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Developing a Framework to Assess Renewable Energy Options for Higher Education Institutions: Values-Based Recommendations for Portland State University

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Developing a framework to assess renewable energy options for higher education institutions: values-based recommendations for Portland State University

by

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Report submitted in partial fulfillment of the
requirements for the degree of

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In
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Masters Project Committee:
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Executive Summary

Voluntary renewable energy projects offer organizations like Portland State University (PSU) the opportunity to address climate action-related goals and address other environmental, economic, and social values. To achieve the goals of receiving 100% of electricity from renewable sources by 2035 and campus carbon neutrality by 2040, PSU must take voluntary action to increase renewable energy use through direct development of renewable energy generation sources and/or procuring renewable energy or energy credits; the University cannot rely on its electricity providers alone to reach these goals. PSU's utility providers generate or source a growing amount of renewable energy in their power supply in compliance with the Oregon Renewable Portfolio Standard (RPS), but a gap will remain, currently 85% of PSU's electricity usage and plateauing at 50% by 2040 (Figure 0.1).

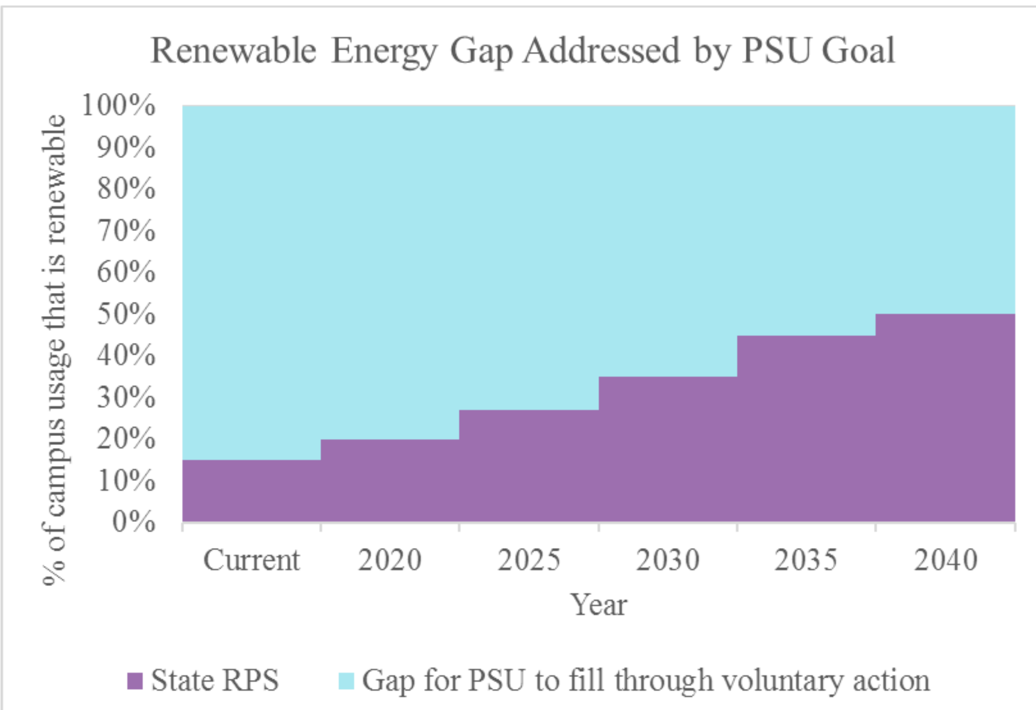

Figure 0.1. The portion of PSU's electricity use, or the gap, that must be addressed through voluntary renewable energy actions.

Fortunately, PSU has several options to close this gap while at the same time satisfying institutional values such as supporting the regional economy through clean energy development, opening up education and research opportunities for students, and more. Over the past two years, these mechanisms were identified and assessed based on each option's ability to match criteria of

PSU stakeholders. Through this process, there is now a vision and roadmap for PSU's renewable energy future.

This roadmap was developed through two major project stages: (1) identification of PSU's voluntary renewable energy options in the context of state, local, and institutional factors and (2) assessment of these options using a values-based scoring process to enable the development of evidence-based recommendations.

To identify PSU's voluntary renewable energy options, several key informant interviews were conducted with local and national consulting firms, utility representatives, nonprofits, and internal staff within PSU's Planning, Construction and Real Estate division. Additional information was gathered through online resource review and attendance at conferences and on webinars. This process led the following options being identified:

- **Conventional Procurement Options** *refer to transactions that don't involve physical energy but use renewable energy credits to account for ownership or use of renewables*: renewable energy certificates (RECs) and utility green power programs (combined with offsite options in the assessment).
- **Offsite Project Options** *involve physical energy generated that enables a customer to identify the source of the renewable energy used to support their voluntary purchasing or development decision*: renewable-specified direct access contract with a specific generator (like a physical power purchase agreement, or PPA) or general renewable resource; virtual PPA; community solar participant; and an ownership model.
- **Onsite Project Options** *include some of the same mechanisms as offsite projects, tailored to adding renewable energy generation on the PSU campus*: PSU-owned solar; third-party PPA; Oregon Clean Power Cooperative program; and community solar host.
- **Other Models** *are emerging or not currently available in Oregon*: Portland General Electric (PGE) green tariff (combined with offsite options in the assessment).

Each option is described in detail in the full project report. There are two key distinguishing factors between these options: whether there is physical energy delivered to PSU and what happens to the RECs associated with the transaction. RECs play a central role in the voluntary renewable energy field – in order for an organization to claim it is using renewable energy, the organization must obtain and retire RECs equivalent to their electricity use.

Studying examples of renewable energy projects at other higher education institutions revealed a number of key takeaways and highlights what makes PSU unique, including factors that may enable or inhibit actions to meet PSU's goals. One key takeaway is that what PSU can do is different than colleges and universities in other states, as utility regulation defines the amount of choice customers have in shaping what types of energy they receive and who energy can be purchased from. PSU should be inspired and motivated by stories of voluntary renewable energy actions at other institutions but must pursue projects that are realistic and feasible given internal and external limitations.

Other key takeaways, like the importance of collaborating with campus stakeholders to set goals and define values were incorporated into the methods used to develop recommendations. Offsite and onsite options were assessed using a scorecard inspired by multi-criteria decision analysis, a decision-making framework that enables input from several stakeholders and multiple criteria to influence decision outcomes. Criteria used in the scorecard were selected and weighted by a group of eight PSU operations stakeholders (Table 0.1).

Table 0.1. Values-based criteria and their associated weights, as indicated by eight PSU stakeholders in the Planning, Construction, and Real Estate division.

Criteria for offsite options						
	Support local generation in the Pacific Northwest	**Long-term savings** are achieved by the project	**Management implications** are minimized	**Pedagogical connections** are available	The project creates **opportunity for partnerships**	Preference for projects with substantial **load coverage**
Weight (out of 100%)	17%	23%	13%	19%	15%	14%
Criteria for onsite options						
	Project demonstrates **Innovation & leadership**	**Long-term savings** are achieved by the project	**Management implications** are minimized	**Pedagogical connections** are available	**Community benefit** is created or enabled	**Marketability** is unique among higher ed projects
Weight (out of 100%)	17%	23%	15%	19%	13%	13%

Using these weights, each voluntary renewable energy option was scored. The fit of each option to the decision-making criteria can be visualized (Figures 0.2 & 0.3). The resulting rankings were used in forming recommendations (Table 0.2).

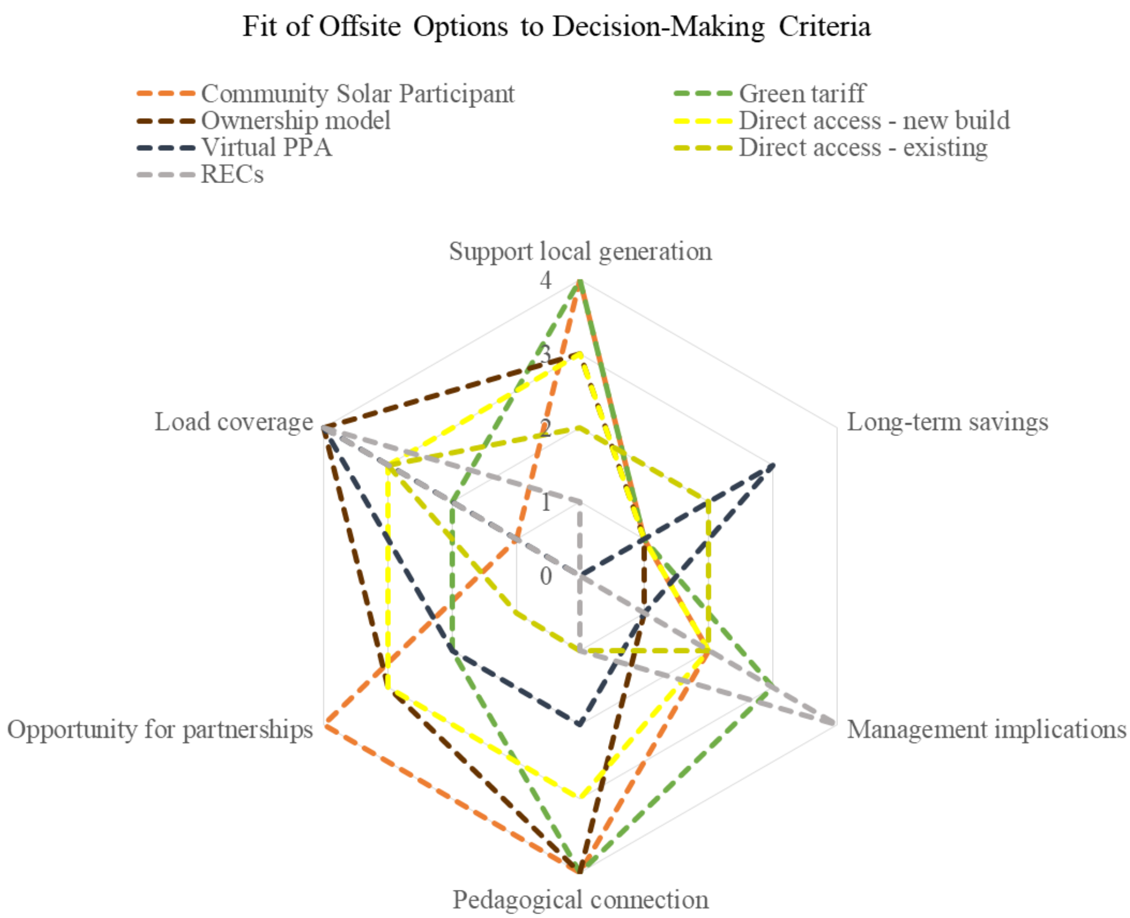

Figure 0.2. Degree to which each offsite option addresses the values-based decision-making criteria. 0 indicates the criterion is not present; 4 incidates the criterion is strongly present.

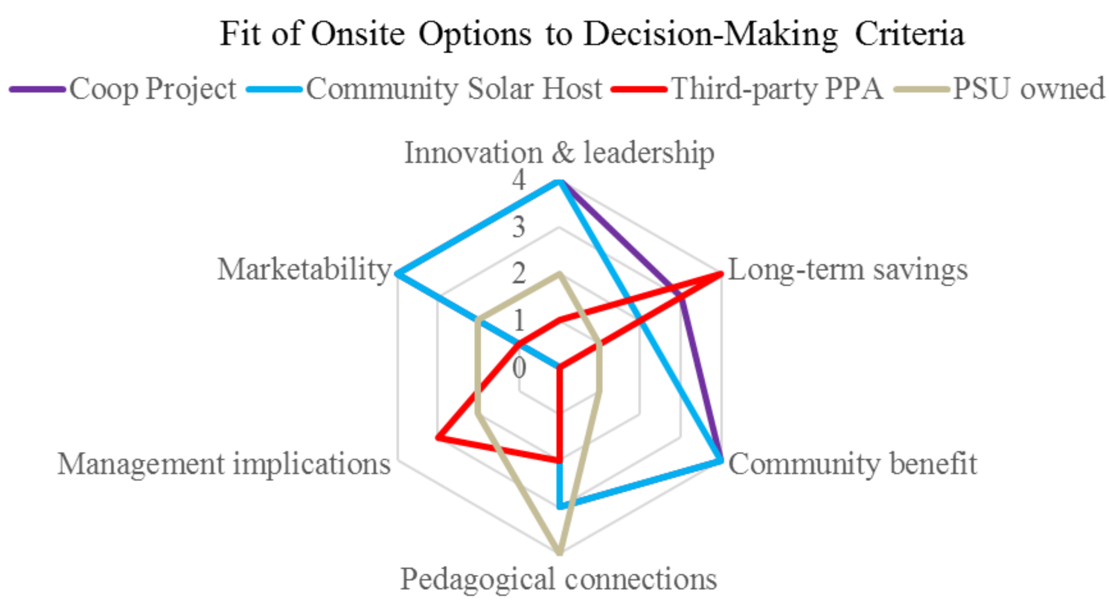

Figure 0.3. Degree to which each onsite option addresses the values-based decision-making criteria. 0 indicates the criterion is not present; 4 indicates the criterion is strongly present.

Table 0.2. Rankings of offsite and onsite project options from the values-based assessment.

Ranking	Offsite Options	Onsite Options
1	Community Solar Participant	Oregon Clean Power Cooperative
2	Green tariff	Community solar
3	Ownership model	Third-party PPA
4	Direct access – new build	PSU owned
5	Virtual PPA	
6	Direct access – existing	
7	RECs	

Drawing from the rankings as well as observations, tips, and lessons learned from external key informants and higher education case studies, the following actions are recommended for PSU to meet the goal of 100% of purchased electricity from renewable sources by 2035. These actions create the recommended roadmap, or pathway, resulting from this project (Figure 0.4). The actions are organized by and address the fact that PSU receives electricity from three different providers, PGE, Pacific Power, and a direct access provider called Calpine Solutions.

Recommended actions:

A. Enroll in the PGE green tariff (immediate time frame, <1 year).
B. Maximize onsite solar capacity through one or more Oregon Clean Power Cooperative Projects (intermediate time frame, 1-5 years).
C. Cover the portion of campus served by Pacific Power through one or more offsite community solar projects (intermediate time frame, 1-5 years).
D. Pursue a direct access contract that includes energy plus RECs from a new build generation source (extended time frame, 5-8 years).
E. Purchase RECs to fill any gaps to ensure that the 100% goal is met, beginning in 2020.

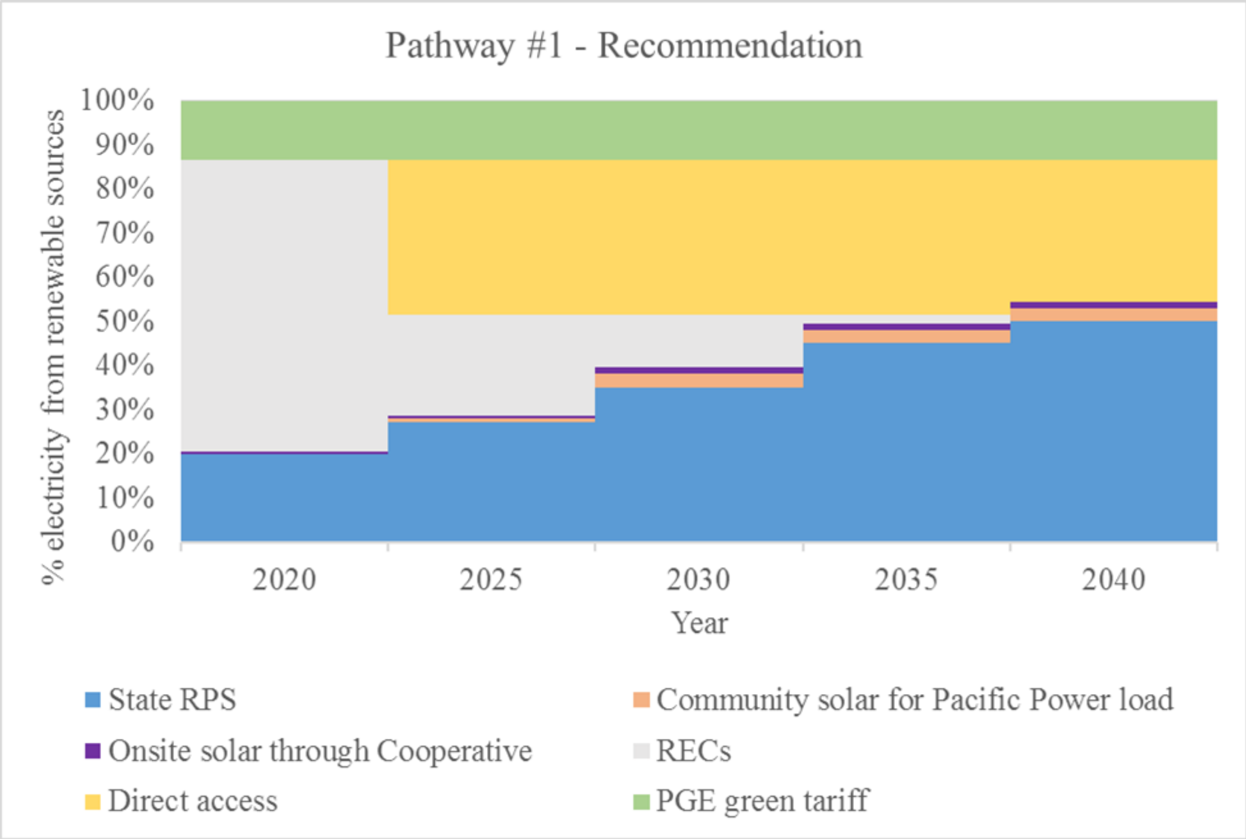

Figure 0.4. Recommended primary pathway to 100% of electricity from renewable sources.

In order to give PSU a sense of the spectrum of approaches that the University can take to meet its goals, the full project report also visualizes alternative pathways. These alternatives show how different approaches can be scale up or scaled back to fill PSU's renewable energy gap, such as focusing on one large project owned by PSU, to relying on conventional procurement options of RECs and green power programs. The alternatives do not address stakeholder values as well as the primary recommended pathway (Figure 0.4).

Regardless of the pathway that PSU takes, there are a number of potential barriers to realizing this vision. To overcome these barriers, PSU can leverage the expertise of its faculty and students, the giving of its alumni, and select roles from outside experts when necessary. Despite these potential challenges, there is no question that PSU can dramatically reduce campus greenhouse gas emissions by increasing renewable energy use on campus starting in 2019 and over the next several years.

The best way to meet campus values will be for PSU to pursue a few projects and mechanisms; where one project shines in community benefit and partnership, another project can realize savings for PSU. A renewable energy strategy that spreads risk across multiple projects will also be more resilient to future opportunities and utility regulation changes. Transitioning to renewable energy sources for campus electricity use is the “low hanging fruit” of emissions reduction; taking action now will free up capacity to address more challenging sources of emissions, like natural gas used for campus heating and fossil fuel-based transportation.

There is another key reason why PSU should begin to act now – the PGE green tariff is launching in spring 2019 and enrollment is first come, first served. Being a part of Oregon’s first green tariff would serve as an inspiring initial action towards 100% renewable energy for purchased electricity, demonstrating leadership by supporting regional clean energy development. PSU’s Campus Sustainability Office CSO is currently leading exploration of the green tariff and additional opportunities. A strong directive from University leadership can jumpstart this process and set up PSU for success on its renewable energy pathway.

Directly using, sourcing, and/or offsetting campus electricity usage with renewable resources will demonstrate PSU’s leadership and commitment to reducing the environmental impact of campus buildings and operations and supporting a clean energy economy in the region and nationally. The time for PSU to begin its journey on the path to 100% renewable energy is now; a proactive approach to transition energy sources matches the urgency to mitigate PSU’s contribution to global climate change.

Acknowledgements

This project was only possible with the guidance and patience of my graduate committee, including ESM advisor Max Nielsen-Pincus; Public Administration faculty Hal Nelson; and PSU Campus Sustainability Director (and my boss) Jenny McNamara. Jenny is one of many PSU staff members who offered their time and expertise over the past two years. Many thanks to the current and former PSU stakeholders that participated in the decision-making framework development process: Jenny McNamara, Noel Mingo, Dan Zalkow, Amanda Wolf, Ron Blaj, Quinn Soifer, Karen Powell, and Rick Viaene. I also want to thank the rest of the Campus Sustainability Office team for supporting the department's capacity to pursue this work.

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Lastly, I am thankful to the Institute for Sustainable Solutions and its Student Fellows program as well as the Ed & Olive Bushby Scholarship Fund for financial support during this project, including funding to attend the 2017 AASHE Conference & Expo.

Table of Contents

List of Tables

List of Figures

Author's Note

I began working on this project in spring 2016 in partnership with the PSU Campus Sustainability Office (CSO). Most of the research and methods described in this report were conducted by December 2016 while I was full-time graduate student. In January 2017 I started a full-time staff position with CSO. This position has offered an excellent opportunity to extend and deepen my work on this project in a staff capacity. I have tried to bring both perspectives, student and staff, to the reflections, recommendations, and discussion in this report - offering pragmatic but idealistic thoughts about PSU's renewable energy path.

Report Introduction

This report summarizes the methods, outcomes, and resulting recommendations of a two-year project to identify and assess Portland State University's (PSU) options to increase renewable energy use on campus. Completed as a masters project for a Professional Science Masters (PSM) in Environmental Science and Management, this project was originally pitched by PSU's Campus Sustainability Office (CSO) through the Living Lab program. The PSU Living Lab program matches students and faculty with staff to advance campus sustainability goals. CSO staff sought assistance through the Living Lab program to support their work implementing PSU's Climate Action Plan. Energy use and sources feature prominently in the plan. As such, I worked closely CSO staff throughout this project and was also supported by stakeholders from PSU's Planning, Construction and Real Estate (PCRE) division and external experts. The project occurred in two major stages:

(1) the research stage, conducted to identify PSU's renewable energy options and develop higher education case studies and
(2) the assessment and recommendation stage, using a values-based decision-making framework and creating a primary recommendation and alternative renewable energy pathways to envision PSU's renewable energy future.

As the primary written deliverable for this project, I have organized the report in three chapters, largely based on these stages. The first is focused on sharing PSU's renewable energy development and procurement options and sharing five case studies representing renewable energy projects from six universities: Oregon State University, Stanford University, Michigan State University, American and George Washington University (a collaborative project), and Boston University. Chapter 2 begins with an overview of PSU's current electricity use and management practices, calling out factors that may enable or inhibit University action to increase renewable energy use. Next, I describe the process for identifying campus stakeholder values and using that information to assess the options outlined in Chapter 1 using a multi-criteria decision analysis-inspired scorecard. Combining the scorecard assessment with research takeaways, I present my recommendations and describe potential barriers and solutions to implementation. Chapter 3 serves as the report's conclusion, providing insight into PSU's current status pursuing some of the recommendations in this report.

My intention with this report is to:

- Communicate the methods employed to identify PSU's renewable energy options, define PSU's renewable energy goal for electricity, create an adaptable assessment system reflective of campus stakeholder values, develop recommendations, and envision PSU's renewable energy future;
- Provide sufficient background information and context so that readers can grasp the basics of utility regulation and the types and distinctions of renewable energy development and procurement strategies;
- Highlight how other higher education institutions are taking steps to meet their renewable energy goals;
- Clearly outline my primary recommendation and alternative pathways to meeting PSU's renewable energy goal;
- Offer solutions to potential barriers in implementation; and
- Capture and summarize PSU's current status in pursuing renewable energy projects.

Beyond simply communicating my project work and outcomes, this report offers a service similar to that of a third-party consultant hired to perform an exploratory renewable energy options feasibility assessment. To that end, the intended audience of this report is PCRE staff responsible for implementing PSU's sustainability goals and Climate Action Plan, as well as managing the institution's energy use and utility relationships. In addition, PSU students and faculty can use this report to understand PSU's renewable energy future and gather ideas for supporting these efforts through research projects and student initiatives. Lastly, this report describes a replicable model for identifying and assessing renewable energy options that other higher education institutions are welcome to adapt.

Chapter 1 Research stage: PSU's renewable energy options & higher education case studies

1.1 Introduction: why pursue renewables?

Like other higher education institutions, corporations, and local governments, Portland State University (PSU) has committed to aligning academic programs, campus operations, and strategic planning to achieve economic, social, and environmental sustainability outcomes. Climate change interacts with sustainability as it is driven by and impacts human activities. To address institution and community contribution to climate change, PSU published its first Climate Action Plan (CAP) in 2010. This plan, focused on mitigating PSU's climate impact, lays out actions across operations to reduce greenhouse gas (GHG) emissions. Specifically, PSU's CAP calls for carbon neutrality by 2040. To achieve this, the CAP outlines strategies for reducing emissions from buildings, materials, travel, and commuting (PSU, 2010). Presumably, institutional GHG emissions remaining in 2040 will need to be offset through the purchase of carbon offsets.

In the Greenhouse Gas Protocol[1] Corporate Standard, purchased electricity falls under the category of "scope 2 emissions", along with cooling, heat, and steam (Greenhouse Gas Protocol, n.d.). Since the launch of the PSU CAP, annual emissions have been reported to specifically reflect purchased electricity as an emissions category. During the 2016 fiscal year, purchased electricity contributed 31% (or 19,196 metric tons) of the University's total 61,923 metric tons of carbon dioxide equivalent ($MtCO_2e$) (PSU, 2017). This significant contribution to institution-wide GHG emissions means that PSU must take voluntary action to move towards the use of 100% renewable, non-carbon emitting energy sources. Because some sources of emissions will be very challenging to reduce or transform, such as natural gas-based building heating, it is important that PSU act as soon as possible on emissions sources that can be more easily addressed, as is the case with purchased electricity. Doing so will free up capacity to address the more challenging emission sources in years to come.

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[1] https://ghgprotocol.org/

Pursuing renewable energy to meet internal climate action goals is one of many motivations for transforming PSU's electricity sources. As numerous resources and case studies explain, investment in and procurement of renewable energy can lower energy costs and reduce risk related to unpredictable and rising costs of conventional energy (Second Nature and Customer First Renewables, 2017; Rotatori & Zanchi, 2017). The extent to which pursuing renewable energy can achieve these outcomes varies state-by-state due to differences in energy regulation, as discussed later in this report. The growing suite of renewable energy procurement and development options also offer a mechanism to support locally-generated clean energy (O'Shaughnessy et al, 2017) which can offer economic or social value to institutions like PSU. Another reason why organizations pursue renewable energy is to demonstrate leadership. By transition to renewable sources for purchased electricity, PSU leadership can demonstrate to students, faculty, staff, alumni, and community members that the institution has concrete plans to follow-through on climate action goals and responsibilities.

1.2 Research stage methods

There are many reasons to pursue renewable energy for purchased electricity, but how can PSU do this? To define PSU's renewable energy options, I conducted research, key informant interviews, and attended webinars and conferences to learn about utility regulation, the voluntary renewable energy market and what actions other higher education institutions are taking in this space. This work addressed two critical research questions:

- What options are available for institutional-scale renewable energy development and procurement?
- How do different case study examples of higher education institutions embody the options and highlight PSU's unique opportunities and challenges?

This research was conducted with a basic understanding of PSU's current practices for purchased electricity: that PSU receives electricity from three different providers - Portland General Electric (PGE), Pacific Power, and direct access provider, Calpine Solutions. The majority of PSU's campus is located in the PGE service territory. A more in-depth review of PSU utility management was conducted and is described in Chapter 2.

The resources and people tapped during this stage brought me in contact with a variety of organizations and professionals across the private, public, and non-profit sectors (Table 1.1). I started this project with limited knowledge about renewable energy, making this process to identify and develop an understanding of the development and procurement options a critical part of my research. Additionally, because there is no go-to source for PSU's unique context, connecting with external stakeholders was critical to the evolution and solidification of my knowledge regarding PSU's options. Therefore, as I started to develop a solid understanding of PSU's options, I continued to review similar information across different sources, asking individual key informants for their perspectives and opinions about PSU's options.

Online sources and conferences provided further opportunities to learn about advancements in renewable energy development and policy at the national, state, and local levels and in the higher education field (Table 1.1). When attending conferences, I targeted content and sessions specific to key policy developments and corporate and higher education renewable energy development.

In addition to gathering information about PSU's renewable energy options through this research, five case studies of renewable energy projects at other universities were developed following this process. Information for these case studies were gathered as follows:

- Oregon State University (OSU): key informant interview and website review,
- Stanford University: website review,
- Michigan State University: live webinar,
- American and George Washington University collaborative project: key informant interview and website review,
- and Boston University (BU): newsletter announcement and website review.

In order for PCRE staff to easily trace ideas, expertise, and creative solutions, I have included reference to personal communications with many of the key informants listed in Table 1.1 in the results section below and later on in Chapter 2. These references are included in the text as personal communication citations, referring back to this Table, but not listed in the report Reference section.

Table 1.1. Summary of interviews, resources, conferences, and webinars utilized in the research stage.

Research Type	Detail	Summary / Purpose	Details / About
Key Informant Interviews	Campus stakeholders	Met with stakeholders from PSU Planning, Construction & Real Estate (PCRE) and to review project details; learn about PSU energy management, utility usage, and relevant contracts; understand stakeholder roles and interest in energy management; and opportunities for cross-departmental collaboration. Began developing an idea of stakeholder values to inform decision-making framework	Approximately 15 + (and ongoing) formal and informal meetings with individuals (directors and staff) from five departments: CSO; Facilities & Property Management (FPM); Capital Projects & Construction (CPC); PCRE leadership
	External	Conducted in person or phone meetings with individuals from higher education institutions, utilities, nonprofits, private consulting firms, and local government to review project; discuss national, state, and local voluntary renewable energy pathways; discuss opportunities for collaboration; share knowledge, ideas, and recommendations; and more	Approximately 20+ informational interviews with individuals from: City of Portland; 3Degrees, Calpine Solutions, Customer First Renewables, Edison Energy; Calpine Solutions; Sustainable Northwest; Energy Trust of Oregon; Bonneville Environmental Foundation; Spark NW; PGE; Avangrid Renewables; OSU; Lewis & Clark; Oregon Clean Power Cooperative; Second Nature, Portland Community College
Resource review	Academic literature	Reviewed studies about and utilizing multi-criteria/attribute decision analysis in the energy management context	Developed understanding about how the principles of MCDA are appropriate for this project; informed stakeholder engagement and criteria weighting activity
	Online sources	Websites, case studies, webinar recordings, training materials, and more were reviewed consistently throughout the project for background context, policy and terminology clarifications, and prepping for key informant interviews	Frequented sites include those hosted by the EPA (Green Power Partnership); National Renewable Energy Laboratory; World Resources Institute; Center for Resource Solutions; PSU utility providers; 3Degrees blog; higher ed case studies; Oregon Public Utilities Commission
	Webinars	Participated in webinars hosted by AASHE and Second Nature along with nonprofit, private, and higher education partners on topics related to renewable energy planning for corporations and higher education customers	Attended seven webinars on projects from: Capital Partners Solar Project; MIT; Michigan State and on specific topics like PPAs; RECs arbitrage; load aggregation
Conferences	Policy	Targeted speakers and sessions related to energy policy; Oregon community solar; opportunities for non-residential customers; and more	- Oregon Energy Futures Conference - Oregon Citizens Utility Board Policy Conference
	Technical	Targeted speakers and sessions related to non-residential renewable energy development; working with key institutional decision-makers; higher education energy management, and more	- Oregon Solar Energy Conference - AASHE Conference & Expo - Washington Oregon Higher Education Sustainability Conference (where I presented a poster with preliminary results)

1.3 Results – the voluntary market

1.3.1 Utility regulation context

Voluntary renewable energy options differ across states based on utility regulation. Although a detailed understanding of generation, transmission, distribution, and use regulation is not needed in order to grasp the information presented in this report, a brief overview provides context for understanding PSU's options presented in the next section. This context is shaped by federal, state, regional, and local regulations and standards (Table 1.2). These are the key arenas in which energy policy is set.

Table 1.2. Important federal and state policies and local drivers that shape renewable energy development in the US, in Oregon, and in the Portland region.

	Policy / Policies	Details, Why Important?
Federal	Investment & Production Tax Credits	- Tax incentives for solar & wind - Set to decline in coming years - Credited with driving development and application of renewable energy in the U.S. Source: US DOE, n.d.a
	Trump Administration Executive Orders & America First Energy Plan	- Favor domestic fossil fuel production - State leaders, like Oregon Governor, Kate Brown, have indicated that this does not significantly alter priorities and renewable energy commitments at the local level Source: The White House, n.d; Burns, 2018
Oregon	Renewable Portfolio Standard (RPS)	- Dictates percentage of energy mix that must be renewable for large utilities in Oregon - Incremental increases: 15% in 2015; 20% in 2020; 27% in 2025; 35% in 2030 45% in 2035; 50% in 2040 - The RPS provides a baseline amount of renewables in the electricity power mix Source: US DOE, n.d.b
	SB 1547 Coal Transition Plan	- Phases out coal in Oregon's electricity mix by 2030 - Updated RPS to levels stated above - Called for creation of Community Solar Program Source: Friedman, 3/11/2016

	Policy / Policies	Details, Why Important?
	AB 603 Community Solar Rulemaking	- Oregon Public Utility Commission docket to determine details of community solar program - Includes parameters like project size, number of customers, program capacity, program administrator, and other definitions and logistics Source: L. Rubado, personal communications, 6/12/17
	SB 1149 electric industry restructuring	- Nonresidential customers of Portland General Electric (PGE) and Pacific Power can choose an alternative electricity provider - Introduced limited retail choice - The bill also dealt with a public purpose charge to fund energy conservation and renewable energy development Source: Public Utility Commission of Oregon, n.d.b
	Docket UM 1690 RE Tariffs	- In 2016, an unsuccessful attempt at a non-residential green tariff for PGE & Pacific Power - Filed in 2018, a green tariff program for PGE non-residential customers, pending approval Source: D. Grady, personal communications, 7/20/17; J. Halley, personal communications, 10/17/18
	Additional relevant laws & regulations	- Both state-level and utility-specific parameters for renewable energy development and investment - Includes size limits for net metering, renewable energy cooperatives, & more Source: multiple personal communications
City of Portland	Climate Action Plan (CAP) - Energy Sources	- 100% of electricity from renewable sources by 2035 - 100% of remaining energy use by 2050 Source: City of Portland & Multnomah County, 2015
	CAP - Carbon Emissions	- 80% reduction below 1990 levels by 2050 - 40% reduction by 2030 Source: City of Portland & Multnomah County, 2015
PSU	CAP - Energy Sources	- Generate 80% of building-related energy from local, renewable sources by 2030 Source: Portland State University, 2010
	CAP - Carbon Emissions	- 80% reduction below 2008 levels by 2030 - Carbon neutral by 2040 Source: Portland State University, 2010

There are many centers of power guiding policy on renewable energy. Changes in any one center is insufficient to change the overarching trajectory of energy investments in the short term, as demonstrated by continued development at the regional and local level under the current federal administration. Oregon and the Portland region have committed to a partial (state level) or full (local level) renewable energy transition in the next 30 years.

To broadly understand the role that utility regulation plays in shaping the voluntary renewable energy field, there are two important distinctions of state-level utility structure: (1) regulated versus deregulated utilities and (2) presence of retail choice (Figure 1.1). In the context of energy utilities, regulation typically involves strict oversight from a state-level body like a public utilities commission that is involved in rulemaking for the energy system. The rulemaking process is designed to cover the utilities' costs while maintaining appropriate generation and supply capacity. In addition, regulation attempts to protect consumers from market price volatility and deal with a variety of historical economic challenges utility customers could otherwise face (Warwick, 2002). In contrast, deregulation and restructuring of energy utilities has occurred over the past several decades in response to changes in oil and gas prices, increases in energy efficiency, and poor long-term planning by conventionally-structured regulated utilities. Deregulation can open the door for competition on the supply side (utilities and other power producers) and allow customers to access more options for where their power comes from, also known as retail choice (Warwick, 2002).

Oregon has regulated utilities, generally, and a partially deregulated electric sector, providing some retail choice (Figure 1.1). Oregon's partial deregulation demonstrates how regulation and choice are more of a spectrum than two distinct realities. Policy initiatives, like Oregon Senate Bill (SB) 1149 allow for nonresidential customers to choose an electricity provider other than the default utility in that customer's service territory. Additional choices, as described below, are offered by the utility, such as ways to opt-in or opt-up for more renewable energy. Put another way, in Oregon, residential and commercial electricity customers have different options when it comes to voluntarily purchasing renewable energy. On the commercial side, entities like PSU have increased retail choice, while on the residential side, although not technically considered retail choice, customers can opt-up or opt-in to a renewable-focused program offered by their utility.

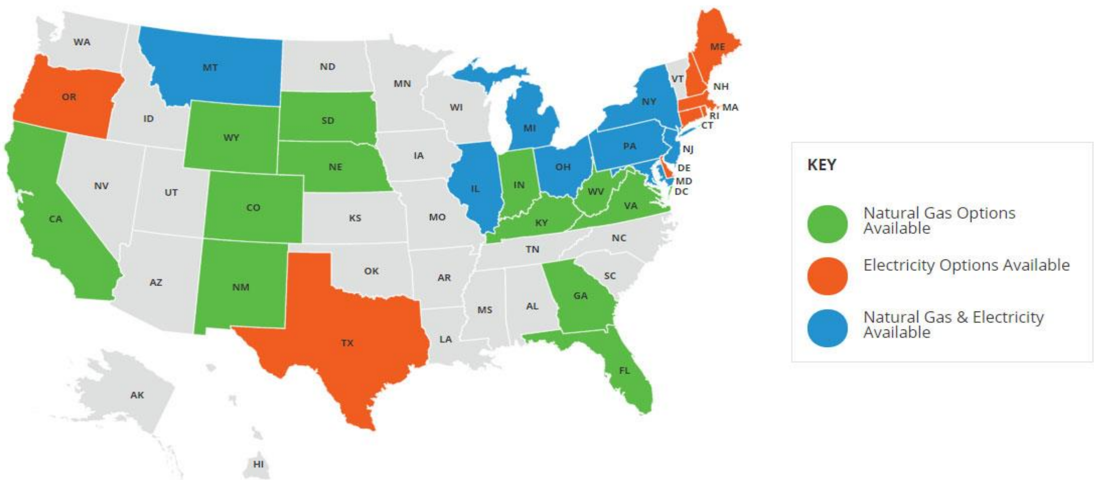

Figure 1.1. Map of states with deregulation for natural gas and/or electric utilities. Oregon has partial retail choice for commercial customers (US Power and Light, 2017).

Utility regulation within Oregon can change, with programs and options currently being debated and designed. Staying up-to-date with these developments will be necessary beyond the scope of this project to stay apprised of opportunities.

1.3.2 Procurement and development options

This section reviews a suite of options available to commercial entities to voluntarily increase use of renewable energy. There are many ways that non-residential electricity users achieve renewable energy goals in the United States and globally. The call to shift electricity production from conventional fossil fuel resources towards low-carbon renewable sources is not unique to any one region. Thankfully, this means that innovative mechanisms are being developed and tested domestically and internationally (O'Shaughnessy et al, 2017; Tawney et al, 2017). Options currently available and under development in Oregon are presented first, followed by a few options not available in the state but included to highlight broader strategies and innovations. I have grouped renewable energy procurement and development options based on similar attributes as follows:

- **Conventional Procurement Options** refer to transactions that don't involve physical energy but use renewable energy credits to account for ownership or use of renewables.
- **Offsite Project Options** involve physical energy generated that enables a customer to identify the source of the renewable energy used to support their voluntary purchase or development project.

- **Onsite Project Options** include some of the same mechanisms as offsite projects, tailored to developing renewable energy generation on the PSU campus.
- **Other Models** that don't fit as neatly into the above categories or are emerging or not currently available in Oregon.

These categories are more of a spectrum of potentially overlapping mechanisms with multiple ways to execute each type of project. Other resources may classify options in different categories, focusing more on transaction type; contractual elements; or by other geographic or technical constraints.

1.3.2a Conventional procurement options

The following mechanisms involve accounting for or offsetting electricity use by paying a premium on top of or separate from regular utility bills. These mechanisms are often available to both commercial and residential customers, in some form, and are generally the simplest way to meet renewable energy goals and therefore can serve as a default or fallback. They are often considered less impactful and less tangible than other mechanisms.

Renewable energy certificates

Renewable energy certificates (RECs) provide a way to track and count the amount of renewable energy generated and fed into the electric grid. RECs are also called green tags or renewable energy credits. As a tradable commodity, RECs represent "the emissions attributes of renewable energy" and "are sold separately from electricity" (Bird & Sumner, 2011). One REC is created when one megawatt hour (MWh) of electricity is generated from a renewable resource (Figure 1.2). RECs can be a confusing concept to understand, so it is important to hold the physical electricity separate from the "claim" that the electricity came from a renewable source. RECs provide a market-based tradeable mechanism for acknowledging the production and use of renewably-generated electricity. Information associated with a REC may include the fuel type, generation location, date the plant was constructed, date the REC was produced (the vintage), and more. RECs must be involved every time an entity claims they are using renewable energy and are "retired" once they have been claimed (EPA Green Power Partnership, 2018b). For all the MWh of renewable energy on the grid now, there is an equal number of RECs that have been produced and may have already been claimed and retired or may still be available for purchase.

An entity like PSU can purchase RECs directly in the RECs marketplace or, as is often done in the voluntary market, through a third-party provider or utility. For example, PSU can purchase RECs through its current electricity providers or through a separate contract with any number of firms. There are several choices when purchasing RECs, allowing this mechanism to be tailored to the purchaser's needs and values, as long as there is sufficient supply. This includes location, generation source, and age of REC. These aspects impact the price of RECs, with new, more locally-generated RECs typically more expensive.

Another distinction between RECs is whether they are Green-e certified. Green-e is a program administered by the Center for Resource Solutions and is described as "the nation's leading independent consumer protection program providing certification and verification for renewable electricity and renewable energy certificates (RECs) sold to households and organizations" (Center for Resource Solutions, n.d.). In some states, RECs generated from solar are kept separate; these SRECs are typically more valuable than RECs from other sources. There is also a concept called RECs arbitrage, when an entity sells the more expensive RECs generated from a project (like SRECs) and purchases cheaper RECs (say, Oklahoma wind) in order to still make a claim about renewable energy usage (EPA Green Power Partnership, 2018a).

Regardless of the mechanisms through which PSU meets it renewable energy goals, RECs will be involved. For example, to meet the state RPS, utilities have to generate or purchase and retire RECs based on criteria from the Oregon Public Utilities Commission (OPUC). Similarly, for any portion of campus electricity use that PSU wants to claim using renewable energy for, PSU will have to obtain and retire the equivalent number of RECs.

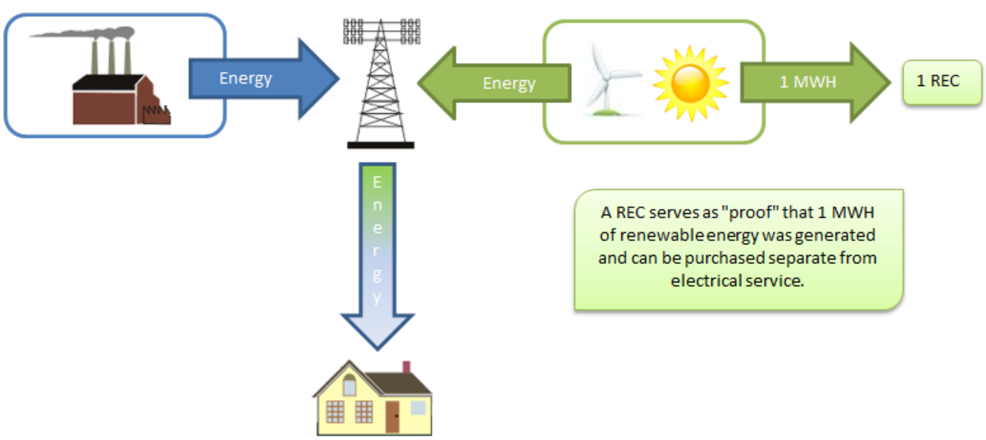

Figure 1.2. RECs are generated for every 1 MWh of renewable energy produced and are accounted for separately than energy on the grid (IREA, 2016).

Utility green power programs

PGE and Pacific Power, like many utilities in the U.S., offer voluntary green power programs that allow customers to purchase renewable energy. Utility green power programs available to PSU include PGE's Clean Wind for Commercial & Industrial [2] and Pacific Power's Blue Sky [3] offerings. These programs involve an indirect RECs transaction, with the utility purchasing and/or retiring RECs on the customer's behalf. Green power programs are a general concept that may look different in other utility regions. For the sake of PSU, our available utility green power programs can simply be thought of as a utility-based REC transaction.

Oregon green power programs are overseen by the OPUC and its Portfolio Options Committee. This Committee advises the Commission on making these programs legitimate and valuable, including pushing for the RECs involved in these programs to be Green-e (Public Utility Commission of Oregon, 2013). A customer can opt to participate in these programs at any time. Both utilities also offer a residential version of these programs.

1.3.2b Offsite project options

One key concept underlying many offsite renewable energy options is the power purchase agreement, or PPA. In its simplest form a PPA is fairly straightforward concept - an agreement between a seller and buyer for power. In the renewable energy context, a PPA is "a contract between two parties where one party sells both electricity and renewable energy certificates (RECs) to another party" (Penndorf, 2/5/2018) (or to multiple parties). PPAs have expanded over time to include both physical PPAs and financial or "virtual" PPAs (described below). Typically, PPAs include a buyer or "offtaker" and a producer or developer. Other entities may be involved to assist with contracting, executing the PPA, transmitting the energy, and more. When using a PPA to meet renewable energy goals, it is important to understand what will happen to the physical energy generated and who will own the associated RECs. When the physical energy and RECs are tied together, it is referred to as "bundled" and "unbundled" when they are separate (Nye, 2015; C. O'Brien, personal communications, 5/19/17).

[2] https://www.portlandgeneral.com/business/power-choices-pricing/renewable-power/clean-wind/clean-wind-ci
[3] https://www.pacificpower.net/bus/bsre.html

Offsite physical power purchase agreement (through Direct Access in Oregon)

A physical PPA is a common procurement strategy for both on and offsite renewable energy. In this case, "physical" refers to the delivery of electricity to the offtaker's local or regional electricity grid. Under an offsite physical PPA, a buyer enters into a contract with a seller (a power producer) to purchase a specific amount of energy. The PPA contract addresses both fixed and a possible price escalator over the length of the contract, which vary from a few years to upwards of 25-30 years. The PPA arrangement also spells out the transfer and ownership of RECs to the offtaker (Figures 1.3 & 1.4), although it is also possible that another party may own the RECs (the Oregon Clean Power Cooperative model described in the onsite section is an example of this).

Another important component to an offsite physical PPA is how the electricity is moved towards the buyer. In reality, there is no way to guarantee that the electricity produced by the specific renewable energy facility is used by the offtaker when it is produced offsite, since once electricity enters the grid it can go anywhere. Therefore, in an offsite physical PPA, a portion of the cost paid is for the service of moving or "wheeling" the electricity to the offtaker's grid region (Penndorf, 2/5/18; T. Espinoza & C. Nelson, personal communications, 10/24/18).

Because Oregon's electricity market is not fully deregulated, PSU would have to work through a direct access provider to pursue something like an offsite PPA. The direct access provider would act as an intermediary between PSU and the seller or developer.

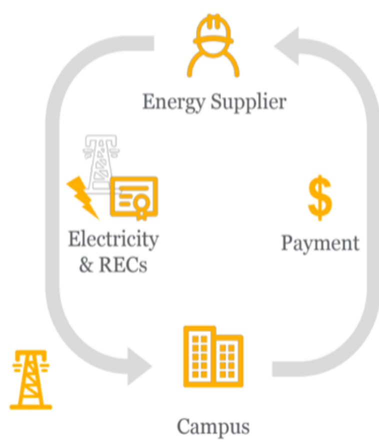

Figure 1.3. In an offsite physical PPA, both electricity and RECs move to the buyer (labeled "campus"). In Oregon, a direct access provider would facilitate a transaction like this (3Degrees, in slides prepared for PSU meeting).

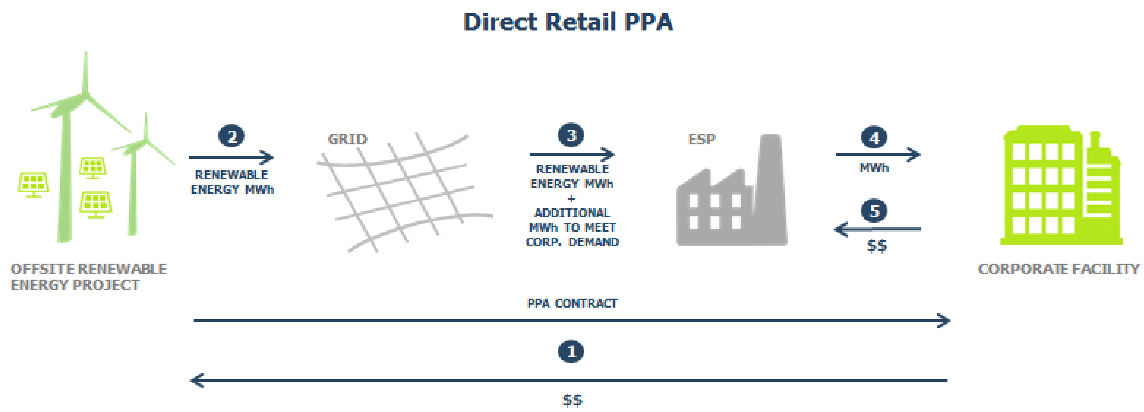

Figure 1.4. A direct retail PPA is like an offsite physical PPA. This schematic acknowledges that additional energy is needed to meet the buyers demand, as the PPA likely does not cover all usage (Royal, n.d.).

Virtual power purchase agreement

The second type of offsite PPA is a financial, or "virtual" transaction. Like a physical PPA, a virtual PPA involves a buyer contracting with a seller to purchase a specified amount of energy and RECs from a renewable energy facility at a fixed price and possible price escalator over the term of the contract. The main distinction between a physical and virtual PPA is the fate of the physical energy – in a virtual PPA the electricity is not delivered to the customer's grid.

The physical energy associated with a virtual PPA is not delivered to the buyer, rather "the seller generates and liquidates a project's energy at market pricing. When the floating market price exceeds the set VPPA price, the developer passes the positive difference to the offtaker. When the converse is true, the market price is below the VPPA fixed price, the offtaker must pay the developer the difference" (Penndorf, 2/5/18) (Figure 1.5). If PSU entered a virtual PPA, for example, PSU would pay the seller the price dictated in the contract, receiving RECs. Physical energy would still need to be purchased from the default utility. The energy associated with the contract will be sold by the seller on the wholesale energy market. If it sells for a price higher than what PSU spent according to the contract, PSU will be paid the difference; if the energy sells for a price lower than the contract price, PSU would have to pay the seller to make up the difference. This structure can also be referred to as a contract for differences, although that term is applied to other types of projects than just virtual PPAs.

Because energy prices are generally expected to rise, a virtual PPA is usually structured in such a way that the buyer expects to save money over the length of the contract. Virtual PPAs are limited to regions where there is a body that manages wholesale electricity transactions, like a “regional transmission organization (RTO) or independent system operator (ISO), which serve as third-party independent operators of the transmission system, ultimately responsible for the flow of electricity within its domain” (Penndorf, 2/5/18; T. Espinoza & C. Nelson, personal communications, 10/24/18). Oregon does not have one of these markets, so while an entity based in Oregon can pursue a VPPA, the actual project will be located elsewhere.

With both physical and virtual PPAs, the buyer can target criteria like generation type, location, new or existing facility, and more, to best align with the buyer’s values.

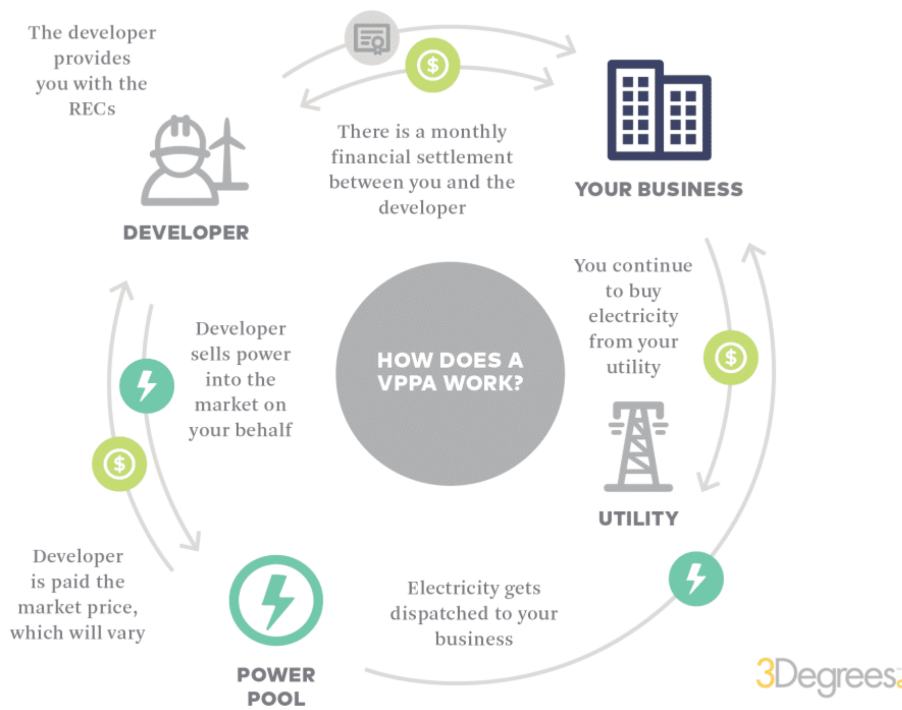

Figure 1.5. In a virtual PPA, the electricity is sold separately from the RECs (Penndorf, 2/5/18).

Community solar – offsite participant

Enabled in Oregon by recent legislation (SB 1547), community solar is designed to bridge a gap in solar access between utility-scale projects and solely-owned residential rooftop systems. Community solar allows utility customers to subscribe to or own a portion of a solar array located at a well-suited site within the community or defined allowable area. A number of states have community solar programs that differ in rules and management, details that Oregon is still finalizing. Based on rulemaking so far[4], community solar projects will need at least five participants (subscribers). Any one subscriber will be limited to 40% of a project’s capacity and

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[4] https://apps.puc.state.or.us/edockets/docket.asp?DocketID=20304

projects have a maximum size of 3 MW. PSU, with buildings in both PGE and Pacific Power territories, should be able to participate in one project per territory (L. Rubado, personal communications, June 7, 2017; J. Valdez, personal communications, 8/10/17).

To enroll in a program, participants will pay a subscription fee, facilitated through their utility. In addition to the fee paid, participants will receive a bill credit that equates to the actual electricity generated by the individual customer's share of the community solar project times a bill credit rate (Figure 1.6). This bill credit rate will be called the resource value of solar (RVOC) (Oregon Public Utilities Commission, 2017).

Each project subscriber will receive the RECs associated with their share of the project. In addition, Oregon's community solar program has additional rules to encourage participation by low-income utility customers (L. Rubado, personal communications, June 7, 2017).

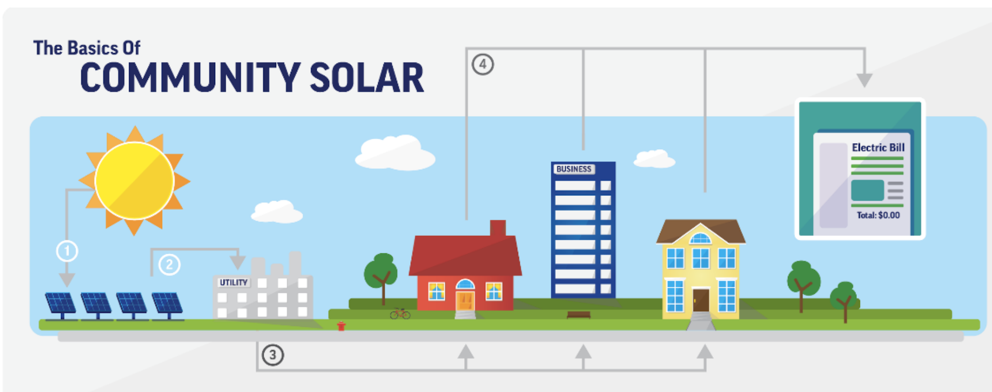

Figure 1.6. Community solar diagram and steps: (1) the community solar array generates electricity; (2) the electricity flows to the electric grid, metered by the utility; (3) the utility measures the amount of energy generated and delivered to customers and multiplies this by a resource value of solar; (4) this calculated amount is credited on customer utility bills (Solect Energy, n.d.).

Direct access

Direct access is a program available to commercial utility customers in Oregon, allowing a customer to choose an alternative electricity provider than the default utility. PSU has participated in direct access for almost 15 years with the same provider – Calpine Solutions, formerly known as Sempra and Noble Energy. With direct access, the provider (the Energy Service Supplier, or ESS) procures electricity for its customers but uses the transmission and distribution infrastructure of the local utilities. Therefore, for the accounts on direct access at PSU, the University pays Calpine for the electricity but still pays PGE for transmission and delivery and other typical bill charges.

Participating in direct access is a regimented process, involving determining eligible accounts, notifying the utility of the intent to move to direct access, completing an authorization, and contracting with the selected direct access provider. Using direct access can be a temporary move, for several years, or be a long-term energy management strategy. Dictated by the terms of the contract and authorization, the customer pays transition charges to the utility (T. Espinoza, personal communications, May 19, 2017; D. Grady, personal communications, December 2017). PSU has been on direct access for long enough that those transition charges have been fully paid.

Most customers pursue direct access to save money. Savings are often realized after the period of time that transition charges are paid to the utility. Long-term savings depend on a variety of factors, such as the wholesale energy market, the regulated prices charged by the utilities, and the negotiated direct access contract. PSU has been on a “commodities” contract with Calpine for years, meaning that Calpine is charged with procuring low cost energy to meet PSU’s demand (N. Mingo, personal communications, May 2017). This “commodities” or “business as usual” approach aims to balance risk and cost on the part of both Calpine and PSU.

To help customers meet renewable energy goals, Calpine and other direct access providers can provide a variety of services and products, from purchasing RECs to procuring bundled renewable energy, to facilitating something like an offsite PPA involving existing generation or a new build (T. Acosta & C. Sumner, personal communications, 6/5/17 & 4/26/18; C. Stockley & S. Rosman, personal communications, 2/28/18). The manner in which an ESS can help a customer meet renewable energy goals will depend on many of the factors acknowledged so far in this report –the customer’s preference for generation type, location, quantity, REC specifications, and more. Each ESS is uniquely suited or challenged to meet renewable energy goals given that the six approved companies in Oregon vary in company structure and values. For example, Avangrid Renewables, another ESS, is a firm that also develops wind power in the Pacific Northwest. This opens the opportunity for Avangrid to potentially sell some of that power to direct access customers (C. Stockley & S. Rosman, personal communications, 2/28/18).

Ownership model

Entities that own land can choose to develop a large-scale renewable energy project to serve their own needs, sell the energy and RECs generated to a utility or other party, or lease that land to another party that wants to develop renewable energy there. In Oregon, pursuing such a project would involve working with (at least) a developer to determine siting, design, financing, and more. In addition, depending on which service territory the project is located, PSU would need to work with either a utility or other potential purchaser of the electricity that is generated, perhaps through a structure like a contract for differences. Or, PSU could work with a third party to wheel the electricity to the PGE grid. Given the intricacies, direct access is a more relevant strategy for large-scale offsite renewable energy in Oregon (T. Espinoza & C. Nelson, personal communications, 10/24/18; J. Barra 5/26/18).

1.3.2c Onsite project options

Based on PSU's campus, rooftop solar is the main option available for generating renewable energy on campus; PSU currently does this in a limited capacity. Although examples of other renewable energy technologies exist in Portland, such as small-scale wind and anaerobic digestion of food waste, onsite solar development was the focus of my research regarding onsite project options. At PSU, to max out solar as an onsite resource, installations will need to occur on rooftops or as shade structures on parking garages of buildings deemed structurally appropriate. The options below describe how onsite solar projects can be funded and managed.

Any onsite solar project requires following the correct process for permitting and bringing the system online, including applying for net metering through PGE or Pacific Power. Net metering allows a customer to offset what it has to purchase from the utility with the energy generated from the onsite project (Figure 1.7). Net metering has been described as letting the meter "spin both ways". To facilitate and lower the cost of installing solar, the Energy Trust of Oregon (ETO) offers incentives to help fund solar feasibility assessments and initial steps to design buildings as solar ready (J. Hall, personal communications, 9/21/17). Customers of PGE can also take advantage of the PGE Renewable Development Fund that helps cover hard project costs and educational components (PGE, n.d.).

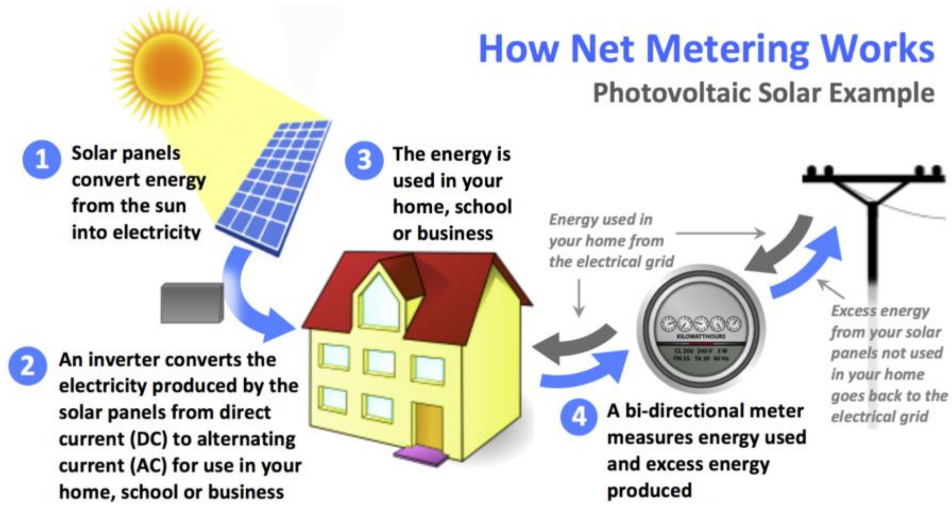

Figure 1.7. Diagram of net metering for onsite solar (HelioPower, 2017).

PSU-owned solar

PSU currently owns the solar installations present on campus, meaning that the University paid in full for the installation and owns the power produced. For PSU or another commercial entity, this process begins with a feasibility assessment, typically followed by a competitive bidding process to find an installer. The competitive bidding process looks at location, capacity, materials (like racking and solar panel type), inverters, metering, and more. The selected bidder installs the system with the owner paying in cash or through loan financing. Unless otherwise stipulated in a financing agreement, the owner gets both the electricity and any RECs generated by the installation, however, typical commercial installations do not necessarily go through the process to register and account for RECs (J. Hall, personal communications, 9/21/17; Solar Oregon, n.d.). This strategy for developing onsite solar typically requires high upfront costs with savings accruing after many years. Like any solar project, there are ongoing preventative maintenance needs.

Third-party power purchase agreement

The PPA model described previously for offsite projects can be applied to onsite renewable energy, like rooftop solar. With an onsite PPA, a business or buyer enters into an agreement with a third party that will install and own the system. The third party owns the installation while the buyer agrees to purchase the electricity produced at a set price (with possible price escalator) over a specific contract length, typically 15-20 years. Here, the third-party owner takes on the risk and responsibility associated with owning a solar installation. At the end of a contract, the buyer and third party can negotiate a new contract, the buyer may purchase the system outright, or the third party could conceivably remove the solar from the buyer's property (Solar Oregon, n.d.).

Depending on the price of electricity and contract details, an onsite PPA can result in cost savings for the buyer or it may cost more than the market price. Either way, for a homeowner or small business, an onsite PPA can offer predictability in energy cost for the term of the contract.

Oregon clean power cooperative

The Oregon Clean Power Cooperative[5] combines investments starting at $1,000 from individuals to fund and manage onsite solar (Figure 1.8). A Cooperative project looks very similar to an onsite PPA - in this case, the Cooperative is the third-party owner and manager of the solar installation. The Cooperative and its financer keep any associated RECs during the contract term while the project recipient receives and uses the solar electricity generated by the project. Because sites like schools, churches, and nonprofits cannot take advantage of federal tax incentives for renewable energy and may otherwise be challenged to fund onsite renewable energy, the Oregon Clean Power Cooperative leverages the tax equity of a private financer, Key Bank, the funding from individual investors, and its team as project managers to help these sites benefit from solar energy (D. Orzech, personal communications, 5/25/18).

The 10-year PPA between the project recipient and the Cooperative is typically structured so that by the end of the contract the recipient will have saved money over what it would have spent if the customer had purchased the equivalent amount of electricity from the utility. At the end of the 10-year contract, the recipient may put those savings towards purchasing the solar installation from the Cooperative. Of the completed and current Cooperative projects in Oregon, two are in the Portland area, including the complete installation at Mazamas[6] in Southeast Portland, and a pending project at the First Unitarian Church of Portland, near PSU (D. Orzech, personal communications, 5/25/18). The Cooperative uses the phrase "community-owned renewable energy" to describe its mission, but the details are different than and shouldn't be confused with the Oregon Community Solar Program.

[5] http://oregoncleanpower.coop/
[6] https://www.solarpowerworldonline.com/2017/07/elemental-energy-completes-36-kw-solar-project-mazama-community-oregon/

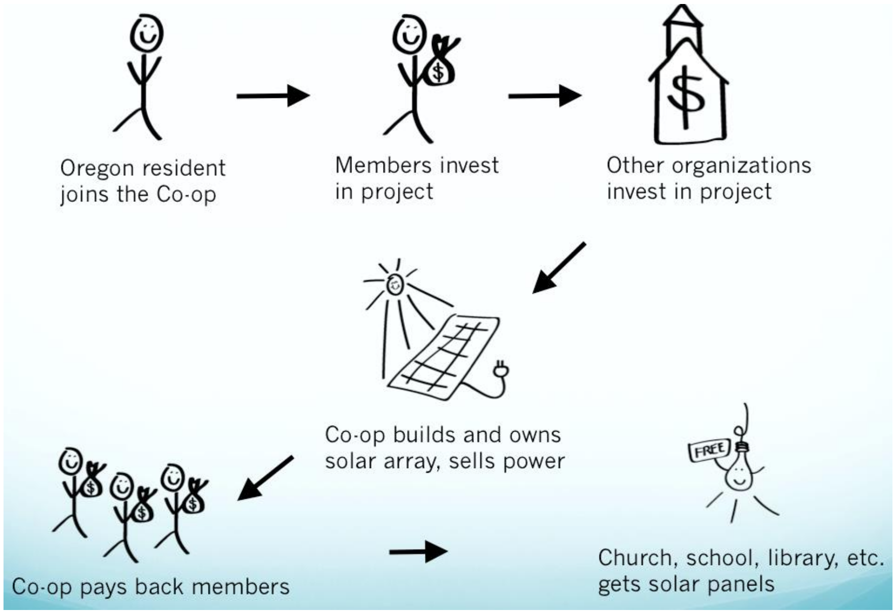

Figure 1.8. Oregon Clean Power Cooperative (n.d.) process, combining investments from individuals to build solar.

Community solar – host

Another option for hosting or receiving a solar installation is through the Oregon community solar program. Once the community solar program launches, PSU can participate as a subscriber or part owner of an offsite project (described above) and/or be a host or recipient for a project located on one or more PSU buildings. PSU could, but would not be required to be a subscriber to a community solar installation hosted on campus. Either way, PSU would be offering its rooftops to support new renewable energy development. PSU would only own RECs if participating both as the host and a subscriber.

As with any renewable energy project, aggregating load typically results in economies of scale and lower costs for buyers. This would likely be true for many of the mechanisms described so far, including community solar. As a community solar host, for example, PSU could host one community solar project up to 3 kW capacity, across multiple rooftops, as long as they are in the same IOU territory (L. Rubado, personal communications, June 7, 2017; J. Valdez, personal communications, 8/10/17).

1.3.2d Other models

This section describes three models – one that is coming soon to Oregon (green tariff) and two that are not available here (fully competitive supply and community choice aggregation). The latter two are included so readers can understand the broader voluntary landscape as these options are relevant to universities in other states.

Green tariffs (coming soon to PGE, the "Green Future Impact" program)

Utility green tariffs are typically a specific "product" or offering to customers involving the transfer of energy and/or RECs from a single or set of specific generation sources. Green tariffs offer more impact and tangibility than RECs alone or traditional utility green power programs. Green tariffs are viewed as encouraging or enabling the development of new or planned renewable energy projects, often located locally or regionally. Utilities in several states have or currently offer a green tariff-like product (Figure 1.9). Tawney & Ryor (2014) explain the advantage of a green tariff as "customers that are happy with their electricity today would not be impacted, while those that want to go above and beyond the standard mix could purchase local, renewable energy".

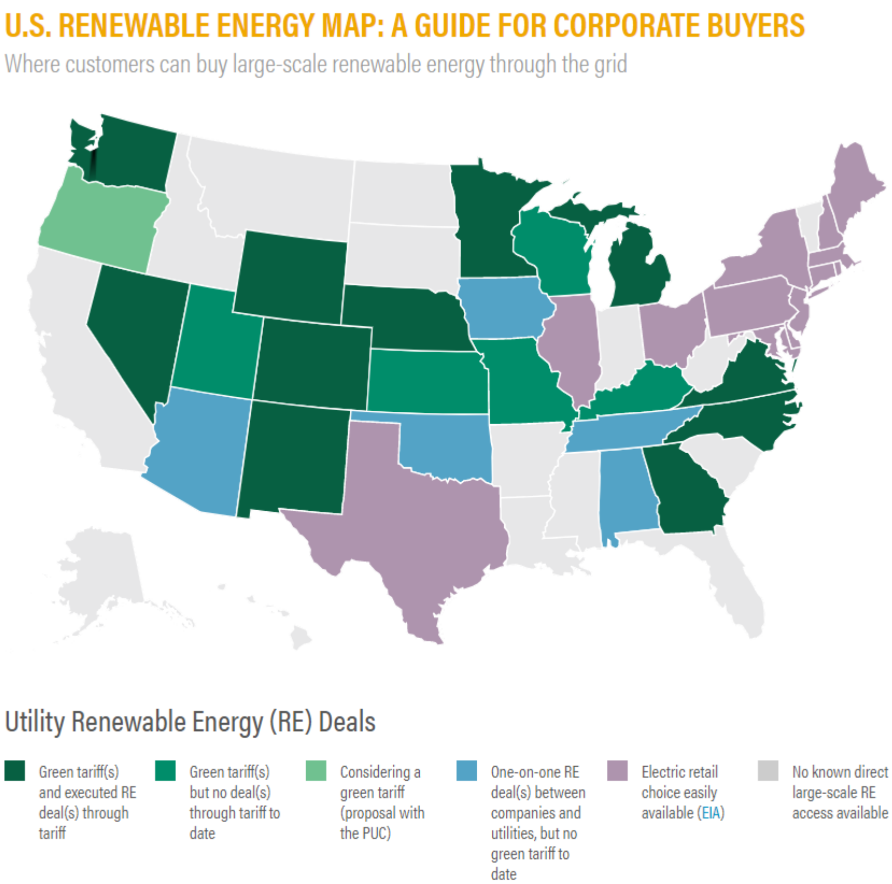

Figure 1.9. Map showing green tariffs, retail choice, and other options that corporate buyers have across the United States. Green tariffs are coming in Oregon (World Resources Institute, 2018).

From 2014-2016 the Oregon Public Utilities Commission considered a green tariff for PGE and Pacific Power. The effort was supported by municipal and commercial utility customers but ultimately was not successful. In the meantime, several organizations have continued to support this mechanism as an option for Oregon utility customers. After a series of stakeholder and public meetings, PGE filed a new application to offer a green tariff to its commercial customers in March 2018. A number of factors have aligned to move the green tariff forward this time. PGE's green tariff, Green Future Impact, is anticipated to launch in Spring 2019 (J. Halley & Jill King, personal communications, October 2018). At this time, rulemaking is still underway.

Interested commercial customers will need to apply to the Green Future Impact program, opting to enroll some or all of their PGE-served capacity. After signing a 10 or 15 year contract with PGE, the customer will receive a both the renewable energy and RECs associated with their contract. In phase one of this program, energy and RECs will come from a specific new project, likely solar or wind to be constructed in Oregon or Washington. The OPUC has approved a program design that ensures only those customers enrolled in the green tariff bear the cost; ensuring no rate impact across all PGE's customers (J. Halley & Jill King, personal communications, October 2018). Program development and decisions can be tracked through the OPUC dockets UM 1690[7] and UM 1953[8].

Fully competitive supply (not available in Oregon)

In a fully deregulated or restructured market, customers have retail choice, meaning that they can decide who to buy electricity from. This decision may not be driven by renewable energy or sustainability goals, but a competitive market opens up the opportunity to search for suppliers that meet these goals and criteria. When choosing a supplier based on renewable energy goals, transactions typically include both renewable energy and RECs (O'Shaughnessy et al 2017). With Oregon's partially regulated utility electric utility sector, this degree of choice is not available to PSU. PSU's retail choice is limited to the direct access program.

[7] https://apps.puc.state.or.us/edockets/docket.asp?DocketID=21421
[8] https://apps.puc.state.or.us/edockets/docket.asp?DocketID=18956

Community choice aggregation (not available in Oregon)

According to O'Shaughnessy et al (2017) seven states "have passed legislation that allows certain jurisdictions to form community choice aggregations (CCA)." A CCA takes the economies of scale realized with aggregation to procure a desirable energy mix (like 100% renewable energy) for the customers in the participating jurisdictions. Typically, energy procured by a CCA uses the existing transmission and distribution infrastructure. To aggregate as much demand as possible, customers are usually automatically enrolled into the local CCA where they can opt for one or more products. For example, in Marin Clean Energy (MCE) territory (a CCA located in California), customers are automatically enrolled in the 50% renewable "Light Green" product but can opt-up to a 100% "Deep Green" product, a 100% "Local Sol" solar product, or opt-out and return to receiving their electricity from the default utility, Pacific Gas & Electric. Although CCAs may not be strictly voluntary (in the case that customers are automatically enrolled), they often offer the opportunity to opt-up to a more renewable-focused product. MCE's model may not be representative of all CCAs, but it does represent a model focused on supplying customers with renewable energy. The CCA model is not currently and is not likely to be available in Oregon in the near future.

1.3.3 Voluntary renewable energy in higher education: case studies

Stories of voluntary large-scale and often low-cost renewable energy deals are increasingly making the news. While the market has been traditionally driven by corporate players, higher education institutions are increasingly choosing renewable energy as well, through a variety of mechanisms. According to Andrews et al. (2017) 240 campuses used approximately 3,063,804 MWh of renewable energy in 2014 and it is expected that these numbers will grow (Table 1.3). Like PSU's motivations, many of these institutions are driven by climate action plan goals or similar commitments but are also often motivated by cost-saving opportunities, marketing, risk management, pedagogical opportunities, and more.

Table 1.3. Number of campuses pursuing voluntary renewable energy transactions (Andrews et al, 2017).

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014
# campuses	22	55	82	96	164	176	201	215	240

Most higher education renewable energy projects historically involved the purchase of RECs. Despite the historical reliance on RECs purchases, larger-scale physical offsite projects have grown in popularity in recent years, while onsite projects tend to play a smaller, but still important role (Figure 1.10) (Second Nature & Customer First Renewables, 2017).

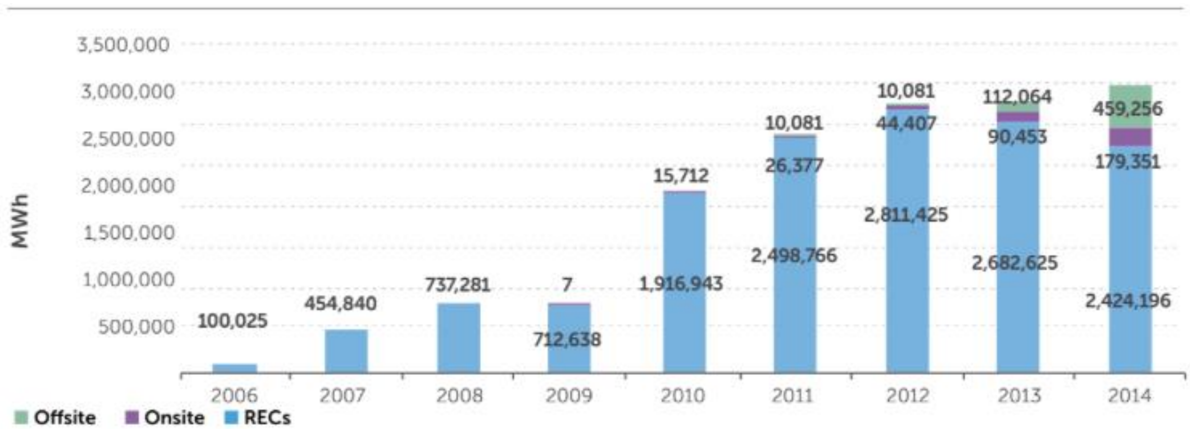

Figure 1.10. Growth and source of voluntary renewable energy use in higher education (Andrews et al, 2017).

Here, I highlight five higher education renewable energy projects that go beyond just purchasing RECs. It should be noted that although all of these examples use solar as the renewable energy technology, other renewable energy sources have been used to meet higher education and corporate renewable energy goals. The EPA's Green Power Partnership[9] offers a comprehensive list of entities in the US that use renewable energy and is recommended as a source if more examples are desired.

Oregon State University Onsite Solar

Oregon State University (OSU) finalized the installation of five ground-mount solar arrays in 2013. All five systems are located on University-owned land adjacent to the main campus and have a combined capacity of approximately 2.83 megawatts (MW), producing 3-4% of OSU's total electricity usage annually. Developed and installed as part of a statewide Oregon University System (OUS – now disbanded) initiative called "Solar by Degrees", the project is structured as a net-metered PPA. Under this arrangement, a third party maintains ownership and

[9] https://www.epa.gov/greenpower/green-power-partner-list

maintenance of the arrays while OSU purchases the project's output for an agreed-upon price. OSU still receives most of its electricity from its default provider, Pacific Power (B. Trelstad, personal communications, August 2017; Oregon State University, n.d.).

Within Oregon, this project is unique in that it occurred with substantial support from a statewide program that is no longer available for PSU to utilize. In addition, net-metering is possible with these arrays because they are located on OSU-owned land, meaning the arrays are an onsite solution to doing larger-scale renewable energy development. This is more likely to occur on a more suburban or rural campus, like OSU.

Stanford University offsite solar

Under the umbrella of the Stanford Energy System Innovations project (SESI), about 50% of Stanford's electricity is supplied by solar. The majority of this comes from a 67 MW offsite solar farm in Kern County, CA. Working with SunPower, Stanford entered into an offsite PPA to purchase the output from this solar farm. In addition to procuring the bundled energy (the actual electricity produced and the RECs) Stanford benefits from this investment as the solar farm acts as a demand management strategy, able to cover Stanford's peak electricity demand of 42MW. The PPA in this case is a 25-year agreement between Stanford and SunPower (Kubota, 2016; Stanford University, 2017).

Both the size and contract length of this project are notable. California has even more aggressive state-wide renewable energy mandates than Oregon and is a good location for solar, receiving a lot more sun than many parts of Oregon. Not only is Stanford located in a renewable energy-friendly state, the institution itself is well-endowed. These factors help to contextualize this impressive offsite project.

Michigan State University solar carports

To work towards the goals in their Energy Transition Plan, Michigan State University (MSU) finished construction of several carport solar arrays on its campus in 2017. There are five sites with carport solar arrays, covering 5,000 parking spots over 45 acres, for a total capacity of 13.4 MW. MSU worked with consultant Customer First Renewables to develop, issue, and manage responses to RFPs for the installations. Similar to OSU, an onsite PPA is used here, which allowed MSU to negotiate a purchase price for the electricity produced during the lifetime of the 25-year contract. This PPA functions like many others, where the agreed upon price in the short term is greater than the default utility rate, but as energy prices rise in the future, the price MSU is paying through the agreement is predicted to be lower than the wholesale price. Estimated savings are $10 million over the next 10 years (Bauer & Boomer, 2017).

American and George Washington collaborative procurement

The Capital Partners Solar Project between American University, George Washington University, and the George Washington University Hospital demonstrates the economies of scale realized when demand is aggregated. Through an offsite PPA, the collaborative contracted with Duke Energy Renewables to develop 52 MW of solar capacity, constructed in North Carolina. Each institution can cover about 50% of its electricity demand through this project and should save millions of dollars over the 20-year contract with a fixed PPA price anticipated to remain below the wholesale energy price over this period (Carter et al, 2017; GW Office of the Provost, n.d.; Lazarova, 11/22/2015).

Focusing in on American University's perspective, the story of pursuing this project mirrors many other higher education institutions. The University had essentially maximized its onsite solar capacity and had turned to purchasing RECs to meet its climate commitments. Despite American's purchase of RECs, the university maintained a desire to drive greater impact in the renewable energy field. Getting the word out about their interests led to learning of other interested partners. To overcome potential decision-making and approval barriers, American was intentional in engaging critical stakeholders and leadership early in the process. The collaborative is located in a fully deregulated market which opened their options for an offsite project like this (C. O'Brien, personal communications, 5/19/17).

Boston University virtual wind PPA

In September 2018, Boston University (BU) announced a PPA with ENGIE North America to purchase wind energy from a new wind project in South Dakota. The 15-year agreement is for 48.6 MW of wind capacity, enough to cover all of BU's annual electricity use. While it is not explicitly stated on BU's website, this is a virtual PPA with the physical energy feeding into the South Dakota grid and the Green-e RECs transferring to BU. Additional benefits include educational and research opportunities structured into the contract. BU Sustainability (n.d.) stated that “out of 127 wind and solar project proposals received from across the country, BU chose a project with the greatest impact on global emissions. This new South Dakota wind farm will realize 2 to 3 times greater avoided emissions than a project in New England due to the large percentage of green power already in the ISO-New England electrical grid”.

This project is interesting for a few reasons, including the related climate action goal, institutional criteria, and project marketing. BU’s climate action plan opens the door for RECs to be a central mechanism, with the institution goal to “match electricity needs with new renewable resources” (Boston University Sustainability, n.d.). “Match” feels less stringent and specific than say the “generates” statement in PSU’s CAP. Criteria considered by BU’s Climate Action Plan Task Force called for the selected project to be new; include Green-e RECs; have favorable project economics and developer financial strength; global emissions impact; and presence of environmental, health, education and research opportunities.

BU’s strategy also reflects the idea that universities can use their purchasing power to encourage renewable energy development in a place where it is less likely to occur and/or in disadvantaged communities. By leading with a “matching” strategy BU did not need to focus on whether or not the associated energy is used within their regional grid.

1.4 Conclusion: PSU’s renewable energy options: key takeaways

It is clear that PSU has several options for increasing renewable energy use on campus. A critical lesson I learned while researching the voluntary renewable energy market is this: PSU’s renewable energy procurement and development options are largely defined at the state level and are further dependent on the fact that PSU is located in two IOU service territories. Therefore, what businesses and higher education institutions can do in other states to meet renewable energy goals is not necessarily reflective of PSU’s options. Other ideas, questions, and considerations gleaned from interviews include:

- Oregon has relatively inexpensive energy prices and peak demand pricing (especially compared to California). This may make it more difficult to find options that are financially feasible or cost-saving (personal communications, multiple stakeholders).
- There are other ways that PSU can support renewable energy development and adoption beyond sourcing it for use on campus. What if PSU “matched” its energy use by supporting and enabling its students, faculty, and staff to increase their use of renewable

energy at home? For example, PSU could facilitate community solar projects or a Solarize[10] program for its faculty, staff, donors, and alumni (E. Ramsey, D. Wanderscheid, & L. Kappel, personal communications, 8/11/17; J. Valdez, personal communications, 8/10/17).

- Many key informants felt positive about direct access as an opportunity and mechanism to increase renewable energy use. This was especially the case given that PSU is already a direct access customer. For the most part, key informants were not familiar with Calpine Solution's renewable offerings for customers. Instead, Avangrid Renewables and 3Phases Renewables are two direct access providers that were often mentioned as "renewable friendly" (D. Grady, personal communications, 10/2/17; K. Nelson, personal communications, 10/24/17).
- There was a lot of enthusiasm for partnership opportunities across the board, from aggregating PSU load with other customers, to corporate sponsorship of renewable energy development in PSU's name. Ideas here included aggregating with other Oregon higher education institutions, the City of Portland, or Oregon Department of Transportation; and/or sponsorship through Under Armour or Providence Park (N. Mingo, personal communications, 5/4/17; L. Rahr, personal communications, 6/28/17).

There was a key difference between conversations with internal and external stakeholders. A number of PSU stakeholders expressed enthusiasm for the idea of PSU developing a large offsite project, using something like the ownership model described above. On the other hand, this option was not typically recommended by external key informants, noting access to a site (land) and various technical and administrative barriers. This disconnect highlights the value of the methodology used in this project; taking a wide look at PSU's options and assessing them based on multiple values and criteria is important because individuals have different perspectives regarding what PSU should do to meet renewable energy goals.

There is one more takeaway from key informant interviews to mention – PSU's options for renewable energy development and procurement are not as discrete or mutually exclusive as they initially appear. The voluntary renewable energy market is constantly evolving, with

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[10] https://sparknorthwest.org/projects/solar/solarize-northwest/

contracting strategies often being tailored to each project's needs. In addition, physical energy and/or RECs can be combined to meet goals in a variety of ways. Therefore, while there are clear differences between a virtual and physical PPA, for example, there are multiple ways of pursuing either one of those mechanisms. Combining implementation flexibility with utility regulation opportunities and barriers in Oregon, customers are unlikely to find two identical voluntary renewable energy deals; each one looks different based on customer needs and desires (T. Espinoza & K. Nelson, 10/24/17; E. Ramsey, D. Wanderscheid, & L. Kappel, personal communications, 8/11/17; D. Grady, personal communications, multiple occasions). In many ways this is good because it is a buyer's market, but flexible and tailored options make clear identification and assessment of PSU's options complicated.

1.4.1 Case studies lessons

The case studies presented in this report represent a spectrum of larger-scale projects, including onsite and offsite projects as well as physical and virtual agreements. All of these projects are well promoted by the host institution and most received recognition is higher education sustainability resources and webinars. Beyond their visibility, there are a number of important takeaways from these examples.

Economies of scale, particularly as realized through load aggregation. A single higher education customer may not have significant electricity demand to warrant a new large-scale project to be built. Therefore, by pursuing a collaborative procurement model, several entities can aggregate their load and go out to bid together. A larger project (say, 50 MW capacity instead of 5 MW capacity) often attracts more bidders at competitive prices (Carter et al, 2017; Second Nature & Customer First Renewables, 2017). Because PSU does have a relatively large load, leading a project with other small local institutions may be a viable option for aggregation.

If partnering with multiple entities is not feasible, a single institution can look to plan strategically to aggregate its own load, particularly over a large campus or decentralized institution. For example, MSU went out to bid for multiple onsite parking lot sites at once resulting in a better financial deal than putting solar over each parking lot one-by-one.

Clearly stated goals and parameters are critical and must be agreed upon by key stakeholders. To move forward with any large-scale renewable energy project, key stakeholders, such as sustainability and facilities staff, as well as financial and administrative decision-makers have to be involved. In the case studies, these key players identified and developed consensus on several important factors and considerations, from acceptable cost premiums, to management implications, to preference for regional supply, and more. A challenge in facilitating and involving many stakeholders is that each will have a different degree of expertise and connection to the project's outcome, but it is critical to engage them nonetheless. This sentiment was reflected in references to failed campus projects as well.

Describing projects is not all that easy. Explaining the details of a project and how it contributes to or allows an institution to meet its renewable energy goals must be done correctly and transparently. The campus community and public are an important audience so information needs to be communicated in a straightforward and easily digestible manner while not omitting so many details that the outcomes are vague or misleading. Doing this is a challenge; it's hard to find a single sentence description that accurately and completely sums up any one project. In addition, there is a lot of technical jargon – it makes sense that BU does not use "virtual PPA" to describe its project as that will not mean anything to many in their audience.

This communication challenge should not be a deterrent from pursuing renewable energy projects but identifies a skillset needed on the project team. It is certainly possible that university staff can do this sufficiently, but there are often third-parties involved. In addition to other services, a third-party (consultant, service provider, legal team, developer) often assist the higher education institution develop, implement, and publicize their project. Therefore, an important role for any larger-scale renewable energy project team is someone to develop appropriate marketing language to describe the project.

Project options are shaped by local, state, and regional energy policy. Although case studies of higher education institutions are helpful, it is critical to understand that what one institution can do may be very different than a similar institution located in a different region or state. Local and regional utility regulation and energy policy frame the possibilities in any given location. Despite similarities in number of students, budget, and other factors between higher education institutions, similar institutions in different locations may not be able to pursue similar projects. Therefore, it's important to glean transferable information from case study examples and set goals that are realistic to an institution's legislative and policy context in addition to its institutional features.

Chapter 2 Assessment of options & recommendations for PSU

2.1 Introduction: PSU's unique context & current energy use

Higher education institutions pursue renewable energy projects through a variety of mechanisms, from developing solar on institution-owned land to collaboratively procuring electricity and RECs from a facility located several states away via a power purchase agreement (PPA). Despite some similarities between PSU and the case study institutions reviewed in Chapter 1, it is important to define PSU's unique context, including factors that may enable or inhibit efforts to meet renewable energy goals.

Oregon-based entities face limited retail choice compared to institutions in some other states, particularly compared to places with a fully deregulated market. As previously explained, however, PSU does still have several options available. Of the options identified in this project, the following are applicable to PSU:

- **Renewable energy certificates or credits (RECs)**: RECs need to be obtained and retired in order for an organization to claim it is using renewable energy. A tradeable mechanism to indicate renewable energy that has been generated, one REC equals one megawatt hour (MWh) of renewable energy produced. PSU can purchase RECs through its current electricity providers or through a third-party vendor.
- **Utility green power programs**: REC-based program with the utility retiring RECs on behalf of the customer. For PSU, available programs are Portland General Electric's (PGE) Clean Wind for Commercial & Industrial and Pacific Power's Blue Sky program.
- **Direct access – new build & existing bundled energy**: commercial customers purchasing electricity from an alternative Energy Service Supplier (ESS) under Oregon's direct access program can dictate renewable energy as part of the contract. A bundled purchase (energy plus the associated RECs) could come from a new or existing generation source. This is similar to an offsite physical PPA available in other states.
- **Virtual PPA**: a financial transaction where the physical energy produced stays on its local grid and the associated RECs transfer to the buyer. PSU can enter a virtual PPA but the generation source has to be located in a state with a regulated wholesale market, like California and other areas, but not in Oregon.

- **Portland General Electric (PGE) green tariff**: commercial customers receiving electricity from PGE can enroll in the upcoming Green Futures Impact program, paying a premium for energy and RECs from a to-be-determined new solar or wind facility in Oregon or Washington under a 10 or 15-year contract.
- **Oregon community solar program – offsite participant or onsite host**: following program launch (timeline unknown) PSU and other businesses and residents within investor-owned utility (IOU) territory can subscribe to a community solar project located offsite and/or host a project. Subscribers will have a net cost based on a subscription fee minus a bill credit and will own the RECs associated with their subscription level.
- **Onsite physical solar PPA**: PSU can add more solar installations on campus through an onsite PPA. Under such an agreement, an external entity would finance and build the installation on one or more PSU buildings and PSU would agree to purchase the electricity generated by the installation(s). RECs may or may not be involved.
- **Oregon Clean Power Cooperative project**: like an onsite solar PPA but sponsored and managed by the Oregon Clean Power Cooperative, a nonprofit. The Cooperative would collect individual investments and, with the backing of Key Bank, finance the solar installation(s) upfront, with PSU paying the Cooperative an agreed upon price for the electricity produced. RECs generated during the contract are retained by the Cooperative and its partners.
- **Offsite or onsite ownership model**: PSU can build a renewable energy facility offsite or on campus. If offsite, PSU would need to work with the utility in that area, potential purchasers of the electricity produced, and/or pay for the electricity produced to be moved towards PSU's local grid. If onsite, PSU would cover all costs for an installation and work with the City, utility, and other players on permitting, metering, and incentives.

PSU's urban 50-acre campus inherently causes some challenges to onsite generation with only a few buildings being a good fit for solar. With very little open space and land, conventional wind power is out of the question and microturbines tend to be cost prohibitive. PSU can strive to max out onsite solar capacity and prioritize solar on new buildings and major renovations but even with that strategy, onsite generation is only every likely to produce a small percent of total electricity needs. To that end, mechanisms to develop more onsite solar and max out PSU's capacity are assessed in this chapter. Onsite solar, despite capacity restrictions, is an important factor in PSU's renewable energy goals.

Given the negligible amount of electricity being produced by onsite solar, it is important to understand where PSU's purchased electricity currently comes from and how much the campus uses. According to 2015 and 2016 fiscal year energy data, PSU uses approximately 49,600 MWh of electricity annually (personal communications, N. Mingo, 2017-2018). The electricity used on campus is supplied by three providers across two utility service territories. The Portland metro area is located within two IOU service territories, whereas other portions of Oregon are covered by different types of utilities, like public utility districts. The two IOUs operating in Portland are PGE and Pacific Power. Pacific Power, under the umbrella of PacifiCorp, is owned by Berkshire Hathaway Energy (Pacific Power, 2018).

Most of the PSU campus is located in PGE's service territory, with a small portion (the Richard and Maurine Neuberger Center and the future Fourth & Montgomery Building) in Pacific Power territory. The two sites in Pacific Power territory receive electricity from Pacific Power, however, the sites in PGE territory receive electricity from two providers: PGE and Calpine Solutions, PSU's direct access provider, one of six approved ESS in Oregon. PSU's current three-year contract with Calpine Solutions is up for an extension in 2020.

The share of campus electricity usage covered by PGE, Calpine, and Pacific Power ranges from 3% to 75% (Table 2.1). With six of PSU's largest accounts, including the campus energy loop, Calpine supplies almost three-quarters of campus electricity.

Table 2.1. Total electricity usage and breakdown by electricity provider.

	Whole Campus	**PGE**	**Calpine**	**Pacific Power**
% of usage	100%	22%	75%	3%
Annual usage (MWh)	49,600	10,912	37,200	1,488

Unlike other universities with multiple campuses, PSU has a dense 50-acre urban campus. Therefore, while it is complex that PSU receives electricity from three different providers, having to find renewable energy solutions for one campus is less complicated that identifying multiple solutions for different campus locations.

2.1.1 Campus energy mix

PSU's three electricity providers procure and/or generate electricity for use by its customers using a combination of long and short-term strategies to ensure that enough electricity is available on the grid at any one time. The source or type of electricity in each providers' energy portfolio makes up its "energy mix". Oregon utilities and direct access providers must meet certain benchmarks for their energy mixes as set in Oregon's renewable portfolio standard (RPS). The RPS requires the IOUs and direct access providers serving IOU territories to supply more renewable energy than smaller utilities (DSIRE, 2016). To determine the portion of renewable energy in PSU's energy mix, PSU can use its electricity suppliers' mix as a baseline. Assuming PGE, Pacific Power, and Calpine are complying with the RPS, their energy mix at any given time contains at least the state RPS of renewables, currently 15%.

PSU's real-time energy mix is more challenging to define because of the large portion that is provided by Calpine Solutions, which does not report its energy mix as regularly, due to their energy procurement strategies. In 2014, Calpine reported that approximately 23% of their energy mix was provided by renewable energy, clearly above the RPS for that time (T. Acosta, personal communications, June 2017). Because the current PSU-Calpine Solution contract does not dictate a specific energy mix, it may change year-to-year. Therefore, to be conservative, the rest of this report will rely on the state RPS to define PSU's base level of renewables.

Beyond renewable energy, Oregon utilities also provide "carbon free" energy, principally, hydropower. On average, PSU's three electricity providers source 16% of their supply from hydro. Combining hydro as a carbon free electricity source with the state RPS renewables category, PSU's electricity mix is approximately 31% carbon free with the majority coming from carbon-intensive, non-renewable sources that lead to the GHG emissions targeted by PSU's carbon neutrality goal (Figure 2.1)

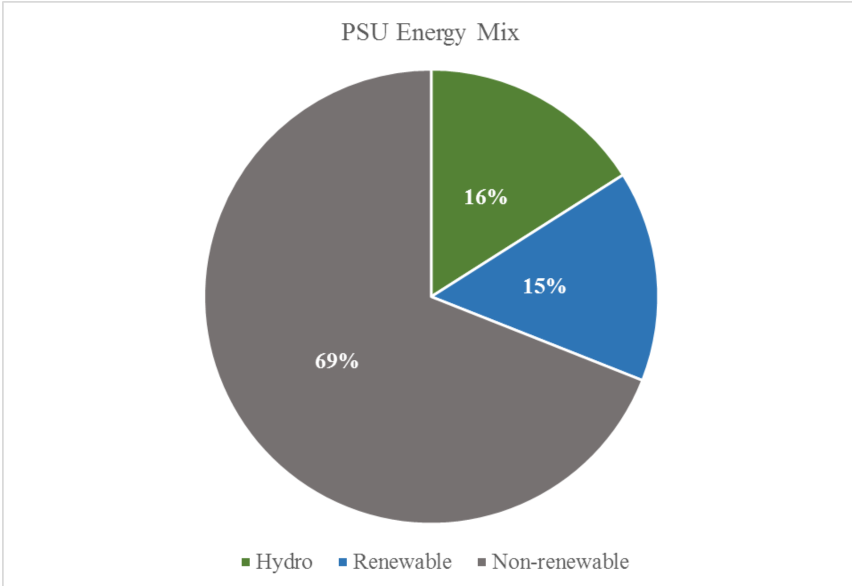

Figure 2.1. Simplified energy mix for PSU purchased electricity. Put together, hydro and renewable represent the carbon free portion of PSU's energy mix.

A final nuance to PSU's purchased electricity practices and energy mix is the University's history with RECs. From 2008-2011 PSU purchased RECs through Calpine Solutions to offset the energy used by a few buildings on campus. For those years, PSU's renewable energy use increased due to these actions. This practice was discontinued in favor of considering other alternatives, spurring this project and other efforts. RECs have also been purchased for one-off building projects, usually to get LEED credit towards a building's certification, as was recently done for the Karl Miller Center (J. McNamara & N. Mingo, personal communications, 2017-2018).

2.1.2 Decision-making for renewable energy

PSU has several options for expanding renewable energy use on campus and each option presents opportunities and challenges given PSU's current purchased electricity practices. Bringing these considerations into an assessment system is complex, so an important question I considered before designing an assessment system for this project was: how can I make recommendations that are actionable? It became clear that this project needed an assessment system to support recommendations with clearly defined next steps reflecting the reality of PSU.

Multi-criteria decision analysis (MCDA) emerged as a framework to support the creation of a values-based assessment system. Without labeling their suggested process as MCDA, a number of the higher education resources and examples reviewed for Chapter 1 used a values-based decision system. Key informants and online information about the case study projects, in particular, Boston University and Georgetown and American Universities, highlighted the importance of gathering input and criteria from diverse stakeholders. In addition, in their higher education white paper on large-scale renewable energy projects, Second Nature and Customer First Renewables (2017) noted the importance of gathering the right people to launch and direct decisions related to renewable energy.

The importance of including multiple perspectives reflects literature on MCDA, which acknowledges that single-criterion decision-making, such as selecting a project based solely on cost-effectiveness, is generally considered insufficient in the sustainability and energy planning fields. MCDA is both an academic and practitioner approach to address complementary and competing preferences and values in decision making. This is particularly important in the higher education sustainability field where social, environmental, and economic factors must be balanced with potential risks and rewards of operations decisions. MCDA is supported as a tool globally not only for the resulting decision-making outcomes, but also as a process that facilitates inclusion and balanced negotiation (Wang et al, 2009; Daim et al, 2013).

The MCDA framework can be applied to a broad array of decisions types where negotiation among multiple objectives is important. The breakdown and number of steps to perform MCDA vary, but generally include:

- specifying the decision-making group;
- outlining goals and objectives;
- identifying alternative options available to address those objectives;
- sharing and confirming criteria, values and interests;
- and determining the decision-making outcome or outcomes (which may or may not lead to action being taken).

Some or all parts of the process may be repeated, even multiple times, until stakeholders are satisfied with the outcome (Department for Communities and Local Government, 2009; Natural Resources Leadership Institute, n.d.; Hoberg & Peterson, 2015). Because the process can be tailored to the needs of the decision context, stakeholders may also include the public and other interests groups, in addition to institutional decision makers, as explored by Stagl in the case of UK energy policy (2006).

In the energy and sustainability fields, four main categories of criteria are often used - technical, economic, environmental, and social, covering a wide range of considerations from emissions and land use, to efficiency, to political acceptability and job creation (Wang et al, 2009; Haddad et al, 2017). While the number of criteria can indicate how comprehensive the MCDA process is, it is important that the number and types of criteria fit the individual context of any single decision. MCDA techniques also vary in terms of the weighting and scoring methodology and sensitivity used. These methods can be objective (equal-weighting) or subjective (rank-order weighting) and may incorporate qualitative and/or quantitative analyses. Wang et al (2009) observed in their review paper that equal weighting is often used in MCDA for renewable energy projects.

There are a number of technical methods for MCDA which are beyond the scope of this project. One such method, the analytical hierarchy process (AHP) was used by Haddad et al. (2017) to examine which renewable energy resources are preferred to address Algeria's dependence on fossil fuels. The process allowed for input from several subject-matter experts and revealed the importance of social and environmental aspects of decision-making for renewable energy. Also on the policy and planning side, Tsoutsos et al (2008) used MCDA methodology to examine alternative energy plans for meeting energy demand in Crete. Actors included local and regional governments, communities, and environmental activists. Seven criteria were included in their analysis, with each criterion broken down into five values. Stakeholders then indicted their preference for sub-criteria, which resulted in a preferred policy alternative, such as meeting demand with 100% wind energy or through a combination of sources. This studied utilized the approach called preference ranking organization method for enrichment evaluations (PROMETHEE) (Tsoutsos et al, 2008).

2.2 Methods

To inform recommendations, this project contained four major stages building off the general framework of MCDA:

(1) initial stakeholder engagement and goal development;
(2) identification, weighting, and incorporation of values and criteria into a decision-making and assessment scorecard;
(3) assessment of options using the decision scorecard;

(4) development of recommendations and alternative renewable energy pathways combining the scorecard results and takeaways from the research stage of this project.

The MCDA step of identifying alternative options is described in full in Chapter 1 of this report.

Early on, I began meeting with campus stakeholders to understand their potential role in this project and learn their perspectives and thoughts on PSU's renewable energy goals. Given some ambiguity in the University Climate Action Plan (CAP), I discussed possible opportunities to solidify PSU's renewable energy goal for purchased electricity, at least to guide my continued work on this project.

2.2.1 Stakeholder engagement: criteria identification & weighting

Following initial conversations with stakeholders to more clearly outline PSU's renewable energy goals, I commenced with research to identify PSU's renewable energy options. Next, the outcomes of those early conversations and my research were used to prepare for and conduct two major rounds of campus stakeholder engagement: an in-person discussion and online criteria weighting activity. The results of this process were used in the assessment phase.

On October 24th, 2017 eight PSU stakeholders from the Planning, Construction and Real Estate (PCRE) division gathered to review PSU's renewable energy goals and options for renewable energy development and procurement and to identify important values and considerations to shape a decision-making strategy. The eight stakeholders represented PCRE leadership and three of PCRE's departments: Facilities & Property Management, Capital Projects & Construction, and the Campus Sustainability Office (CSO). Two consultants, Kourtney Nelson and Tyler Espinoza from 3Degrees[11] , attended the meeting to assist with presenting the development and procurement options and to answer technical questions. In addition, important background content was covered, including an overview of PSU's current electricity use practices and related policies and utility regulation that shape customer utility choice in Oregon.

To frame the discussion and begin the conversation about values and criteria, the following considerations were displayed. These considerations were selected as conversation starters as they reflect many of the research and case study takeaways highlighted previously in this report.

[11] https://3degreesinc.com/

Scope & size:

- What is the desired capacity of a project and/or what current usage do we want to match?
- Do we find a solution to cover the whole campus, or one solution per utility territory?

Physical nature & tangibility:

- How important is tangibility and impact?
- Should there be a relationship between power generated and the electricity used at PSU? (preference for bundled solutions?)

Ownership & parties involved:

- Should we go for solutions that are PSU-owned and managed or by a 3rd party?
- Are we aiming to procure, develop, or invest in solutions alone or aggregated with other partners and buyers?

Financial:

- What types of projects and assets are interesting?
- What is the desired balance of upfront and/or long-term costs?

Access, resilience, innovation & community:

- Is there a preference for a "local" source of power and/or RECs?
- Do we prioritize an opportunity for energy storage and/or tie-in to a microgrid?
- What is the importance of potential educational and research opportunities?
- Should there be the potential for community members (individuals or organizations) as partners, investors, or beneficiaries of one or more projects?

Risk, execution & start-up time:

- What is stakeholders' tolerance for types and amount of risk or risk mitigation?
- What is the desired ease of implementation?
- Does implementation depend on the availability of in-house and/or external support?
- How long do we want to wait until we can begin to say we have met our goal?

During the meeting, these considerations were not necessarily all answered but they served as a backdrop of the typical considerations and questions that need to be addressed with renewable energy projects. Stakeholders were then prompted with two questions:

(1) What is important to you and what are your concerns when it comes pursuing PSU's renewable energy goals?

(2) Do any of the project options stand out to you as a good fit for PSU? Any that do not seem appropriate? Why?

The discussion portion of the meeting was recorded for internal note-taking.

The ideas, opinions, and sentiments shared at the meeting were used to develop an online Qualtrics-based criteria prioritization activity, completed by the same eight stakeholders present at the workshop. First, notes from the meeting were distilled and narrowed down to two sets with six decision-making criteria each - one set for offsite project options and one set for onsite. These criteria and their definitions were refined with assistance from my graduate committee. The criteria were listed and defined in Qualtrics as shown below in Tables 2.2 and 2.3.

Table 2.2. List of offsite project decision-making criteria used in the criteria weighting activity.

Criteria	***Offsite* Projects**
Support local generation	Preference is given to projects containing bundled renewable energy credits (RECs) with generation sources located within the Pacific Northwest.
Long-term savings	Preference is given to projects that are expected to recoup upfront costs with long-term cost savings.
Management implications	Preference is given to projects with reasonable time and material requirements. This means that project development, execution, management, and maintenance can occur with a combination of existing in-house staff expertise and external consultants (no new PSU staff need to be hired).
Pedagogical connection	Preferences is given to projects that make educational and research opportunities easily accessible through transparency of data, information about generation and transmission technologies, and potential access to the generation site(s).
Opportunity for partnerships	Preference is given to projects that facilitate partnering with other organizations or businesses to enhance sustainability outcomes or the realization of other institutional values.
Load coverage	Preference is given to projects that can overcome technical and policy barriers to cover all or nearly all of PSU's campus electricity load.

Table 2.3. List of onsite solar development decision-making criteria used in the criteria weighting activity.

Criteria	***Onsite* Projects**
Innovation and leadership	Preference is given to projects that demonstrate innovation and leadership in such a way that stands out among other higher ed renewable energy projects. This may be achieved through design; financing; deployment; integration with other programs and certifications; and/or inclusion of demand-response or storage elements.
Long-term savings	Preference is given to projects that are expected to recoup upfront costs through long-term cost savings.
Community benefit	Preference is given to projects that enable tangible community benefits like financial return and/or access to renewable energy for community members who may be investors, funders, and/or beneficiaries of a project.
Pedagogical connection	Preferences is given to projects that make educational and research opportunities easily accessible through transparency of data, information about generation and transmission technologies, access to the generation site(s), and professional development opportunities.
Management implications	Preference is given to projects with reasonable time and material requirements. This means that project development, execution, management, and maintenance can occur with a combination of existing in-house staff expertise and external consultants (no new PSU staff need to be hired).
Marketability	Preference is given to projects that result in ownership of renewable energy credits (RECs) so that PSU can make claims about both using and supporting renewable electricity.

After reviewing the criteria, participants were asked to weight them by assigning a weight of 0-120 to each criterion. 120 was used to aid in dividing between an even number of criteria. For example, a weight of 20 for each criterion would represent equal priority given to each. The activity wrapped up with the following four optional questions.

- Are there any other criteria that you would add to this list? Please explain in the space provided below. If there are no other criteria that you would add, please go to the next question.
- How would you revise the definitions of the above criteria? Please explain in the space provided below. If there are no revisions to the criteria definitions that you would suggest, please go to the next question.
- Are there any questions that you have about this project or the decision-making framework this project is attempting to develop?
- Is there anyone else you think should participate in this activity? Everyone invited to the 10/24/17 stakeholder meeting has already been asked to participate.

Participation in the weighting activity was requested by email and completed between December 12th-22nd, 2017. This process was granted an exempt review by the PSU Institutional Review Board. Screenshots of the activity are provided in Appendix A. Individual responses are not included for privacy, although no identifying information was collected from respondents

2.2.2 Scoring of options & application of criteria weights

After stakeholders completed the criteria weighting activity, results were downloaded and analyzed using Excel. Average scores for each criterion across stakeholders were used to develop the decision scorecard. The two scorecards (offsite and onsite) were applied combining criteria weights and points that I assigned (filling the role of "technical expert") to each criterion/project combination. The offsite scorecard was used to assess options currently or pending availability to PSU: direct access mechanisms; virtual PPA; community solar participant; ownership model; green tariff; and RECs purchasing. I did not include utility green power programs in the offsite scorecard given that green power programs are essentially the same as purchasing RECs. There are two direct access mechanisms included in the scorecard, including bundled renewables from a new build as well as from existing sources. The latter describes how something like an offsite physical PPA can be done in Oregon. For the onsite scorecard, I included all the mechanisms for funding and managing future campus solar installations: community solar host; third-party PPA; Oregon Clean Power Cooperative; and ownership model.

Two main scoring schemes were used to assess the fit of each project option for PSU. In order for the scoring to underpin my recommendations, I wanted to see whether the offsite and/or onsite options were sensitive to different scoring strategies. If a recommended option was really sensitive to the scheme it may present increased risk; whereas recommending an option that scored well on both schemes is likely to pan out as desired.

In the **first scoring scheme**, I assumed a "default" action of purchasing RECs for offsite projects options and PSU-owned solar for onsite project options. Then, to score options based on the set of criteria, I assigned points based using:

- -1: the project option fares less favorably than RECs / PSU-owned solar for this criterion
- 0: the project option fares similar to RECs / PSU-owned solar for this criterion
- +1: the project option fares more favorably than RECs / PSU-owned solar for this criterion

Purchasing RECs was used as the offsite criteria default for a number of reasons. At least initially, purchasing RECs was considered a “last resort” option for achieving renewable energy goals by project partners. With a strong desire for tangibility and impact, stakeholders expressed that while RECs will always be an option, other mechanisms will hopefully meet a greater variety of values. Another reason for using RECs as the default for offsite options is, without any other actions, in order to meet PSU’s renewable energy and climate action goals, RECs will have to be purchased since they are the most readily available mechanism.

For onsite options, I used PSU-owned solar as the baseline because this is how PSU has developed onsite solar in recent years. Even though PSU could continue developing onsite solar through University-owned projects, including other mechanisms in the decision-making framework provides an opportunity to introduce and assess other options.

For the **second scoring scheme**, I assigned points based on the degree of relevance of each renewable energy project option, including RECs and PSU-owned solar, for each criterion:

- 0: this criterion is not present or relevant for this project option
- 1: this criterion is somewhat present or relevant for this project option
- 2: this criterion is present or relevant for this project option
- 3: this criterion is strongly present or relevant for this project option

This scoring scheme provided a way to assess each project option as is, instead of comparing it to a default option.

After assigning points, I used Excel to multiply points by criteria weights and calculate final scores for each renewable energy project option. To explain this process to someone unfamiliar with my project, I like to compare this to a weighted course grade. With a weighted grade, the teacher decides how important each component is (for example, homework is worth 20%), then computes a final grade using the score(s) received and weight for that category. In this project, eight stakeholders key to the decision-making process for PSU investments in renewable energy anonymously decided the importance, or weight, of the criteria.

2.2.3 Development of recommendations

After completing the scoring and assessment process, I shared the results with project partners to observe initial reactions. Pairing the scorecard results with lessons learned and takeaways from my research about PSU’s renewable energy options and higher education case studies, I developed a primary recommendation for PSU to meet its renewable energy goal for purchased electricity. To account for future uncertainties and acknowledge that my primary recommendation may not be implemented in full, I also developed alternative pathways to express the variety of ways that PSU can approach its goal.

2.3 Results & interpretation

2.3.1 PSU renewable energy goal

There are several ways in which pursuing renewable energy aligns with PSU's strategic goals, mission, and values but it is important to have a clear goal that the recommendations in this report address. In the 2010 PSU CAP, the 2030 Buildings target #2 states that PSU will:

> "[Generate] 80% of total building-related energy use from local, renewable sources" (PSU, 2010, p. 35).

Action items offered to meet the CAP target include exploring solar, wind, and biomass energy, as well anaerobic digestion to turn organic materials into energy that can be used in buildings. Because of space and capital constraints, these mechanisms are not likely to be implemented on campus, revealing a need to reconsider PSU's potential renewable energy actions and sparking this project. The lack of progress on this existing goal calls for an alternative vision of the future. PSU's goal for renewable electricity could match the City of Portland's goal: *100% of the community's electricity from renewable sources by 2035*. The City's definition of renewable energy is:

> "WHEREAS, "renewable energy" includes energy derived from hydrogen, wind power sited in ecologically responsible ways, solar, existing and low-impact hydroelectric, geothermal, biogas (including biogas produced from biomass), and ocean/wave technology sources. These sources of energy can have significant public health and other co-benefits that can help address pressing ecological and environmental justice challenges in sensitive ecosystems and communities in Oregon and around the country;" (City of Portland, 2017).

After conversations about the City's goal, project partners felt comfortable adopting this as a guide for PSU. Goal-related discussions with stakeholders also revealed an important layer – the desire to achieve "impact". PSU is not alone in this desire; the renewable energy field has used the term "additionality" for a number of years to refer to the idea that actions taken by an entity like PSU results in new renewable energy generation capacity being added to the electricity grid. A lofty and somewhat unrealistic ambition, a 2018 paper from the World Resources Institute offered a more realistic spin to this sentiment, suggesting that pursuing "impact" as a more realistic framework.

Another broad framing for PSU's renewable energy goal is generation type, or the technology used to create electricity, as the City's definition addresses. There are several ways to generate renewable energy and each has pros, cons, and critics, as do non-renewable sources. To further narrow PSU's goal, sourcing was discussed with project partners, with a focus on hydropower. Hydropower is associated with many significant environmental, ecological, and economic impacts and recent studies have examined previously under-estimated GHG emissions that result from hydro (Deemer et al, 2016). The project team looked to the City's definition of renewable energy, which specifies 'existing and low-impact' hydro as acceptable. To mitigate potential concerns about even existing hydropower, this report ultimately focuses on renewable sources, not including hydropower. If needed, PSU can consider putting hydropower back on the drawing board, as it is an important source of carbon free energy in the Pacific Northwest.

Setting a goal for use in this project was and continues to be an iterative process. At the time of writing, this project and report aim to assess options for and suggest a path for PSU to procure or supply all of its electricity needs from renewable sources by 2035 by expanding use of electricity generated by solar, wind, or geothermal. This charges the University to close the gap between the state RPS and 100% of campus electricity usage (Figure 2.2).

Currently, with 85% (or 42,160 MWh) of PSU's energy mix coming from non-renewable sources, approximately 17-34 MW of solar photovoltaic (PV) capacity requiring 122-244 acres would be necessary to meet renewable energy goals (calculated using low and high capacity factors from Renewable Northwest, 2007 and using large PV capacity-weighted average land use from Ong et al, 2013).

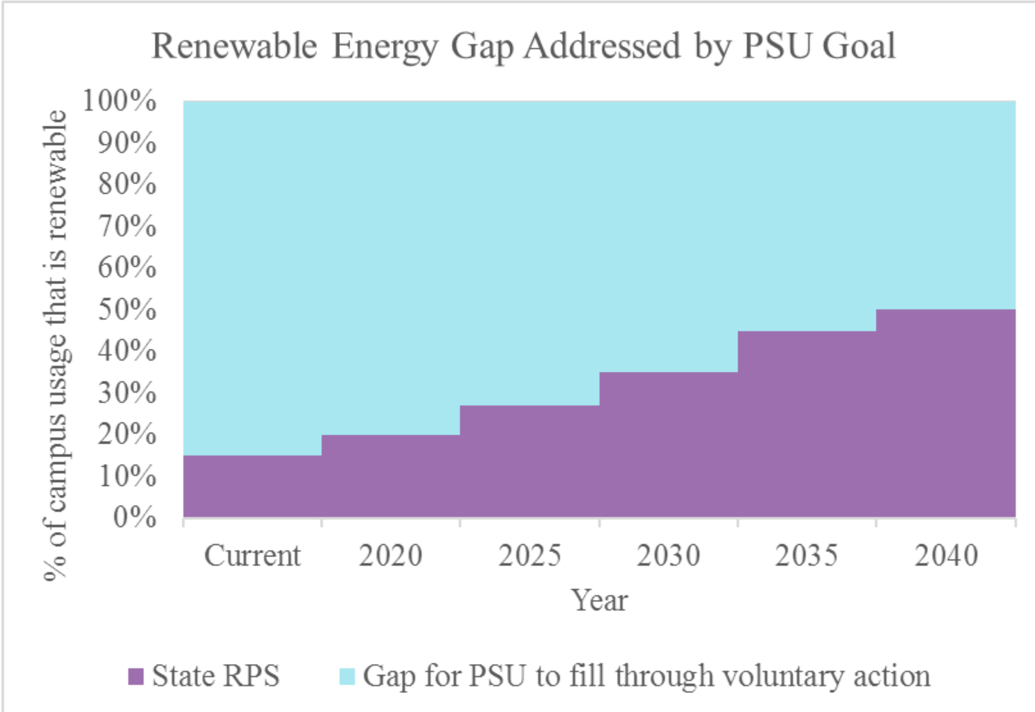

Figure 2.2. Oregon RPS and remaining gap to be filled through voluntary actions

2.3.2 Decision-making scorecard criteria weights

The eight stakeholders from PCRE who participated in the in-person workshop also completed the online criteria weighting activity, indicating the relative importance of each criterion in decision-making. I summarized the criteria weighting results for offsite (Table 2.4) and onsite (Table 2.5) renewable energy development mechanisms, by calculating the minimum, maximum, median, and modal weights for each criterion, as well as the average weight and percentage out of 120 points. Lastly, the number of respondents weighting each criterion below, at, or above 20 is shown. A weight of 20 for each criterion indicates an equal importance for all criteria, while weights above 20 indicate a higher priority for the criteria and weights below 20 indicate a lower priority for a given criteria.

Table 2.4. Summary of weights assigned to the decision-making criteria for offsite procurement and development options. Participants assigned a number from 0 to 120 which was converted into a percentage (% out of 120) for the final weight.

	Support local generation	Long-term savings	Management implications	Pedagogical connection	Opportunity for partnerships	Load coverage
Min	10	20	0	15	5	5
Max	40	40	30	40	40	25
Median	20	22.5	17.5	20	17.5	20
Mode	20	20	20	20	20	20
Average	20.625	27.5	15	23.125	17.5	16.25
% out of 120	17%	23%	13%	19%	15%	14%
# < 20	2	0	4	2	4	3
# = 20	4	4	3	3	3	3
# > 20	2	4	1	3	1	2

Table 2.5. A summary of weights assigned to the decision-making criteria for onsite solar development options.

	Innovation & leadership	Long-term savings	Community benefit	Pedagogical connections	Management implications	Marketability
Min	10	15	5	15	10	5
Max	30	40	20	30	35	20
Median	20	27.5	15	22.5	15	20
Mode	20	30	15	20	10	20
Average	20	27.5	15.625	23.125	18.125	15.625
% out of 120	17%	23%	13%	19%	15%	13%
# < 20	2	1	5	1	4	3
# = 20	4	2	3	3	2	5
# > 20	2	5	0	4	2	0

For *offsite* renewable energy development the long-term savings criterion received the highest weight and both long-term savings and pedagogical connections received an average weight substantially greater than 20. Of all individual responses, only one respondent assigned a weight of zero for any single criterion – management implications. Three criteria – management implications, opportunities for partnerships, and load coverage – all received an average weighting below 20; however, two participants weighted load coverage greater than 20, indicating that at least some PCRE stakeholders view load coverage as a priority criterion. Most criteria received at least one weight lower than, at, or higher than 20, except for long-term savings, which was consistently weighted at or above 20 by all of the PCRE participants. Half of the PCRE participants gave long-term savings criterion a weight of 20 and half provided a score greater than 20.

Long-term savings also received the highest average weight for *onsite criteria*. No *onsite criterion* received a weight of zero, but three criteria – marketability, community benefit, and management implications – received an average weight below 20, indicating relatively low priority for those criteria relative to the others. Community benefit received a weight of less than 20 from five respondents, while marketability received a weight of 20 from five respondents. These two criteria received the lowest average weights.

2.3.2.1 Criteria weights interpretation

Before applying the criteria weights to score offsite and onsite project options, there are some interesting observations to make based on the relative importance indicated by the assigned weights. First, the financial implications of PSU's renewable energy options were important to the stakeholder participants; the results show that projects that don't promise long-term savings may not be supported by PSU leadership. Second, that a pedagogical connection was the next most prioritized criteria for both offsite and onsite projects suggests that proponents of PSU renewable energy investments can communicate added value for investments that pose opportunities to build on the educational mission of the university. Third, the relatively small spread in weights across all of the criteria (between 13% and 23%) suggests that PCRE stakeholder participants, and potentially PSU leadership more generally, will not make renewable energy investments on financial considerations along, but instead perceive the importance of multiple criteria for renewable energy projects.

Nonetheless, for both sets of criteria, long-term savings is almost twice as important as the least important criterion, (management implications for offsite; community benefit and marketability for onsite). For offsite projects, one might interpret these results as meaning that more complicated projects (like a virtual PPA) may be palatable if they result in long-term savings and other benefits; whereas projects that do not create long-term savings (like purchasing RECs) or other benefits may be less desirable despite their ease to set up and their ability to technically accomplish the university's renewable energy goals.

2.3.3 Scoring of options

The two scoring schemes produced almost identical rankings, indicating that the outcomes were not simply an artifact of the scoring. For offsite options, participating in community solar scored highest on both scoring schemes (Table 2.6). Direct access from existing generation sources scored lowest with the first scheme and purchasing RECs, the baseline, scored lowest with the second scheme. With onsite options, the Oregon Clean Power Cooperative option consistently scored highest with a third-party PPA scoring lowest on the first and the baseline of PSU-owned scoring lowest on the second scoring scheme (Table 2.7).

Comprehensive scoring and total scores for offsite and onsite options are shown first (Tables 2.6 & 2.7), followed by rankings for each category (Tables 2.8 & 2.9). For offsite options the only difference between the two scoring schemes are the green tariff and ownership model switching spots for 2nd and 3rd place (Table 2.8). The rankings did not change between the two schemes for onsite solar options (Table 2.9). Despite receiving a negative total score compared to PSU-owned solar in the first scoring scheme, a third-party PPA fared slightly better the University-owned solar in the second.

Comprehensive Scoring

Table 2.6. Points assigned and total scores for offsite renewable energy development and procurement options for Scoring Scheme 1 (a) and Scoring Scheme 2 (b). Direct access is noted as DA.

a) Scoring Scheme 1 Offsite Baseline: RECs							
Project Options	**Support local generation**	**Long-term savings**	**Management implications**	**Pedagogical connection**	**Opportunity for partnerships**	**Load coverage**	**Total score**
Community Solar	1	1	-1	1	1	-1	0.48
Ownership model	1	1	-1	1	0	0	0.47
Green tariff	1	1	0	0	1	-1	0.41
DA - new	1	0	0	1	1	-1	0.38
Virtual PPA	-1	1	-1	1	1	0	0.27
DA - existing	0	1	0	0	0	-1	0.09
b) Scoring Scheme 2: no comparison							
Project Options	**Support local generation**	**Long-term savings**	**Management implications**	**Pedagogical connection**	**Opportunity for partnerships**	**Load coverage**	**Total score**
Community Solar	4	1	2	4	4	1	2.66
Green tariff	4	1	3	4	2	2	2.63
Ownership model	3	1	1	4	3	4	2.62
DA - new	3	1	2	3	3	3	2.42
Virtual PPA	0	3	1	2	2	4	2.03
DA - existing	2	2	2	1	1	3	1.80
RECs	1	0	4	1	0	4	1.41

Table 2.7. Points assigned and total scores for onsite solar development mechanisms using Scoring Scheme 1 (a) and Scoring Scheme 2 (b).

a) Scoring Scheme 1 Onsite Baseline: PSU owned							
Project Options	**Innovation & leadership**	**Long-term savings**	**Community benefit**	**Pedagogical connections**	**Management implications**	**Marketability**	**Total score**
Cooperative Project	1	1	1	1	-1	1	0.70
Community Solar Host	1	0	1	1	-1	1	0.47
Third-party PPA	0	1	-1	-1	1	-1	-0.07
b) Scoring Scheme 2 Onsite Options							
Project Options	**Innovation & leadership**	**Long-term savings**	**Community benefit**	**Pedagogical connections**	**Management implications**	**Marketability**	**Total Score**
Cooperative Project	4	3	4	3	0	4	2.97
Community Solar Host	4	2	4	3	0	4	2.75
Third-party PPA	1	4	0	2	3	1	2.05
PSU owned	2	1	1	4	2	2	2.03

Rankings

Table 2.8. Ranking of offsite renewable energy development and procurement mechanisms. Assigned points were multiplied by the average weights determined by stakeholders.

Ranking	Scoring Scheme 1	Scoring Scheme 2
1	Community Solar Participant	Community Solar Participant
2	Ownership model	Green tariff
3	Green tariff	Ownership model
4	Direct access – new build	Direct access – new build
5	Virtual PPA	Virtual PPA
6	Direct access – existing	Direct access – existing
7	NA	RECs

Table 2.9. Ranking of onsite solar development mechanisms using the decision-making scorecard. Assigned points were multiplied by the average weights determined by stakeholders.

Ranking	Scoring Scheme 1	Scoring Scheme 2
1	Oregon Clean Power Cooperative	Oregon Clean Power Cooperative
2	Community solar	Community solar
3	Third-party PPA	Third-party PPA
4	NA	PSU owned

Radar plots provide an opportunity to visualize how the different offsite and onsite options relate to the criteria (Figures 2.3 & 2.4). For offsite options, this reveals how poorly the options address the criterion of long-term savings (Figure 2.3). Because the rankings are so similar between the two scoring schemes, only scores from the second are shown in these plots. This keeps all the options on the table (including the defaults of RECs and PSU-owned solar).

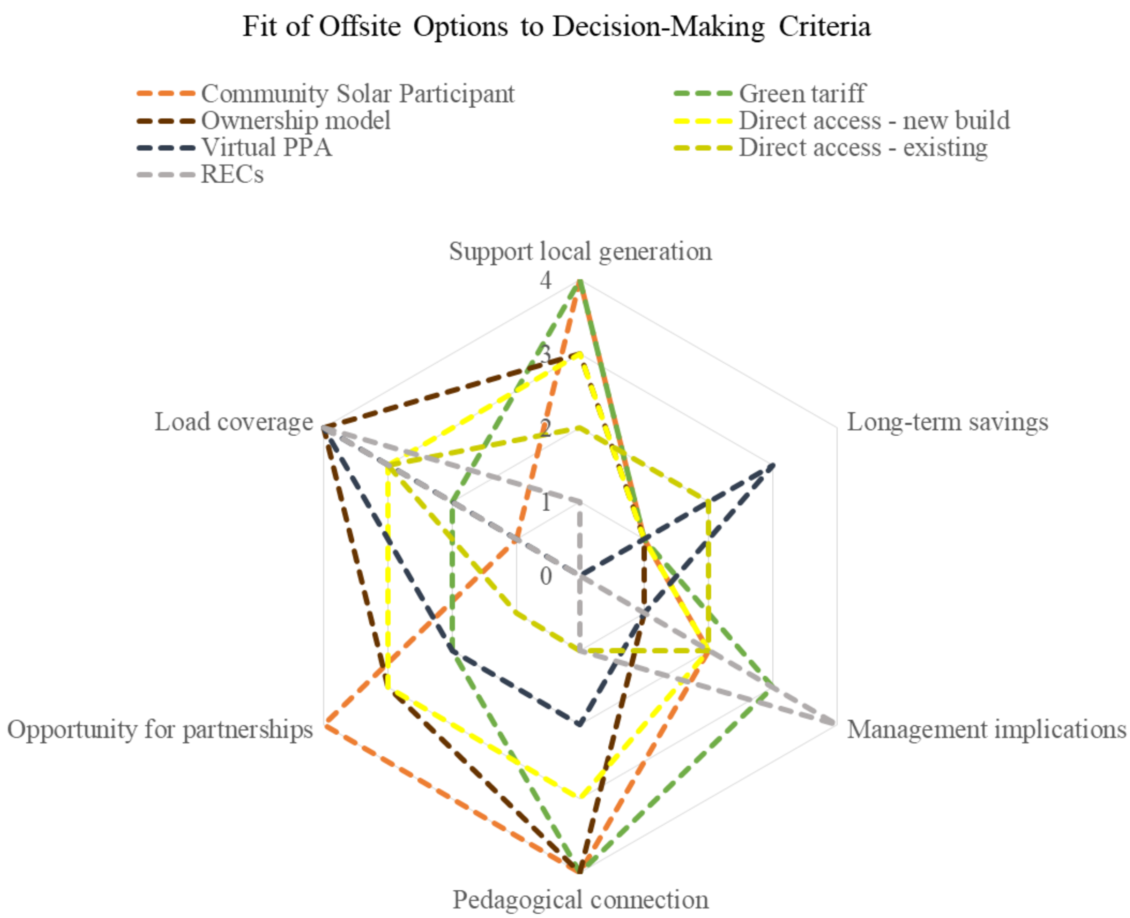

Figure 2.3. Fit of offsite options to the criteria; 4 = strong fit; 0 = no fit.

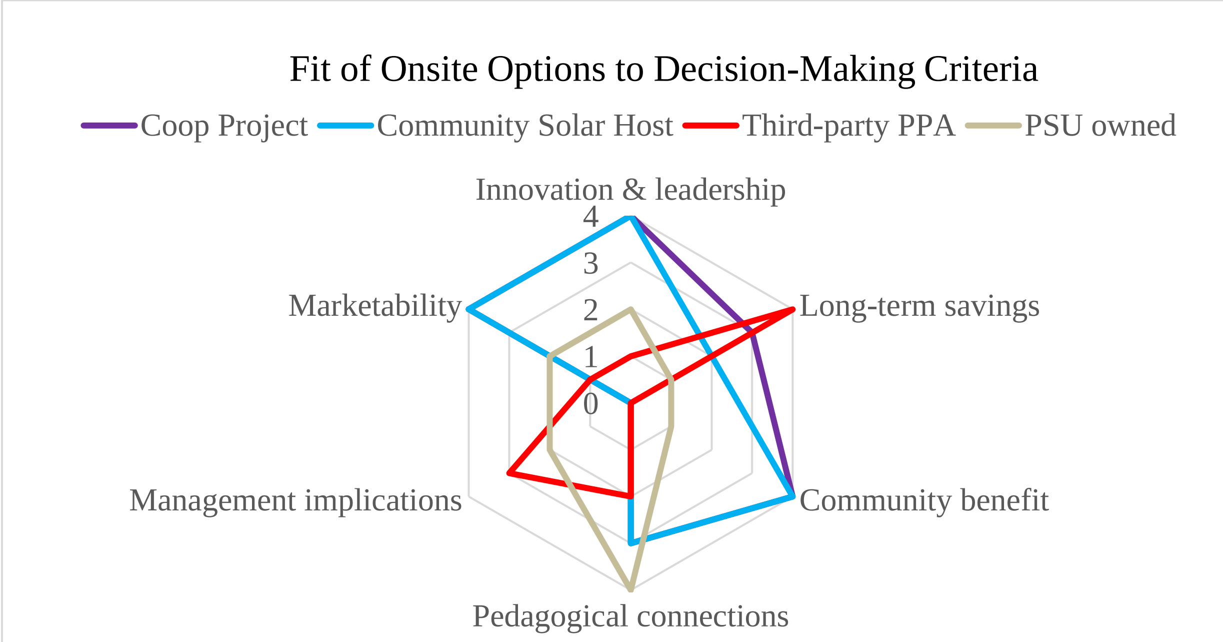

Figure 2.4. Fit of onsite options to the criteria; 4 = strong fit; 0 = no fit.

2.3.3.1 Scoring interpretation & discussion

The inclusion of multiple criteria in the weighting activity demonstrates that while finances are important there are other interests, values, and outcomes that pursuing renewable energy goals can address. The scoring process indicates that PCRE stakeholders are likely to perceive community solar as the best fit option for offsite projects while the Oregon Clean Power Cooperative may be the best fit for onsite options. When included in the scoring, the baseline mechanisms of RECs and University-owned onsite solar are the least preferred options; otherwise existing renewables through direct access and an onsite third-party PPA are the least preferred. Offsite project options represent the best fit or preferred mechanisms to achieve PSU's renewable energy goals because these are the projects that can be combined or scaled up to cover all of PSU's electricity use. The onsite project options represent different management and funding mechanisms for building additional solar on the PSU campus. In both bases, the scoring suggests that one or more top-scoring options should be seriously considered given their fit with stakeholder values.

Interestingly, community solar is the same recommendation that students in a prior School of Business capstone project recommended to PSU but through a very different process (as presented at BA 495 capstone presentations on 3/13/17). An important caveat to community solar ranking the highest is that it can only cover a small portion of campus load, as indicated by the score it received for that criterion on both scorecards. This means that it must be combined with other mechanisms to build a strategy for meeting the 100% goal.

2.4 Discussion & recommendations

The following recommended actions, proposed renewable energy pathways, and discussion in this section combine the following:

- The results of the MCDA-inspired decision-making process, including stakeholder engagement, criteria weighting, and project options scoring process;
- Takeaways from campus stakeholder and external key informant interviews;
- Lessons learned from case studies at other higher education institutions;
- Personal thoughts and opinions after many months of working on this project.

In addition, there are some key assumptions underlying my recommendations, including the need for PSU to pursue multiple projects, the role of the Oregon RPS in combination with the 100%

by 2035 goal, and the final "claim" that PSU intends to make regarding this goal. To make the boldest renewable energy claims, PSU would need to own and retire RECs for every MWh of electricity is uses, however, given the University's fiscal reality, claiming renewable energy use beyond the RPS and up to 100% will be less costly, albeit more difficult to explain.

Multiple Projects

Throughout this project it has become apparent that PSUs renewable energy goals can only be met by pursuing multiple actions. While at the end of the day, RECs can be purchased to match all of campus electricity use, my research has demonstrated that there are multiple values to be met through renewable energy actions and that RECs are unlikely to address those values on their own. The best way to meet these values will be for PSU to pursue a few projects and mechanisms; where one project shines in community benefit and partnership, another project can realize savings for PSU. A renewable energy strategy that spreads risk across multiple projects will also be more resilient to future opportunities and utility regulation changes.

Another factor necessitating a strategy with multiple projects is the complex nature of management and operations at PSU. Not only is electricity coming from three different providers, there are multiple entities and budgets responsible for paying utility bills. As individual project opportunities begin to materialize, it is unlikely that a single project will serve every need. Therefore, instead of recommending a single project for PSU to pursue, it is important to envision a pathway that acknowledges accessible short-term opportunities and sets up University staff to follow and drive innovative opportunities that may take more time to pursue or are not yet on the radar.

Instead of only differentiating these multiple projects as offsite or onsite, I use the structure of PSU's current energy use in my recommendations – considering the portions of campus served by PGE, Pacific Power, and through direct access. In the future, others may see a need to split up the campus differently, like by who pays the utility bills, by academic versus auxiliary buildings, or by buildings with and without retail spaces.

Use State RPS as baseline and desired "claims"

As much as I would like PSU to pursue the boldest claims about renewable energy use as possible, it may be fiscally irresponsible and ultimately unnecessary to do so. RECs help to account for each MWh of renewably-generated electricity on the grid and must be retained and retired by the entity seeking to make claims about using renewable energy. This system helps provide a market for renewable energy and ensures that there is no double-counting. Therefore, the boldest route for PSU would involve multiple projects that contained or separately include RECs for every MWh of campus electricity usage. Although this route may be an option for PSU, I assume and recommend that PSU use the Oregon state RPS as the baseline amount of renewable energy in the campus electricity mix, meaning that development and procurement mechanisms are used to fill the gap between the RPS and the 100% goal. Currently that gap is 85% but will be 50% by 2040. My recommendations strive to fill this gap, with the opportunity for PSU pursue additional renewable capacity and/or RECs at any time.

2.4.1 Primary recommendation

To meet the university's renewable energy goals, I recommend PSU do the following:

F. Cover the portion of campus served by PGE through the Green Future Impact green tariff (immediate time frame, <1 year).

G. Maximize onsite solar capacity through an aggregated or multiple Oregon Clean Power Cooperative Projects (intermediate time frame, 1-5 years). PSU's potential onsite solar capacity is beyond the scope of this project but the assumption of up to 1.5% of campus electricity load is used in in the next section.

H. Cover the portion of campus served by Pacific Power through one or more offsite community solar projects (intermediate time frame, 1-5 years). Initial calculations indicate that all of PSU's Pacific Power load can be covered through community solar.

I. Cover the portion of campus served by direct access by purchasing bundled energy plus RECs from a new build generation source through a direct access provider (extended time frame, 5-8 years). I suggest undergoing a competitive bidding process to achieve the best fit project, which may mean switching direct access providers.

J. I also recommend purchasing RECs to fill any gaps to ensure that the 100% goal is met, beginning in 2020. The number of RECs purchased can decline over time as additional projects begin delivering energy and/or RECs to PSU. Any of PSU's utility providers can serve as the RECs supplier or PSU could purchase from 3Degrees through an existing collaborative procurement contract with the City of Portland.

This recommendation achieves PSU's renewable energy goal for electricity long before 2035, with the role of RECs in meeting that goal diminishing over time. By meeting the goal starting in 2020 (largely through RECs), PSU can demonstrate leadership, a commitment to the necessary funding and labor needed to achieve the goal, and space for focusing on more challenging emissions sources. This recommendation is ambitious but is designed to provide a staggered approach to achieving the 100% goal. Using RECs offers flexibility for realizing the other projects over the next 10 years, with the most complex project through direct access, being given the most time and space to secure.

It is very important to consider what this recommendation means for the claims that PSU can make regarding its renewable energy use. As described previously, an entity needs to own and retire RECs in order to say it is using renewable energy or matching energy use with renewable sources. In this case, because this recommendation includes using the state RPS as a baseline, PSU would have to explain something like: "PSU is using RECs, a green tariff, community solar, and direct access to go above the state RPS and match the remainder of campus electricity use to meet our goal of 100% of electricity coming from renewable sources".

Each part of this recommendation can be tweaked according to changes in values, priorities, and funding availability. In addition, the capacity or scale of each project is flexible i.e. there are multiple "levers" that can be adjusted in search of the best fit projects. Some levers that may be considered include the energy capacity (in kWh or MWh); number of RECs purchased for any one project; the weight given to criteria like importance of location (building from or separate from the decision-making criteria identified in this project); and more. This is especially true as the state RPS grows, shrinking the gap between RPS and PSU's 100% goal. For example, looking only at the portion of campus served by PGE, PSU could take the approach of enrolling 50% of this load into the Green Future Impact green tariff, so that in 2040 the state RPS will supply renewables to the other half of that load. Or, if looking across all campus electricity use, if PSU enrolls all its PGE load into green tariff, that "excess" RECs capacity could be applied to a portion of the direct access of Pacific Power load.

The presence of these levers means there are additional decisions to make even if my recommendation is strictly followed. To address this and to envision different pathways for PSU, I offer four possible pathways that could lead to PSU meeting its goal.

2.4.2 Proposed pathways

Building off my primary recommendation, the following four proposed renewable energy pathways provide a sense of the spectrum of alternative futures for PSU in pursuit of the 100% by 2035 goal. These by no means represent all the possible pathways to meeting the goal but represent (1) adoption of my primary recommendation; (2) a greater role for a larger offsite project like a virtual PPA; (3) a focus on a large offsite project owned by PSU and (4) an approach using the utility green power programs and RECs.

All four pathways use RECs to meet the 100% renewable energy goal starting in 2020. The role of RECs in meeting the goal diminishes and disappears over time except Pathway #4. In addition, for the sake of showing the range of alternative futures, I did not include onsite solar or community solar in Pathways 3 and 4. These can easily be added or removed from any pathway. Stakeholders can play with these pathways by viewing the project options as a “menu of options” used to form a complete vision.

Pathway #1: adoption of primary recommendation

This pathway offers a way to visualize my primary recommendation (Figure 2.5). In this pathway, the PGE green tariff and direct access strategy are used for portion of their respective loads, to prepare for the state RPS increasing to 50% by 2040. Higher enrollment in the green tariff would require less MWh contracted through direct access, and vice versa. It is possible that all the components of this pathway will require contract extensions or renegotiations, so PSU should maintain its capacity to administer and maintain these projects once executed.

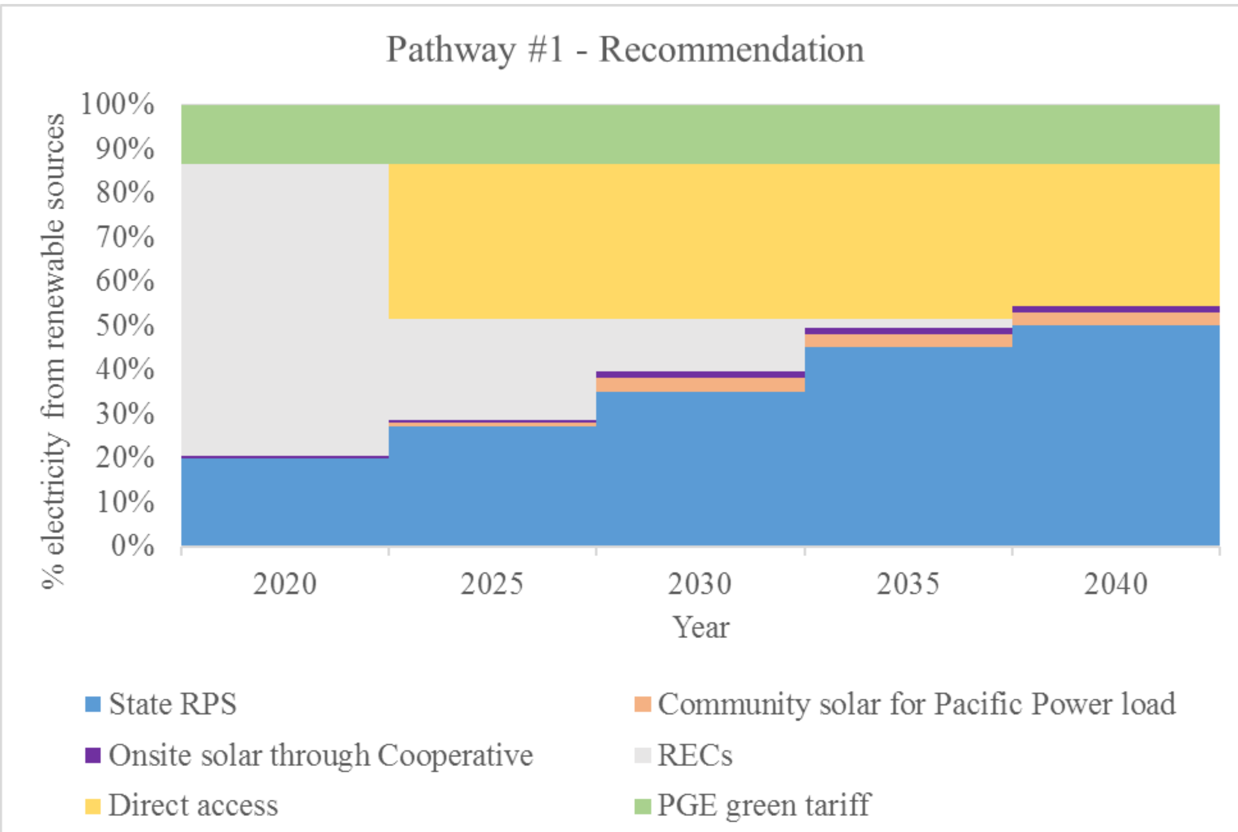

Figure 2.5. Pathway #1 reflecting the primary recommendation, involving onsite solar, community solar, the Green Future Impact green tariff, RECs and energy plus RECs from a new generation source through direct access.

Pathway #2: virtual PPA

Pathway #2 reduces the number of projects pursued to meet PSU's goal by focusing on developing a virtual PPA agreement (Figure 2.6). The PGE Green Future Impact green tariff program helps increase renewable use until the virtual PPA is put into place. Since the Green Future Impact program allows for a 10, or 15-year contract, this strategy provides time for developing the more complex virtual PPA while still addressing values and using renewable energy in the interim. Because Oregon does not have the regional wholesale market to support virtual PPAs, the generation site will have to be located elsewhere. PSU could consider an approach like Boston University's, selecting a location with a relatively carbon-intensive grid.

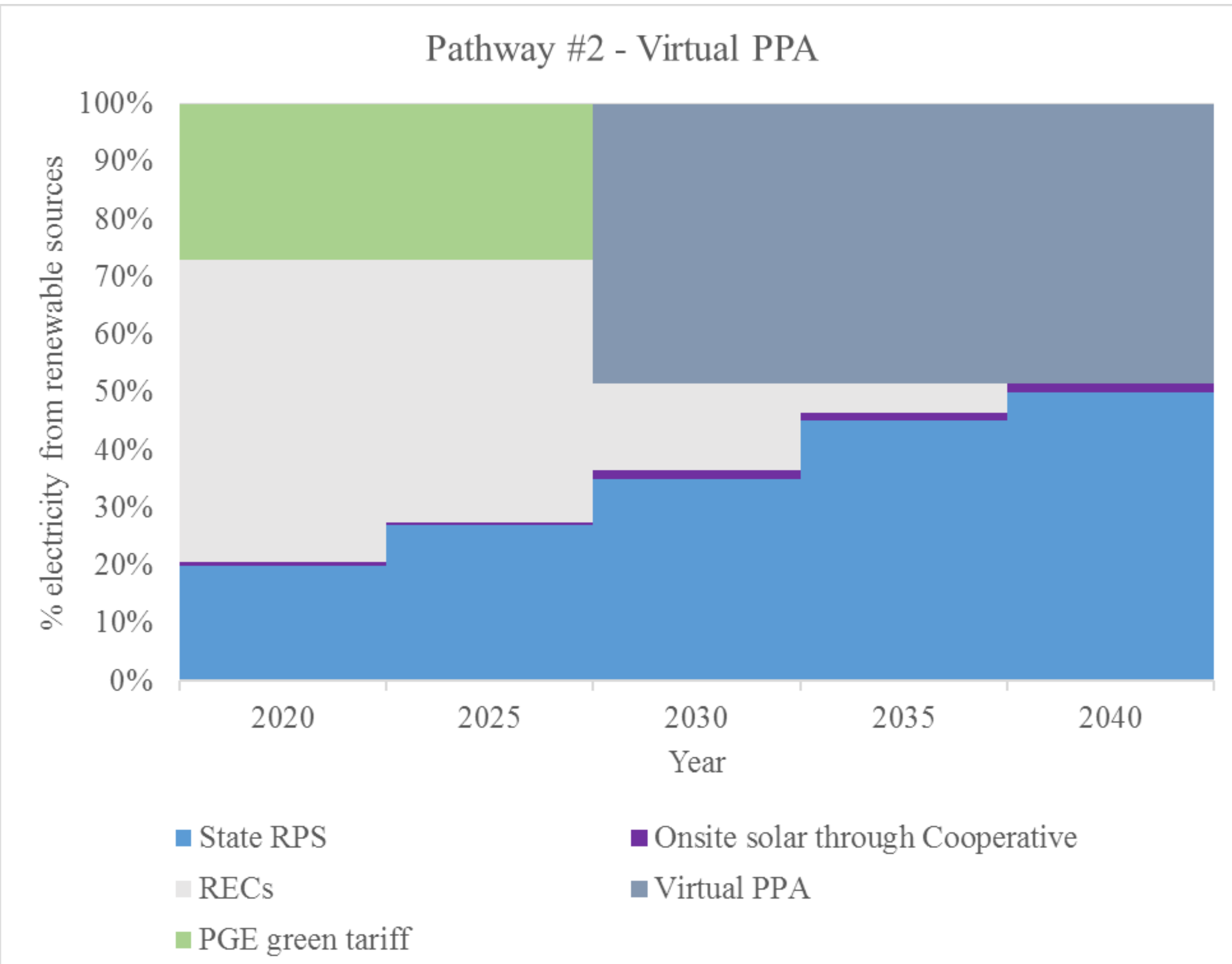

Figure 2.6. Pathway #2 reflecting the role that a virtual PPA could play as the primary mechanism for meeting the 100% goal.

Pathway #3: large offsite project owned by PSU

Despite the many challenges to pursuing a large offsite project that PSU owns, I included this pathway to reflect PSU stakeholder enthusiasm for the possibility. Here, I accommodate this possibility by allowing time for PSU to first secure land then begin developing the project. In addition, because of the complexities of this pathway, PSU might consider issuing a request for information (RFI) to begin exploring partnerships to support this pathway (Figure 2.7).

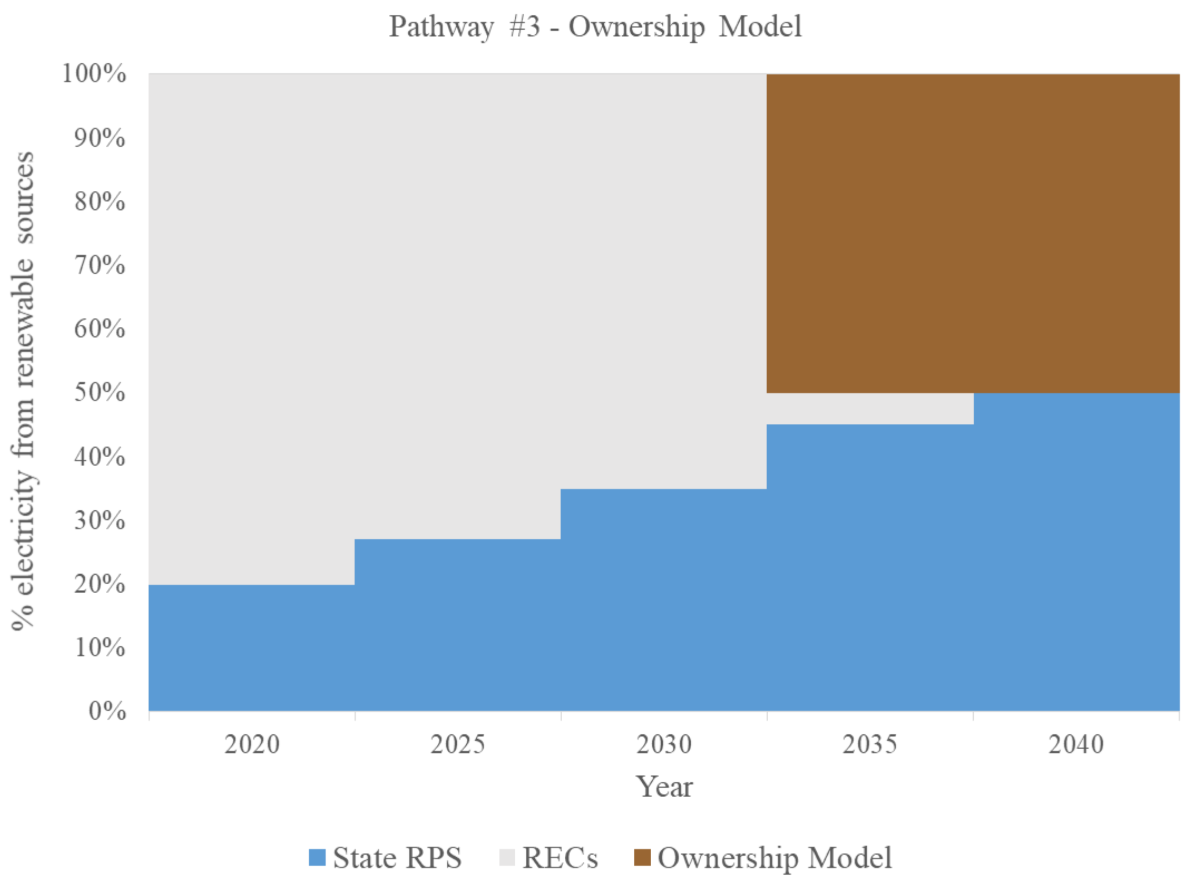

Figure 2.7. Pathway #3 reflects the vision for a large offsite project owned by PSU.

Pathway #4: RECs based

This pathway uses convention procurement mechanisms - utility green power programs and RECs to meet the 100% goal. PGE's Clean Wind program accounts for all PGE-load (22%), Pacific Power's Blue Sky program accounts for that load (3%) and RECs are used to fill the gap between these and the state RPS (Figure 2.8). Here, by accounting for the IOU-served portion of campus through each utility's program, the RECs can be thought of as a strategy for the direct access portion of campus or more broadly as simply filling the gap.

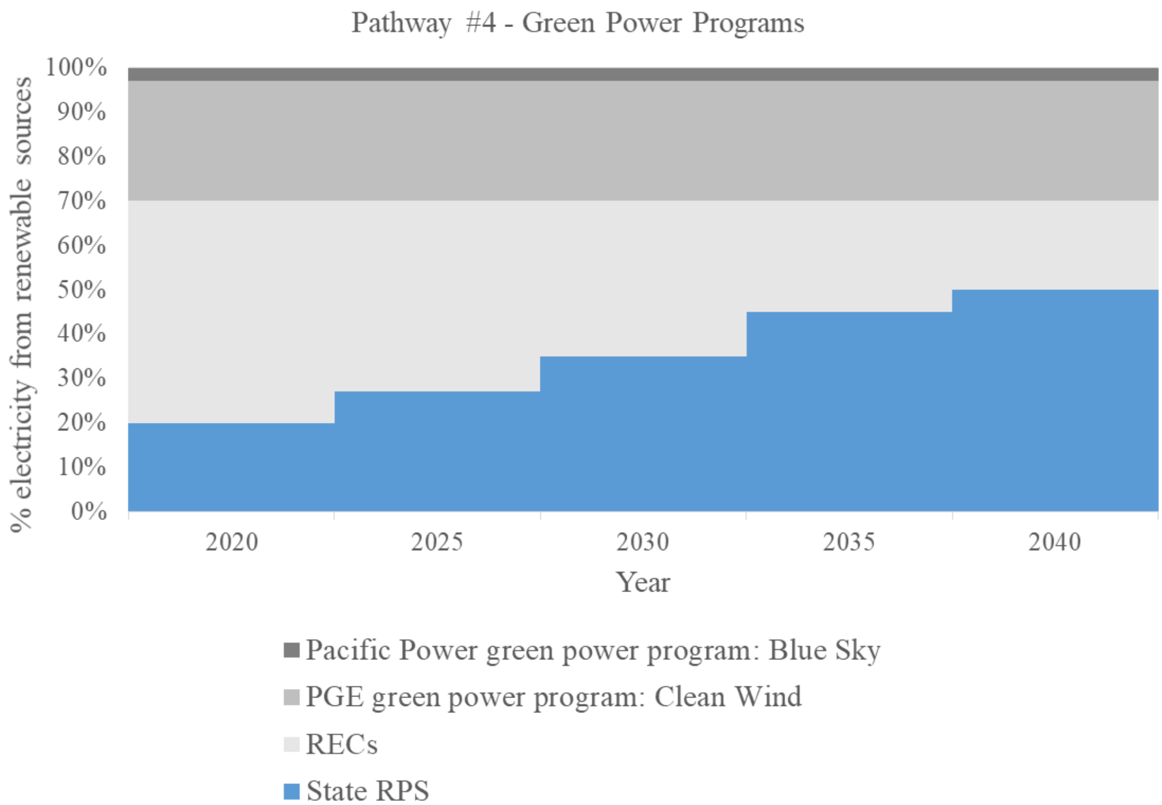

Figure 2.8. Pathway #4 which uses the utility green power programs, PGE's Clean Wind and Pacific Power's Blue Sky, to meet the 100% goal with RECs filling in the remaining gap.

2.4.3 Challenges & Potential Solutions

This project has added intellectual and technical capacity to the Campus Sustainability Office and partners within the PCRE division regarding the opportunities and barriers to achieving 100% renewable energy for electricity sources. With this also comes greater recognition of the challenges for realizing this goal. I believe it is important to be transparent in recognizing these challenges but cognizant that there are potential solutions to overcome them. These solutions serve as supplementary recommendations to the University.

Commitment and Directive

PSU's Climate Action Plan needs an update, if not an overhaul. A new plan is needed to better reflect the reality of work and achievements to date as well as gaps and needs in PSU's work to minimize institutional GHG emissions and increase resilience on campus. With renewable energy, and specifically electricity, the plan's 80% by 2030 goal lacks specificity which is why the City of Portland's goal was adopted for this project. The City's goal acts as a well-defined directive but doesn't serve as a driver quite like how a PSU-specific commitment would. Not having a PSU-specific, time bound, well-defined goal makes implementing the recommendations in this report or any renewable energy strategy challenging.

Key informants shared that a strong top-level directive can serve as a driver for action on renewable energy. In addition, in Spring 2018, Campus Sustainability conducted a Living Lab project with the ESM 464/564 Climate Adaptation course to examine, compare, and assess climate action plans across several colleges and universities. Students observed that institutions appear to be performing better on well-defined short-term goals over loosely-defined long-term (and often lofty) goals.

A high-level aggressive PSU directive, such as achieving 100% renewable energy for electricity by 2025, would offer a strong driver where the climate action plan does not offer one. A dedicated movement amongst the PSU community, including students, faculty, and staff could help raise the visibility of this opportunity. Understandably, PSU and CSO as the implementer of the Climate Action Plan must balance numerous priorities. Additional Living Lab projects could help estimate how the benefits and costs of acting on PSU's electricity mix stacks up compared to tackling other emissions sources or focusing CSO's energy elsewhere.

Intellectual & Technical

Regardless of the driver or directive to achieve 100% renewable energy, understanding options for and pursuing most development and procurement options is complex. PSU has some experience with RECs and onsite University-owned solar but only theoretical knowledge of the more complex options. The road to pursue any of the actions recommended or mentioned in this report will include additional decisions - the levers described previously - as well as technical, legal, and contractual details to work out. PSU's complex utility system, with three different electricity providers and multiple budgets billed for utilities, further complicates the challenge.

To deal with these challenges, I strongly urge PSU to consider hiring a consultant to assist with this work. While I hope that this project provides a service similar to a consultant at the exploratory phase, external expertise will be very valuable if pursuing the more complex mechanisms, including mechanisms through direct access and virtual PPAs. The consultants that I spoke to for this report all have experience with higher education clients - 3Degrees, Customer First Renewables, and Edison Energy. Along with investing in consulting services, PSU can continue to seek resources through its memberships with AASHE and Second Nature. For instance, Second Nature has helped facilitate aggregated offsite renewable energy projects among some of its members. In addition to bringing in-depth knowledge of development and procurement mechanisms, a consultant can also be hired to assist with the development of a request for proposals (RFP), manage the competitive bidding process, and advocate for PSU in selecting a vendor for one or more projects. Lastly, consultants can also help with the contracting phase and by determining the best way to publicize actions. For example, K&L Gates is a law firm with strong experience in this arena.

Short of, or in addition to hiring a consultant, future Living Lab projects can further assist the University in pursuing renewable energy goals. At the time of writing this report, an Engineering & Technology Management graduate student is conducting a Living Lab project to examine solar plus storage feasibility for the Peter Stott Center and Viking Pavilion. This project will help expand PSU's readiness to pursue more onsite solar. Additional project ideas include:

- Refinement or reimagining of decision-making framework and modeling;
- Expanding input to this process to include the wider PSU community, such as identifying criteria and values important to faculty and students;
- Exploring funding and implementation strategies, such as:
    - Feasibility assessment for a student green fee,
    - Advertisement of investment opportunities in an onsite cooperative project,
    - Outreach for community solar participants,
    - Identification of additional funding sources; grant writing;

- Technical assistance and design for new generation sources; piloting of innovative technologies (like in-pipe hydroelectric);
- Planning and deployment of distributed energy generation in coordination with municipal or utility partners.

Financial

Because of Oregon utility regulation, relatively inexpensive energy prices, and already being a direct access customer, it will be challenging for PSU to find voluntary renewable energy mechanisms that save money. Although long-term savings are still the most important criterion for offsite and onsite projects, other values play an almost equally important role in decision making. Recognition of multiple values does not erase tough budget realities at PSU, however, so a clear financial plan is important. This challenge can be viewed as both a *willingness* to spend more on more renewables, and the *ability* to actually do so.

In an ideal scenario, PSU will be able to fund whatever investments are needed to meet renewable energy goals, but there are other funding possibilities. First, by utilizing onsite solar development opportunities that require less upfront funding and are likely to save more money over time (like the Oregon Clean Power Cooperative), PSU could re-allocate money that would have otherwise been spent on PSU-owned onsite solar projects to offsite actions. Other solutions include seeking initial and/or a dedicated funding stream such as through the PSU Foundation, alumni donations, or a student green fee, or using savings from energy efficiency projects to pay for renewable energy through something like the University's Green Revolving Fund. These sources could help pay for any or all of a project's needs - from consultant fees to hard costs.

External

PSU's options for renewable energy development and procurement will change over time as utility regulation shifts. In general, the voluntary market continues to expand, but in some states, utilities have successfully limited or closed channels in the voluntary market. Potential expansion or shrinking of the voluntary market in Oregon will be influenced by utility commission dynamics, climate change policy, politics, global and national priorities and investment in renewable energy, and more. In addition, options may become available quickly or take a long time to materialize, like the slow-to-develop Oregon community solar program.

These external factors make staying informed challenging, but it is important for the University to commit internal capacity to following developments through assigned staff, future student projects, and/or consultants. Conferences and community meetings provide a ready opportunity for this, or PSU could consider convening a bi-annual discussion with local municipal and higher education partners on the topic. In addition, PSU can take a more active role in voicing its support or opposition to developments by attending OPUC hearings and submitting comments when the opportunity arises. For this, CSO might partner with faculty specializing in energy and public policy to follow developments and formulate comments.

Decision-making framework and capacity

Over the course of this project, there has been turn-over in PSU staff, including three key stakeholders that participated in the criteria weighting activity. Turnover raises the question of how well the decision-making framework represents values of current staff. Another challenge associated with the decision scorecard I developed is the lack of granularity in differentiating project options. For example, there are many mechanisms that are unlikely to result in long-term savings. These costs, or degree of not achieving the criterion of long-term savings varies widely. As I explain in the next section, a few team members from CSO and FPM received pricing from Calpine in recent months that showed some options, like bundled energy from existing sources, costing approximately four times what RECs might cost.

To address these challenges, I recommend that PSU revisit the decision framework used in this project to determine its ongoing applicability and/or repurpose it as a template for adding additional input and values and testing another scoring strategy. In addition, by engaging other students and faculty, a more robust framework can be developed, if deemed desirable. Another option is to build from existing institutional decision processes, like scoring matrices for contracts and job candidates. These systems may provide additional ideas that resonate with PSU staff, leadership, and decision-makers.

Chapter 3 Report conclusions

3.1 Current Status

This project is already laying the groundwork for PSU to meet the goal of 100% of electricity from renewable sources by 2035. As Campus Sustainability Office (CSO) full-time staff, I have had the opportunity to move some of the ideas from this project forward, facilitating initial steps to more concretely explore options. At the time of finalizing this report, the following summarizes PSU's status in pursuing some of the renewable energy development and procurement options outlined in this project.

To explore offsite and other procurement options, CSO and FPM staff have taken a deep dive into products from our direct access provider, Calpine Solutions. The products include purchasing RECs (national or regional); unbundled energy from low-impact hydro; or bundled energy and RECs from an existing generation source or the "premium" product – from a new build generation source. In general, these products can be organized from low to high cost as well as lower impact and tangibility to higher impact and tangibility, as shown in Figure 3.1.

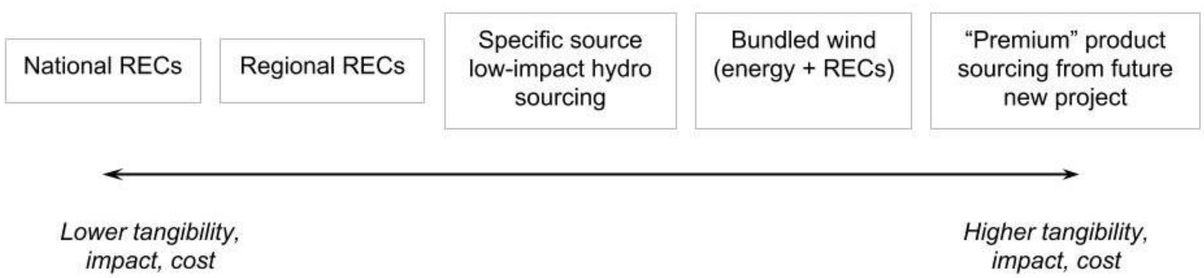

Figure 3.1. Renewable energy solutions and products discussed with Calpine Solutions in 2018. These options vary in terms of their tangibility, impact, and cost.

In addition to receiving indicative pricing for these products from Calpine, we also looked at what RECs would look like if purchased from 3Degrees through an existing collaborative procurement agreement with the City of Portland. Another strategy we have been exploring is the PGE Green Future Impact green tariff. I have spoken with representatives from PGE to understand the status of the program and am sharing the opportunity with University staff.

PSU will likely be extending its contract with Calpine Solutions after the current one ends in December 2019. The contract extension, in addition to the pending launch of the green tariff, means it is a critical time to act on renewables. This sentiment and two recommendations were presented to PSU's Vice President of Finance and Administration in February 2019, along with the head of Planning, Construction and Real Estate (PCRE). We recommended the following short-term actions as part of our larger vision to meet the 100% goal:

- Enroll in the PGE Green Future Impact green tariff program
- Purchase RECs to cover the direct access portion of campus
- No action now on the Pacific Power load; track community solar development

The presentation included estimated impacts on PSU's utility budget and greenhouse gas emissions. We received permission to move forward in preparing to enroll in the PGE green tariff and will be working with additional campus stakeholders on this process. For now, we will hold off on purchasing RECs.

To address onsite solar capacity, the solar plus storage Living Lab project mentioned previously is currently conducting a feasibility assessment for the Peter Stott Center and new Viking Pavilion. This project will be finalized and presented to PSU stakeholders in June. In conjunction with and inspired by the this project, PCRE stakeholders are laying the groundwork to better tap ETO incentives for future solar feasibility assessments by creating a "shortlist" of eligible buildings based on criteria like roof and structural integrity, roof age, shading and mechanical systems barriers, and more. This is also an ongoing process.

3.2 Next Steps

In addition to the work ahead embedded in the efforts that I described above, there are many additional next steps for PSU. Some of these were presented as secondary recommendations in the Challenges & Potential Solutions section in Chapter 2. These steps include:

- Commitment and project management:
  - Commit to a renewable energy vision with clear objectives and timeline;
  - Examine and determine budget and staff availability for project management and implementation;
  - Consider contracting for consulting services for general guidance and/or for RFP development for the more complex projects.
- Funding opportunities and partnerships:
  - Conduct outreach or develop an RFI to spread the word about PSU's efforts to increase renewable energy use;

    - Continue engaging local stakeholders, such as the City of Portland, Portland Community College, partners through the Washington Oregon Higher Education Sustainability Conference, and PSU utility providers;
    - Through staff time or student projects, begin exploring grant opportunities and other innovative funding mechanisms;
    - Engage PSU Foundation representatives to discuss support mechanisms through external giving.
- Decision-making framework and capacity:
    - Revisit and/or consider alternatives to the decision-making framework used in this project and expand it to include more members of the PSU community;
    - Include University leadership in this process to gain buy-in;
    - Explore application of decision-making strategies when it comes time to select among individual bids.

3.3 Final Thoughts

Portland State University is poised to address a significant source of institutional greenhouse gas emissions by voluntarily increasing renewable energy use on campus. Electricity is the "low hanging fruit" of energy-related greenhouse gas emissions reduction efforts. Acting on electricity now opens the time and space to address campus reliance on natural gas for heating and other services. Following years of strong energy efficiency program expansion, the Campus Sustainability Office and its operational partners in the Planning, Construction and Real Estate division have positioned themselves to pursue renewable energy development and procurement projects, having already taken many steps to reduce overall campus electricity use.

This project included identifying development and procurement mechanisms available to PSU and assessing them using a process designed to reflect PCRE stakeholder values. To shape my recommendations, I also considered the expertise and learnings of professionals specializing in this field as well as higher education institutions with experience of voluntary renewable energy projects. Ultimately, PSU can select from a menu of options to create its renewable energy future. To do so, it is important to engage different segments of the PSU community. Fortunately, there are many opportunities to engage students, faculty, staff, and alumni to assist in making a final vision reality.

PSU has committed to reducing its emissions to mitigate institutional impact on global climate change. The University has also committed to improving the resilience of the campus community and its systems to inevitable climate change impacts. Acting on renewable energy is more than climate action work; it is an opportunity to use PSU's purchasing power to select energy products that match community values and drive the transition to a clean energy future. Portland State has an opportunity to take actions that build capacity for renewable energy across the region, to do this with partners, and to open up research and learning opportunities for students. I am hopeful and excited to see what PSU's renewable energy future holds.

For more information about renewable energy planning developments, contact the Campus Sustainability Office (greencampus@pdx.edu).

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Appendix A – Criteria Weighting Activity Survey Instrument

PSU Renewable Energy Procurement & Development Decision-Making Framework Activity

You are invited to participate in a research study about decision-making criteria that stakeholders believe should be used in determining PSU's renewable energy procurement and development path. This study is being conducted by PSU faculty Max Nielsen-Pincus and graduate student Emily Quinton from the Environmental Science and Management Department at Portland State University as part of a graduate student project.

By clicking "next" at the end of this page, you are consenting to participate in this survey. If you want more information, read below. Please navigate away if you do not consent.

There are no known risks if you decide to participate in this research study. There are no costs to you for participating in the study. The information you provide will be used to develop a decision-making framework and project scorecard to assess offsite and onsite renewable energy procurement and development options. The survey activity will take about 10 minutes to complete. The information collected may not benefit you directly, but the information learned in this study should provide more general benefits.

This survey activity is anonymous. No names, titles, or IP addresses will be collected although it is important to note that absolute anonymity cannot be guaranteed over the internet. No one will be able to identify you or your answers, and no one will know whether or not you participated in the study. Individuals from the Institutional Review Board may inspect these records. Should the data be published, no individual information will be disclosed.

Your participation in this study is voluntary. By completing and finishing the online survey activity you are voluntarily agreeing to participate. You are free to decline to answer any particular question you do not wish to answer for any reason.

If you have any questions about the study, please contact Max Nielsen-Pincus and Emily Quinton, PO Box 751-ESM, Portland OR 97207, 503-725-2827, maxnp@psu.edu, equinton@pdx.edu.

The Portland State University Institutional Review Board has reviewed this project. If you have any concerns about your rights in this study, please contact the PSU Office of Research Integrity at (503) 725-2227 or email hsrrc@pdx.edu.

By clicking "next" at the end of this page, you are consenting to participate in this survey.

About
This activity is designed to gather input from stakeholders on the relative importance (prioritization) of key decision-making criteria that will be used to assess and make recommendations for PSU's path towards 100% electricity from renewable sources by 2035. *There are two sets, each with six criteria: one set for offsite projects and one for onsite projects.* A few criteria appear in both sets.

The criteria presented here reflect the discussion held at a stakeholder meeting on October 24th involving individuals from Campus Sustainability, Facilities & Property Management, and Capital Projects & Construction, as well as representatives from renewable energy consultants, 3Degrees.

How will this information be used?
The prioritization provided by stakeholders will be used to develop a multi-criteria decision framework. Each of the project options will then be assessed based on this framework. The results of this process will be discussed in the final project report.

Please review the criteria and definitions in the tables below.

Criteria	Definition for Use in PSU Framework - *Offsite* Projects
Support local generation	Preference is given to projects containing bundled renewable energy credits (RECs) with generation sources located within the Pacific Northwest.
Long-term savings	Preference is given to projects that are expected to recoup upfront costs with long-term cost savings.
Management implications	Preference is given to projects with reasonable time and material requirements. This means that project development, execution, management, and maintenance can occur with a combination of existing in-house staff expertise and external consultants (no new PSU staff need to be hired).
Pedagogical connection	Preferences is given to projects that make educational and research opportunities easily accessible through transparency of data, information about generation and transmission technologies, and potential access to the generation site(s).
Partnership Opportunities	Preference is given to projects that facilitate partnering with other organizations or businesses to enhance sustainability outcomes or the realization of other institutional values.
Load coverage	Preference is given to projects that can overcome technical and policy barriers to cover all or nearly all of PSUs campus electricity load.

Criteria	Definition for Use in PSU Framework - *Onsite* Projects
Innovation & leadership	Preference is given to projects that demonstrate innovation and leadership in such a way that stands out among other higher ed renewable energy projects. This may be achieved through design; financing; deployment; integration with other programs and certifications; and/or inclusion of demand-response or storage elements
Long-term savings	Preference is given to projects that are expected to recoup upfront costs with long-term cost savings.
Community benefit	Preference is given to projects that enable tangible community benefits like financial return and/or access to renewable energy for community members who may be investors, funders, and/or beneficiaries of a project.
Pedagogical connection	Preference is given to projects that make educational and research opportunities easily accessible through transparency of data, information about generation and transmission technologies, access to the generation site(s), and professional development opportunities.
Management implications	Preference is given to projects with reasonable time and material requirements. This means that project development, execution, management, and maintenance can occur with a combination of existing in-house staff expertise and external consultants (no new PSU staff need to be hired).
Marketability	Preference is given to projects that result in ownership of renewable energy credits (RECs) so that PSU can make claims to both using and supporting renewable electricity.

Thank you. Your participation is greatly appreciated!

When you are ready, hit "next".

Please assign weights to the criteria for evaluating PSUs offsite and onsite renewable electricity options.
Enter numbers between 0 and 120 to the right of the criteria listed below in each table. The total must equal 120 in each table. *The first table is focused on offsite projects and the second table is for onsite projects.*

For example, if you believe that evaluating PSUs offsite renewable electricity options should be based on each criteria equally, then you would assign 20 to each individual criterion. Or, if you believe that any of the below criteria should not be assessed when evaluating PSUs options, then you would assign 0 to those criteria.

***Offsite* Projects**

	Enter a number between 0 and 120 in each of the boxes below
Support local generation: Preference is given to projects containing bundled renewable energy credits (RECs) with generation sources located within the Pacific Northwest.	
Long-term savings: Preference is given to projects that are expected to recoup upfront costs with long-term cost savings.	
Management implications: Preference is given to projects with reasonable time and material requirements. This means that project development, execution, management, and maintenance can occur with a combination of existing in-house staff expertise and external consultants (no new PSU staff need to be hired).	
Pedagogical connection: Preferences is given to projects that make educational and research opportunities easily accessible through transparency of data, information about generation and transmission technologies, and potential access to the generation site(s).	
Opportunity for partnerships: Preference is given to projects that facilitate partnering with other organizations or businesses to enhance sustainability outcomes or the realization of other institutional values.	
Load coverage: Preference is given to projects that can overcome technical and policy barriers to cover all or nearly all of PSU's campus electricity load.	
Total	

***Onsite* Projects**

	Enter a number between 0 and 120 in each of the boxes below
Innovation and leadership: Preference is given to projects that demonstrate innovation and leadership in such a way that stands out among other higher ed renewable energy projects. This may be achieved through design; financing; deployment; integration with other programs, initiatives and certifications; and/or inclusion of demand-response or storage elements	
Long-term savings: Preference is given to projects that are expected to recoup upfront costs with long-term cost savings.	
Community benefit: Preference is given to projects that enable tangible community benefits like financial return and/or access to renewable energy for community members who may be investors, funders, and/or beneficiaries of a project.	
Pedagogical connections: Preference is given to projects that make educational and research opportunities easily accessible through transparency of data, information about generation and transmission technologies, access to the generation site(s), and professional development opportunities.	
Management implications: Preference is given to projects with reasonable time and material requirements. This means that project development, execution, management, and maintenance can occur with a combination of existing in-house staff expertise and external consultants (no new PSU staff need to be hired).	
Marketability: Preference is given to projects that result in ownership of renewable energy credits (RECs) so that PSU can make claims to both using and supporting renewable electricity.	
Total	

Are there any other criteria that you would add to this list? Please explain in the space provided below. If there are no other criteria that you would add, please go to the next question.

How would you revise the definitions of the above criteria? Please explain in the space provided below. If there are no revisions to the criteria definitions that you would suggest, please go to the next question.

Are there any questions that you have about this project or the decision-making framework this project is attempting to develop?

Is there anyone else you think should participate in this activity? Everyone invited to the 10/24/17 stakeholder meeting has already been asked to participate.