Designing Place-Based Renewable Energy Infrastructure

Exploring Opportunities and Challenges for the Pacific Northwest Region

Workshop Briefing Document
Workshop Dates: January 10 and 12, 2023

University of Oregon
Pacific Northwest National Laboratory

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Contents

Summary

Rapid deployment of renewable energy and improved energy efficiency are urgently needed to meet the critical global challenge of accelerating the transition to carbon neutrality. Numerous roadblocks exist, however, in siting energy infrastructure in ways that are accepted and supported by neighboring communities. Overcoming these roadblocks will help reduce conflicts among people, agriculture, and wildlife habitat. To accomplish a fair and just transition, tangible local value must be created by new renewable energy infrastructure that harmonizes with other values, such as ecosystem conservation and environmental justice.

The field of landscape architecture, with its inherent attention to place, people, and ecology, provides a valuable lens with which to address this complex set of challenges. In June 2021, an article in *Landscape Architecture Magazine* highlighted the roles of landscape architecture and other design professions in renewable energy transitions.[1] Soon after, the Pacific Northwest National Laboratory (PNNL) noticed this potential and invited the authors to collaborate in writing a white paper investigating future directions for place-based renewable energy infrastructure.[2] Continuing this effort, PNNL is now supporting the University of Arizona and the University of Oregon in hosting two regional workshops to explore innovative design strategies to meet their respective challenges.

This design brief is the guiding document for the U.S. Pacific Northwest regional workshop, to be hosted in virtual form by the University of Oregon on January 10 and 12, 2023. The objectives of this workshop are (i) to identify opportunities and challenges for the Pacific Northwest region, (ii) to explore synergies and tradeoffs in designing place-based renewable energy infrastructure, and (iii) to develop design strategies illustrating the integration of at-scale energy infrastructure into landscapes in the region, supporting existing uses and creating synergistic hybrids where possible.

Audience & Sponsor

We invite landscape architects, design professionals, planners, engineers, non-profit stakeholders, and researchers to join in this workshop, bringing their experience and perspectives to bear in meeting this tremendous challenge and opportunity. The primary purpose of this workshop is to create connections among these groups to enhance the design process, facilitating the development of pace-based renewable energy transitions across large scales. ***Please sign up for the workshop here.***

The Pacific Northwest National Laboratory (PNNL) is a national research laboratory operated by Batelle, Inc. for the United States Department of Energy (DOE), with headquarters in Richland, WA. PNNL has distinctive strengths in chemistry, environmental sciences, biology, national security, data science, and sustainable energy; for more information, please see https://www.pnnl.gov/.

Workshop Objectives

The goal of this workshop is to support participating designers, energy professionals, and local stakeholders in developing and visualizing design strategies for the integration of renewable energy infrastructure into existing landscapes and communities.

In the workshop, we specifically aim (i) to explore opportunities and challenges for place-based energy transitions and (ii) to develop design strategies illustrating the integration of at-scale energy infrastructure into landscapes in the region, responding to local socioeconomic conditions, ecosystem contexts, and existing land uses. The desired outcomes will support the communities and enhance the land uses that currently exist. Participants will explore and develop these design strategies through three case studies, addressing urban, rural, and coastal communities in the state of Oregon. Participants will select one project of interest during pre-workshop registration. The products of this workshop are intended to aid local communities in understanding the benefits and trade-offs that new renewable energy development will bring, ultimately supporting them in adopting localized renewable energy infrastructure that supports their cultures, landscapes, and long-term visions.

By the end of the workshop, participants will have:

- Collaborated with relevant professionals and stakeholders in designing place-based renewable energy landscapes.
- Contributed to building collective knowledge and insights regarding place-based renewable energy infrastructure at landscape and community scales.
- Increased their own understanding of the opportunities and challenges, as well as synergies and trade-offs, involved in designing place-based renewable energy landscapes in the Pacific Northwest.

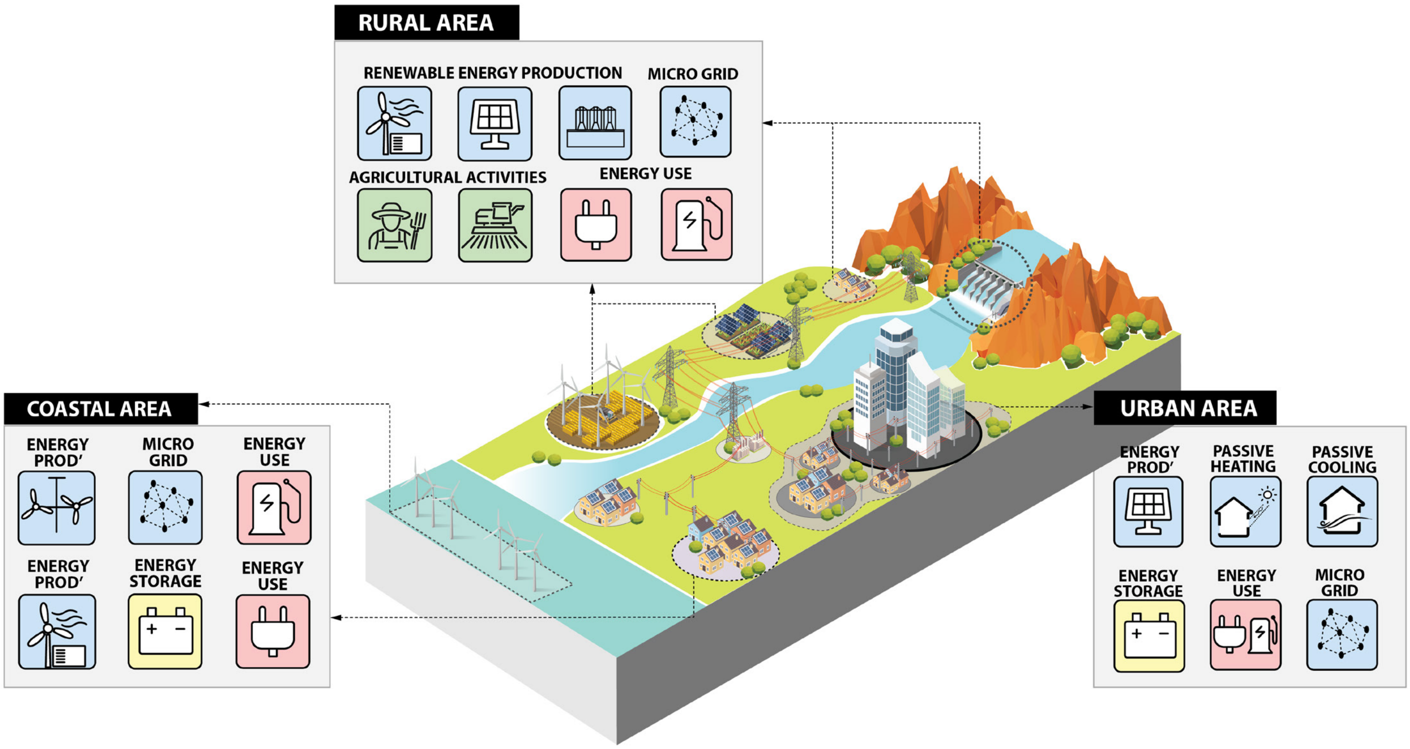


Fig. 1. Renewable energy landscape transect

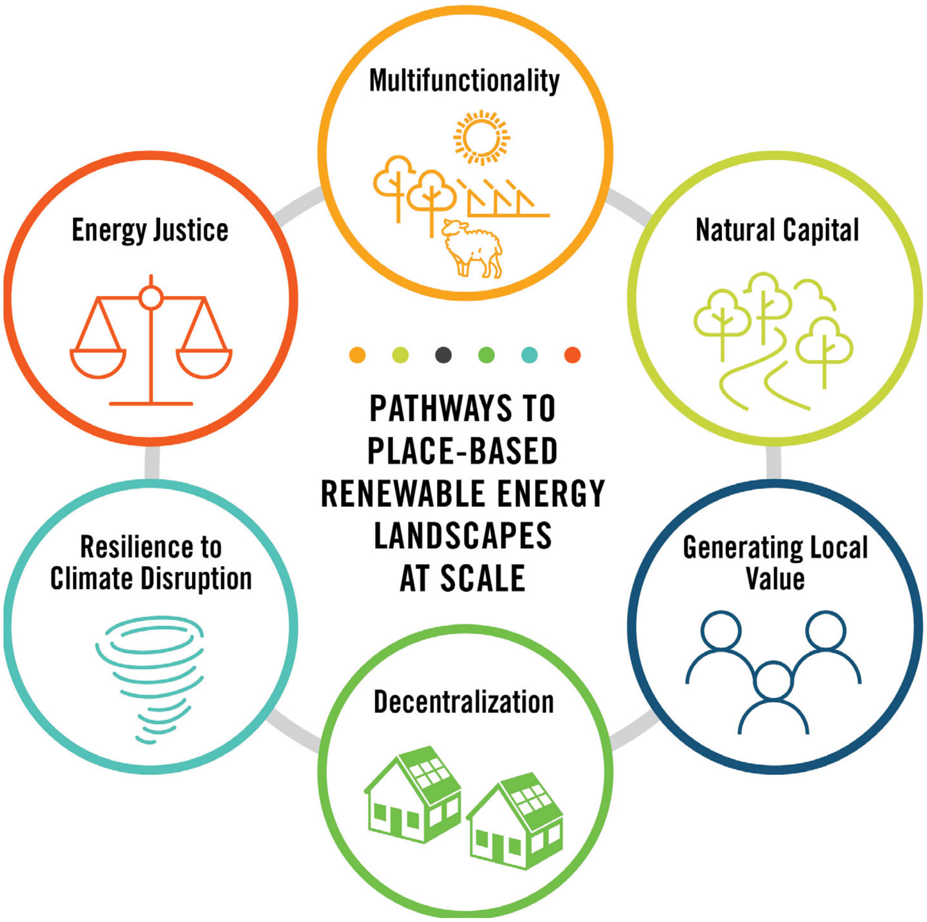


Fig. 2. Renewable energy landscape transect

In this workshop, we will explore six pathways for guiding the development of place-based renewable energy landscapes at landscape and community scales; these were originally developed by the authors of the white paper, "Renewable Energy Landscapes: Place-based Infrastructure for Scale". The participants are strongly encouraged to read the white paper to explore the six pathways prior to the workshop.

Regional Context: Pacific Northwest Renewable Energy Landscapes

The Pacific Northwest (PNW) benefits from extensive renewable energy resources: rivers for hydropower; terrestrial and offshore wind for wind power; an extensive coastline for wave power; abundant solar energy, cloudy winter skies notwithstanding, for solar photovoltaic power and passive solar heating; geothermal resources for heat; and cool summer night air for passive cooling. PNW regional policies and plans also support the transition to a carbon-free economy by recommending increases in renewable electricity generation and energy efficiency. The Northwest Power and Conservation Council, for example, recommends that regional electric utilities both expand their resource mixes to include 3.5 GW of renewable energy sources, and offset 750 MW to 1 GW of electricity loads through energy efficiency measures, by 2027.[3] These goals appear to be readily achievable given the PNW's abundant renewable energy resources. This section presents the needs and opportunities for place-based renewable energy development in the PNW, organized by resource type, that are most relevant to our design challenges.

Regional Context: Pacific Northwest Renewable Energy Landscapes

Hydropower

The Columbia River, the largest river in the Pacific Northwest, is the largest hydropower source in the United States. Along it, thirty-one hydroelectric dams generate 22 GW of carbon-free electricity, equivalent to 30% of the PNW's annual electricity demand.[4] In a renewable electricity mix, this hydropower provides stability, compensating for fluctuations in wind and solar power. Currently, however, several dam removal projects are under discussion, with the goals of restoring habitat for salmon and other species and of supporting Indigenous culture and sovereignty. Questions are therefore emerging regarding the best ways to compensate for lost hydropower with other renewables while maintaining grid stability. One of the alternatives is micro-hydropower generation which harvests excess water transmission pressure in drinking water pipelines into carbon-free electricity. In 2020, the City of Hillsboro launched its In-Pipe hydroelectric project and generated about 200,000 kWh of electricity annually.

Offshore wind

Additionally, the PNW coast has extraordinary wind power potential, and the Biden administration plans to initiate a 30 GW offshore wind project along the Oregon coast by 2030. A recent PNNL study reports that this wind farm could not only meet the full electricity needs of local coastal communities, but also meet much of the electricity demand throughout the Willamette Valley and enhance grid stability.[5] However, coastal communities remain concerned about preserving recreational access; local jobs in the fishing, seafood, and tourism industries; energy sovereignty for tribal nations; and healthy coastal ecosystems.[6] A place-based approach, involving stakeholder engagement, will be critical in developing plans that generate local value and provide energy justice to these communities.

Solar photovoltaics

The PNW region also has excellent potential for solar electricity generation, both at grid scale in sunny inland areas and in smaller installations throughout coastal and Willamette Valley cities. Many PNW communities support annual net metering, which credits solar energy system owners for their excess electricity fed into the grid, and participate in community solar programs, which facilitate the deployment of decentralized generation and often prioritize disadvantaged communities. For example, the Oregon cities of Pendleton, Warm Springs, and Talent were recently awarded grants by the U.S. Department of Energy's *Energy Storage for Social Equity Initiative*, which funds underserved and frontline communities in developing energy storage to improve their energy resilience. Additionally, the Bonneville Environmental Foundation, a non-profit based in Portland, Oregon, recently supported a community solar program available to all residents of a mobile home park.

Recently, the potential of solar photovoltaics (PV) and solar water heating to enhance land productivity and multifunctionality has gained new attention. For example, large rooftops on commercial buildings have the ability to accommodate commercial-scale solar PV electricity generation for on-site daytime use.[7] In addition, solar PV installations can create synergies with rooftop gardens and green roofs for stormwater management, heat island mitigation, and outdoor space.[8] Recent research has shown, for example, that shade from solar PV on green roofs improves the survival of native vegetation such as sedums that receive little or no irrigation.[9] On farmland, additionally, the integration of photovoltaic arrays into agricultural landscapes, in systems known as agrivoltaics, provide partial shade for crops and increase their productivity during Oregon's dry summers.[10]

Passive heating and cooling in buildings

Additionally, the PNW possesses outstanding climatic resources for direct solar heating, natural ventilation, evaporative cooling, daylighting, and other "passive" strategies with which to meet the space heating, cooling, ventilation, and lighting needs of buildings. Effective use of these resources has the potential to reduce space conditioning loads by 50% or more, both accelerating decarbonization and freeing renewable electricity supplies for end uses that require electricity.[11][12]

Design Challenges

Given the abundant renewable energy resources available in the PNW, we propose a new approach for exploring renewable energy landscapes that respects places, people, and ecosystems across regional landscape transects. The goal of this approach is to facilitate productive discussions regarding the ways in which place-based renewable energy infrastructure can best serve urban, suburban, rural, and coastal communities in light of their unique physical and socioeconomic attributes. This design brief presents three specific cases, each representing two interrelated pathways, in the PNW context:

- Multifunctionality + Decentralized Energy Capture in Portland, Oregon
- Generating Local Value + Natural Capital in Klamath Falls, Oregon
- Coastal Resilience + Energy Justice, San Juan Islands, Washington

The following section presents these case studies sequentially, including brief descriptions of each pathway involved, a statement of the problems facing each study site, and a summary of the opportunities and challenges for potential design interventions in each case. The purpose of this section is to support workshop participants in understanding the pathways and the corresponding design problems, and in this way to assist them in preparing their ideas and insights prior to the workshop itself. Although these case studies are hypothetical, currently, they each have great potential to initiate ideas for future implementation.

Design Exploration I:
Multifunctionality + Decentralized and Distributed Energy Capture

Seeking meaningful multifunctionality

Multifunctionality describes the collocation of renewable energy infrastructure with other technologies and land uses in urban, suburban, rural, and coastal communities. A combination of planning, design, modularity, and (miniaturization) technology has the potential to allow renewable energy technology (RET) deployment to occur in locations with existing land uses, thus increasing land use efficiency. The design process involved in establishing RET infrastructure can also offer benefits beyond energy performance, such as community engagement and energy literacy education.[13] Additionally, the deployment of new infrastructure in underdeveloped areas has the potential to promote urban regeneration through investment, and RET integration at neighborhood scales (e.g., through micro-grids) promises social and economic benefits. At the same time, such efforts increase the possibility that new conflicts among landowners, technology owners, and stakeholders might occur, resulting from concerns regarding the interference of new infrastructure with existing uses, management, and/or maintenance. For this reason, current land-use regulations limit renewable energy collocation with other uses in many parts of the U.S. More calls for zoning reforms are emerging to allow more RET in urban areas.[14]

Decentralized and Distributed Energy Capture

Decentralized renewable energy resources are those that can be captured by small installations or distributed throughout the site of consumption. Energy capture and distribution technologies that are deployable at building and community scales support many of the goals addressed by multifunctionality approaches. First, they allow individuals and neighborhoods to capture renewable energy with small spaces, such as building and road surfaces. Second, in urban areas, they lessen demands on grid electricity, giving them the potential both to reduce the need for grid capacity expansions and to serve as backup systems, reducing consumers' vulnerability to grid power outages. Third, they minimize transmission losses because they are sited near locations of consumption. As a result, these technologies have the potential to improve resilience to heatwaves and other extreme events. Still, the widespread adoption of such systems faces several challenges. First, stakeholders are often not fully aware of their energy-generating and/or economic potential, limiting interest and motivation. Second, the physical appearance of some systems can limit their aesthetic or cultural acceptance; similarly, their forms and space requirements can pose challenges in effective siting. Third, community-owned distributed energy resources require ongoing coordination and governance among participants. Additionally, financial incentives to promote the adoption of building- and community-scale systems remain limited.

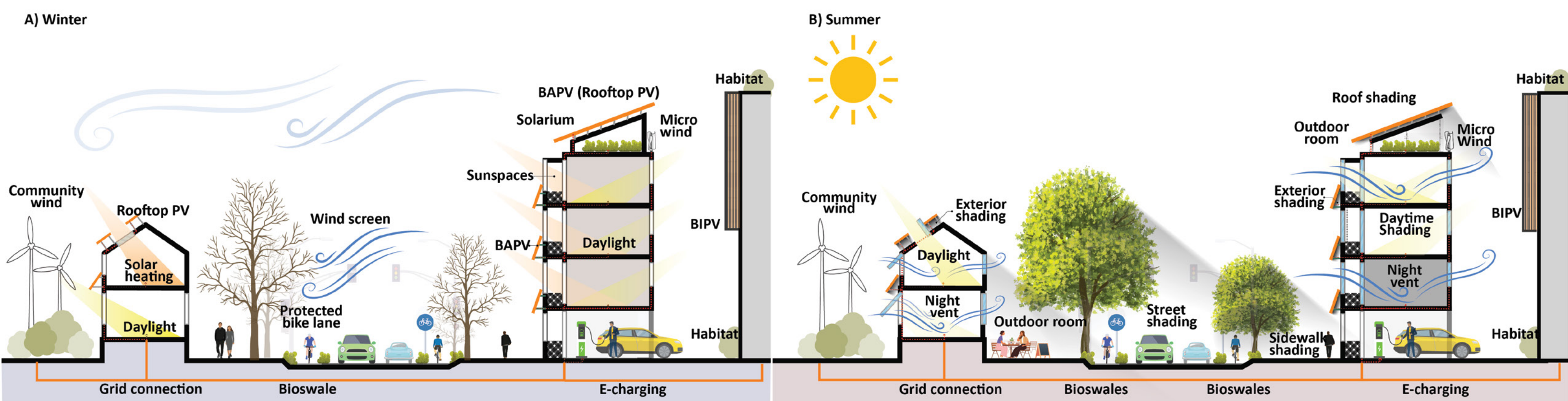


Fig. 3. Decentralized renewable energy technologies in an urban context

Project Site: Portland, Oregon

The integration of RET infrastructure with other uses has primarily been explored through prototypes at the scales of individual sites through architectural projects (e.g. rooftops, facades, and parking lots). In contrast, case studies of multifunctional neighborhood-scale deployment of RET are rare, despite their potential benefits.

This design exploration will focus on integrating RET infrastructure and energy capture into the Lents, a diverse neighborhood of southeast Portland, with the goal of achieving compatibility between renewable energy infrastructure and existing land uses as well as synergetic energy, environmental, and social performance. Building upon a recent renewable energy design proposal to Lents (see pp.66-96), this case study will consider three categories of distributed energy resources: (i) distributed energy capture and electricity generation, including rooftop photovoltaic arrays, micro-hydro and -wind turbines, direct solar heating, passive cooling, and daylighting; and (ii) energy storage, including both electricity storage in batteries and thermal storage in materials. This investigation will include building-scale measures (e.g., skylights, window security, roof shading) for reducing building heating, cooling, ventilation, and lighting loads through passive heating and cooling; active measures for providing and storing electricity; cycling and walking infrastructure; and ecosystem services such as stormwater management and habitat creation.

Design for passive survivability during heatwaves is a particular interest, since the Pacific Northwest is experiencing heatwaves with increasing frequency and severity, and heat-related illnesses and deaths are rising as a result. The goals of the neighborhood designs are to integrate measures that (i) reduce summer urban heat island effects; (ii) reduce summer solar heat gain on buildings; (iii) create ample winter solar access; (iv) support night ventilation; (v) create cool, breezy outdoor spaces for summer use; (vi) locate community- and building-scale renewable electricity generation and storage sufficient to meet the remaining loads, and (v) support walking and cycling for transportation.

Overall, this exploration is intended to reveal the challenges, opportunities, and benefits of integrating decentralized RET infrastructures and energy capture into urban neighborhoods. We are especially interested in responding to the obstacles that our stakeholders foresee in these efforts, and in ways that the design process could accommodate and/or overcome them. This exploration will address issues related to planning (land-use regulations, ownership), design (passive + active strategies, multifunctionality), implementation (management, maintenance), and evaluation of the ultimate energy and socio-economic performance of such interventions, creating a model for urban transitions to carbon neutrality in the Pacific Northwest.

Fig. 4. Multifunctional decentralized energy colocation

Design Exploration II:
Benefiting Natural Capital and Generating Local Value

Benefiting natural capital

Natural capital describes the societal and economic benefits that ecosystems provide to people. Like other infrastructure developments, renewable energy development can adversely affect natural ecosystems and communities who rely on natural resources. Renewable energy deployment designed with natural capital in mind, however, can mitigate the ecological harms of an installation and enhance the ecosystem services provided by its site. For example, native plants grown under PV arrays can create pollinator-friendly environments and reduce the need for energy-intensive maintenance such as mowing and herbicides.[15] Likewise, carefully-designed floating PV arrays on lakes and reservoirs can lower water temperatures, preventing algal blooms and enhancing water quality.[16] Place-based renewable energy design can also ensure that critical, multi-species habitats are protected in the vicinity of renewable energy installations.

Generating local value

Generating local value through renewable energy landscapes requires attention to the uniqueness of each place. With close attention to local communities' values and priorities, place-based renewable energy projects can support local amenities and cultures, including economic well-being. In addition, careful design of these projects has the potential to yield valuable co-benefits, addressing current and emerging concerns of harms to the local economy and human health. For example, rural communities in the Pacific Northwest are facing increasingly severe droughts and water insecurity, significantly affecting agricultural production. PV arrays positioned over farmlands and irrigation canals have the potential to improve agricultural production and to secure water resources in areas that are stressed and disrupted by warming and droughts. Questions remain, however, regarding the ways in which local farmers, land owners, and communities might obtain direct benefits from energy production. One promising approach is emerging in the form of community benefit agreements (CBAs), which requires the developers' commitment to local benefits in exchange for the community's support, and are therefore promoting social acceptance. Additional efforts are needed, however, in the integration of collaborative design, implementation, operations, and shared community ownership to distribute costs and benefits fairly and to mitigate conflicts among community values.

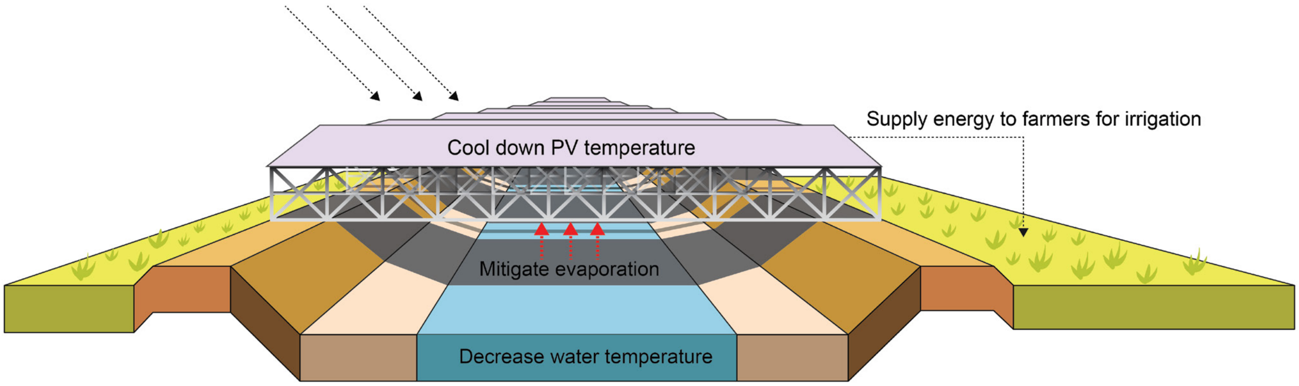


Fig. 5. Multiple benefits of PV arrays over irrigation canals

Project Site: Klamath Falls, Oregon

A place-specific, innovative, high-stakes example of renewable energy infrastructure that could benefit natural capital is the placement of PV arrays over Klamath Project canals. This design exploration will focus on the collocation of PV arrays over irrigation canals to address the challenges of the Klamath River, OR. Threatened by climate change, its diminished flows can no longer supply water reliably to farmers and threatened wildlife. The complex Klamath Basin Restoration Agreement (2010) seeks to address this problem, although it currently faces legal barriers. This Agreement provides funding to diverse restoration projects, including the removal of four hydropower dams; as a consequence, this measure would entail the loss of about 165 MW of hydropower capacity.

At the same time, farming communities are suffering from years of drought. About 500,000 acre-feet/year of Klamath and Lost River water have historically been delivered to 305,000 acres of farms along ~717 miles of irrigation and drainage canals. Since 2000, however, little water has been delivered to these farms because of priority allocation to the Upper Klamath Lake and to the Klamath River to maintain flow levels for fish. Intensifying the problem, during times when water has been available for delivery to farms through the canals, 15-25% of the total, or ~200,000 acre-feet, are lost annually to evapotranspiration.[17]

The Klamath Irrigation District which operates a complex of canals is seeking ways to improve water use efficiency in delivering scarce water to farmers and then from them to the Tule and Lower Klamath National Wildlife Refuges, which are now often dry. All the irrigation districts in the region and other agencies are participating in a study investigating approaches for replacing the lost hydropower with affordable electricity for their region. One option is to cover larger canals with solar PV arrays.[18] The shading of the water is intended to reduce solar heat gain, make PVs more efficient, and cool water temperatures to levels more favorable for current wetland and lacustrine ecosystems. Evaporation rates are predicted to fall accordingly, reducing water loss and augmenting water supplies for both farms and, ultimately, the wildlife refuges.[19] Through these mechanisms combined, such a project could benefit natural capital while providing renewable electricity.

Precedent exists for such an effort in the extensive PV arrays built over irrigation canals in India. Additionally, the 2022 Inflation Reduction Act notes that such arrays are applicable to large aqueducts in California and Arizona. These arrays must be designed to shade the water most of the day throughout the year, mitigate wind, be compatible with the canals' integrity and operations, and transmit electricity along channels to substations connected to the grid. In all such projects, impacts related to water quality, land use, wildlife, and aesthetics must be addressed. In this workshop, participants will consider a representative set of channels in the Klamath Project, including their operational requirements, orientations, contexts, and profiles, and explore options for PV shading design. As the PNW is experiencing more severe and prolonged droughts, we expect that other rural communities that face similar challenges in the region will benefit from this exploration.

(c) Brian Gailey, Klamath Falls News

Design Exploration III: Resilience + Energy Justice

Resilience

Well-designed local renewable energy infrastructure can help PNW communities withstand climate-related natural disasters, such as heatwaves, storms, floods, and wildfires, which often lead to power outages and threats to air and water quality. Prioritizing the benefits of such resilience has the potential to motivate communities to become early adopters of renewable energy in their nearby landscapes. Technological advancements in sensors, mobile computing, LiDAR, and digital communication have opened new pathways for providing real-time information that shares air and water quality data with communities, empowering them to take effective actions. Further, the deployment of such sensors over a range of scales, from individual homes to larger community buildings and neighborhoods, has the potential to monitor, protect, and improve urban wildlife habitat and neighborhood-level climate resilience.

Energy Justice

An energy justice lens centers the issues of who benefits, who is burdened, and who makes decisions as a fundamental component of renewable energy design.[20] Designing for energy justice requires work across societal sectors to ensure that emerging energy economies provide opportunities for historically marginalized communities, the material burdens of energy development are borne equally, and decision-making authority is shared. A just energy transition must ensure that historically marginalized communities do not bear unequal burdens of pollution, extraction, siting, or displacement due to energy development. It must grapple with ongoing legacies of economic and social inequity, and it requires thoughtful community involvement as well as shared decision-making authority. Energy landscapes and the history of resource extraction and waste disposal throughout North America, including the PNW region, are bound up inextricably in ongoing settler colonial legacies that include land dispossession and systematic government-led efforts to destroy Native American cultures; therefore, Indigenous sovereignty and resurgence lie at the heart of a just energy transition. In the Pacific Northwest, these entwined issues are exemplified by current efforts to reconcile low carbon energy production with struggles to protect Native lifeways, improve water quality, and prevent the extinction of Pacific salmon and resident orca whales of the Salish Sea.

Fig. 6. A resilience hub design example

Project Site:
Coast Salish Cultural and Natural Heritage Center, San Juan Island, WA

Design for resilience and energy justice offers an opportunity to demonstrate how each commitment can support the other. For instance, air and water quality issues vary in severity from persistent health hazards to catastrophic emergencies, both of which affect marginalized communities disproportionately. Design for resilience requires solutions to air and water quality degradation, while design for energy justice requires recognition of the ways in which benefits and burdens are distributed. In PNW tribal communities, energy justice and renewable energy landscapes are inseparable from issues of cultural sovereignty. For example, while existing hydropower systems provide a low-carbon energy base for the region, the extensive network of dams within the Columbia River basin is contributing to the drastic decline of the culturally essential Pacific salmon. This network of dams also significantly affects resident orca populations of the Salish Sea with which tribal cultures share deep connections. Dams have also flooded Indigenous lands and fishing areas of high cultural significance. Design for climate resilience must therefore accompany context-specific design for energy justice.

This design exploration will address the goals of climate resilience and energy justice through an inquiry into an envisioned Coast Salish Cultural and Natural Heritage Center on the Washington State San Juan Islands, located in the Salish Sea. This project includes the physical site and structures, as well as a virtual reality educational component that will engage people from around the region and the world. We will adopt a collaborative design approach with the leaders of an Indigenous-led nonprofit organization called Se'Si'Le (pronounced saw-see-lah, the Lummi word for grandmother), who will join us as the project's leaders and visionaries. Working with regional architects and landscape designers, we will articulate cultural and resilience priorities through a conceptual site design. This design is intended to celebrate Indigenous heritage within the San Juan Islands and the Salish Sea, and to situate the envisioned center within the complicated web of broader regional issues related to energy transitions, climate resilience, and Indigenous sovereignty and resurgence.

This project will explore the ways in which renewable energy strategies, cultural priorities, air quality shelters, and water filtration methods can be considered together through the creation of the Coast Salish Natural and Cultural Heritage Center. We will examine possibilities for on-site energy production and creating charging stations that can help meet the local challenges for EV transportation on the islands and to and from the mainland.[21] We will also investigate the locations and synergies with existing programs that might be used to support San Juan Islands communities during environmental emergencies, such as those created in the Resilient Power Puerto Rico initiative in 2018. By engaging local communities, Indigenous nations, U.S. national and state funding, and private equity, resilience planning can support just and equitable community coexistence.

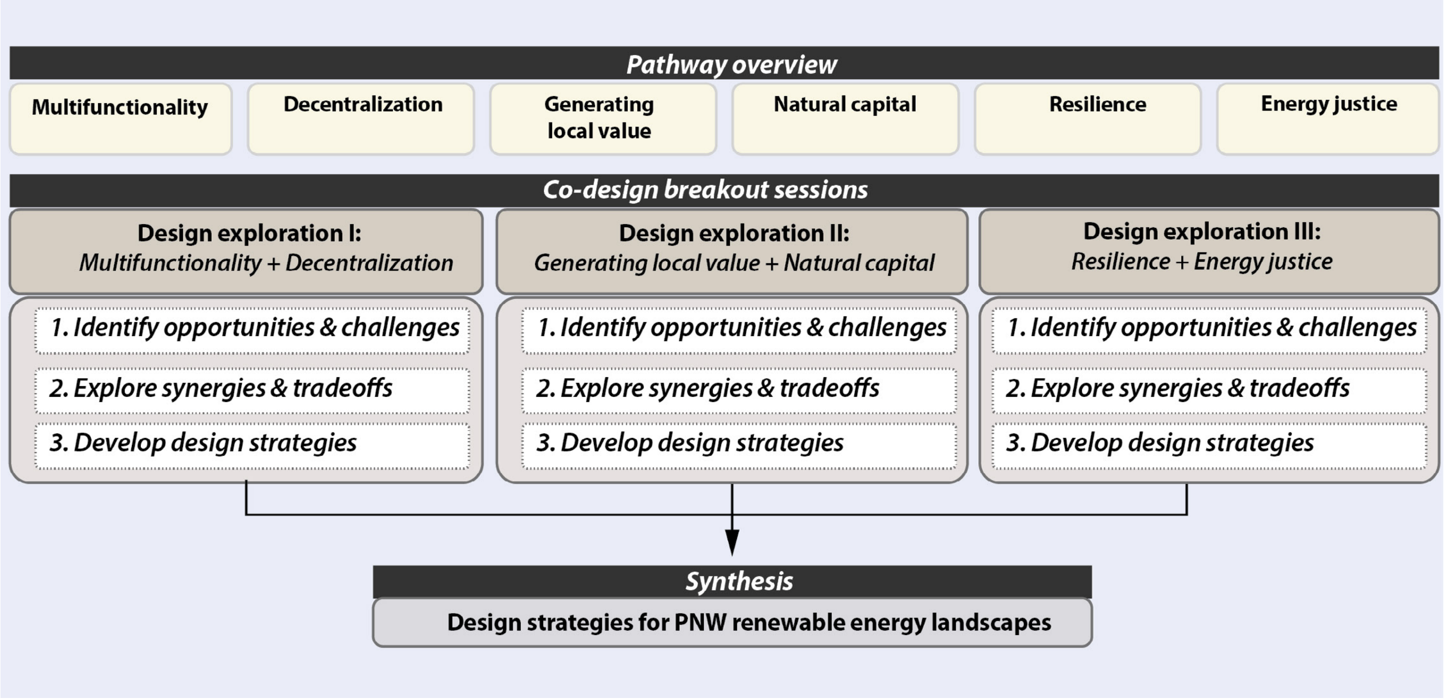
Process

Participants will select one project of interest during the pre-workshop registration; they are also encouraged to prepare for the discussions by reading this design brief carefully and by consulting several of the most relevant supporting documents.

After short welcoming remarks, the workshop will begin with a keynote speech from Simon Gore of the Department of Energy, explaining the context for the workshop and inviting participants to consider future collaboration after the workshop concludes. Next, Danielle Preziuso from the Pacific Northwest National Laboratory and the workshop host, Dr. Yekang Ko, will introduce the key concepts of each pathway and the role of landscape architecture in designing place-based renewable energy infrastructure, with reference to the PNNL white paper and several design examples. After this introductory work, participants will divide into their pre-assigned groups in breakout rooms for the co-design break-out session to address their respective renewable energy projects, integrating the socio-ecological dimensions of the corresponding pathways. Miro boards will be used throughout the workshop to organize, visualize, and share ideas. The three groups will meet together once during the workshop and once at the conclusion to report their ideas and to provide questions and input to the other groups.

Discussions and outcomes of the workshop will be documented in a final report to be published by PNNL in 2023. With permission, participants will be listed and their contributions will be acknowledged in the report. Key questions to answer during the workshop will include:

- What opportunities and challenges are revealed in applying the corresponding pathways to each case study?
- What synergies and trade-offs emerge in each specific design project?
- What scales and design strategies should be prioritized for each design project to support place-based renewable energy infrastructure?



Workshop overview

Schedule The University of Oregon will host the two-day virtual workshop from 12-14:45 Pacific Standard Time on January 10 and 12, 2023. Below is the draft agenda.

[DAY 1] JANUARY 10, 2023, PST

Please sign up for the workshop here

Activity	Duration	Start	End
Opening remarks - Welcome and workshop overview	5 minutes	12:00	12:05
Keynote presentation - Simon Gore, Department of Energy	12 minutes	12:05	12:17
Pathway overview - Danielle Preziuso, Pacific Northwest National Laboratory - Yekang Ko, University of Oregon	13 minutes	12:17	12:30
Co-design breakout group session 1 - Identify opportunities and challenges	30 minutes	12:30	13:00
Break	10 minutes	13:00	13:10
Co-design breakout group session 2 - Explore synergies and tradeoffs	60 minutes	13:10	14:10
Three groups brief report out - Brief presentations, feedback, and Q&A	30 minutes	14:10	14:40
Wrap up	5 minutes	14:40	14:45

[DAY 2] JANUARY 12, 2023, PST

Activity	Duration	Start	End
Day 2 overview	5 minutes	12:00	12:05
Co-design breakout group session 3 - Develop design strategies and prepare a group presentation	75 minutes	12:05	13:20
Break	10 minutes	13:20	13:30
Three groups report out - Presentations, feedback, and Q&A.	45 minutes	13:30	14:15
Discussion: synthesis	20 minutes	14:15	14:35
Final thoughts and next steps	5 minutes	14:35	14:40
Closing	-	14:40	14:45

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