URBAN INFRASTRUCTURE LAB
at the UNIVERSITY of WASHINGTON

Economic Impact Analysis of Community Solar Programs for the State of Washington

January 2025

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Funding for this research was provided by the *Coalition for Community Solar Access* (CCSA, https://communitysolaraccess.org/), a national trade organization representing solar companies, businesses and non-profit organizations working to promote policies, programs, and practices, to expand customer choice and access to solar for American households and businesses through community solar. Cover credit: American Public Power Association and Lincoln Electric Systems.

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About the Urban Infrastructure Lab

The Urban Infrastructure Lab (UIL) at the University of Washington, under the direction of Professor Jan Whittington, brings together students and faculty with a shared interest in the planning, governance, finance, design, development, economics, and environmental effects of infrastructure. Our studies integrate empirical and applied methods of research to discover the means to obtain long-run objectives, such as decarbonization, resilience, social equity, and information security, through decisions made today.

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EXECUTIVE SUMMARY

This report forecasts the economic potential of corporate-owned community solar installations in Washington state. This research and report was prepared by the Urban Infrastructure Lab at the University of Washington, under the direction of Prof. Jan Whittington. This research was requested and funded by the Coalition for Community Solar Access (CCSA).

In a corporate model of community solar development, a third party owns the project (neither the utility nor the customer) and the public is given the ability to subscribe to the solar energy output of the third party through their utility bill. This model of solar service can grow the market, harnessing the latent capacity and interest of the public in solar. Subscriptions can provide a foundation for private financing of new solar developments, while public choice through the utility bill lowers barriers to participation. Across the nation, corporate-owned community solar systems increasingly fill a neglected niche in the market for systems sized between 100 kWac and 5 MW ac, breaking ground dual uses of land, such as working agricultural land with solar providing partial shade and additional value to the property, as well as solar on under-utilized properties and rooftops. In this way, the corporate model of community solar development can be complementary to the expansion of "community-owned" solar, where community members are, themselves, the collective owners of the assets.

This assessment relies on four main data sources to model the economic impact of an improved enabling environment for community solar development in Washington state;

1. Results from a survey of community solar developers, detailing the costs of actual recent solar developments and collecting their impressions of latent demand and barriers that impede community solar development in Washington state;
2. Cost data from the US National Renewable Energy Laboratory (NREL), to benchmark and validate survey results;
3. Land rent data from the National Agricultural Statistics Service (NASS), pertinent to cost estimates to lease land for solar development; and
4. The input-output datasets of the IMPLAN model for economic impact analysis, which traces transactions across industries and institutions to account for direct, indirect and induced effects of economic activities.

This study envisions three growth scenarios:

- **Scenario 1**: business-as-usual growth of 60 MWac;
- **Scenario 2**: modest policy changes with growth of 220 MWac; and
- **Scenario 3**: policy incentives that emulate those of other states recently enabling and exhibiting community solar growth, such as New York and Minnesota, resulting in 500 MWac.

All three scenarios forecast growth in the form of new community solar systems added to the state over a 10 year period, with an additional period of operations for each system for the typical warrantied life of 25 years. The highest of these scenarios would represent an overall growth of about 2% of the residential electricity market of the state of Washington.

Given that 18% of the fuel mix of electricity provided to residents of Washington state is provided by natural gas, the replacement of any of these natural gas supplies with community solar would result in a sustained decrease in emissions. A one-to-one replacement of a kilowatt-hour of natural gas with solar results in a 91% decrease in lifecycle greenhouse gas emissions. Overall, air pollutants from the electricity provided to Washington state residents produces an estimated $638 million per year in climate and health damage that could be avoided when switching to solar.

While the total economic impact of improving the enabling environment for community solar will depend on the actual distribution of project sizes and specific implementation details, under the most ambitious policy scenario, the development of 500 MWac of community solar over 10 years could:

- Contribute up to $1.76 billion to the state's Gross State Product (GSP);
- Generate $76.49 million in state tax revenues over a 10-year period;
- Support 16,521 job-years, equivalent to 1,652 annual full-time jobs per year over the next 10 years;
- Enable landowners participating in the program to see cumulative lease payments of up to $4.66 million over the 10-year period.

Results also include labor income, value-added to the Gross State Production (GSP), and tax income for the state, assuming their present values while accounting for inflation and discounting.

Scenario	Total Nameplate Capacity over 10 years (MWac)	Employment (job-year)	Labor Income (PV in million dollars)	Value Added (PV in million dollars)	State Tax (PV in million dollars)	Lease Payment (present value in million dollars)
1	60	1,999	148.31	213.73	9.31	0.56
2	220	7,331	543.82	783.67	34.14	2.05
3	500	16,521	1,225.51	1,760.74	76.49	4.66

Table ES 1: Summary of Economic Contribution Estimates from Improved Community Solar in Washington State (PV = present value, 2023 dollars)

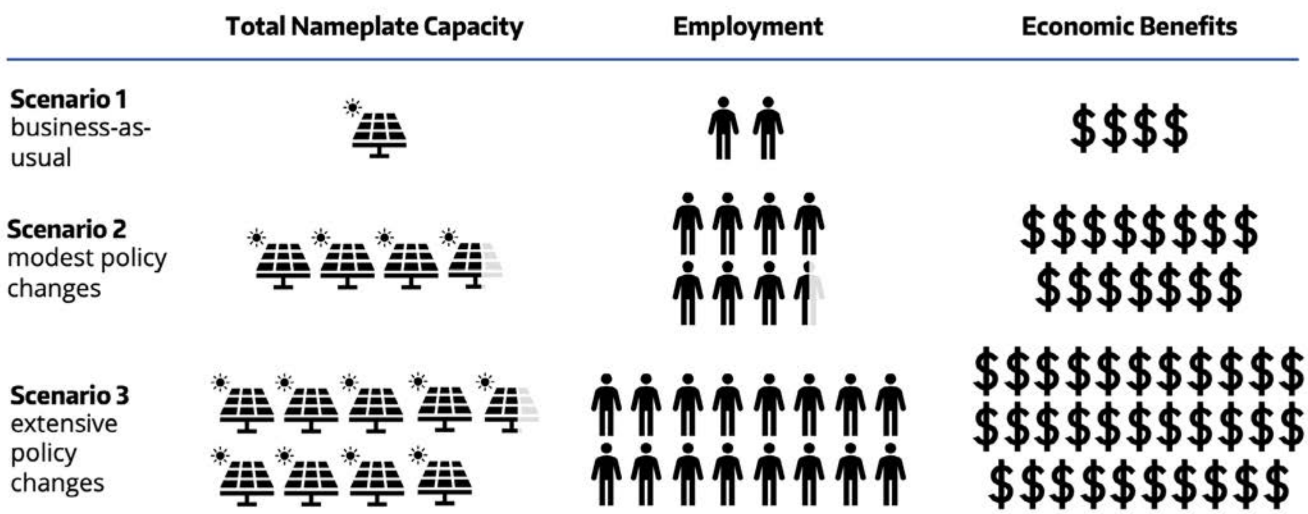


Figure ES 1: Infographic of Economic Impact from Improved Community Solar in Washington State

There is a latent demand in Washington state for community solar, including corporate-owned owned community solar, that may be prompted by enabling legislation. Developers surveyed refer to policy barriers—such as a lack of consolidated billing with itemized community solar subscription expenses and credits, the need for robust credit rates, the presence of restrictive program caps, and inconsistent siting and permitting guidelines.

We note several actionable policies that can be utilized to accelerate community solar development:

1. Expand the capacity limitations of community solar projects to allow for economies of scale;
2. Educate communities on the benefits of community solar projects and involve them in the decision-making process;
3. Standardize interconnection cost-sharing;
4. Create a long-term incentive structure with consideration for gradual and clearly defined incentive levels, if such programs are needed; and
5. Improve billing transparency through consolidated billing, net crediting, or other alternatives.

These results are evidence-based and reliable, and they form a reasonable guide for statewide policy making, but they are not meant to be interpreted as comprehensive. Input-output models such as IMPLAN, used with linear projections do not provide sensitivity tests against future shifts in pricing or consumer behavior. What this report provides is a clear understanding of the general magnitude of the economic contribution that corporate-owned community solar could make to Washington state, as measured by the current value of transactions.

LIST OF ACRONYMS

ac	alternating current
BOS	balance of system
dc	direct current
EBOS	electrical balance of system
ESS	energy storage system
ILR	inverter loading ratio
IRA	Inflation Reduction Act
kWh	kilowatt-hour
LMI	low- and moderate-income
MMP	modeled market price
MSP	minimum sustainable price
MWdc	megawatts direct current
NREL	National Renewable Energy Laboratory
O&M	operations and maintenance
PV	photovoltaics (used in energy and solar-related contexts)
PV	present value (used in financial and economic contexts)
SBOS	structural balance of system
SEIA	Solar Energy Industries Association
USD	U.S. dollars

I - INTRODUCTION

The state of Washington—home of the first community solar project in the US—is currently ranked 31st across 50 states in the fast-moving sector of community solar development (Hackney, 2023). The Urban Infrastructure Lab at the University of Washington prepared this research report to quantify the potential economic impact of the development and deployment of community solar for the state, and to outline the challenges faced in the state today by corporate developers of community solar. This report, requested by the Coalition for Community Solar Access (CCSA), is a primer on the potential economic benefits of corporate-owned community solar in the state of Washington.

Box 1: Report Structure

Section One: Introduction introduces the concept of community solar, outlines its benefits, and examines common challenges in its development along with solutions offered by current literature.

Section Two: Methodology and Assumptions details the methodology used and underlying assumptions applied to our projections of economic benefit from community solar.

The results of our projections and their economic impact are shown for three scenarios in ***Section Three: Economic Impact Analysis***.

The report concludes with a review of the challenges faced by corporate developers of community solar in Washington state, and recommendations for future action in ***Section Four: Conclusion***.

The US Department of Energy defines community solar as:

> *[A]ny solar project or purchasing program, within a geographic area, in which the benefits of a solar project flow to multiple customers such as individuals, businesses, nonprofits, and other groups. In most cases, customers benefit from energy generated by solar panels at an off-site array. Community solar subscribers typically receive a monthly bill credit for electricity generated by their share of the solar PV system, as if the system were located on their premises. (Department of Energy, n.d.)*

The term "community" refers to the ease of recruitment and heightened participation of the public in the benefits from these infrastructure assets. These facilities are not typically owned by utilities—when a utility develops a solar asset, it commonly mixes the resulting solar energy with other energy sources within existing pricing systems for consumers.

The focus of this report is on corporate-owned community solar installations and their economic potential for Washington state (Figure 1). In a corporate model of community solar development, a third party owns the project (neither the utility nor the customer) and the public is given the ability to subscribe to the solar energy service of the third party through their utility bill. Ease of public access to support solar development provides encouragement to corporate developers of solar facilities, who may also be influenced by tax credits or other subsidies. Corporate-owned community solar facilities are often arranged through the lease of land, though rooftop array development is also a possibility. Thus, solar growth increases the opportunity for payments from corporate developers and owners of the arrays to landowners of rural, commercial, and industrial property.

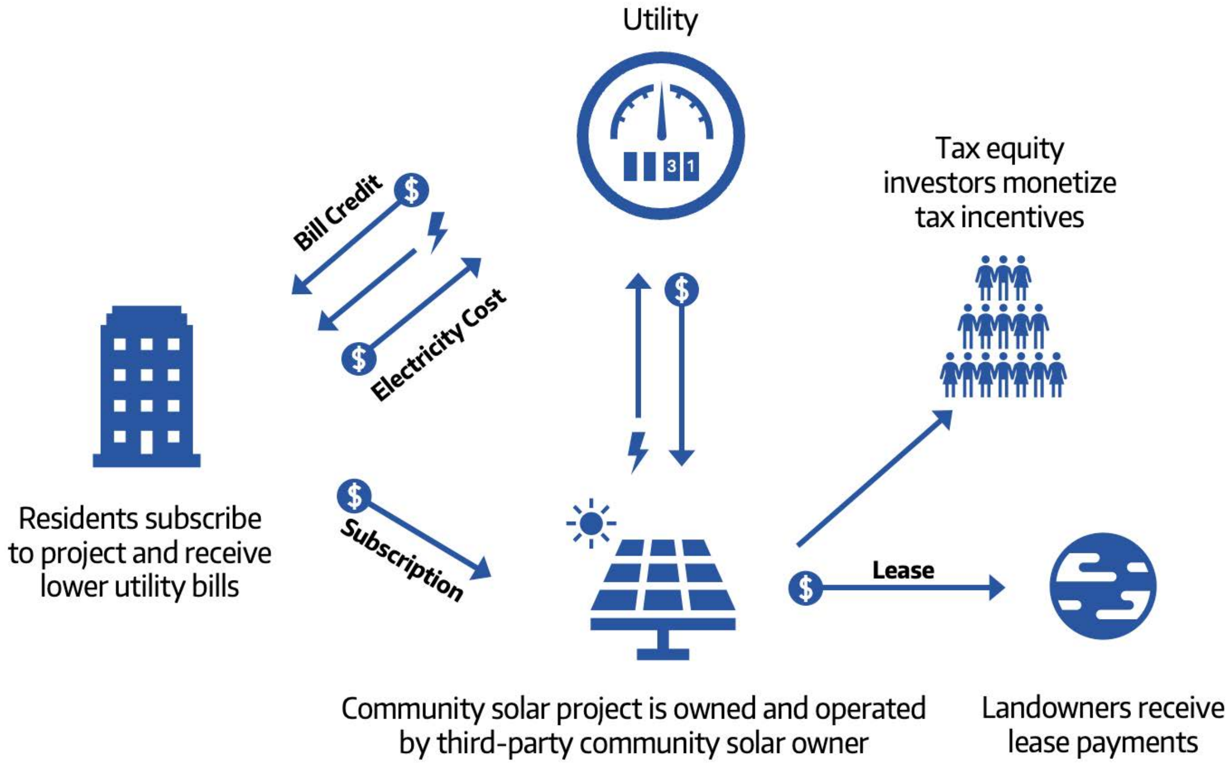


Figure 1. Infographic of Community Solar Financial Relationships; Example of the self-built off-site community solar model (adapted from NREL, 2022)

This model of community solar development can function to grow the market, harnessing the capacity and interest of the public in solar. Subscriptions can provide a foundation for private financing of new solar developments. Public choice through the utility bill lowers barriers to participation. In this way, the corporate model of community solar development can be complementary or perhaps a precursor to the expansion of "community-owned" solar, where community members are, themselves, the collective owners of the assets.

The rapid and recent growth of community solar is owed at least in part to the gap it fills in the market for solar energy. According to CCSA, community solar facilities fill an important gap between large utility-scale projects and smaller commercial and residential installations (CCSA, 2024). Corporate-owned community solar facilities usually have less than five megawatts (MW), and greater than 100 kilowatts (kW) of electrical capacity, and vary in the number of acres affected.

Demand exists and continues to grow for clean and inexpensive sources of energy across the US. These factors are driving companies to find ways to fulfill this demand and for state legislatures to adopt enabling legislation. Signs of latent demand for solar have emerged in the wake of enabling legislation, which at the time of writing has been passed in 24 states. Over the past five years, community solar has become one of the fastest growing sectors of the US solar market, with substantial capacity additions (Figure 2) (Department of Energy, 2024; Rocky Mountain Institute, 2017).

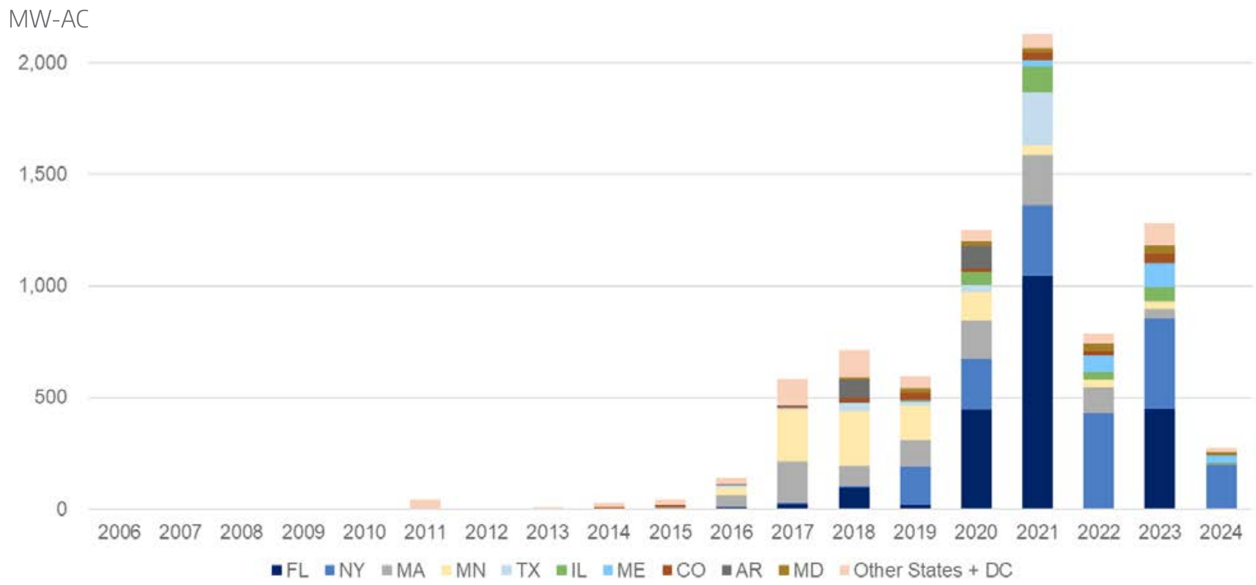


Figure 2. Community Solar installed Capacity by Year of Interconnection (Source: NREL Share the Sun)

Benefits of Community Solar

Corporate-owned community solar can offer advantages to traditional methods of energy production and delivery to subscribers, communities, grid operators, and underserved populations. Among the possibilities are financial savings, economic growth, environmental sustainability, and social equity.

Financial Benefits to Subscribers

Cost Savings: Companies surveyed for this report indicate that residential subscribers typically account for 40%-60% of community solar participants. Based on experience in other states, subscribers to corporate-owned community solar services can expect to save between 10%-15% on their household electricity bills. That said, the cost of energy is regressive for most households—residents in lower income households likely pay a larger portion of their income for energy than residents of higher earning households. The savings potential can increase to about 20% for households with low incomes, enhancing energy affordability.

Local Economic and Community Advantages

Job Creation: The deployment of community solar stimulates job growth in trades such as engineering, construction, and operations (Rocky Mountain Institute, 2017; Waechter et al., 2024). These jobs may be unionized, and may offer high wages and reduced income disparities across demographic lines, for a workforce that may be more reflective of the community. The sector is also known for establishing a safe working environment.

Income for Landowners: Lease payments to landowners, including farmers and rural property owners, provide a steady income stream, most often supporting agricultural communities and promoting land use diversification (Heeter et al., 2021; Rocky Mountain Institute, 2017). Dual use of property for agriculture and solar—'agrisolar'—is a growing phenomenon (AgriSolar Clearinghouse, 2024). As described by the Agrisolar Clearinghouse:

> *The co-location of solar and agriculture is a climate solution that can save water, build the soil, produce healthy, high-yielding crops, increase pollinator habitat, provide new income for existing farms and land access to beginning farmers, and improve the resilience of rural communities.*

Figure 3. Argisolar (Source: National Center for Appropriate Technology)

Tax Revenues for Government: Community solar projects boost local service industries, increase the value of property, and provide long-lived and durable infrastructure assets. As a result, they generate tax revenues for local, state, and federal governments, such as property taxes, excise taxes, sales and use taxes, and net income taxes (Heeter et al., 2021; Rocky Mountain Institute, 2017; Stoel Rives LLP, n.d.).

Grid and Environmental Benefits

Environmental Impact: Adoption of renewable energy can mitigate environmental and climate-related externalities by reducing reliance on fossil fuels. The US National Renewable Energy Lab estimates that, from cradle to grave, the supply chain of solar energy in the US emits 46 grams of carbon dioxide equivalent greenhouse gases (gCO2eq) per kilowatt-hour (kWh) of electricity consumed. This is far lower than natural gas, at 486 gCO2eq/kWh (Coleman & Nichols, 2021; Nicholson & Heath, 2021).

Consider how this difference stacks up for Washington state residents. Famously, Washington state is the nation's largest supplier of hydroelectric power. However, our second largest source of electricity is natural gas, which comprised 18% of electricity generated in 2023 (EIA, 2024b). The average Washington state household consumed 12,556 kWhs of electricity (EIA, 2024a, Table 2.8; United States Census Bureau, 2024). This means that the average Washington state household generated just over 1 million gCO2eq of greenhouse gas emissions in 2023 due to natural gas in the fuel mix of their electricity, and are on track to do the same in 2024, and the year after. Over a 25 year period—the typical warrantied lifespan of a solar system—these emissions amount to 27 million gCO2eq per household, which is the equivalent of each household in the state burning 30,000 pounds of coal, or driving an additional 70,000 miles on gasoline (EPA, 2024). The lifecycle of solar has a comparatively tiny carbon footprint. If the natural gas in electricity generation were replaced with solar, these lifecycle emissions would drop by 91%, to the equivalent of driving about 6,200 miles, a level that would allow for sequestering the remaining carbon emissions by having each household plant and nurture 40 seedlings in a working Washington state forest for about 10 years.

Accelerated Decarbonization of Electricity: State law is currently set to eliminate emissions from fossil fuels in retail electricity supplies over the next 20 years, and community solar can accelerate its implementation. The Clean Energy Transformation Act (CETA) (SB 5116, 2019) commits Washington state to a greenhouse gas emissions-free electricity supply by 2045. Collectively, the 3.1 million households in this state are on track to produce an estimated 3.4 trillion gCO2eq of emissions each year, as long as 18% of their electricity continues to be sourced from natural gas, with lifecycle emissions from natural gas at 486 gCO2eq/kWh (Coleman & Nichols, 2021; Nicholson & Heath, 2021). Community solar has the potential to reduce this figure, now and into the future, to the extent that it can replace natural gas with solar as a source of residential electricity.

Public Health Benefits: Renewable energy systems improve air quality, combat climate change, and contribute to public health benefits by reducing harmful pollutants (Heeter et al., 2021; Millstein et al., 2024). Recent advances in epidemiological research are producing results that show much higher societal costs from air pollution than previously known. A recent well-regarded study examined the impact of wind and solar energy growth in the US (Millstein et al., 2024).

The pollutants of interest are those avoided when solar and wind replace fossil fuels in electricity production: CO2 emissions, of concern as a greenhouse gas, and SO2 and NOX as precursors to mortality risk from particulate and ozone pollution. The monetary value of avoiding emissions in the form of CO2, also known as the social cost of carbon, includes drivers such as impacts to agricultural productivity and mortality risk due to rising outdoor air temperature, at $185 per metric ton of CO2 (note: 1 metric ton is equal to 1 million gCO2eq) (Rennert et al., 2022). Findings show that wind and solar generation reduced CO2 emissions in the US by an estimated 900 million metric tons between 2019 and 2022, and provided an estimated $249 billion in climate and health benefits (Millstein et al., 2024). The combined climate and health benefits of converting to solar were estimated at $100 per MWh per year nationwide, $91 per MWh in the western states, including Washington state (2022). As high as these monetary values appear to be, they are actually conservative. They rely on operational emissions, which are a tiny fraction of the lifecycle emissions for these harmful air pollutants.

Enhanced Grid Resilience and Reliability: Community solar projects, if developed in locations closer to where energy is consumed, have the potential to offer resilience and reliability to complement traditional, centralized systems. By reducing reliance on long-distance transmission, they are less vulnerable to disruptions from extreme weather and technical failure, and may alleviate strain on aging US energy infrastructure. When paired with battery storage, community solar can enhance efficiency with resilience if used to serve peak energy demand (so-called peak shaving), deferring costly infrastructure upgrades, and provide reliable power during outages caused by extreme weather or grid failures (Gui et al., 2017; Coleman & Nichols, 2021; Rickerson et al., 2022) (Coleman & Nichols, 2021; Gui et al., 2017; Rickerson et al., 2022).

Support for Underserved Populations

Energy Equity: Community solar can advance energy equity and justice by providing access to renewable energy at reduced rates to low-to-moderate-income (LMI) households and renters, who might otherwise be excluded from clean energy initiatives (Aznar & Gagne, 2018; Coleman & Nichols, 2021; Hoesch et al., 2024; Waechter et al., 2024). Corporate-owned community solar may be particularly beneficial for individuals who cannot adopt rooftop solar due to financial constraints, property ownership limitations, or inadequate roof conditions, yet bear the burden of direct payments to utilities for energy consumption (Heeter et al., 2020). For multi-family residential properties, fragmented decision-making complicates the implementation of solar projects (NREL, 2022). Renters do not generally have the authority to make solar investments on premises. Community solar can expand solar access among multifamily housing occupants, renters, and low-income households (O'Shaughnessy et al., 2024). Many community solar programs are specifically designed to reduce energy burdens, defined as the proportion of income spent on energy bills, for disadvantaged populations (Heeter et al., 2020; Coleman et al., 2017; Gai et al., 2021). According to the US Department of Energy, Washington state households with less than 50% of average median income have energy burdens that exceed 5%, while median income households have burdens of 1% (Department of Energy, 2024).

Challenges of Community Solar

Despite its benefits, implementation of and access to community solar faces barriers today in Washington state. When people think of community solar, they are often imagining solar investments that are organized and financed by community members ("community-owned"), but there are several hurdles for such projects to overcome, some of which can be alleviated by corporate-ownership of community solar ("corporate-owned"), making corporate ownership a potential stepping stone to further growth in solar through community development of the asset.

Cost Barriers: High upfront costs and difficulties securing financing for community-owned solar installations can deter property owners from investing in solar technologies (NREL, 2022). High "soft costs," such as the costs related to permitting and interconnection delays, are especially significant concerns (Heeter et al., 2021). Interconnection refers to the process of physically and technically connecting a renewable energy project, such as community solar, to the existing electrical grid. This involves assessing the capacity of the local grid, determining the necessary upgrades, and ensuring compliance with technical standards to allow safe and reliable energy transmission (Hirsh Bar Gai et al., 2021). The interconnection challenge has two primary dimensions: "Who should pay for interconnection?" and "How should interconnection costs be distributed?" (Hirsh Bar Gai et al., 2021). Other studies have identified the lack of economies of scale as a significant challenge in the development of community solar projects. This smaller scale leads to reduced profitability, especially when considering the relative time and soft costs involved (Hirsh Bar Gai et al., 2021; O'Shaughnessy et al., 2022). With the exception of the question about economics of scale, the hurdles to community solar are absorbed by the developers and owners of corporate-owned community solar.

Regulatory and Policy Challenges: Typical regulatory barriers to community solar include limitations on generation capacity, inconsistent standards, and a lack of enabling regulations. These challenges are particularly pronounced in efforts focused on expanding capacity (Hirsh Bar Gai et al., 2021; Thakur & Wilson, 2024). Each state may have its own barriers depending on the regulatory context. The adoption of enabling legislation for corporate-owned community solar in 24 states is evidence of the main policy pathway currently being taken across the US to expand these facilities.

Billing Complexity: Community-owned solar programs usually require subscribers to manage two separate bills—one from the utility and another from the community solar provider. This dual-billing system can be confusing for customers, making it harder to understand their expenses and savings. The complexity increases further when the billing cycles for the two statements do not align (Case et al., 2024). Enabling legislation supporting community solar commonly includes consolidated billing or net crediting, where both the subscription fees and bill credits appear side-by-side on each residential utility bill, as found in New York and Illinois, for example.

Unique challenges in the State of Washington: Washington's relatively low wholesale energy prices and relatively low-emission energy mix, compared to the rest of the United States, may curb interest in community solar investments. While projected to grow significantly over time, Washington's average retail electricity rate of $0.13 per kWh currently remains below the 2024 national average of $0.19 per kWh (Electricity Cost in Washington, 2024). Additionally, Washington's electricity landscape is characterized by a diverse mix of 64 electric utilities. Many consumer-owned utilities benefit from long-term contracts with the Bonneville Power Administration, which provides access to affordable, low-emission hydroelectric power, though this comes with ecological impacts associated with our abundant energy from hydroelectric dams (Schmutz & Moog, 2018). As a result, many utilities in the state deliver clean energy with low emissions and competitive costs. For instance, Seattle City Light has an emission intensity of just over 10 gCO_2e/kWh (2.8 gCO_2e/MJ). For the average household in our state, this is just over 125,000 gCO_2eq per year, equivalent to a one-way drive from Bremerton to Spokane, or a round trip between Olympia and Yakima.

That said, the state's average electricity emission factor is 228.20 gCO_2e/kWh (equivalent to 63.39 gCO_2e/MJ), approaching 3 million gCO_2eq per year per household. This amount of emissions would be equivalent to the greenhouse gas emissions from more than 20,000 additional miles of driving per household per year. Some utilities in Washington state exhibit emission intensities as high as 641.95 gCO_2e/kWh (178.32 gCO_2e/MJ), nearly three times as much emissions as the state-wide average (Utility-Specific Carbon Intensity of Electricity, 2023). For these higher emission service areas, community solar—whether corporate or community-owned—can offer significant cost savings while also playing a crucial role in reducing greenhouse gas emissions and enhancing local energy resilience.

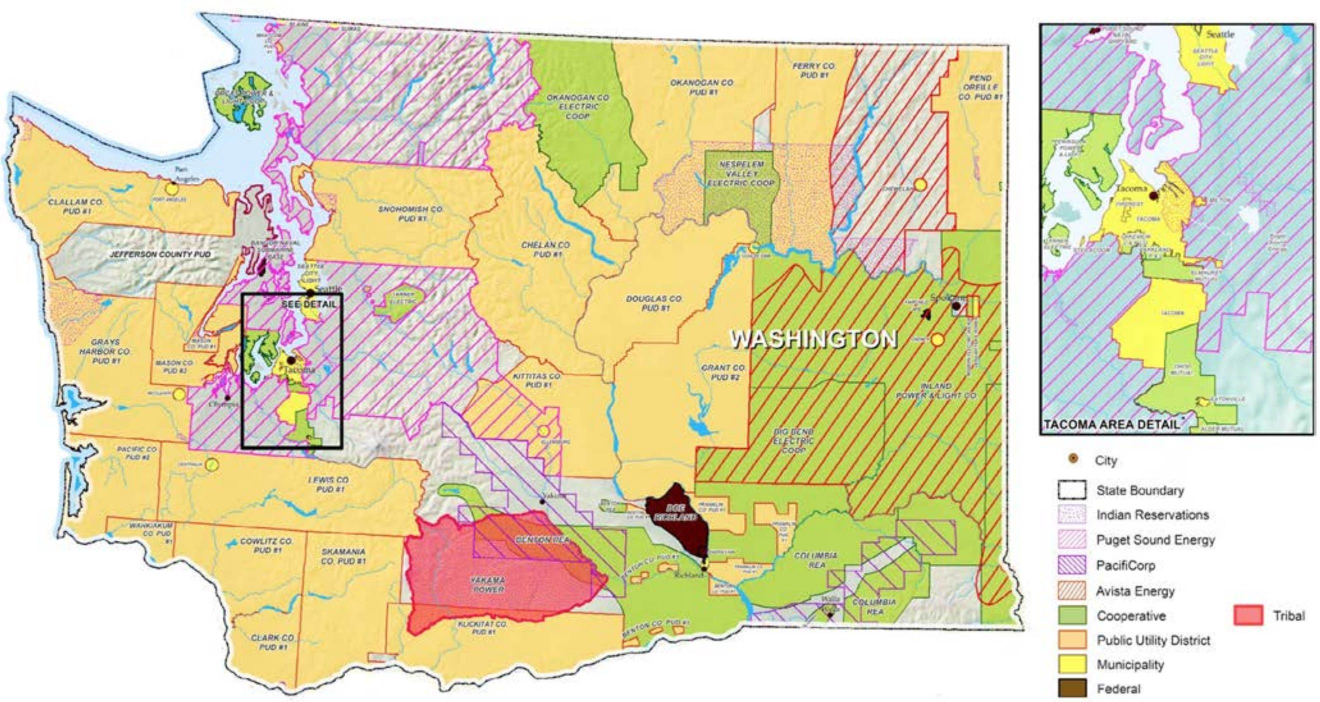


Figure 4. Electric Utility Jurisdictions and Type of Utility (Source: Solar Washington)

Policy Recommendations for Community Solar Development

Several recommendations can be gleaned from existing studies and findings from implementation in other states.

Scale of Projects and Portfolio Approach: Economies of scale in solar project development provide developers of large systems with significantly lower cost per solar panel and for other hardware (inverters, wiring, rack-mounts), as well as soft costs for design, permitting, and financing. All of these savings translate into greater return on investment for larger projects, though corporate-owned community solar systems tend to be fewer than 5 MWac in size (nameplate capacity). Community-owned projects and projects "behind the meter" (owned by and serving individual commercial and residential property owners) tend to be smaller in size than corporate-owned community solar systems. Washington state currently limits community solar certification for incentive payments to systems with a direct current nameplate capacity of no more than one thousand kilowatts (1 MWdc) (RCW 82.16.170). The statute also includes a secondary definition of a "community solar project," limited to those with "a direct current nameplate capacity that is greater than 12 kilowatts but no greater than 199 kilowatts, and … at least two subscribers or one low-income service provider subscriber" (RCW 82.16.170 (3)).

Recommendations to overcome this hurdle include the adoption of a portfolio approach to project development, and changing regulations to allow for larger generation capacities (Heeter et al., 2021). Such changes provide the following benefits: (1) achieving cost efficiencies through bulk equipment purchases, (2) building the skills and knowledge necessary to lower installation expenses, and (3) distributing overhead and soft costs across a larger number of megawatts of energy capacity, improving overall cost-effectiveness (Heeter et al., 2021). For example, in 2018, New York State expanded its community solar project cap from 2 MW to 5 MW (New York Expands Solar Access With Larger Community Projects, 2018), and annual community solar growth leaped from 9.84 MW in 2018 to 184.87 MW in 2019 (Xu et al., 2024). Of course, policy changes in other aspects can contribute to such growth, but increasing the capacity limit is undeniably one of the most important incentives.

Project Coordination and Site Location: Educating communities on the benefits of community solar projects and involving them in the decision-making process is important, as it can contribute to the public awareness and participation necessary to make opt-in programs successful. Coordination with utilities and city officials is essential, especially in early project phases to avoid delays. Strong engagement among interested parties is needed to address educational and coordination gaps (Case et al., 2024). For corporate-owned community solar, much of this coordination occurs between the third party, the utilities, and the local authorities. Yet, public engagement remains a significant portion of the effort that leads to success in any opt-in energy program.

Standardizing Interconnection Cost Sharing: Energy storage has been historically viewed as an expensive and more questionable investment than renewable energy generation, though the two operate in tandem, increasing the returns for one another. Studies propose standardizing cost-sharing mechanisms and recognizing grid performance benefits from large-scale energy storage systems (Hirsh Bar Gai et al., 2021). Energy storage costs in the form of battery systems have been declining in the US over time, with some of the more significant forms of energy storage, such as pumped hydroelectric storage, also used in Washington state. Storage has become a strategic tool to bolster the grid, serve rapidly rising energy demands, and enhance the value of renewable energy projects. Such investments in storage in strategic locations across the state can bolster local utilities' capacity to resiliently tie in to community solar systems. For example, in August 2023, New York launched its first state-owned utility-scale battery energy storage project, a 20 MW facility operated by the New York Power Authority. Located in a region where over 80% of electricity comes from renewable sources—including the 800 MW St. Lawrence-Franklin D. Roosevelt hydropower project and 650 MW of wind generation—the facility stores and releases power during periods of peak demand. This integration enhances grid stability, reduces congestion, and supports renewable energy adoption, enabling community solar projects to contribute more effectively to the power system (American Public Power Association, 2023; Bery et al., 2024).

Create Long-term Incentive Structures: Markets benefit from stability, and this includes reliable signals that allow participants to manage expectations for incentives from governmental programs. To create a stable and sustainable market for community solar and energy storage projects, incentive programs should be designed with long-term predictability, avoiding sudden funding cutoffs. Programs like NYSERDA's NY-Sun MW Block structure provide a helpful example, as they offer developers clarity on step-down incentive levels, enabling improved planning and investment decisions. A similar approach should be applied to energy storage incentives, ensuring gradual, transparent reductions instead of abrupt funding cutoffs once budgets are exhausted. Regular evaluations and adjustments of incentive programs are essential to maintain their effectiveness and avoid market volatility (Case et al., 2024).

Improve Bill Transparency: An essential component of any effort to scale up community solar involves introducing consolidated billing or net crediting, which integrates community solar credits directly into utility bills, allowing consumers to see their expenses and savings from community solar participation clearly and transparently. However, lessons learned from a recent NREL report also suggest that consolidated bill implementation can be complex and will need careful consideration of financial, technical and administrative factors (Sandler et al., 2024). To further enhance clarity and accessibility, utilities and stakeholders could collaborate with subscribers (e.g., conduct focus groups with potential commercial and residential subscribers) to identify sources of confusion and develop simplified, user-friendly billing statements. This approach will improve customer understanding, build trust, and support greater adoption of community solar programs (Case et al., 2024). If implemented appropriately, the consumer will see and the utility will maintain records that show the flow of every dollar spent and received by the corporate owner of solar, the utility, and the consumer. Such record-keeping is not unusual for utilities, and it facilitates reporting for regulatory purposes.

II - METHODOLOGY AND ASSUMPTIONS

This report presents a review of the literature (above), recommendations (above), the results of a survey of corporations pertinent to community solar costs and potential in Washington state, and an analysis estimating the economic effect of improving the enabling environment for corporate-owned community solar investment in Washington state.

This section of the report describes the methods used to conduct the survey and describes the inputs generated from survey results that we then incorporated into our economic impact analysis. To conduct the economic impact analysis, we relied on a widely-used set of software, developed by a team from the University of Minnesota and funded by public agencies such as USFS and FEMA, known as IMPLAN. The choice and use of the IMPLAN model is discussed in the opening of the next section of this report. To see the results of the economic impact analysis, advance to the next section of the report.

Survey Instrument

We developed a survey instrument to collect information about current market conditions for Washington state, from the membership of CCSA and solar developers with a presence in the state of Washington. We asked the respondents to recall a recently completed community solar project most likely to resemble the kind of community solar projects they would consider developing in the state of Washington, if they haven't developed the project in Washington already.

Although the survey sample size was very small (N=9), limiting statistical analysis, it provided measures of actual costs of community solar facilities internal to solar developers, and survey respondents elaborated on these costs across the various phases of project development. This type of data is not typically available to the public; pricing information is widely available, while the cost borne by developers is typically held private. Of the projects identified in the survey, three came from Washington, four from Illinois, one from New York, and one from Minnesota. Six respondents provided information for projects over 1 MWac capacity and, as would be expected due to Washington state restrictions, the three respondents in Washington provided details about community solar projects that are below 1 MWac.

The findings in this study are derived from using the survey results cited here, to model three scenarios for the construction of corporate-owned community solar facilities across the state of Washington. Each modeled facility represents a 1 MWac (megawatt alternating current) unit. A 1 MWac solar facility can generate enough electricity to power approximately 111 homes in Washington (SEIA, n.d.). At today's level of energy consumption, about 28,000 MWac (28 gigawatts ac) would be needed to provide the electricity needs of the 3.1 million households in Washington state. The three scenarios run for this report forecast the effect of providing an additional 60 MWac, 220 MWac, and 500 MWac, of corporate-owned community solar in Washington state, through incremental project development over a 10 year period. Thus the maximum amount of community solar modeled here represents just under 2% of the residential electricity currently needed and supplied in the state.

Land Acquisition Costs

Rooftop solar arrays were in our survey responses, alongside ground-mounted solar projects. However, due to a lack of available rooftop lease pricing data and the potential size limitations of rooftop installations, our modeling of economic impact focuses exclusively on solar projects mounted on the ground.

A recent study by NREL provides land use benchmarks of approximately 3.57 acres per MWac for fixed-tilt systems and 5.56 acres per MWac for tracking systems. We note that community solar systems that include tracking tend to track on a single axis. These benchmarks are derived from the study's recommendations of 0.28 MWac per acre (0.69 MWac per hectare) for fixed-tilt systems and 0.18 MWac per acre (0.45 MWac per hectare) for tracking systems (Bolinger & Bolinger, 2022). The CCSA Policy Guidebook reported slightly higher land use requirements, providing a more conservative estimate, "Each MW typically requires about 5–7 acres of land or approximately 70,000–100,000 square feet of commercial/industrial rooftop space" (CCSA, 2024).

Recognizing that land requirements per MWac can vary by latitude (Bolinger & Bolinger, 2022), we also analyzed data from the US Large-Scale Solar Photovoltaic Database (USGS) for projects in Washington State completed after 2019 (United States Large-Scale Solar Photovoltaic Database - ScienceBase-Catalog, n.d.). This analysis yielded an average land requirement of 5.12 acres per MWac on average. The average amount of land for fixed-tilt systems was 4.68 acres per MWac, and for single axis tracking systems it was 5.41 acres per MWac.

Based on these findings, we adopt a conservative assumption of 5.12 acres per MWac for estimating land lease revenue. This assumption reflects the average land requirement derived from actual project data in Washington state.

Given that all ground-mounted solar projects in our sample are located on agricultural or open land, we have based our land lease cost estimates on farmland rental prices. Farmland rates can vary significantly depending on the year, type of land, and regional factors. According to data from the National Agricultural Statistics Service (NASS), the monthly rental price for farmland in 2023 ranges from $76 to $440 per acre, with an average of $238 per acre (NASS, 2024). Applying this average to an estimated land requirement of 5.12 acres per MWac, the potential annual rental revenue ranges from approximately $389 to $2,252 per MWac.

Since our sample indicates relatively high land lease costs, we adopt the upper estimate of $2,252 as a conservative estimate for the annual land lease price for 1 MWac of electricity produced. For the purposes of this analysis, we assume that lease payments will increase along with inflation at a 2.5% rate.

It is important to note that farmland lease rates are subject to fluctuation, influenced by factors such as interest rates, market conditions, and the demand for agricultural commodities. These lease prices and the willingness of property owners to participate will also be highly influenced by the ability of farmers to continue to benefit from agricultural production on the same property that houses the solar systems, as in an "agrisolar" configuration of farming activities with solar infrastructure systems (AgriSolar Clearinghouse, 2024). However, our model will not consider those fluctuations.

Construction Costs

The cost or value of construction is a key variable in studies of economic impact. Construction costs for solar installations can be categorized into three main components: materials and equipment costs, labor costs, and other setup costs (including permitting, office work, and fieldwork). The US National Renewable Energy Lab (NREL) provides cost estimates in this way, and in aggregate for total cost per kWdc. NREL provides cost estimates for residential, community level and utility scale solar systems (Ramasamy et al., 2023). We compare NREL aggregate costs for solar and solar with storage at appropriate scale to the construction costs accrued from our survey results. This activity offers a way to validate our results, providing a test of quality assurance.

Figure 5 compares construction costs from UW survey results to NREL's 2023 benchmarks for U.S. community-level solar projects. As shown by NREL, costs are higher for solar with storage systems compared to solar-only systems. The minimum sustainable price (MSP) for solar-only systems has the lowest total cost at $1,489 per kWdc, while the modeled market price (MMP) for solar with storage has the highest total cost at $2,944 per kWdc. Minimum sustainable price (MSP) is modeled at the lowest prices at which product suppliers can remain financially solvent in the long term, based on input costs that represent the lowest prices each input supplier can charge to remain financially solvent in the long term (Ramasamy et al., 2023, Table 2). Modeled market price (MMP) estimated bottom-up overnight capital costs (i.e., cash costs) of representative PV and storage components under market conditions experienced during the analysis period' (Ramasamy et al., 2023, Table 2).

NREL uses kilowatts of direct current (kWdc) whereas our study uses kilowatts of alternating current (kWac). Given the losses that accrue from converting from direct to alternating current, and the inverter loading ratio (ILR) used by NREL, we multiplied the cost of $/kWdc from NREL by 1.34 to obtain cost per kWac. The resulting NREL MMP is $2,360/kWac for solar-only systems, and $3,945/kWac for solar with storage systems. As shown in the fifth group in the figure, UW survey results suggest an average construction cost of $3,009/kWac, which falls within the range of the NREL modeled market price (MMP) for solar only and solar with storage.

This validation of survey results allowed the UW team to rely on our own survey results in modeling the economic impact of community solar for the state of Washington. In terms of methods, this means that UW survey results were the main inputs the team used for the IMPLAN economic modeling software. There are two reasons why our own survey results were used. First, our sample average is a mixture of solar-only and solar with storage systems. This reflects, more accurately, the likely system characteristics of future community solar projects in Washington state. Second, our data contains samples from Washington while the NREL benchmarks are not tailored to Washington state. Labor costs, interconnection fees, transmission lines, permitting fees, and taxes can vary greatly depending on local and regional factors. In general, Washington has higher labor costs than the national average (Employer Costs for Employee Compensation for the Regions – June 2024, 2024). Our sample is generally higher in terms of the electrical balance of system (EBOS), structural balance of system (SBOS), inverter, and modules. Thus using UW survey results may allow this study to more closely reflect real market conditions rather than theoretical model predictions.

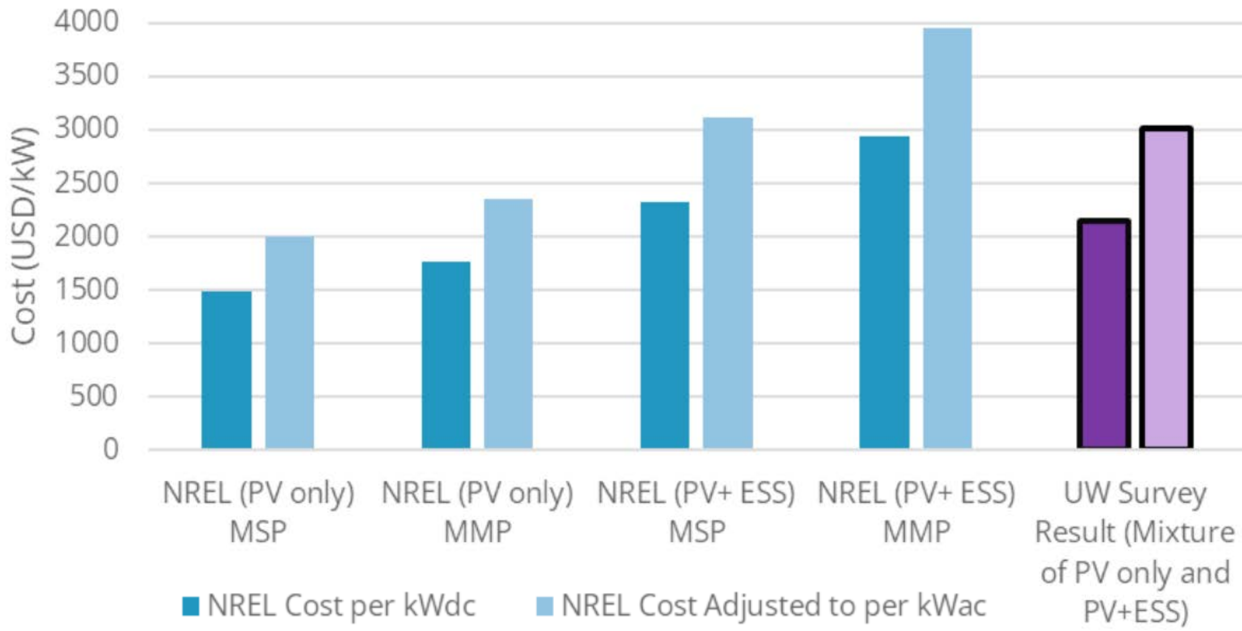


Figure 5: Cost Comparison with NREL Benchmark Costs. *This figure compares costs against the National Renewable Energy Laboratory (NREL) benchmark values (Ramasamy et al., 2023). Key terms include PV (photovoltaic), ESS (electricity storage system), MMP (modeled market price) and MSP (minimum sustainable price). Survey results collected by the University of Washington team are shown on the far right, in kWdc and kWac, for ease of comparison to NREL cost benchmarks. The survey was designed to provide MMP measures, and results show 11% of kWac accompanied by ESS.*

Operation and Maintenance Costs

In general, annual maintenance and operation of solar systems requires fewer employees and a small fraction of expenses compared to construction. Annual operation and maintenance costs include material and equipment replacement costs (e.g., solar panels tend to outlive inverters, thus the lifespan of a solar system likely includes at least one round of replacement of inverters), worker compensation, taxes and fees, lease payments, and administrative costs. Due to the proprietary nature of the data received in our UW survey, we cannot disclose the survey responses in detail, but instead provide aggregate results. Maintenance and operations are assumed to continue until the end of the project life, which in today's market is typically 25 years under warranty. Compiling all data provided by survey respondents and average subscription costs provided by NREL (Ramasamy et al., 2023), the estimated annual cost of asset operation and maintenance is $36,000, and the subscription management cost is $12,380 per MWac per year. The total annual operation, maintenance and management cost is assumed to be $48,380 for 1 MWac of community solar.

10 Year Timeline

To generate an economic impact analysis of expanded community solar access and development, the abovementioned costs were organized according to three scenarios for development over time in Washington state, to be used as inputs to the IMPLAN software system. The timelines for the construction and operation phases are discussed in this section.

The UW team developed three 10-year policy scenarios and assumed that a sustained number of community solar projects would be constructed each year of the ten year period.

- **Scenario 1** assumes business-as-usual average growth rate of 6 MW of community solar added annually over the following 10 years.
- **Scenario 2** assumes conservative policy-driven growth, adding 22 MW of community solar projects annually over the following 10 years.
- **Scenario 3** assumes ambitious policy-driven growth adding 50 MW of community solar projects annually over the following 10 years.

As described further in the next section of this report, for each 10-year scenario, construction, land lease, operation and maintenance, and subscription management costs were applied to the IMPLAN model for each solar project. Given that community solar projects are generally under the 5 MW size, we assume a linear relationship between community solar size and costs.

Inflation and Discounting

A final set of assumptions needed for economic impact analysis includes factors for discounting/interest and inflation/deflation. Our analysis assumes that the real spending and cost of a 1 MW solar project will remain consistent over the next 10 years. However, there are two important factors to be considered: inflation, which suggests that costs of goods and services will increase over time, and the discount rate, which is the preference for current dollars over future dollars.

The inflation rate we apply is 2.5%, and the discount rate we apply is 5%. Both the inflation and discounting are calculated in UW's own model using Excel.

III – ECONOMIC IMPACT ANALYSIS

One of the most common methods of economic impact analysis is input-output analysis. It is a technique widely used to rely on historical data to statistically analyze the likely effects of changes in the economy. Researchers and policymakers rely on this form of analysis to see how changes in one part of the economy can affect other parts of the economy. These models grow in their value over time. If they are well-maintained and updated, they can be used to see what the economic impact would be of increased spending or employment in particular sectors.

One popular online model that embodies this technique is IMPLAN (https://implan.com/). Developed by researchers from the University of Minnesota, it is an accessible online input-output economic model for the US economy. The IMPLAN model is widely used to analyze the economic impact in various fields, such as the energy sector, education, public health, forestry, etc (Bae & Dall'erba, 2016; Chi, 2018; Meghea et al., 2021; Parajuli et al., 2018). Active since 2001, the model contains some 500 industries with many indicators, all updated annually:

- Industry insights include employment, labor income, revenue, intermediate input expenditures, and more.
- Commodity-level data elements include foreign and domestic trade of goods and services, household and government commodity demand, and more.
- Geographic and demographic data elements include household counts by nine household income categories, savings rates, commuting rates, regional GDP, an economic diversity index, and more.
- IMPLAN Cloud's continuously expanding data suite also includes occupation, core competency, and environmental data by industry.

IMPLAN defines three types of impact in its economic model, as illustrated in the following section.

Box 2: IMPLAN Terminology – Impacts

Direct Impact: The initial expenditures or production changes that result from a specific activity or policy. These represent the immediate economic outputs generated by producers or consumers and can have either positive or negative consequences (Charney & Leones, 1997).

Indirect Impact: The business-to-business transactions within the supply chain that occur as a result of the initial industry expenditures. These effects capture the additional economic activity generated as businesses procure goods and services from regional suppliers (Charney & Leones, 1997).

Induced Impact: Induced effects arise from household spending of labor income, excluding taxes, savings, and commuter income. These impacts reflect the economic contributions of employees within the business supply chain as they spend their earnings on goods and services in the local economy (Charney & Leones, 1997).

Our analysis includes each phase of solar project development, with a focus on direct impact and overall impact using the IMPLAN model.

Construction Phase

As noted above, a 1 MWac community solar installation costs an estimated $3.01 million to build. The construction of a 1 MWac community solar project is expected to directly support 22.7 full-time equivalent (FTE) jobs in a year, with 85% of the jobs in the construction industry. The total labor income (including proprietary income) coming from the jobs is estimated to be $1.71 million (including both employee compensation and proprietary income).

That said, economic impacts should take into account both the direct impact and the indirect effects coming from purchasing and expenditure captured by the direct effects. A solar construction company might need to purchase solar panels, and those solar panel manufacturers will need to purchase semiconductor materials, and so on.

When we take into consideration all the direct, indirect and induced effects, we estimate the construction phase of the 1 MWac community solar project will support about 32.6 full-time jobs in a year, generating $2.67 million in employment income (including proprietor income), and contribute $3.79 million to the Gross State Product (GSP).

Impact	Employment (job-year)	Labor Income (million dollars)	Value Added (million dollars)	State Tax (million dollars)
Direct	22.682	1.794	2.191	0.054
Indirect	3.308	0.364	0.565	0.041
Induced	6.634	0.508	1.030	0.067
Total	32.625	2.666	3.786	0.162

Table 1: Economic Impact of the Construction Phase of a 1 MWac Community Solar Project in Washington state (Present Value, 2023 dollars)

Operation and Maintenance Phase

The operation and maintenance phase of a 1 MWac community solar facility requires significantly fewer materials, equipment, and labor compared to the construction phase. Our analysis estimates that operating a 1 MWac community solar facility directly supports 0.1 full-time equivalent jobs per year.

When accounting for direct, indirect, and induced impacts, the total annual contribution to the Washington state economy is projected to be $42,000, including $20,000 in labor income and the support of 0.17 FTE jobs annually.

Impact	Employment (job-year)	Labor Income (million dollars)	Value Added (million dollars)	State Tax (million dollars)
Direct	0.08	0.013	0.028	0.002
Indirect	0.04	0.004	0.007	0.000
Induced	0.05	0.004	0.008	0.001
Total (annual)	0.17	0.020	0.042	0.002

Table 2: The Annual Economic Impact of the Operation Phase of a 1 MWac Community Solar Project in Washington state (Present Value in 2023 dollars)

Table 3 illustrates the overall economic impact of a 1 MWac community solar project. Over 25 years of maintenance and operation, a 1 MWac community solar project can generate approximately 36.79 job-years, contribute $3.05 million to labor income, and add $4.59 million to the Gross State Product (GSP) (Present Value, 2023).

Project Year	Employment (job-year)	Labor Income (present value in million dollars)	Value Added (present value in million dollars)	State Tax (present value in million dollars)
Construction Phase (Year 0)	32.62	2.67	3.79	0.162
Operation Phase (Year 1-25)	4.16	0.38	0.80	0.047
Total	36.79	3.05	4.59	0.21

Table 3: 1 MWac Community Solar Economic Impact in Washington state over the Project Lifespan (25 years, Present Value in 2023 dollars)

Tax Generation

The construction phase of a 1 MWac project is estimated to generate $0.16 million in state tax and $0.63 million in federal tax. In the operation and maintenance phase, each 1 MWac community solar facility will generate $2,479 in state tax and $5,423 in federal tax annually. It should be noted that the tax income from IMPLAN is a rough estimate, which does not account for the tax credits or incentives.

Aggregation Over Time

The previous sections outline the economic impact of a single 1 MWac community solar project during construction and operation in current dollars (2023). We now shift focus to the aggregated economic impact of construction and operations under the three policy scenarios over the next 10 years. All dollar values incorporate an assumed inflation rate of 2.5% and a discount rate of 5%. The economic impact of different scenarios can be found in Table 4.

Scenario	Total Name-plate Capacity over 10 years (MWac)	Employment (job-year)	Labor Income (present value in million dollars)	Value Added (present value in million dollars)	State Tax (present value in million dollars)	Lease Payment (present value in million dollars)
Scenario 1	60	1,999	148.31	213.73	9.31	0.56
Scenario 2	220	7,331	543.82	783.67	34.14	2.05
Scenario 3	500	16,521	1,225.51	1,760.74	76.49	4.66

Table 4: Summary of Scenarios for the Economic Impact of Community Solar in Washington State over the Next 10 Years (Present Value in 2023 dollars)

Over the 10-year period, under the first scenario (business as usual), 60 MWac of community solar construction and operations generates 1,999 job-years, equivalent to 200 full-time jobs annually. This activity is expected to produce $148.31 million in labor income and contribute $213.73 million to the state's GSP. Additionally, the state is estimated to collect $9.31 million in state tax revenue from the construction and operation of community solar facilities under this scenario. Landowners would receive 0.56 million in lease income.

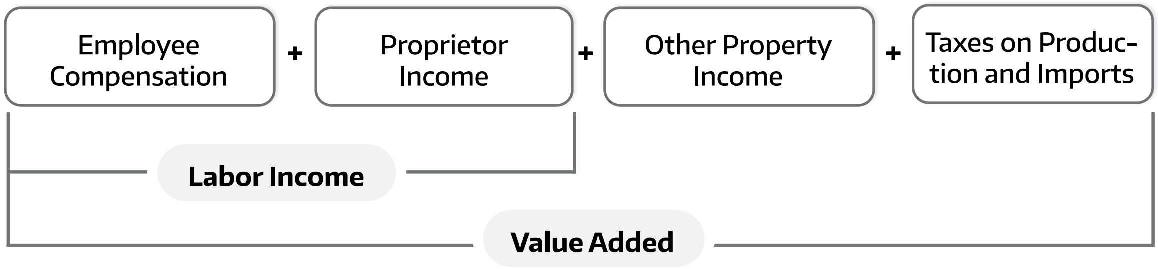
With the implementation of the second scenario, the economic impact increases at an improved but conservative rate. Over the next decade, 220 MWac of community construction and operations are anticipated to support 7,331 job-years, translating to approximately 733 full-time

Box 3: IMPLAN Terminology - Value Added (Understanding Output, 2019)

Value Added

Value Added measures an industry's contribution to GSP. It represents the difference between the total value of its output and the cost of the inputs it uses. It includes three main components:

- Labor Income (LI): Wages, salaries, and proprietor income.
- Other Property Income (OPI): Income from assets like rent or dividends.
- Taxes on Production and Imports (TOPI): Taxes minus any subsidies.



jobs annually. This scenario is projected to generate $543.82 million in labor income and contribute $783.67 million to GSP. Furthermore, state tax revenue from these activities is expected to total $34.14 million. For landowners who leased the land to community solar, $2.05 million of lease income is estimated to accrue.

Under the third scenario with more aggressive policy incentives, the economic impact reaches higher levels. Over 10 years, 500 MWac of community construction and operations are estimated to create 16,521 job-years, equivalent to 1,652 full-time jobs annually. This would result in $1.23 billion in labor income and a contribution of $1.76 billion to the state's GSP. State tax revenue generated for the state under this scenario is projected to be approximately $76.49 million. Farmers and landowners benefit from community solar with $4.66 million in lease payments.

Over time, the economic impact of community solar projects will be most pronounced during the construction phase. Figure 6 illustrates the employment changes for these three scenarios of improved community solar development over 35 years. During the construction phase, the 500 MWac scenario is projected to generate over 1,600 jobs annually. However, the operation and maintenance phases will also continue to contribute to the local economy and employment. During the maintenance phase, it is estimated that an average of 78 jobs will be generated annually. By the 26th year, the first batch of installed panels will start to reach the end of their lifespan. This study does not account for economic activities resulting from the refurbishing or replacement of these community solar projects, though it is important to note that the reliable and useful life of solar systems has been shown to extend for decades beyond the period of the manufacturer's warranty, and this includes additional returns on investment over time and a positive resale value at the end of the warranty period.

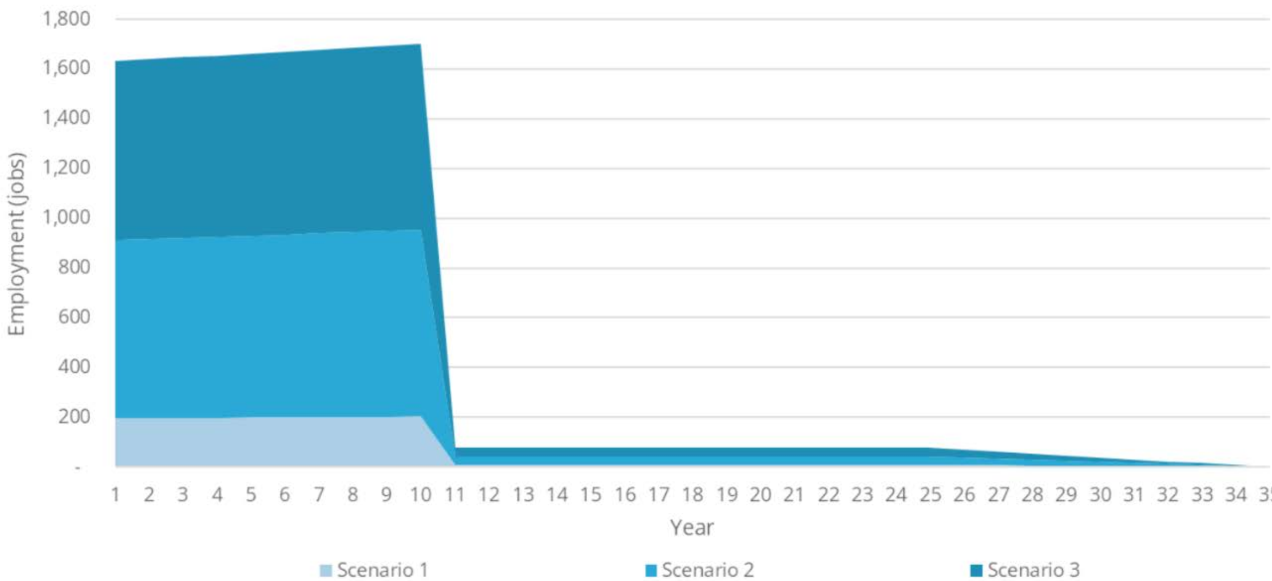


Figure 6: Economic Contribution to Employment over 35 Years (Note that this visual only considers 10 years of construction and extends beyond this term for an additional 25 years of operation of facilities under warranty)

IV – CONCLUSION

Improvements to the enabling environment for corporate-owned community solar in Washington state could contribute significantly to the state and local economy.

If we continue the **business-as-usual approach** to community solar development, the state will only accrue another 60 MWac of these facilities over the next 10 years creating 200 jobs annually, generate $148.31 million in labor income, and contribute $213.73 million to the gross state product (GSP).

A **modest policy scenario** could substantially improve these outcomes, offering 220 MWac, to reach 733 jobs annually, and $543.82 million in labor income, with $783.67 million added to the gross state product (GSP).

If Washington state were to produce **a policy scenario to emulate the growth observed in other states**, such as New York, Minnesota, Massachusetts, and Illinois, Washington state could observe the development of 500 MWac of additional community solar over the next 10 years, creating 1,652 jobs annually, generating $1.23 billion in labor income, and adding an estimated $1.76 billion to the gross state product (GSP). Additionally, such development could yield $74.9 million in state tax revenues and provide $4.66 million in lease payments to farmers and rural landowners.

Beyond financial savings, corporate-owned community solar projects offer a wide range of benefits, particularly for residential and low-income subscribers. These subscribers typically save 10%-15% on their electricity bills, with low-income participants saving up to 20%. Mandating a specific percentage of residential or low-income subscribers can improve equitable access to these savings. Community solar can become instrumental in supporting underserved populations, such as renters and low-income households, who face barriers to access traditional on-site solar solutions.

In addition to its economic and social benefits, community solar can significantly contribute to Washington's environmental objectives by reducing greenhouse gas emissions. Collectively, the 3.1 million households in this state are on track to produce an estimated 3.4 trillion gCO2eq of emissions each year, as long as 18% of their electricity continues to be sourced from natural gas, with lifecycle emissions from natural gas at 486 gCO2eq/kWh (Coleman & Nichols, 2021; Nicholson & Heath, 2021). Community solar has the potential to reduce this figure, now and into the future, to the extent that it can replace natural gas with solar as a source of residential electricity. With some utilities in the state still operating with high carbon intensities—reaching as high as 641.95 gCO_2e/kWh (178.32 gCO_2e/MJ), nearly three times as the state-wide average (Utility-Specific Carbon Intensity of Electricity, 2023)—community solar can help lower the carbon footprint of electricity in these regions. Community solar projects can also enhance grid reliability and resilience by integrating solar energy and storage solutions, reducing the need for costly infrastructure upgrades while supporting the broader adoption of renewables.

There is a latent demand in Washington state for community solar, including corporate-owned community solar, that may be prompted by enabling legislation. Developers surveyed and existing studies refer to legislative and policy barriers—such as a lack of consolidated billing with itemized community solar subscription expenses and credits, the need for robust credit rates, the presence of restrictive program caps, and inconsistent siting and permitting guidelines. Under existing systems in Washington state, separate bills made it complex for consumers to understand and navigate the benefits of community solar. As one developer noted, successfully managing these projects involves navigating additional red tape, longer timelines, and securing funding and subscribers, which demands a dedicated approach. Traditional wholesale models often fall short for community solar due to revenue volatility.

Other states across the US offer a roadmap for overcoming these hurdles with enabling legislation, to experience rapid growth in corporate-owned community solar, paving the way for a subsequent increase in community-owned solar. Corporate developers of community solar take on the risk of high interconnection costs, lengthy review and permitting processes, and project financing. They can press forward with utilities and government entities to ensure the needs of the public for clear and transparent billing and robust benefits from these systems, growing the market and making the results sustainable over time.

We note several actionable policies that can be utilized to accelerate community solar development:

1. Expand the capacity limitations of community solar projects to allow for economies of scale;
2. Educate communities on the benefits of community solar projects and involve them in the decision-making process;
3. Standardize interconnection cost-sharing;
4. Create a long-term incentive structure with consideration for gradual and clearly defined incentive levels, if such programs are needed; and
5. Improve billing transparency through consolidated billing, net crediting, or other alternatives.

In conclusion, Washington state has the opportunity to establish rapid and sustained community solar development by implementing thoughtful, forward-looking policies and fostering collaboration among stakeholders. This will not only advance the state's clean energy transition but also contribute to a variety of economic, social, and environmental benefits.

BIBLIOGRAPHY

AgriSolar Clearinghouse. (2024, December 11). https://www.agrisolarclearinghouse.org/

American Public Power Association. (2023). NYPA Utility-Scale Battery Energy Storage Project is Now Operating. https://www.publicpower.org/periodical/article/nypa-utility-scale-battery-energy-storage-project-now-operating

Aznar, A. Y., & Gagne, D. A. (2018). Low-Income Community Solar: Utility Return Considerations for Electric Cooperatives (No. NREL/TP--7A40-70536, 1432761; p. NREL/TP-7A40-70536, 1432761). http://www.osti.gov/servlets/purl/1432761/

Bae, J., & Dall'erba, S. (2016). The economic impact of a new solar power plant in Arizona: Comparing the input-output results generated by JEDI vs. IMPLAN. Regional Science Policy & Practice, 8(1–2), 61–73. https://doi.org/10.1111/rsp3.12073

Bery, S., Gunn, W., Mahieu, A., McLaughlin, M., Snider, M., & Vargas-Weil, D. (2024). Comparative Analysis of U.S. Community Solar Initiatives:

Bolinger, M., & Bolinger, G. (2022). Land Requirements for Utility-Scale PV: An Empirical Update on Power and Energy Density. IEEE Journal of Photovoltaics, 12(2), 589–594. IEEE Journal of Photovoltaics. https://doi.org/10.1109/JPHOTOV.2021.3136805

Case, T., Leifer, D., Reilly, L., Reisman, R., & Sweeney, E. (2024). Community Solar and Community Solar+Storage: A Roadmap of Barriers and Solutions for Commercial Systems in NYC (No. NREL/SR--7A40-90019, 2377973, MainId:91797; p. NREL/SR--7A40-90019, 2377973, MainId:91797). https://doi.org/10.2172/2377973

CCSA. (2024). Policy Guidebook—Expanding Solar Access Thourgh Informed Policy Decisions. https://communitysolaraccess.org/wp-content/uploads/Policy-Guidebook_2024.pdf

Charney, A. H., & Leones, J. (1997). IMPLAN's Induced Effects Identified Through Multiplier Decomposition. Journal of Regional Science, 37(3), 503–517. https://doi.org/10.1111/0022-4146.00066

Chi, Y. N. (2018). Scenario Economic Impact Analysis of Offshore Fishing Tournaments in Ocean City. International Journal of Business, Economics and Management, 5(5), 128–134. https://doi.org/10.18488/journal.62.2018.55.128.134

Coleman, L., & Nichols, C. (2021). Solar HBCU Innovation in Microgrids & Resiliency with Solar + Storage (No. NREL/SR--7A40-90011, 2394636, MainId:91789; p. NREL/SR-7A40-90011, 2394636, MainId:91789). https://www.osti.gov/servlets/purl/2394636/

Department of Energy. (n.d.). Community Solar Basics. Energy.Gov. Retrieved December 23, 2024, from https://www.energy.gov/eere/solar/community-solar-basics

Department of Energy. (2024). Community Solar Market Trends. Energy.Gov. https://www.energy.gov/communitysolar/community-solar-market-trends

EIA. (2024a). Electric Power Annual—U.S. Energy Information Administration (EIA). https://www.eia.gov

EIA. (2024b). U.S. Energy Information Administration—EIA - Independent Statistics and Analysis. https://www.eia.gov/state/analysis.php?sid=WA

Electricity Cost in Washington: 2024 Electric Rates. (2024). EnergySage. https://www.energysage.com/local-data/electricity-cost/wa/

Employer Costs for Employee Compensation for the Regions – June 2024. (2024). Bureau of Labor Statistics. https://www.bls.gov/regions/southwest/news-release/employercostsforemployeecompensation_regions.htm

Gui, E. M., Diesendorf, M., & MacGill, I. (2017). Distributed Energy Infrastructure Paradigm: Community Microgrids in a New Institutional Economics Context. Renewable and Sustainable Energy Reviews, 72, 1355–1365. https://doi.org/10.1016/j.rser.2016.10.047

Heeter, J., Sekar, A., Fekete, E., Shah, M., & Cook, J. (2021). Affordable and Accessible Solar for All: Barriers, Solutions, and On-Site Adoption Potential (No. NREL/TP--6A20-80532, 1820098, MainId:43734; p. NREL/TP--6A20-80532, 1820098, MainId:43734). https://doi.org/10.2172/1820098

Hirsh Bar Gai, D., Shittu, E., Attanasio, D., Weigelt, C., LeBlanc, S., Dehghanian, P., & Sklar, S. (2021). Examining community solar programs to understand accessibility and investment: Evidence from the U.S. Energy Policy, 159, 112600. https://doi.org/10.1016/j.enpol.2021.112600

Hoesch, K. W., Bessette, D. L., & Bednar, D. J. (2024). Locally Charged: Energy Justice Outcomes of a Low-Income Community Solar Project in Michigan. Energy Research & Social Science, 113, 103569. https://doi.org/10.1016/j.erss.2024.103569

Meghea, C. I., Montgomery, B. W., Ellington, R., Wang, L., Barajas, C., Lewis, E. Y., Yeary, S. T., Van Egeren, L. A., & Furr-Holden, D. (2021). An NIH investment in health equity—The economic impact of the Flint Center for Health Equity Solutions. BMC Public Health, 21(1), 1774. https://doi.org/10.1186/s12889-021-11795-5

Millstein, D., O'Shaughnessy, E., & Wiser, R. (2024). Climate and air quality benefits of wind and solar generation in the United States from 2019 to 2022. Cell Reports Sustainability, 1(6). https://doi.org/10.1016/j.crsus.2024.100105

NASS. (2024). Press Release.

New York Expands Solar Access With Larger Community Projects. (2018). SEIA. https://seia.org/blog/new-york-expands-solar-access-larger-community-projects/

Nicholson, S., & Heath, G. (2021). Life Cycle Greenhouse Gas Emissions from Electricity Generation: Update. NREL.

NREL. (2022). Community Solar Barriers, Project Models, and Considerations for Multifamily Affordable Housing. https://www.nrel.gov/docs/fy22osti/82966.pdf#page=1.00&gsr=0

O'Shaughnessy, E., Dong, S., Cook, J. J., Cruce, J., Ardani, K., Fekete, E., & Margolis, R. (2022). Effects of local permitting and interconnection requirements on solar PV installation durations. Energy Policy, 161, 112734. https://doi.org/10.1016/j.enpol.2021.112734

Parajuli, R., Henderson, J. E., Tanger, S., Joshi, O., & Dahal, R. (2018). Economic Contribution Analysis of the Forest-Product Industry: A Comparison of the Two Methods for Multisector Contribution Analysis Using IMPLAN. Journal of Forestry, 116(6), 513–519. https://doi.org/10.1093/jofore/fvy047

Ramasamy, V., Zuboy, J., Woodhouse, M., O'Shaughnessy, E., Feldman, D., Desai, J., Walker, A., Margolis, R., & Basore, P. (2023). U.S. Solar Photovoltaic System and Energy Storage Cost Benchmarks, With Minimum Sustainable Price Analysis: Q1 2023. Renewable Energy.

Rennert, K., Errickson, F., Prest, B. C., Rennels, L., Newell, R. G., Pizer, W., Kingdon, C., Wingenroth, J., Cooke, R., Parthum, B., Smith, D., Cromar, K., Diaz, D., Moore, F. C., Müller, U. K., Plevin, R. J., Raftery, A. E., Ševčíková, H., Sheets, H., … Anthoff, D. (2022). Comprehensive evidence implies a higher social cost of CO2. Nature, 610(7933), 687–692. https://doi.org/10.1038/s41586-022-05224-9

Rickerson, W., Zitelman, K., & Jones, K. (2022). Valuing Resilience for Microgrids: Challenges, Innovative Approaches, and State Needs (No. DOE-NARUC--OE0000818, 1984433, DE-OE0000810; p. DOE-NARUC--OE0000818, 1984433, DE-OE0000810). https://www.osti.gov/servlets/purl/1984433/

Rocky Mountain Institute. (2017). Financing Community-Scale Solar: How the Solar Financing Industry Can Meet $16 Billion in Investment Demand by 2020. https://rmi.org/wp-content/uploads/2017/06/RMI_Financing_Community_Scale_Solar_Insight_Brief_2017.pdf

Sandler, S., Paulos, B., & Harmon, J. (2024). Community Solar Consolidated Billing: An Exploration of Implementation and Alternatives. NREL.

Schmutz, S., & Moog, O. (2018). Dams: Ecological Impacts and Management. In S. Schmutz & J. Sendzimir (Eds.), Riverine Ecosystem Management (pp. 111–127). Springer International Publishing. https://doi.org/10.1007/978-3-319-73250-3_6

SEIA. (n.d.). What's in a Megawatt. SEIA. Retrieved December 2, 2024, from https://seia.org/whats-in-a-megawatt/

Stoel Rives LLP. (n.d.). Tax Issues. Retrieved December 23, 2024, from https://www.stoel.com/insights/reports/the-law-of-solar/tax-issues2

Thakur, P., & Wilson, V. H. (2024). Analysis of barriers affecting the adoption of community solar from consumer's perspective: A hybrid ISM-DEMATEL approach. Energy & Environment, 35(1), 113–141. https://doi.org/10.1177/0958305X221122930

Understanding Output. (2019, September 17). IMPLAN - Support. https://support.implan.com/hc/en-us/articles/360035998833-Understanding-Output

Unite States Census Bureau. (2024). Washington—Census Bureau Profile. https://data.census.gov/profile/Washington?g=040XX00US53

United States Large-Scale Solar Photovoltaic Database—ScienceBase-Catalog. (n.d.). Retrieved December 9, 2024, from https://www.sciencebase.gov/catalog/item/66707f69d34e89718fa3f82f

Utility-Specific Carbon Intensity of Electricity. (2023). Washington State Department of Ecology. https://apps.ecology.wa.gov/publications/documents/2414014.pdf

Waechter, K., O'Shaughnessy, E., Kannan, S., & Burton, R. (2024). Technical Potential and Meaningful Benefits of Community Solar in the United States (No. NREL/TP--6A20-87524, 2308823, MainId:88299; p. NREL/TP-6A20-87524, 2308823, MainId:88299). https://www.osti.gov/servlets/purl/2308823/

Xu, K., Chan, G., & Kannan, S. (2024). Sharing the Sun Community Solar Project Data (December 2023) (p. 1 files) [Dataset]. National Renewable Energy Laboratory - Data (NREL-DATA), Golden, CO (United States); National Renewable Energy Laboratory (NREL), Golden, CO (United States). https://doi.org/10.7799/2320235

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