Oregon must retain policies that effectively support solar development and revise these policies as needed to enable the industry to adjust to declining federal subsidies.

PRIORITY STRATEGIES: KEEP POLICIES THAT WORK

1. **Extend the RETC:** The RETC is an essential incentive program for residential solar development throughout Oregon. As a taxpayer-funded program, the RETC helps reduce the payback period for residential solar installations across the state. For example, under Oregon's current average cost of $3.50 per watt for residential PV, a 5 kilowatt (kW) residential solar PV system has an approximate upfront cost of $17,500. However, residential solar PV installations are eligible to receive a federal ITC worth 30 percent of total system costs ($5,250 for a $17,500 system) and a RETC worth $6,000. After these tax incentives are applied, the total system cost for a 5 kW system drops to $6,250. With average statewide electricity rates of $0.11 per kilowatt-hour,[88] a 5 kW PV

system installed in 2017 would save an average Oregon homeowner an estimated $712 per year in electricity costs[89] and would have a payback period of approximately nine years. If Oregon allows the RETC to expire in 2017, the payback period for an average 5 kW system would increase to 17 years. Payback periods beyond 10 years deter many homeowners from investing in solar, and a 17-year payback period would reduce residential solar installations.

Residential solar incentives are particularly important because they keep investment dollars in the state—local contractors employ local labor to install residential PV systems on local homes. It is therefore imperative that the Oregon Legislature extend the RETC in 2017. Policymakers should renew the RETC and adopt a timeline for reviewing average residential PV costs on an interim basis and adjusting the RETC as needed to ensure that residential PV installations retain average payback periods of 10 years or less. This will enable the state to better prepare for the phase-down and eventual expiration of the federal ITC, while also accounting for future cost declines in residential PV.

2. **Extend the property tax exemption for alternative energy systems:** Oregon's property tax exemption for alternative energy systems removes a significant economic deterrent to solar development. Without the property tax exemption, property owners would be required to pay an average of $41,000 in additional property taxes after installing solar projects on their land.[90] This additional expense would threaten the economic viability of a project and could present a significant deterrent for solar development across the state, particularly for commercial installations that are reliant on net metering for cost recovery. Without the property tax exemption, many solar projects may not get developed in the state. Therefore, Oregon's property tax exemption does not directly represent a loss of revenue for the state or local communities; instead, it removes a significant soft cost that has the potential to prevent solar development across the state. If Oregon allows the property tax exemption to expire in 2018, the state could experience a reduction in solar-related revenues accompanied by little to no increase in property tax revenues.

3. **Protect net metering:** Net metering is an essential state solar policy because it enables homes and businesses to invest in solar energy to meet their own electricity needs. Due to the variable nature of solar energy generation, it is not always feasible for solar owners to use the energy generated by their systems. Solar owners have two options for dealing with this issue: they can invest in energy storage devices that store solar energy for later consumption, or they can connect their solar array to the local electric grid. Most solar owners choose the second option and allow their excess solar output to flow back into the grid. Oregon's net metering policy allows solar owners to earn credits on their electricity bills for the energy they transmit into the grid. This effectively enables solar owners to "use" their solar output at a later time by offsetting the electricity they purchase from their utilities with the solar electricity they produce. At the end of each billing cycle, solar owners are charged for any electricity they used that exceeded the solar energy they produced.

In jurisdictions without net metering, solar owners receive only wholesale electricity rates for the energy they produce. This means that solar owners must purchase electricity from their utilities at the retail rate (for example, $0.12 per kilowatt-hour), yet earn only the wholesale rate for the solar energy they sell onto the grid (for example, $0.03 per kilowatt-hour).

By allowing solar owners to offset their retail electricity consumption, net metering enables them to recover the value of their investment over time. Solar investments are less economical in states that lack net metering, and repealing or revising net metering policies can reduce the viability of state solar industries. For example, when Nevada revised its net metering policy in February 2016, rooftop solar development ground to a halt and several large solar companies pulled out of the Nevada market.[91] Net metering continues to be an essential solar policy in Oregon, and the state should retain and protect its existing net metering policy.

4. **Effectively implement PURPA:** The Public Utility Regulatory Policies Act is an important driver of renewable energy development in Oregon.[92] Under PURPA, electric utilities are required to purchase electricity produced by "qualifying facilities" (QFs), which include small renewable energy producers and electricity co-generators. [93] Independent solar energy facilities with capacities of 80 MW or less are eligible for QF status. Section 210 of PURPA directs utilities to 1) purchase electricity from QFs, 2) connect the QFs to the electricity grid, and 3) pay QFs rates that do not exceed the utilities' own "avoided costs."[94] PURPA's purchase and interconnection mandates enable solar QFs to access the market and sell their output to the electric utilities operating in Oregon.

   Because PURPA is a federal law, the Federal Energy Regulatory Commission (FERC) has primary rulemaking authority under the statute. States are required to implement PURPA and FERC's regulations, and they have authority to adopt laws and regulations to tailor PURPA's requirements within the state. The Oregon legislature adopted PURPA implementing legislation in 1983,[95] which directed the PUC to administer PURPA in the state.[96] The PUC subsequently issued regulations implementing PURPA's purchase mandate and interconnection obligation.[97] In addition, the PUC adopted PURPA policies that enable "small" QFs with capacities up to 10 MW to enter into "standard offer contracts" with utilities for terms of up to twenty years.[98]

   Standard offer contracts significantly reduce transaction costs for smaller QFs and enable QFs to obtain adequate financing for their projects.[99] The availability of standard offer contracts is essential to support solar QF development in Oregon. However, in 2016 the PUC adopted Order 16-130, which modified PacifiCorp's obligation to enter into standard offer contracts with small solar QFs.[100] Specifically, the PUC reduced PacifiCorp's eligibility cap for small solar QFs from 10 MW to 3 MW.[101] PacifiCorp no longer has to offer standard offer contracts to solar QFs with capacities above 3 MW.

   While the PUC reduced the eligibility cap for PacifiCorp's standard offer contracts for solar QFs, it rejected PacifiCorp's request to reduce the standard offer contract term from 20 years to two years.[102] PURPA does not legally require states to adopt 20-year contract terms, but long-term contracts are necessary to effectuate the purpose of the statute because they enable solar QFs to secure project financing.[103] If long-term contracts are not available to small QFs, PURPA's capacity to support renewable energy development will be greatly diminished. For example, when the Idaho PUC reduced standard offer contract terms from twenty years to five years, QF development plummeted in the state;[104] when the Idaho PUC reinstated the 20-year contract term, Idaho experienced a surge of QF development.[105]

   To support Oregon's solar industry, the Oregon PUC must retain the 10 MW eligibility cap and 20-year term for standard offer contracts for solar QFs. If the PUC reduces the eligibility cap to 3 MW for all of Oregon's electric utilities or reduces the standard offer contract term below twenty years, solar QF development will plummet in the state. The PUC should reject any future requests by utilities to further weaken Oregon's PURPA policies. The Oregon legislature is considering a bill during the 2017 legislative session that aims to codify the 20-year contract term. Introduced as HB 2137, the bill would require utilities to offer QFs contracts for a term of at least twenty years.[106] If the legislature adopts HB 2137, it will limit utilities' abilities to weaken Oregon's PURPA requirements.

B. ENACT POLICIES TO FILL IN THE GAPS

While Oregon's solar policies currently benefit certain industry sectors or incentivize investment within certain customer classes, the state could do much more to grow its solar industry. Solar procurement mandates for utilities are extremely effective state policies for increasing solar deployment, but Oregon's RPS does not directly encourage utilities to procure solar capacity within the state. In addition, Oregon lacks effective policies for incentivizing commercial solar development on a statewide basis. Over the next decade, the state should work to address barriers to solar development by adopting policies that stimulate utility demand for solar resources,

incentivize commercial solar development, establish a viable community solar sector, provide stable solar financing options, and help grow the market for solar energy in Oregon. In addition, Oregon should adopt policies to require resiliency planning at the state and utility levels.

PRIORITY STRATEGIES: FILL IN THE GAPS

1. **Support Predictable In-State Solar Development:** Oregon's solar policies should provide predictability, stability, and regulatory certainty for the solar industry. State policies that provide predictability and regulatory assurances will enable the industry to plan and prepare for stable, long-term growth.

   Solar procurement mandates, such as solar capacity standards or RPS carve-outs, present an available policy option that can provide predictability, stability, and certainty to the industry. Solar mandates are incredibly effective tools for increasing deployment because they stimulate utility demand for solar energy. Seven of the top ten-ranked states in installed solar capacity have RPS carve-outs for solar and/or distributed generation.[107] For example, Massachusetts adopted a solar carve-out to its RPS in 2010 that directed retail electric suppliers to procure 400 MW of solar capacity by 2020.[108] The program was so successful in incentivizing solar development that the state met its initial capacity target in 2013 and adopted a second solar carve-out in 2014 to support the development of 1,600 MW of solar capacity by 2020.[109]

   States can tailor solar capacity standards to support development of different system types, such as distributed rooftop systems or community solar installations, or to support development of systems with certain characteristics, such as resources that have additional resiliency features. For example, a state could adopt a resiliency-focused solar carve-out that directs utilities to procure solar capacity along with necessary supporting infrastructure to increase resiliency of local grid networks.

   Oregon repealed its solar capacity standard when it enacted SB 1547 in 2016. The state's investor-owned utilities were well on track to comply with the standard,[110] and the legislature voted to repeal the capacity standard in exchange for strengthening Oregon's RPS to require 50 percent renewable energy by 2040. The stronger RPS standard will likely encourage Oregon's utilities to procure additional solar capacity as part of their renewable energy mixes. However, because the RPS gives equal treatment to in-state and out-of-state resources, it does not directly incentivize solar development within Oregon. Additionally, the RPS does not encourage the utilities to support deployment of distributed rooftop solar.

   The Oregon solar industry should work with regulators to identify opportunities to promote in-state solar development through implementation of the current RPS and assess whether the existing RPS is effectively incentivizing in-state development. If regulatory options are not available and the RPS does not effectively incentivize in-state development, the state should consider adopting a new solar capacity standard to more effectively support solar deployment in Oregon. A new solar capacity standard could be tailored to support solar development within industry sectors that provide additional benefits to Oregonians. For example, a solar capacity standard directing utilities to collectively procure 500 MW of distributed generation within their service territories by 2025 would support the residential and commercial solar sectors and reduce demand for new transmission infrastructure, while a solar capacity standard directing utilities to procure 500 MW of community solar capacity by 2025 would increase equitable access to solar energy, particularly in low-income communities. Or the state could adopt a resiliency-based solar capacity standard that requires utilities to procure a certain amount of distributed solar PV and additional infrastructure, such as advanced inverters and grid-tied battery-backed energy storage resources, to increase resiliency within the system and provide power to critical facilities during emergencies.

2. **Enact Policies to Support Commercial Solar Development:** Oregon currently lacks an effective incentive program to support commercial solar development on a statewide basis. Before its sunset in 2014, Oregon's BETC program incentivized the deployment of more than 36 MW of solar PV capacity, much of which was commercial capacity. Since the repeal of the BETC, Oregon has lacked an effective policy for incentivizing commercial solar development throughout the state. ETO cash incentives are available for PGE's and Pacific Power's commercial customers, and these incentives continue to support small-scale commercial solar development in parts of the state.[111] However, ETO incentives are not available outside of the investor-owned utilities' territories, and by themselves the ETO incentive rates and maximums are not high enough to effectively incentivize development of large-scale commercial systems.[112] In addition, Oregon's RED Grant program offers a limited number of grants for commercial projects.[113] However, because RED grants are awarded on a competitive basis, the program does not provide sufficient certainty or predictability to support commercial development on an ongoing basis.

   Oregon needs a replacement for the BETC (beyond the RED grant program) to spur development in the commercial sector. One option would be to evaluate the effectiveness of the large-scale solar production incentive and consider extending and expanding the program for commercial installations. Another option would be to establish another tax credit or rebate program for commercial installations that avoids many of the BETC's complexities and includes a lower maximum credit value. Finally, Oregon could adopt a RETC-like incentive program to encourage participation in community solar projects, which would support the commercial solar sector by expanding the community solar market.

3. **Adopt Effective Community Solar Rules:** The Oregon PUC is currently engaged in a rulemaking to implement the Community Solar program established by SB 1547. The PUC and stakeholders should work together to craft rules that will effectively promote a market for community solar in Oregon. In doing so, the PUC should ensure that community solar bill credit rates are high enough to support the creation of a viable community solar market. Community solar may take many forms in Oregon; for example, residential, commercial, and utility-scale projects could all function as community solar projects. Regulators should therefore avoid pursuing a "one-size-fits-all" approach and instead encourage the creation of multiple models. The PUC's top priority should be to ensure that the rate credits for community solar participants, reflecting the resource value of solar energy determined by the PUC, are high enough to incentivize customer participation and create a viable market for community solar developers. The PUC should also work with the industry to develop community solar policies that promote equitable participation in community solar projects for Oregonians and effectively support low-income access to community solar. If the PUC concludes that the community solar program established in SB 1547 will not achieve these outcomes (for example, if the PUC determines that higher rates are preempted by federal law), it should recommend that the Oregon legislature revise its community solar policies to provide greater support for community solar development.

4. **Local Governments Should Adopt Property Assessed Clean Energy Programs:** Municipalities in Oregon are authorized to adopt programs to assist property owners in financing solar energy installations.[114] Local governments may therefore adopt Property Assessed Clean Energy (PACE) programs that provide loans to finance solar installations that property owners then pay back through property taxes. PACE programs enable property owners to secure low-cost, long-term financing for renewable energy installations, and thus make it easier for property owners to install solar on their properties. To facilitate the adoption of residential PACE programs nationwide, the

U.S. Department of Energy has issued Best Practice Guidelines.[115] Local governments in Oregon should adopt PACE programs for both residential and commercial properties to support solar development throughout the state. In 2015, Multnomah County adopted a PACE program for commercial, industrial, and multifamily properties.[116] The county is now evaluating strategies to expand its PACE program to include residential properties.

5. **Adopt Solar Building Standards:** Solar building standards are state or local requirements for installing solar energy systems on new or renovated buildings.[117] Solar building standards can take different forms. One approach is to mandate that solar PV be installed on all new residential and/or commercial construction (with a provision that allows developers to pay an alternative compliance fee if a structure is shaded or otherwise unsuitable for solar energy production). Another approach is to require that new construction be "solar ready," which means the building is structurally prepared to support solar panels and that electrical panels and wiring are in place to connect a solar installation to the building's electrical system. A third approach is to require that all new construction be energy-neutral, which would require all new buildings to maximize energy efficiency and generate sufficient solar energy to offset the building's annual electricity consumption.[118]

   Solar building standards help to create a stable market for local solar industries and drive down solar soft costs by creating a predictable customer base for solar installers and reducing costs associated with installing, permitting, and inspecting solar PV systems.[119] While some municipalities, including the California cities of Lancaster and Sebastopol, have adopted solar building standards,[120] Oregon's statewide building code prohibits local governments from enacting their own building standards.[121] However, Oregon law allows any person to propose amendments to the state building code that apply to all or some municipalities within the state.[122] The solar industry should work with the Department of Consumer and Business Services to develop and propose amendments to the state building code to include solar building standards for new construction.

6. **Require Resiliency Planning:** Distributed solar PV systems have the potential to increase the resiliency and reliability of local grid networks during emergency power outages. However, Oregon is not currently realizing these benefits because currently deployed technologies and utility practices force grid-tied solar resources to shut down during system disturbances.[123] Technologies such as battery storage and advanced inverters are available today to enable grid-tied solar PV to operate during emergencies, but utility interconnection standards must authorize customers to install and use these technologies.[124]

   Grid resiliency is particularly important in the Pacific Northwest, where an earthquake along the Cascadia Subduction Zone could cause the grid to fail and result in power outages lasting months.[125] Critical facilities such as hospitals have diesel-fired generators that provide emergency back-up power during grid outages, but these facilities generally only store enough fuel to operate their generators for three days.[126] In the wake of a high-magnitude earthquake, it could take months to replenish fuel supplies. With adequate planning and investment, solar energy could provide a viable alternative to fuel-dependent emergency generators.

   To promote the deployment of solar PV to increase grid resiliency, Oregon should create a state resiliency plan that identifies the areas and facilities within the state that require continual access to electricity and outlines the resources and technologies that must be deployed to increase resiliency of those local grid networks. The PUC should then adopt policies directing the utilities to conduct their own resiliency assessments and requiring the utilities to revise their interconnection requirements, if necessary to facilitate investment in resiliency resources.

C. GROW OREGON'S SOLAR WORKFORCE

Increased solar deployment will create thousands of new jobs in Oregon over the next 10 years, and the solar industry's workforce will need to expand significantly to keep pace with demand. In 2017, Oregon's solar installation workforce will employ between 400 and 1,000 electricians, apprentices, material handlers, and technicians. This workforce will include an estimated 120 to 400 workers in the utility-scale sector[127] and an estimated 280 to 600 workers in the rooftop solar sector. To meet the Oregon Solar Plan's 2027 solar deployment targets, Oregon's solar workforce will need to grow to support 2,000 to 4,000 electricians, 1,000 to 2,000 apprentice electricians, and 1,000 to 2,000 general laborers and technicians. However, Oregon has stringent labor rules and license requirements that currently constrain solar development in the state. Because Oregon's labor rules only authorize licensed electricians to perform certain installation tasks,[128] a shortage of licensed electricians in the state is limiting solar development and driving up installation costs. Oregon offers a limited renewable energy technician (LRT) license for small-scale projects of 25 kilowatts or less, but this license is too restrictive to sufficiently encourage individuals to pursue licensure or incentivize installation contractors to seek out licensed LRTs.[129] As a result, there are currently only 60 licensed LRTs in the state, and 15 of these LRTs also possess more advanced licenses.[130] Moreover, the state does not offer a comparable license for projects above 25 kilowatts, which has created a labor gap for commercial and utility-scale installations.

Oregon has an opportunity to greatly expand its solar workforce and create new high-paying jobs for Oregonians. A 2009 study from the University of California-Berkeley determined that 25 job-years are created for every megawatt of solar capacity installed.[131] This means that Oregon could create 100,000 job years by deploying 4 GW of solar capacity by 2027. Solar installation creates high-paying jobs; on average, journeymen electricians working in Oregon's solar industry reportedly earned $54 per hour and apprentices earned $33 per hour in 2014.[132] Moreover, the solar workforce is not limited to the installation sector; in addition to installation and maintenance jobs, solar development creates jobs in a variety of related sectors, such as the manufacturing and retail sectors. Oregon should take advantage of available strategies to grow its solar installation workforce, which will expand the industry's solar deployment potential and as a result create additional jobs in related sectors.

WORKFORCE DEVELOPMENT STRATEGIES

1. **Determine optimal licensing classification for solar installation to ensure a competitive workforce:** Electrical unions and the solar industry should work with policymakers to develop optimal licensing classifications for solar laborers that enables the industry to build the workforce it needs while ensuring that workers are being treated and compensated fairly. Licensing requirements should ensure safety, recognize the reality of solar worksites, and create ongoing career paths for solar installers. Trained and licensed solar laborers should be authorized to work on racking, bonding, and panel installation for roof and ground-mounted systems of any size. Prospective solar licensees should have the option to participate in a union pre-apprenticeship program that enables interested participants to apply their training toward an electrician apprenticeship.

2. **Increase access to training programs:** Electrical and LRT apprenticeships must fulfill specific education and classroom training requirements.[133] Oregon's electrical labor unions and some community colleges offer education and training options for registered electrical apprenticeships, but these programs are only offered at certain locations throughout the state. Clackamas Community College offers some distance learning options, but the majority of the school's renewable energy technology courses are only available at its Oregon City campus. Oregon's solar industry needs an integrated

and coordinated training structure to build the technical expertise necessary to grow the industry and expand the market. Oregon should create a unified training structure that can be administered by community colleges throughout the state and help facilitate the development of an online training program.

3. **Create a plan for predictable workforce growth that aligns with targeted installation levels:** Oregon's solar workforce will need to grow to enable the state to reach the installation targets projected by the Oregon Solar Plan. To ensure that the state has enough licensed and qualified workers to meet installation demands, Oregon should identify strategies for promoting participation in training programs and apprenticeships and create a plan to guide the expansion of its solar workforce.

D. ALIGN LAND USE AND RENEWABLE ENERGY POLICIES

Oregon has more than sufficient available land and rooftop space to deploy 4 GW of solar PV. Two GW of ground-mounted utility-scale solar PV would require an estimated 14,000 acres of suitable land, which would occupy approximately 22 of Oregon's 98,000 square miles, or 0.02 percent of the state's total land area.[134] The city of Portland alone has enough rooftop space to support 8 GW of solar PV.[135] Therefore, land and roof space availability should not constrain solar development in Oregon. However, Oregon's renewable energy siting processes are complex, time-consuming, and potentially costly. In addition, the state's land use policies restrict utility-scale solar development on certain types of land, particularly high-value farmland, depriving landowners of the choice or opportunity to earn revenue from solar production. The creation of an online landscape-level energy planning tool would help to simplify solar project siting and help regulators balance competing policy priorities when making siting decisions. In addition, Oregon should aim to coordinate its land use goals with its energy goals to facilitate solar deployment while protecting valuable farmland.

LAND USE AND SITING STRATEGIES

1. **Create an Online Landscape-Level Energy Planning Tool**: Recognizing the need to align Oregon's energy goals with its land use goals, Oregon's 10-Year Energy Action Plan recommended that the state engage in landscape-level energy planning.[136] Oregon's energy siting requirements are highly dependent on a parcel's land use classification (such as high-value farmland) and other local physical characteristics (such as soil type), which add costs and complexity to the solar project siting process. The focus on local characteristics can draw attention away from the cumulative impacts and benefits associated with a given project. As the 10-Year Energy Action Plan recognized, "too often, individual siting decisions lack context for evaluating tradeoffs among conflicting public policy priorities."[137] An online landscape-level energy planning tool could help add essential context to local siting processes. Such a publicly available planning tool could help simplify the siting process and reduce costs by providing the public with integrated maps depicting land use classifications, recorded soil types, the location of transmission and distribution infrastructure and existing and proposed energy facilities, and relevant environmental and cultural data. The State of Hawaii has created an energy planning and siting website that could provide a model for a comparable planning program in Oregon.[138] The Hawaii State Energy Office website contains several planning tools, including a mapping tool, a permitting wizard, and a renewable energy project directory. These tools provide prospective solar developers with resources that simplify the siting process and help facilitate renewable energy development in the state. An online landscape level planning tool could provide similar benefits for solar developers in Oregon, while also enabling state and local siting regulators to better track the cumulative impacts and benefits associated with multiple energy projects within a given area.

2. **Coordinate Land Use Planning Goals with Energy Goals:** Oregon has a progressive land use planning program based around 19 Statewide Planning Goals & Guidelines. The planning goals represent mandatory requirements for local land use planning, while the guidelines introduce voluntary suggestions for how a municipality could implement the mandatory goals. Each city and county within Oregon must develop comprehensive land use plans and adopt local zoning rules that conform to the statewide planning goals.[139] Oregon's planning goals serve as the foundation for all local decision-making and activities related to land use and thus have a significant impact on solar energy development. Utility-scale solar development requires open space with unobstructed sunlight; however, Oregon's planning goals currently prioritize the preservation of farmland for agricultural use,[140] the preservation of forestland for timber production,[141] and the conservation of open spaces.[142] When these goals are incorporated into local comprehensive land use plans, they can create unnecessary impediments for solar development. While none of Oregon's planning goals directly promotes renewable energy production, Goal 13 prioritizes energy conservation.[143] Goal 13 states: "Land and uses developed on the land shall be managed and controlled so as to maximize the conservation of all forms of energy, based upon sound economic principles."[144] Goal 13's planning guidelines state that land use should "seek to minimize the depletion of non-renewable sources of energy" and that when possible, development actions permitted under local land use plans should use renewable energy sources.[145] However, only the goals themselves are mandatory; the guidelines are merely "suggestions about how a goal may be applied."[146] Oregon should therefore amend Goal 13 to prioritize renewable energy production in addition to energy conservation. If Goal 13 were revised to state: "Land and uses developed on the land shall be managed and controlled so as to maximize the conservation of all forms of energy and promote energy generation from renewable sources," Oregon's land use planning could promote, rather than impede, solar energy development.

E. EXAMINE TRANSMISSION AND TECHNICAL CONSTRAINTS

Transmission access is a major obstacle to deploying new renewable generation on today's electricity system. Historical practices for offering transmission access are overly conservative and make inefficient use of existing infrastructure. The Federal Energy Regulatory Commission sought to remedy that situation by encouraging the formation of regional transmission operators (RTOs) such as the California Independent System Operator (ISO). However, in 2005, Congress passed a law that protects Oregon utilities' existing firm transmission rights and allows them to exercise monopoly control over transmission access.[147] State-level actions are needed to limit Oregon utilities' monopoly powers. The creation of an RTO and state legislation aimed at liberalizing utility transmission access practices will help support solar development in Oregon.

Transmission is a highly complex issue that requires and deserves additional analysis to determine the extent of existing transmission constraints, whether and how transmission capacity will open up with the retirement of existing fossil fuel resources, and the combination of strategies with the best potential to mitigate Oregon's transmission constraints. For example, the Northwest could potentially alleviate many of the region's transmission constraints by creating an RTO or expanding the California ISO. If Oregon declines to enter into an RTO or engage in regional power trading, regulators could consider amending existing transmission-related policies to increase efficiencies within the system, expand grid operators' abilities to integrate variable renewables, and encourage investments in new "right-sized" transmission and distribution infrastructure. In addition, Oregon could enact policies to alleviate existing transmission-related constraints that may prevent solar energy producers from entering the market. For example, utilities currently require solar producers to procure firm transmission rights that are severely limited in the state.[148]

Short of directing utilities to join an RTO or ISO, Oregon can address inefficient use of transmission by prohibiting utilities from requiring renewable resources to possess firm transmission rights to deliver their output to the utility, as utilities are amply protected by existing under-performance guarantees given the variability of the solar resource in the first place. Removing utility requirements for firm transmission rights is a necessary but not sufficient step to unlocking Oregon's vast solar potential. Lenders need assurance that a solar project will be able to repay its debts in the event that its output cannot be delivered to the utility due to transmission congestion.[149] To address this financing constraint, Oregon could create a statewide congestion fund that guarantees reimbursements to solar producers when renewables are curtailed.

F. PROMOTE STRONG SOLAR GOVERNANCE

Oregon policymakers should commit to growing the state's solar industry. In the past 10 years, Oregon has opted to advance the state's solar industry by implementing pilot programs (such as the volumetric incentive rate program, which was very effective in incentivizing solar deployment but could not be expanded to scale because the costs to consumers were too great). These short-term programs have created an uncertain regulatory environment for Oregon's solar industry and have contributed to sporadic and unpredictable growth within Oregon's solar market. This market uncertainty is exacerbated by Oregon's tendency to repeal or sunset policies that have supported industry growth.

Policymakers should avoid adopting short-term policies that create uncertainty for the solar industry. Instead, Oregon should prioritize policy stability with an emphasis on policies that are affordable, scalable, and encourage long-term investment and growth within the industry. The state should only enact pilot programs if they are scalable and include systems and mechanisms to review outcomes and enable the creation of a permanent program if desired outcomes are met. Rather than adopt temporary energy policies, policymakers should prioritize strategic, long-term energy planning and enact policies that conform to the state's long-term energy goals.

V. CONCLUSION

Imagine an Oregon where local contractors are busy installing solar panels on thousands of rooftops, solar arrays and other renewable energy resources replace polluting fossil fuel plants, electrical vehicles fuel up at roadside solar-powered charging stations, electricity costs fall in low-income communities that share energy from community solar projects, Oregonians find easy entry into a strong solar workforce, and local manufacturing plants produce the highest-quality solar panels in the world. Imagine an Oregon powered by the sun, and the wind, and the rain, rather than fuels mined from miles beneath the earth and transported thousands of miles to power plants that emit greenhouse gases and other pollutants into Oregon's air.

This clean, sustainable energy future is coming, and it is not far off. The Oregon Solar Plan's target of 10 percent solar energy in 10 years powering 500,000 homes presents an achievable and feasible goal for advancing solar energy development in the Oregon and helping the state regain its status as a solar leader. To make a clean, sustainable energy future a reality will require commitment and determination from policymakers, the solar industry, and many energy sector stakeholders. It is time to start making decisions to make this energy future a reality.

A BLUEPRINT FOR OREGON'S SOLAR FUTURE

Oregon's existing renewable energy policies provide a regulatory foundation for the state's solar industry, and it is essential that Oregon retain existing policies that effectively support solar development in the state. However, Oregon's legal and regulatory framework also contains policy gaps that currently impede certain types of solar development in the state. To meet the Oregon Solar Plan's solar deployment targets, the state and the solar industry must work together to meet the following goals:

- Ensure payback period for rooftop and distributed PV systems does not exceed 10 years
- Grow the solar workforce and stabilize existing jobs within the solar industry
- Reduce solar soft costs while supporting and maintaining living wages for solar workforce
- Reduce or eliminate persistent barriers to market entry or participation
- Develop a solar policy framework for Oregon to sustain a stable solar industry

To achieve these goals, Oregon must provide certainty and predictability within its policies, governance, regulations and workforce. The following strategies will help Oregon reach the goal of 10 percent solar energy within 10 years.

- Keep Policies that Work
  - Extend the Residential Energy Tax Credit
  - Extend the property tax exemption for alternative energy systems
  - Protect state net metering and PURPA policies
- Enact Policies to Fill in the Gaps
  - Support in-state solar development through a solar capacity standard or renewable energy portfolio standard's solar carve-out
  - Enact policies to support commercial solar development
  - Adopt effective community solar regulations
  - Local governments should adopt property assessed clean energy programs
  - Adopt solar building standards
- Grow Oregon's Solar Workforce
  - Determine optimal licensing to ensure a competitive workforce
  - Increase access to training programs
  - Create a plan to ensure adequate workforce levels to achieve targeted installation levels
- Align Land Use and Renewable Energy Policies
  - Create an online landscape-level energy planning tool
  - Coordinate state land use planning goals with energy goals
- Examine Transmission and Technical Constraints
  - Evaluate strategies to increase transmission capacity within the existing system, such as creating or joining a Regional Transmission Organization or eliminating contractual obligations to secure firm transmission rights
  - Adopt a combination of strategies with the best potential to mitigate Oregon's transmission constraints

ENDNOTES

[1] S.B. 1547 § 5, 78th Leg. Assem., Reg. Sess. (Or. 2016) (to be codified at OR. REV. STAT. § 469A.052).
[2] H.B. 3543, 74th Leg. Assem., Reg. Sess. (Or. 2007) (codified at OR. REV. STAT. §§ 468A.200–260 (2014)).
[2] H.B. 3543, 74th Leg. Assem., Reg. Sess. (Or. 2007) (codified at OR. REV. STAT. §§ 468A.200–260 (2014)).
[3] The ITC is scheduled to phase-down starting in 2020. U.S. Dept. of Energy, *Business Energy Investment Tax Credit (ITC),* ENERGY.GOV, http://energy.gov/savings/business-energy-investment-tax-credit-itc; U.S. Dept. of Energy, *Residential Renewable Energy Tax Credit,* ENERGY.GOV, https://energy.gov/savings/residential-renewable-energy-tax-credit.
[4] *See* Nat'l Renewable Energy Lab., *Western Wind and Solar Integration Study*, NREL.GOV, https://www.nrel.gov/grid/wwsis.html.
[5] *See* C.J. Colavito, *How Utilities Can Use Solar to Reduce Congestion and Save Costs*, AMERICAN PUBLIC POWER ASSOCIATION, January 18, 2017, http://blog.publicpower.org/sme/?p=1170.
[6] In 2014, an estimated 5% of the electricity generated in the U.S. was lost during transmission, representing approximately $21 billion worth of electricity. GIDEON WEISSMAN & BRET FANSHAW, SHINING REWARDS: THE VALUE OF ROOFTOP SOLAR POWER FOR CONSUMERS AND SOCIETY 12 (2016), *available at* http://www.environmenttexas.org/sites/environment/files/reports/TXE%20ShiningRewards%20Rpt%20Oct16.pdf.
[7] *See* PACIFICORP, 2014 WIND AND SOLAR CAPACITY CONTRIBUTION STUDY (2014), *available at* http://www.pacificorp.com/content/dam/pacificorp/doc/Energy_Sources/Integrated_Resource_Plan/2015IRP/2015IRPStudy/2015IRP-Apdx-O-CapacityContribution_DRAFT.pdf.
[8] *See* COMMISSION FOR ENVIRONMENTAL COOPERATION, RENEWABLE ENERGY AS A HEDGE AGAINST FUEL PRICE FLUCTUATION (2008), *available at* http://www.cec.org/islandora/en/item/2360-renewable-energy-hedge-against-fuel-price-fluctuation-en.pdf.
[9] WARD BOWER ET AL., SANDIA NAT'L LAB., SOLAR ENERGY GRID INTEGRATION SYSTEMS 11 (2012), *available at* http://energy.sandia.gov/wp-content/gallery/uploads/121395.pdf.
[10] For example, the city of Prineville recently had to turn away a new manufacturing facility because the local transmission network did not have enough available capacity to deliver power to the proposed facility. If Prineville's energy-intensive industries instead consumed electricity from locally sited solar arrays, there would be less competition for the electricity flowing through the transmission network, which could enable Prineville's manufacturing sector to grow. *See* Mike Rogoway, *Prineville is Running Out of Electricity, Jeopardizing New Manufacturing Jobs,* OREGONLIVE.COM, Jan. 26, 2017, http://www.oregonlive.com/silicon-forest/index.ssf/2017/01/prineville_is_running_out_of_e.html.
[11] Wendy Culverwell, *Poll: Oregonians of All Stripes Support Renewable Energy,* PORTLAND BUSINESS JOURNAL ONLINE, Dec. 11, 2014, http://www.bizjournals.com/portland/blog/sbo/2014/12/poll-oregonians-of-all-stripes-support-renewable.html
[12] Solar Energy Industries Assoc., *Oregon Solar,* http://www.seia.org/state-solar-policy/oregon.
[13] OREGON PUB. UTIL. COMM'N, HB 2941 SOLAR INCENTIVES REPORT 6 (2016), *available at* http://www.puc.state.or.us/electric_gas/2016%20HB%202941%20Solar%20Incentives%20Report.pdf.
[14] PORTLAND GENERAL ELECTRIC, 2016 INTEGRATED RESOURCE PLAN 190 (2016), *available at* https://www.portlandgeneral.com/our-company/energy-strategy/resource-planning/integrated-resource-planning.
[15] *Id.* at 214.
[16] Jessica Shankleman & Chris Martin, *Solar Could Beat Coal to Become the Cheapest Power on Earth,* BLOOMBERG.COM, Jan. 3, 2017, https://www.bloomberg.com/news/articles/2017-01-03/for-cheapest-power-on-earth-look-skyward-as-coal-falls-to-solar.
[17] INTERSTATE RENEWABLE ENERGY COUNCIL, U.S. SOLAR MARKET TRENDS 2008 at 9 (2009), *available at* http://www.irecusa.org/publications/annual-u-s-solar-market-trends-report/.
[18] INTERSTATE RENEWABLE ENERGY COUNCIL, U.S. SOLAR MARKET TRENDS 2009 at 9 (2010), *available at* http://www.irecusa.org/publications/annual-u-s-solar-market-trends-report/; INTERSTATE RENEWABLE ENERGY COUNCIL, U.S. SOLAR MARKET TRENDS 2010 at 9 (2011), *available at* http://www.irecusa.org/publications/annual-u-s-solar-market-trends-report/.
[19] Christina Williams, *Oregon Tops in Solar Manufacturing,* PORTLAND BUSINESS JOURNAL ONLINE, Oct. 17, 2010, http://www.bizjournals.com/portland/news/2010/10/17/oregon-tops-in-solar-manufacturing.html.

[20] In 2015, Oregon was ranked 21st in total installed solar capacity. SOLAR ENERGY INDUSTRIES ASSOC., SOLAR SPOTLIGHT: OREGON (2016), *available at* http://www.seia.org/sites/default/files/OR%20State%20Factsheet_6.15.2016.pdf.
[21] GTM RESEARCH, U.S. SOLAR MARKET INSIGHT Q4 2016: EXECUTIVE SUMMARY 10 (2016), *available at* http://www.seia.org/sites/default/files/H7D82HD9F238SMI2016Q4.pdf; Pete Danko, *Oregon Solar Powers Up,* PORTLAND BUSINESS JOURNAL ONLINE, Nov. 23, 2016, http://www.bizjournals.com/portland/feature/oregon-solar-powers-up.html.
[22] GTM RESEARCH, U.S. SOLAR MARKET INSIGHT Q4 2016: EXECUTIVE SUMMARY 10 (2016), *available at* http://www.seia.org/sites/default/files/H7D82HD9F238SMI2016Q4.pdf.
[23] Solar Energy Industries Assoc., *Oregon Solar,* http://www.seia.org/state-solar-policy/oregon. All capacity values represent DC capacity. We applied a dc-to-ac ratio of 1.1 to convert utility-reported W_{ac} to W_{dc}. *See* Nat'l Renewable Energy Lab., *PVWatts Calculator,* http://pvwatts.nrel.gov/pvwatts.php (applying a default dc-to-ac ratio of 1.1).
[24] Solar Energy Industries Association, *What's in a Megawatt?,* SEIA.ORG, 2016, http://www.seia.org/policy/solar-technology/photovoltaic-solar-electric/whats-megawatt.
[25] Pete Danko, *Oregon Solar Powers Up,* PORTLAND BUSINESS JOURNAL, Nov. 23, 2016, http://www.bizjournals.com/portland/feature/oregon-solar-powers-up.html (citing Greentech Media projection that Oregon will install 400 MW of solar PV in 2017).
[26] According to U.S. Census data, Oregon had 1,718,409 housing units in 2015. United States Census Bureau, *Quickfacts: Oregon,* CENSUS.GOV, http://www.census.gov/quickfacts/table/PST045215/41.
[27] THE SOLAR FOUNDATION, NATIONAL SOLAR JOBS CENSUS 2016, APP. A (2017), *available at* http://www.thesolarfoundation.org/wp-content/uploads/2017/02/National-Solar-Jobs-Census-2016-Appendix-A.pdf.
[28] The Solar Foundation recorded 2,999 solar jobs in Oregon in 2015 and 4,509 solar jobs in Oregon in 2016. *Id.*
[29] *Id.*
[30] THE SOLAR FOUNDATION, NATIONAL SOLAR JOBS CENSUS 2015 (2016), *available at* http://solarstates.org/#state/oregon/counties/jobs.
[31] NECA-IBEW Local 48 Electrical Training Center, NIETC.ORG, http://nietc.org.
[32] OregonTech, *Renewable Energy Engineering,* http://www.oit.edu/wilsonville/academics/degrees/renewable-energy-engineering.
[33] Clackamas Community College, *Renewable Energy Technology,* http://www.clackamas.edu/RET/Courses/.
[34] Oregon Process Innovation Center for Sustainable Solar Cell Manufacturing, http://opic.oregonstate.edu/.
[35] Oregon's solar workforce estimates were produced through employer surveys and independent research conducted by the Green Energy Institute from April 2015 through May 2016. In May 2016, the Green Energy Institute estimated that 200 entities were participating Oregon's solar industry, employing 3,365 workers.
[36] OR. REV. STAT. § 757.300 (2016).
[37] U.S. ENERGY INFO. ADMIN., ELECTRICITY: FORM EIA-826 DETAILED DATA—NET METERING (Oct. 2016), *available at* https://www.eia.gov/electricity/data/eia826/.
[38] OR. REV. STAT. § 469B.100 (2016); OR. ADMIN. R. § 330-070-0013.
[39] OR. ADMIN. R. § 330-070-0022(3)(e).
[40] Data from the Oregon Department of Energy (current through 2016). *See* OREGON PUBLIC UTILITY COMMISSION, HB 2941 SOLAR INCENTIVES REPORT 12 (2016), *available at* http://www.puc.state.or.us/electric_gas/2016%20HB%202941%20Solar%20Incentives%20Report.pdf.
[41] Residential PGE customers may receive cash rebates of $0.40 per watt up to a maximum of $3,200 per home, and residential Pacific Power customers may receive rebates of $0.50 per watt up to a maximum of $4,000 per home. Energy Trust of Oregon, *Solar for Your Home,* https://www.energytrust.org/incentives/solar-for-your-home/#tab-two.
[42] Commercial PGE customers are eligible to receive rebates between $0.45 and $0.85 per watt up to a maximum of $135,000, and commercial Pacific Power customers are eligible to receive rebates between $0.50 and $0.90 per watt up to a maximum of $100,000. Energy Trust of Oregon, *Solar for Your Business,* https://www.energytrust.org/incentives/solar-for-your-business/#tab-two.
[43] OR. REV. STAT. § 757.612(1) (2016).
[44] Data from the Energy Trust of Oregon (2016). *See* OREGON PUB. UTIL. COMM'N, HB 2941 SOLAR INCENTIVES REPORT 22 (2016), *available at* http://www.puc.state.or.us/electric_gas/2016%20HB%202941%20Solar%20Incentives%20Report.pdf.
[45] OR. REV. STAT. § 307.175 (2016). "Alternative energy systems" include "property consisting of solar, geothermal, wind, water, fuel cell or methane gas energy systems for the purpose of heating, cooling or generating electricity."

[46] The solar PV system must be net metered or "primarily be designed to offset onsite electricity use" to qualify for the exemption. *Id.*
[47] OREGON PUBLIC UTILITY COMMISSION, HB 2941 SOLAR INCENTIVES REPORT 14 (2016), *available at* http://www.puc.state.or.us/electric_gas/2016%20HB%202941%20Solar%20Incentives%20Report.pdf.
[48] Business Oregon, *Rural Renewable Energy Development Zone,* http://www.oregon4biz.com/Oregon-Business/Tax-Incentives/Renewable-Energy/Zones/.
[49] OR. REV. STAT. § 307.175 (2016).
[50] S.B. 1547, 78th Leg. Assem., Reg. Sess. (Or. 2016).
[51] U.S. Dept. of Energy, *Business Energy Investment Tax Credit (ITC),* ENERGY.GOV, http://energy.gov/savings/business-energy-investment-tax-credit-itc; U.S. Dept. of Energy, *Residential Renewable Energy Tax Credit,* ENERGY.GOV, https://energy.gov/savings/residential-renewable-energy-tax-credit.
[52] A qualifying facility is either a qualifying small power producer or a qualifying co-generator. 16 U.S.C. § 824a-3(a) (2012). Qualifying small power producers must generate 80 MW or less from renewable energy sources. 16 U.S.C. § 796(17)(A). FERC regulations further refine the definitions of qualifying facilities. *See* 18 C.F.R. § 292.203–205.
[53] 16 U.S.C. § 824a-3(a)–(b).
[54] GTM RESEARCH, U.S. SOLAR MARKET INSIGHT Q4 2016: EXECUTIVE SUMMARY 10 (2016), *available at* http://www.seia.org/sites/default/files/H7D82HD9F238SMI2016Q4.pdf.
[55] For example, Connecticut, Maryland, Massachusetts, New Jersey, New York, and Pennsylvania all have more solar capacity installed than Oregon, and on a per-capita basis, Vermont's installed solar capacity far exceeds Oregon's.
[56] *See, e.g.,* Sarah Friesen, *SolarWorld's Hillsboro Deal Ranked Among Top 10,* OREGONLIVE.COM, May 13, 2008, http://blog.oregonlive.com/breakingnews/2008/05/solarworlds_hillsboro_deal_ran.html (listing BETC support as one of the primary factors influencing SolarWorld's decision to build a solar panel manufacturing plant in Hillsboro).
[57] SOLAR ENERGY INDUSTRIES ASSOC., SOLAR SPOTLIGHT: OREGON (2016), *available at* http://www.seia.org/sites/default/files/OR%20State%20Factsheet_6.15.2016.pdf; GTM RESEARCH, U.S. SOLAR MARKET INSIGHT Q4 2016: EXECUTIVE SUMMARY 10 (2016), *available at* http://www.seia.org/sites/default/files/H7D82HD9F238SMI2016Q4.pdf.
[58] *See* Pete Danko, *Oregon's Sunny Employment News: Solar Jobs Surged in 2016,* PORTLAND BUSINESS JOURNAL ONLINE, Feb. 7, 2017, http://www.bizjournals.com/portland/news/2017/02/07/oregons-sunny-employment-news-solar-jobs-surged-in.html (stating that the Solar Foundation reported 4,509 solar jobs in Oregon in 2016).
[59] Data from the Solar Energy Industries Association (current through 2017).
[60] Data from the Solar Energy Industries Association, (current through 2017).
[61] Data from THE SOLAR FOUNDATION, NATIONAL SOLAR JOBS CENSUS 2016, APP. A (2017), *available at* http://www.thesolarfoundation.org/wp-content/uploads/2017/02/National-Solar-Jobs-Census-2016-Appendix-A.pdf.
[62] Data from the Energy Information Administration. *See* U.S. Energy Info. Admin., *Electricity Data Browser: Retail Sales of Electricity, All Sectors—2015,* ENERGY.GOV, http://www.eia.gov/electricity/data/browser/#/topic/5?agg=2,0,1&geo=00000004&freq=A&start=2014&end=2015&ctype=map&ltype=pin&rtype=s&maptype=0&rse=0&pin=.
[63] Estimate assumes 1,500 MW of total residential and commercial capacity will be installed west of the Cascades and 500 MW of residential and commercial capacity will be installed east of Cascades. If more than 75% of residential and/or commercial systems are installed west of Cascades, total capacity target will be slightly higher.
[64] Output estimates created through NREL's PVWatts calculator, based on average annual production from roof-mounted systems located in Portland, Eugene, Medford, and Bend (assumes 75% of residential and commercial capacity will be sited west of Cascades and 25% will be sited east of Cascades). Nat'l Renewable Energy Lab., *PVWatts Calculator,* http://pvwatts.nrel.gov/pvwatts.php.
[65] Small commercial systems defined as commercially owned PV systems up to 150 kW in capacity.
[66] For the purposes of this report, large commercial systems are defined as commercially owned PV systems 150 kW and above.
[67] Estimate assumes 1,500 MW of total utility-scale capacity will be installed east of the Cascades and 500 MW of utility-scale capacity will be installed east of Cascades. If more than 75% of utility-scale systems are installed east of Cascades, total capacity target will be slightly lower. Nat'l Renewable Energy Lab., *PVWatts Calculator,* http://pvwatts.nrel.gov/pvwatts.php.

[68] Output estimates created through NREL's PVWatts calculator, based on average annual production from single-axis tilt ground-mounted systems located in Burns, Redmond, Klamath Falls, and Salem (and assuming 75% of utility-scale capacity will be sited east of the Cascades and 25% will be sited west of Cascades). *Id.*
[69] Based on estimated total retail electricity sales of approximately 60,000,000 MWhs in 2027, which reflects a 2% average annual increase in retail sales over Oregon's 2015 total retail sales of 47,264,000 MWhs. *Id.*
[70] Based on the estimate that 1 MW of solar PV, on average, produces enough electricity to power approximately 115 Oregon homes. *See* Solar Energy Industries Association, *What's in a Megawatt?,* SEIA.ORG, 2016, http://www.seia.org/policy/solar-technology/photovoltaic-solar-electric/whats-megawatt.
[71] The compound annual growth rates for each sector are as follows: Utility-scale, 26.6%; residential, 22.4%; small commercial, 30.2%; and large commercial, 31.3%.
[72] Solar Energy Industries Association, *Solar Industry Data,* 2016, http://www.seia.org/research-resources/solar-industry-data.
[73] BLACK & VEATCH, SOLAR GENERATION MARKET RESEARCH—TASK 1: SOLAR MARKET ASSESSMENT AND COST PROJECTIONS, Appendix A, tbs. A-1, A-2 (2015), *available at* https://www.portlandgeneral.com/-/media/public/our-company/energy-strategy/documents/2015-08-13-solar-generation-market-research.pdf?la=en.
[74] *Id*.
[75] BLACK & VEATCH, SOLAR GENERATION MARKET RESEARCH (2015), *available at* https://www.portlandgeneral.com/-/media/public/our-company/energy-strategy/documents/2015-08-13-solar-generation-market-research.pdf?la=en; THE CADMUS GROUP, INC., REVISED OVERVIEW OF PV INPUTS, DATA SOURCES, AND POTENTIAL STUDY RESULTS (2012), *available at* http://www.pacificorp.com/content/dam/pacificorp/doc/Energy_Sources/Integrated_Resource_Plan/2013IRP/PAC_2013IRP_Memo_PVInputs_09282012.pdf.
[76] ENVIRONMENT OREGON, SOLAR WORKS FOR OREGON: THE VAST POTENTIAL OF SOLAR POWER TO PROTECT OUR ENVIRONMENT AND CREATE JOBS (2012), *available at* http://www.environmentoregon.org/sites/environment/files/reports/Solar%20Works%20for%20Oregon_Summer%202012.pdf.
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[78] *See* Pete Danko, *Oregon Solar Powers Up,* PORTLAND BUSINESS JOURNAL ONLINE, Nov. 23, 2016, http://www.bizjournals.com/portland/feature/oregon-solar-powers-up.html.
[79] Mass. Office of Energy and Environmental Affairs, *Renewable Energy Snapshot*, MASS.GOV, http://www.mass.gov/eea/grants-and-tech-assistance/guidance-technical-assistance/agencies-and-divisions/doer/renewable-energy-snapshot.html.
[80] North Carolina installed approximately 144 MW and Utah installed approximately 129 MW in the second quarter of 2016. GTM RESEARCH, U.S. SOLAR MARKET INSIGHT Q3 2016: EXECUTIVE SUMMARY 9 (2016), *available at* http://www.seia.org/research-resources/solar-market-insight-report-2016-q3.
[81] Between January and June 2016, Utah installed 129 MW of solar capacity. *Id.* Between January and September 2016, Utah installed 875 MW of solar capacity. GTM RESEARCH, U.S. SOLAR MARKET INSIGHT Q4 2016: EXECUTIVE SUMMARY 10 (2016), *available at* http://www.seia.org/sites/default/files/H7D82HD9F238SMI2016Q4.pdf.
[82] NAT'L RENEWABLE ENERGY LAB., RENEWABLE ELECTRICITY FUTURES STUDY (2012), *available at* http://www.nrel.gov/analysis/re_futures/.
[83] NAT'L RENEWABLE ENERGY LAB., WESTERN WIND AND SOLAR INTEGRATION STUDY (2010), *available at* http://www.nrel.gov/docs/fy10osti/47434.pdf.
[84] In 2015, California's net total electricity generation was 196,704,000 MWh, and its net total solar electricity generation was 20,829,000 MWh. U.S. Energy Info. Admin., *Electricity Data Browser,* EIA.GOV, http://www.eia.gov/electricity/data/browser/#/topic/0?agg=2,0,1&fuel=0004&geo=00000004&sec=g&freq=A&rtype=s&maptype=0&rse=0&pin=&ltype=pin&ctype=map&end=2015&start=2014.
[85] Investment estimates are presented in 2016 dollars. When Black & Veatch's solar cost projections are applied to the Oregon Solar Business Plan's projected annual non-cumulative capacity additions, approximately $5.5 billion would be invested on solar power installations in Oregon between 2017 and 2027. BLACK & VEATCH, SOLAR GENERATION MARKET RESEARCH—TASK 1: SOLAR MARKET ASSESSMENT AND COST PROJECTIONS, Appendix A, tbs. A-1, A-2 (2015), *available at* https://www.portlandgeneral.com/-/media/public/our-company/energy-strategy/documents/2015-08-13-solar-generation-market-research.pdf?la=en.
[86] Based on annual solar generation of 6,000,000 MWh and EPA's annual total output CO_2 emissions rates for the Northwest of 665 lbs. CO_2/MWh. U.S. ENVIRONMENTAL PROTECTION AGENCY, EGRID 2012 GHG ANNUAL OUTPUT

EMISSIONS RATES (2015), *available at* https://www.epa.gov/sites/production/files/2015-10/documents/egrid2012_ghgoutputrates_0.pdf.

[87] Estimate based on University of California-Berkeley estimate that one MW of installed solar PV creates 25 job-years. *See* TRAVIS MADSEN, JORDAN SCHNEIDER, & SARAH HIGGINBOTHAM, SOLAR WORKS FOR OREGON 19 (2012), *available at* https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=0ahUKEwjajv3N_7rRAhWKgFQKHeL2BjQQFggcMAA&url=http%3A%2F%2Fwww.environmentoregon.org%2Freports%2Fore%2Fsolar-works-oregon&usg=AFQjCNG-Ygx9BeCh7iLgPh7k1cN61RCwxg.

[88] Oregon's average residential retail electricity rate in October 2016 was 10.98¢/kWh. U.S. Energy Info. Admin., *Average Price of Electricity to Ultimate Customers by End-Use Sector,* EIA.GOV, Dec. 23, 2016, https://www.eia.gov/electricity/monthly/epm_table_grapher.cfm?t=epmt_5_6_a.

[89] Estimates based on a projected output of 6,476 kWh/year, which is an average of the estimated output of 7,255 kWh/year for a 5 kW system located in Redmond, Oregon, and the estimated output of 5,697 kWh/year for a 5 kW system located in Portland. Nat'l Renewable Energy Lab., *PVWatts Calculator,* http://pvwatts.nrel.gov/pvwatts.php.

[90] Between 2011 and 2016, 5,740 projects received property tax exemptions with a total value of $236,690,708, reflecting an average exemption of $41,235 per project. OREGON PUB. UTIL. COMM'N, HB 2941 SOLAR INCENTIVES REPORT 14 (2016), *available at* http://www.puc.state.or.us/electric_gas/2016%20HB%202941%20Solar%20Incentives%20Report.pdf.

[91] In February 2016, the Nevada PUC revised net metering rates from 9.1¢/kWh to 2.6¢/kWh and tripled fixed charges for net metering customers. As a result, SolarCity, Sunrun, and Vivint withdrew from Nevada entirely and rooftop solar development plummeted in the state. The policy shift initially impacted both existing and prospective solar customers, but in September 2016 Nevada again revised the policy to allow existing net metering customers to continue earning the original net metering rate. *See* Julia Pyper, *Nevada Regulators Restore Net Metering for Existing Solar Customers*, GREENTECHMEDIA.COM, Sept. 16, 2016, https://www.greentechmedia.com/articles/read/nevada-regulators-restore-net-metering-for-existing-solar-customers.

[92] Public Utility Regulatory Policies Act, 16 U.S.C. §§ 2601-2645 (2015).

[93] A qualifying facility is either a qualifying small power producer or a qualifying co-generator. 16 U.S.C. § 824a-3(a) (2012). Qualifying small power producers must generate 80 MW or less from renewable energy sources. 16 U.S.C. § 796(17)(A). FERC's regulations further refine the definitions of qualifying facilities. *See* 18 C.F.R. § 292.203-205.

[94] 16 U.S.C. § 824a-3(a)–(b).

[95] OR. REV. STAT. §§ 758.505–758.555 (2015).

[96] *Id.* § 758.535.

[97] OR. ADMIN. R. § 860-029-0030.

[98] In the Matter of Public Utility Commission of Oregon, Staff's Investigation Relating to Electric Utility Purchases from Qualifying Facilities, UM 1129, Order No. 05-584 (Or. Pub. Util. Comm'n, May 13, 2005).

[99] *Id.* at 16–18.

[100] In the Matter of PacifiCorp, Application to Reduce the Qualifying Facility Contract Term and Lower the Qualifying Facility Standard Contract Eligibility Cap, UM 1734, Order No. 16-130 (Or. Pub. Util. Comm'n, Mar. 29, 2016).

[101] *Id.* at 5.

[102] *Id.*

[103] *See id.* at 3–4.

[104] Idaho had a 20-year standard offer contract term between 1987 and 1995, and 78 MW of QF capacity came online in the state during that period. In re PACIFICORP, Application to Reduce the Qualifying Facility Contract Term and Lower the Qualifying Facility Standard Contract Eligibility Cap, Sierra Club's Opening Brief, at 2–3 (Or. Pub. Util. Comm'n., Feb. 12, 2016). In 1996, the Idaho PUC reduced the contract term to five years, and only 0.6 MW of QF capacity came online between 1996 and 2001.

[105] In 2002, the Idaho PUC increased the contract term to 20 years, and between 2002 and 2015, 626 MW of QF capacity went online in the state. *Id.*

[106] H.B. 2137, 79th Leg. Assem., Reg. Sess. (Or. 2017).

[107] Arizona, Massachusetts, Nevada, New Jersey, New York, North Carolina, and Texas all have solar carve-outs or similar procurement mandates and are ranked in the top ten states for cumulative solar capacity.

[108] Massachusetts Office of Energy and Environmental Affairs, *Solar Carve-Out / SREC I*, MASS.GOV, http://www.mass.gov/eea/energy-utilities-clean-tech/renewable-energy/solar/rps-solar-carve-out/.

[109] Massachusetts Office of Energy and Environmental Affairs, *About the Solar Carve-Out II Program,* MASS.GOV, http://www.mass.gov/eea/energy-utilities-clean-tech/renewable-energy/solar/rps-solar-carve-out-2/about-solar-carve-out-ii.html.
[110] PGE had already procured enough solar capacity to meet its 10.9 MW obligation, and Pacific Power was on track to meet its 8.7 MW requirement by 2020.
[111] Between 2003 and 2015, the average system size for commercial solar projects receiving Energy Trust incentives was approximately 30 kW.
[112] Commercial PGE customers are eligible to receive rebates between $0.45 and $0.85 per watt up to a maximum of $135,000, and commercial Pacific Power customers are eligible to receive rebates between $0.50 and $0.90 per watt up to a maximum of $100,000. Energy Trust of Oregon, *Solar For Your Business—Details,* ENERGYTRUST.ORG, https://www.energytrust.org/incentives/solar-for-your-business/#tab-two.
[113] For a description of Oregon's RED grant program, see Appendix A.
[114] OR. REV. STAT. § 223.680 (2016).
[115] U.S. DEPT. OF ENERGY, BEST PRACTICE GUIDELINES FOR RESIDENTIAL PACE FINANCING PROGRAMS (2016), *available at* https://energy.gov/sites/prod/files/2016/11/f34/best-practice-guidelines-RPACE.pdf.
[116] Multnomah County, *Commercial Property Assessed Clean Energy in Multnomah County*, https://multco.us/sustainability/commercial-property-assessed-clean-energy-multnomah-county.
[117] NICK LAWTON, GREEN ENERGY INST., SOLAR BUILDING STANDARDS (2014), *available at* http://law.lclark.edu/live/files/18782-solar-building-standards-how-american-cities-can.
[118] *See* TRAVIS MADSEN, JORDAN SCHNEIDER, & SARAH HIGGINBOTHAM, SOLAR WORKS FOR OREGON (2012), *available at* https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=0ahUKEwjajv3N_7rRAhWKgFQKHeL2BjQQFggcMAA&url=http%3A%2F%2Fwww.environmentoregon.org%2Freports%2Fore%2Fsolar-works-oregon&usg=AFQjCNG-Ygx9BeCh7iLgPh7k1cN61RCwxg (recommending that Oregon adopt a net-zero energy building code).
[119] NICK LAWTON, GREEN ENERGY INST., SOLAR BUILDING STANDARDS 40 (2014), *available at* http://law.lclark.edu/live/files/18782-solar-building-standards-how-american-cities-can.
[120] *See id.* at 6–7
[121] OR. REV. STAT. § 455.040(1) (2016) ("The state building code shall be applicable and uniform throughout this state and in all municipalities, and no municipality shall enact or enforce any ordinance, rule or regulation relating to the same matters encompassed by the state building code but which provides different requirements unless authorized by the Director of the Department of Consumer and Business Services.").
[122] *Id.* § 455-030(4). Proposed amendments must conform to the purpose of the state building code, which specifies that the code "will provide for the use of modern methods, devices, materials, techniques and *practicable maximum energy conservation*." *Id.* § 455-030(1) (emphasis added). Because solar PV systems enable building occupants to conserve energy through reductions in retail electricity consumption, solar building standards would conform to the purpose of Oregon's statewide building codes.
[123] WARD BOWER ET AL., SANDIA NAT'L LAB., SOLAR ENERGY GRID INTEGRATION SYSTEMS 13 (2012), *available at* http://energy.sandia.gov/wp-content/gallery/uploads/121395.pdf.
[124] *Id.* at 13 ("Due to concerns regarding unintentional islanding, current interconnection standards require distributed PV systems to cease to export power during voltage and frequency disturbances, thereby reducing generation at times when it is needed most.").
[125] *See* Kathryn Schultz, *The Really Big One,* NEWYORKER.COM, July 20, 2015, http://www.newyorker.com/magazine/2015/07/20/the-really-big-one.
[126] For example, the National Fire Protection Association's Standard for Emergency and Standby Power Systems only requires hospitals to have 96-hour fuel supplies on hand. *See* Marina Dishel, *NFPA 110's Fuel Requirements Can Help Guide Backup Power Plans for Hospitals,* Sept. 2013, http://www.facilitiesnet.com/healthcarefacilities/article/NFPA-110s-Fuel-Requirements-Can-Help-Guide-Backup-Power-Plan-For-Hospitals-Facilities-Management-Health-Care-Facilities-Feature--14338.
[127] In 2015, an estimated 15%–20% of Oregon's utility-scale solar workforce was unionized. RAN FU, ET AL., NAT'L RENEW. ENERGY LAB., U.S. SOLAR PHOTOVOLTAIC SYSTEM COST BENCHMARK: Q1 2016 at 25 (2016), *available at* http://www.nrel.gov/docs/fy16osti/66532.pdf.
[128] OR. ADMIN. R. § 918-282-0400(3).
[129] LRTs are authorized to engage in limited electrical work on the load-side (DC-side) of a solar power system, but are not authorized to perform electrical work on the grid-side (AC-side) of a system. OR. REV. STAT. § 479.630(16).
[130] *See BCD - Contractor/Individual License Holder Search*, OREGON.GOV, http://www4.cbs.state.or.us/ex/all/mylicsearch/index.cfm?fuseaction=search.show_download&group_id=30

[131] *See* TRAVIS MADSEN, JORDAN SCHNEIDER, & SARAH HIGGINBOTHAM, SOLAR WORKS FOR OREGON 19 (2012), *available at* https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=0ahUKEwjajv3N_7rRAhWKgFQKHeL2BjQQFggcMAA&url=http%3A%2F%2Fwww.environmentoregon.org%2Freports%2Fore%2Fsolar-works-oregon&usg=AFQjCNG-Ygx9BeCh7iLgPh7k1cN61RCwxg.
[132] JENI HALL, ENERGY TRUST OF OREGON, BENCHMARKING OREGON SOLAR SOFT COSTS: 2014 INSTALLER SURVEY ANALYSIS 8 (2015), *available at* http://assets.energytrust.org/api/assets/reports/Benchmarking_Solar_Soft_Costs_2014.pdf.
[133] *See* OR. ADMIN. R. § 918-282-0205.
[134] Calculation is based on estimated solar PV land use requirements of 7 acres/MW for ground-mount systems. CHRIS ROBERTSON, OREGON SOLAR INDUSTRIES ASSOC. VISION FOR SOLAR IN OREGON 31 (2013).
[135] Mapdwell Solar System Portland, https://www.mapdwell.com/en/solar/portland/about.
[136] GOVERNOR JOHN A. KITZHABER, OREGON 10-YEAR ENERGY ACTION PLAN 29 (2012), *available at* https://www.oregon.gov/energy/Ten_Year/Ten_Year_Energy_Action_Plan_Final.pdf.
[137] *Id.*
[138] Hawaii State Energy Office, *Developer and Investor Center,* energy.hawaii.gov/developer-investor.
[139] Oregon Department of Land Conservation & Development, *Statewide Planning Goals,* OREGON.GOV, https://www.oregon.gov/LCD/Pages/goals.aspx.
[140] OREGON'S STATEWIDE PLANNING GOALS & GUIDELINES, GOAL 3: AGRICULTURAL LANDS (1973), *available at* https://www.oregon.gov/LCD/docs/goals/compilation_of_statewide_planning_goals.pdf.
[141] OREGON'S STATEWIDE PLANNING GOALS & GUIDELINES, GOAL 4: FOREST LANDS (1973), *available at* https://www.oregon.gov/LCD/docs/goals/compilation_of_statewide_planning_goals.pdf.
[142] OREGON'S STATEWIDE PLANNING GOALS & GUIDELINES, GOAL 5: NATURAL RESOURCES, SCENIC AND HISTORIC AREAS, AND OPEN SPACES (1973), *available at* https://www.oregon.gov/LCD/docs/goals/compilation_of_statewide_planning_goals.pdf.
[143] OREGON'S STATEWIDE PLANNING GOALS & GUIDELINES, GOAL 13: ENERGY CONSERVATION (1973), *available at* https://www.oregon.gov/LCD/docs/goals/compilation_of_statewide_planning_goals.pdf.
[144] *Id.*
[145] *Id.*
[146] Oregon Department of Land Conservation & Development, *Statewide Planning Goals,* OREGON.GOV, https://www.oregon.gov/LCD/Pages/goals.aspx.
[147] Federal Power Act § 218, 16 U.S.C. § 824r (2014).
[148] Both PGE and PacifiCorp require independent renewable producers to obtain firm transmission rights through their power purchase agreements. *See* KEN DRAGOON, SMALL RESOURCE TRANSMISSION SCHEDULING: SPECIAL CHALLENGES FACING SMALLER GENERATORS 9 (2014); *see also* PáTu Wind Farm, LLC, v. Portland General Electric, 150 FERC ¶ 61,032 4–5 (Jan. 22, 2015).
[149] *See* STEVEN STOFT, CARRIE WEBER, & RYAN WISER, TRANSMISSION PRICING AND RENEWABLES: ISSUES, OPTIONS, AND RECOMMENDATIONS 13 (1997).

APPENDIX A

KEY STATE AND FEDERAL POLICIES IMPACTING SOLAR ENERGY DEVELOPMENT

KEY STATE SOLAR POLICIES

Net Metering

In Oregon, homes and businesses may generate and consume solar power produced from onsite solar PV systems. Oregon's net metering policy allows homes and businesses to offset their retail electricity purchases with solar power produced from onsite solar PV systems. Net metering customers use "bidirectional" electricity meters that run forwards when customers purchase electricity from the grid and run backwards when customers generate solar power. Net metering is one of Oregon's most essential solar policies because it effectively enables citizens to produce power for their own consumption by offsetting their retail electricity purchases. Approximately 102 MW of distributed solar PV capacity is currently net metered in Oregon.[1]

Residential Energy Tax Credit

Oregon's Residential Energy Tax Credit (RETC) offers tax credits of up to $6,000 for residential installations of "alternative energy devices," including solar PV.[2] The RETC currently provides $1.30 per watt of installed PV capacity and cannot exceed 50% of a system's total installed costs.[3] The RETC is the only solar incentive available to residences statewide and is a significant driver of residential rooftop installations in the state. Though the RETC is available for multiple alternative energy technologies, it is crucial for solar PV. The RETC program has supported installation of more than 40 MW of solar PV capacity in Oregon.[4]

Energy Trust of Oregon Cash Incentives

PGE and Pacific Power customers are eligible to receive one-time cash incentives for solar PV installations. ETO incentive values vary by utility and system type and size. Residential customers are currently eligible to receive cash rebates up to $4,000 per home,[5] and commercial customers are eligible to receive rebates up to $135,000 per business.[6] ETO cash incentives are funded through public purpose charges paid by PGE and Pacific Power customers, and thus are only available for those utilities' customers. Public purpose expenditures are only authorized to fund the "above-market costs of new renewable energy resources;"[7] ETO incentive rates therefore decrease over time as solar PV costs decline. ETO cash incentives have supported installation of more than 83 MW of solar PV capacity in Oregon.[8]

Property Tax Policies

Under Oregon's Alternative Energy Systems exemption, increases in property values resulting from the installation of onsite "alternative energy systems,"[9] including solar PV systems, are exempt from the property's assessed value for property tax purposes.[10] More than 5,700 alternative energy projects have received property tax exemptions under this program.[11] The property tax exemption is scheduled to expire in 2018. Through Oregon's Renewable Energy Development Zone program, solar projects in designated counties may qualify for property tax exemptions for periods of three to five years.[12] Oregon also allows solar project owners to enter into a "fee in lieu of property taxes" agreement with local counties. Under this agreement, the project owner agrees to pay the county $7,000 per megawatt of installed solar capacity on an annual basis for a period up to 20 years.[13] Because the property tax exemption for alternative energy systems only applies to solar arrays that offset onsite electricity use, the payment in lieu of property taxes program helps reduce soft costs for utility-scale solar installations that do not offset onsite electricity use.

Renewable Portfolio Standard

Oregon's Renewable Portfolio Standard (RPS) mandates that 50% of the retail electricity sold by the state's large electric utilities must come from renewable energy sources by 2040.[14] The utilities demonstrate compliance with the RPS by surrendering Renewable Energy Credits (RECs) that are issued for each megawatt-hour of electricity produced by a qualifying renewable resource. Oregon's RPS helps create a foundation for solar growth in Oregon by stimulating utility demand for renewable energy.

Solar Capacity Standard

Until its repeal in 2016, Oregon's Solar Capacity Standard directed PGE, Pacific Power, and Idaho Power to collectively procure 20 MW of solar capacity by 2020.[15] The Solar Capacity Standard was repealed through a bill that otherwise strengthened Oregon's RPS from 25% by 2025 to 50% by 2040.[16] However, Oregon retained the Solar Capacity Standard's REC multiplier for qualifying in-state solar power. Qualifying solar PV systems located in Oregon that came online before January 2016 therefore continue to earn two RECs for each megawatt-hour of solar power the systems produce.[17]

Business Energy Tax Credit & Renewable Energy Development Grants

Until its repeal in 2014, Oregon offered a tax credit for commercial and industrial solar installations. The Business Energy Tax Credit (BETC) program granted businesses tax credits for 50% of eligible project costs, up to a maximum of $10 million per project.[18] Recipients recovered the full credit value over a period of five years. The BETC program supported the installation of more than 36 MW of solar PV capacity in Oregon. In 2011, the Oregon Legislature adopted a Renewable Energy Development (RED) grant program to incentivize commercial solar development after the expiration of the BETC.[19] However, the RED grant program only provides a limited number of grants for eligible solar installations. Grant recipients are selected through a competitive review process and receive grants representing 35% of total project costs up to $250,000.[20] Approximately 4 MW of solar PV capacity has been installed under the RED Grant program.[21]

Solar Volumetric Incentive Rate Pilot Program

Between 2010 and 2015, Oregon's Solar Volumetric Incentive Rate (VIR) pilot program offered production-based incentives for the output from enrolled solar projects.[22] Participants who enrolled in the program before 2015 earn a set incentive rate for each kilowatt-hour of solar power produced by their systems over a 15-year period. The VIR pilot program was a trial attempt at administering a policy similar to a feed-in tariff,[23] and though the program proved to be more costly than anticipated, it was highly effective at incentivizing solar development in the state in a relatively short period of time. More than 27 MW of solar PV capacity was installed under the VIR program.[24]

Large-Scale Solar Production-Based Incentive

Until recently, solar PV installations with nameplate capacities between 2 MW and 10 MW were eligible to enroll in a production-based incentive program that allows producers to earn one-half cent per kilowatt-hour of solar power produced by their systems over a five-year period.[25] The program's enrollment period terminated on January 2, 2017, but enrolled solar producers will continue to earn incentive rates for remainder of their five-year terms.

FEDERAL RENEWABLE ENERGY POLICIES

Federal Investment Tax Credit

The federal Investment Tax Credit (ITC) offers a tax credit of up to 30% of total project costs for eligible solar projects that commence construction prior to December 31, 2019. In 2020, the ITC phases down to 26%, then phases down to 22% in 2021. In 2022, the ITC will phase down to 10% of project costs. Commercial solar projects that commence construction after 2022 are still eligible to receive a 10% ITC, but the credit is scheduled to expire for residential solar projects at the end of 2022.[26]

Public Utilities Regulatory Policy Act (PURPA)

The federal government enacted PURPA in 1978 to support independent electricity production from "qualifying facilities" (QFs), which include small renewable power producers.[27] PURPA directs utilities to 1) purchase electricity from these QFs, 2) connect the QFs to the electricity grid, and 3) compensate QFs for power purchases at rates that do not exceed the utilities' own avoided costs.[28] Under PURPA, Oregon's investor-owned electric utilities must enter into contracts to purchase output from qualifying solar power producers at the utilities' avoided cost rates.

APPENDIX A ENDNOTES

[1] U.S. Energy Info. Admin, Electricity: Form EIA-826 Detailed Data—Net Metering (Oct. 2016), *available at* https://www.eia.gov/electricity/data/eia826/.
[2] OR. REV. STAT. § 469B-100; OR. ADMIN. R. § 330-070-0013.
[3] OR. ADMIN. R. § 330-070-0022(3)(e).
[4] Data from the Oregon Department of Energy (current through 2016). *See* OREGON PUBLIC UTILITY COMMISSION, HB 2941 SOLAR INCENTIVES REPORT 12 (2016).
[5] Residential PGE customers may receive cash rebates of $0.40 per watt up to a maximum of $3,200 per home, and residential Pacific Power customers may receive rebates of $0.50 per watt up to a maximum of $4,000 per home. Energy Trust of Oregon, *Solar for Your Home,* https://www.energytrust.org/incentives/solar-for-your-home/#tab-two.
[6] Commercial PGE customers are eligible to receive rebates between $0.45 and $0.85 per watt up to a maximum of $135,000, and commercial Pacific Power customers are eligible to receive rebates between $0.50 and $0.90 per watt up to a maximum of $100,000. Energy Trust of Oregon, *Solar for Your Business,* https://www.energytrust.org/incentives/solar-for-your-business/#tab-two.
[7] OR. REV. STAT. § 757.612(1) (2016).
[8] Data from the Energy Trust of Oregon (current through 2016). *See* OREGON PUB. UTIL. COMM'N, HB 2941 SOLAR INCENTIVES REPORT 22 (2016).
[9] OR. REV. STAT. § 307.175 (2016). "Alternative energy systems" include "property consisting of solar, geothermal, wind, water, fuel cell or methane gas energy systems for the purpose of heating, cooling or generating electricity."
[10] The solar PV system must be net metered or "primarily be designed to offset onsite electricity use" to qualify for the exemption. *Id.*
[11] OREGON PUBLIC UTILITY COMMISSION, HB 2941 SOLAR INCENTIVES REPORT 14 (2016).
[12] Business Oregon, *Rural Renewable Energy Development Zone,* http://www.oregon4biz.com/Oregon-Business/Tax-Incentives/Renewable-Energy/Zones/.
[13] OR. REV. STAT. § 307.175 (2016).
[14] S.B. 1547, 78th Leg. Assem., Reg. Sess. (Or. 2016).
[15] O.R.S. § 757.370 (repealed by SB 1547 in 2016).
[16] S.B. 1547, 78th Leg. Assem., Reg. Sess. (Or. 2016).
[17] O.R.S. § 757.375 (2016).
[18] O.R.S. § 315.356; O.A.R. § 330-090-0105.
[19] H.B. 3672, 76th Leg. Assem., Reg. Sess. (Or. 2011).
[20] O.R.S. § 469B.256(2).
[21] Data from the Oregon Department of Energy (2016).
[22] O.R.S. § 757.365.
[23] The VIR program was not a true feed-in tariff because it did not provide incentive rates for solar output that exceeded a participant's retail electricity purchases on an annual basis.
[24] Data from the Oregon Public Utility Commission (2016).
[25] H.B. 4037, 78th Leg. Assem., Reg. Sess. (Or. 2016).

[26] U.S. Dept. of Energy, *Business Energy Investment Tax Credit (ITC),* ENERGY.GOV, http://energy.gov/savings/business-energy-investment-tax-credit-itc; U.S. Dept. of Energy, *Residential Renewable Energy Tax Credit,* Energy.gov, https://energy.gov/savings/residential-renewable-energy-tax-credit.
[27] A qualifying facility is either a qualifying small power producer or a qualifying co-generator. 16 U.S.C. § 824a-3(a) (2012). Qualifying small power producers must generate 80 megawatts or less from renewable energy sources. 16 U.S.C. § 796(17)(A). FERC's regulations further refine the definitions of qualifying facilities. *See* 18 C.F.R. § 292.203-205.
[28] 16 U.S.C. § 824a-3(a)–(b).