Wallowa County Microgrid Plan

February 2024

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Executive Summary

This report was the culmination of a year-long planning project commissioned by Wallowa Resources Community Energy Program pursuant to the technical requirements of contracts with the Oregon Department of Energy and the Idaho National Laboratory. The Energy Trust of Oregon was a constant and valuable facilitator of the project. The project aligned with Wallowa County's Community Energy Strategic Planning (CESP) process, which identified the following goals:

1. Supply critical infrastructure with renewable energy capable of withstanding a two-week outage
2. Reduce outage events and duration in the cities
3. Increase county-wide renewable generation capacity
4. Reduce the community-wide fossil fuel footprint

In support of these goals, the project planned for the development of a resilience corridor in the Wallowa Valley, spanning twenty-five (25) miles along Oregon Route 82. The corridor would establish resilient microgrid hubs in the cities of Wallowa, Enterprise, and Joseph, Oregon. Ten microgrid scenarios were modeled and evaluated.

- **Three facility-level microgrids** at critical facilities to serve as anchor projects and resilience hubs (Heartwood Biomass, the Doug McDaniel Building, and Joseph High School).
- **Three partial feeder-level microgrids** serving only critical loads.
- **Three full feeder-level microgrids** powering entire distribution circuits with the resilience hub anchor projects included with feeder-level anchor assets.
- **One community-level microgrid** capable of providing resilient power for five distribution circuits inclusive of all sub projects and scenarios.

The modeling stipulated that the designs be capable of riding through an outage of at least two weeks. The following table summarizes the project magnitudes—first showing the three anchor projects, then subtotals of the partial and full feeder designs, and finally the capacities of the entire community. These figures do not include all of the substantial distribution system upgrades that would be required.

Microgrid System	**Generation** kW_{ac}	**BESS** kWh	**CapEx** $MM	**OpEx** $k
Heartwood Biomass	1,150	1,000	3.76	47.4
Doug McDaniel Building	290	450	1.82	22.8
Joseph High School	499	500	1.87	26.5
Combined Partial Feeders	5,680	4,500	15.24	222.8
Combined Whole Feeders	31,000	36,600	132.6	1461.3
Whole Community	38,267	40,900	158.49	1720.7

The planning project finds that leveraging facility-level microgrids as catalysts for expansion into partial or full feeder-level microgrids is a flexible and effective plan. The projects for facility-level microgrids are well suited for federal and state grant funding, a range of which are identified in this report. The analysis shows that the County has the ability to achieve its stated goals by pursuing development of the corridor. The next steps include the following:

1) Engaging Pacific Power to develop the scope and budgetary cost estimates of required distribution system upgrades. First for the partial feeder, and potentially for the full feeder options.
2) Pursuing a strategic approach to simultaneously gather feedback and cost implications for recircuiting for the partial feeder option, and to conduct a cost benefit analysis against the full feeder option, considerate of available funding and long-term goals.
3) Securing funding for professional services (legal representation, technical experts, and project financing) to begin project implementation.

Acknowledgements

The ProtoGen team wishes to extend a special thanks for assistance in development of this report to:

- Joe Basile
- Gavin Collier
- Nils Christoffersen
- Jay Dallas
- John Hillock
- Matthew King
- Timothy McJunkin
- Kyle Petrocine
- Jim Reilly
- Ryan Sheehy
- Lori Wyman

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1 Introduction

This report was developed for Wallowa Resources Community Energy Program (WRCEP) by ProtoGen, Inc. pursuant to the technical requirements of contracts with the Oregon Department of Energy and the Idaho National Laboratory (INL). The report serves as a plan for establishing an energy resilience corridor extending 25 miles along Oregon Route 82 with proposed community microgrid hubs in the cities of Wallowa, Enterprise, and Joseph, Oregon. The work was performed in support of Wallowa County, Oregon's Community Energy Strategic Planning (CESP) process. Funding for this work was provided through the US Department of Energy (DOE/OE Microgrid Program) and the Oregon Department of Energy (ODOE – CREP Program).

Wallowa County initiated its CESP process in October 2021 with endorsements from the three County Commissioners. Wallowa County's CESP process followed the U.S Department of Energy - Guide to Community Energy Strategic Planning. The Wallowa Resources Community Energy Program Team acted as Plan Manager on behalf of the County. The CESP planning process was funded primarily by Energy Trust of Oregon. A CESP Leadership Team was established in April 2022 comprised of local leaders, interested citizens, and a wide range of community, business, and agricultural stakeholder groups. The CESP development process was completed in November 2023 and the plan was adopted by the county commissioners on December 20, 2023. The ongoing CESP process will be a collaboration between the Wallowa County Commission and Wallowa Resources. With the CESP adopted, a CESP Implementation Advisory Group (IAG) will be formed and the WRCEP Team will continue to serve as Facilitator as outlined under the "Blueprint for Implementation" section of the CESP. The CESP development and ongoing implementation ensures that strategic energy planning—a "long-range, dynamic blueprint will focus and guide actions toward creating a defined energy vision" that, among other things:

- sets out goals;
- creates a comprehensive, prioritized list of local opportunities;
- creates short- and long-term strategies and funding to make projects really happen; and
- coordinates with other local long-range planning to maximize impact. [1]

In January 2023, ProtoGen was contracted by WR and INL to develop a plan for the implementation of an energy resilience corridor in the Wallowa Valley in support of the County's CESP process. The plan identified ten scenarios that reflect a continuum of resilience opportunities to allow the community to selectively advance through the goals established for Wallowa, Enterprise, and Joseph. The ten scenarios include:

- **three critical facility microgrids** (Heartwood Biomass, Doug McDaniel Building, Joseph High School)
- **three partial-feeder microgrids** (Wallowa, Enterprise, and Joseph—critical loads only)
- **three full-feeder microgrids** (Wallowa, Enterprise, and Joseph—all loads)
- **a full community microgrid** serving all five feeders

Requirements were gathered over a series of interviews, meetings, and research. The stakeholders that manage the critical facilities, county and the local electric utility, and Pacific Power were all engaged for additional input and feedback throughout the project. Numerous types of data were collected and/or developed to support modeling, simulation, and planning activities. These include, but are not limited to, conceptual designs, electric loads, microgrid equipment costing, business model planning and information pertaining to energy markets and regulatory structures.

Equipment design layouts, software-based modeling, and simulations were developed for each of the microgrids. The ten scenarios were then iteratively refined and analyzed to draw out critical insights and conclusions. The report defines the system capacities, capital and operating expenses, and projected CO_2 reduction for each configuration; supporting discussion and key findings are also provided. A robust Geographic Information System (GIS) based map was developed to identify and display the microgrids and circuit paths. Additionally, 15% engineering drawing sets were developed. The design drawings include 3D drawings, electrical single-line drawings, and charts and graphs illustrating the distributed energy resource (DER) dispatch characteristics. It

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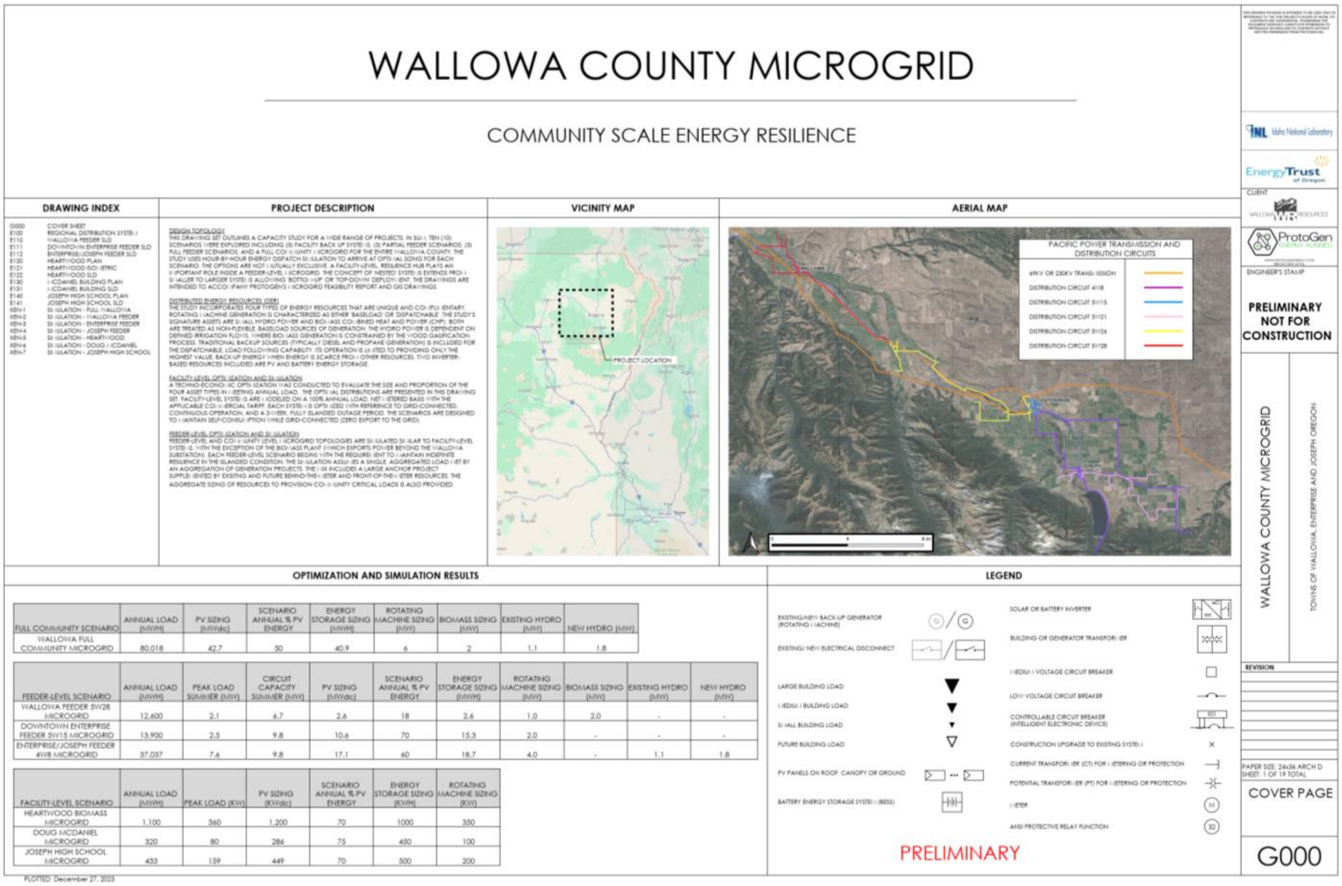
[1] Wallowa County, "Community Energy Strategic Plan", 2023.

is recommended that readers refer to these materials while reading the report. The drawing sets can be found in Appendix 7.1. Figure 1 shows the cover page of the engineering drawing set.



WALLOWA COUNTY MICROGRID

COMMUNITY SCALE ENERGY RESILIENCE

DRAWING INDEX

G000	COVER SHEET
E100	REGIONAL DISTRIBUTION SYSTEM
E110	WALLOWA FEEDER SLD
E111	DOWNTOWN ENTERPRISE FEEDER SLD
E112	ENTERPRISE/JOSEPH FEEDER SLD
E120	HEARTWOOD PLAN
E121	HEARTWOOD ISOMETRIC
E122	HEARTWOOD SLD
E130	MCDANIEL BUILDING PLAN
E131	MCDANIEL BUILDING SLD
E140	JOSEPH HIGH SCHOOL PLAN
E141	JOSEPH HIGH SCHOOL SLD
XEN-1	SIMULATION - FULL WALLOWA
XEN-2	SIMULATION - WALLOWA FEEDER
XEN-3	SIMULATION - ENTERPRISE FEEDER
XEN-4	SIMULATION - JOSEPH FEEDER
XEN-5	SIMULATION - HEARTWOOD
XEN-6	SIMULATION - DOUG MCDANIEL
XEN-7	SIMULATION - JOSEPH HIGH SCHOOL

PROJECT DESCRIPTION

DESIGN TOPOLOGY
THIS DRAWING SET OUTLINES A CAPACITY STUDY FOR A WIDE RANGE OF PROJECTS. IN SUM, TEN (10) SCENARIOS WERE EXPLORED INCLUDING (3) FACILITY BACK UP SYSTEMS; (3) PARTIAL FEEDER SCENARIOS; (3) FULL FEEDER SCENARIOS; AND A FULL COMMUNITY MICROGRID FOR THE ENTIRE WALLOWA COUNTY. THE STUDY USES HOUR-BY-HOUR ENERGY DISPATCH SIMULATION TO ARRIVE AT OPTIMAL SIZING FOR EACH SCENARIO. THE OPTIONS ARE NOT MUTUALLY EXCLUSIVE. A FACILITY-LEVEL RESILIENCE HUB PLAYS AN IMPORTANT ROLE INSIDE A FEEDER-LEVEL MICROGRID. THE CONCEPT OF 'NESTED' SYSTEMS EXTENDS FROM SMALLER TO LARGER SYSTEMS ALLOWING 'BOTTOM-UP' OR 'TOP-DOWN' DEPLOYMENT. THE DRAWINGS ARE INTENDED TO ACCOMPANY PROTOGEN'S MICROGRID FEASIBILITY REPORT AND GIS DRAWINGS.

DISTRIBUTED ENERGY RESOURCES (DER)
THE STUDY INCORPORATES FOUR TYPES OF ENERGY RESOURCES THAT ARE UNIQUE AND COMPLIMENTARY. ROTATING MACHINE GENERATION IS CHARACTERIZED AS EITHER 'BASELOAD' OR 'DISPATCHABLE'. THE STUDY'S SIGNATURE ASSETS ARE SMALL HYDRO POWER AND BIOMASS COMBINED HEAT AND POWER (CHP). BOTH ARE TREATED AS NON-FLEXIBLE, BASELOAD SOURCES OF GENERATION. THE HYDRO POWER IS DEPENDENT ON DEFINED IRRIGATION FLOWS, WHERE BIOMASS GENERATION IS CONSTRAINED BY THE WOOD GASIFICATION PROCESS. TRADITIONAL BACKUP SOURCES (TYPICALLY DIESEL AND PROPANE GENERATION) IS INCLUDED FOR THE DISPATCHABLE, LOAD FOLLOWING CAPABILITY. ITS OPERATION IS LIMITED TO PROVIDING ONLY THE HIGHEST VALUE, BACK-UP ENERGY WHEN ENERGY IS SCARCE FROM OTHER RESOURCES. TWO INVERTER-BASED RESOURCES INCLUDED ARE PV AND BATTERY ENERGY STORAGE.

FACILITY-LEVEL OPTIMIZATION AND SIMULATION
A TECHNO-ECONOMIC OPTIMIZATION WAS CONDUCTED TO EVALUATE THE SIZE AND PROPORTION OF THE FOUR ASSET TYPES IN MEETING ANNUAL LOAD. THE OPTIMAL DISTRIBUTIONS ARE PRESENTED IN THIS DRAWING SET. FACILITY-LEVEL SYSTEMS ARE MODELED ON A 100% ANNUAL LOAD, NET METERED BASIS WITH THE APPLICABLE COMMERCIAL TARIFF. EACH SYSTEM IS OPTIMIZED WITH REFERENCE TO GRID-CONNECTED, CONTINUOUS OPERATION, AND A 2-WEEK, FULLY ISLANDED OUTAGE PERIOD. THE SCENARIOS ARE DESIGNED TO MAINTAIN SELF-CONSUMPTION WHILE GRID-CONNECTED (ZERO EXPORT TO THE GRID).

FEEDER-LEVEL OPTIMIZATION AND SIMULATION
FEEDER-LEVEL AND COMMUNITY LEVEL MICROGRID TOPOLOGIES ARE SIMULATED SIMILAR TO FACILITY-LEVEL SYSTEMS, WITH THE EXCEPTION OF THE BIOMASS PLANT (WHICH EXPORTS POWER BEYOND THE WALLOWA SUBSTATION). EACH FEEDER-LEVEL SCENARIO BEGINS WITH THE REQUIREMENT TO MAINTAIN INDEFINITE RESILIENCE IN THE ISLANDED CONDITION. THE SIMULATION ASSUMES A SINGLE, AGGREGATED LOAD MET BY AN AGGREGATION OF GENERATION PROJECTS. THE MIX INCLUDES A LARGE ANCHOR PROJECT SUPPLEMENTED BY EXISTING AND FUTURE BEHIND-THE-METER AND FRONT-OF-THE-METER RESOURCES. THE AGGREGATE SIZING OF RESOURCES TO PROVISION COMMUNITY CRITICAL LOADS IS ALSO PROVIDED.

VICINITY MAP

PROJECT LOCATION

AERIAL MAP

PACIFIC POWER TRANSMISSION AND DISTRIBUTION CIRCUITS

69KV OR 230KV TRANSMISSION	🟧
DISTRIBUTION CIRCUIT 4W8	🟪
DISTRIBUTION CIRCUIT 5W15	🟦
DISTRIBUTION CIRCUIT 5W21	▭
DISTRIBUTION CIRCUIT 5W26	🟨
DISTRIBUTION CIRCUIT 5W28	🟥

OPTIMIZATION AND SIMULATION RESULTS

FULL COMMUNITY SCENARIO	ANNUAL LOAD (MWH)	PV SIZING (MWdc)	SCENARIO ANNUAL % PV ENERGY	ENERGY STORAGE SIZING (MWH)	ROTATING MACHINE SIZING (MW)	BIOMASS SIZING (MW)	EXISTING HYDRO (MW)	NEW HYDRO (MW)
WALLOWA FULL COMMUNITY MICROGRID	80,018	42.7	50	40.9	6	2	1.1	1.8

FEEDER-LEVEL SCENARIO	ANNUAL LOAD (MWH)	PEAK LOAD SUMMER (MW)	CIRCUIT CAPACITY SUMMER (MW)	PV SIZING (MWdc)	SCENARIO ANNUAL % PV ENERGY	ENERGY STORAGE SIZING (MWH)	ROTATING MACHINE SIZING (MW)	BIOMASS SIZING (MW)	EXISTING HYDRO (MW)	NEW HYDRO (MW)
WALLOWA FEEDER 5W28 MICROGRID	12,600	2.1	6.7	2.6	18	2.6	1.0	2.0	-	-
DOWNTOWN ENTERPRISE FEEDER 5W15 MICROGRID	13,900	2.5	9.8	10.6	70	15.3	2.0	-	-	-
ENTERPRISE/JOSEPH FEEDER 4W8 MICROGRID	37,037	7.6	9.8	17.1	60	18.7	4.0	-	1.1	1.8

FACILITY-LEVEL SCENARIO	ANNUAL LOAD (MWH)	PEAK LOAD (KW)	PV SIZING (KWdc)	SCENARIO ANNUAL % PV ENERGY	ENERGY STORAGE SIZING (KWH)	ROTATING MACHINE SIZING (KW)
HEARTWOOD BIOMASS MICROGRID	1,100	360	1,200	70	1000	350
DOUG MCDANIEL MICROGRID	320	80	286	75	450	100
JOSEPH HIGH SCHOOL MICROGRID	433	159	449	70	500	200

PLOTTED: December 27, 2023

LEGEND

EXISTING/NEW BACK-UP GENERATOR (ROTATING MACHINE)
EXISTING/ NEW ELECTRICAL DISCONNECT
LARGE BUILDING LOAD
MEDIUM BUILDING LOAD
SMALL BUILDING LOAD
FUTURE BUILDING LOAD
PV PANELS ON ROOF, CANOPY OR GROUND
BATTERY ENERGY STORAGE SYSTEM (BESS)
SOLAR OR BATTERY INVERTER
BUILDING OR GENERATOR TRANSFORMER
MEDIUM VOLTAGE CIRCUIT BREAKER
LOW VOLTAGE CIRCUIT BREAKER
CONTROLLABLE CIRCUIT BREAKER (INTELLIGENT ELECTRONIC DEVICE)
CONSTRUCTION UPGRADE TO EXISTING SYSTEM
CURRENT TRANSFORMER (CT) FOR METERING OR PROTECTION
POTENTIAL TRANSFORMER (PT) FOR METERING OR PROTECTION
METER
ANSI PROTECTIVE RELAY FUNCTION

PRELIMINARY

CLIENT
ENGINEER'S STAMP
PRELIMINARY NOT FOR CONSTRUCTION
WALLOWA COUNTY MICROGRID
TOWNS OF WALLOWA, ENTERPRISE AND JOSEPH OREGON
REVISION
PAPER SIZE: 24x36 ARCH D
SHEET: 1 OF 19 TOTAL
COVER PAGE
G000

Figure 1: Drawing set cover page

The report concludes by providing actionable recommendations for the next steps. The recommendations will help Wallowa County prioritize investments to achieve its goals of county-wide resilience and enhanced sustainability. The report and drawings will enable Wallowa County to confidently advance planning, utility negotiations, design, and grant submissions. They can also be used to develop a bid specification for engineering and construction of the envisioned microgrid projects.

2 Background

Wallowa County is a remote, rural community located in the northeastern corner of Oregon. It is the sixth least populated of the state's thirty-six counties[2] (est. pop. 7,659 as of July 1, 2022), the ninth largest by area[3] (3,146 mi^2), and the seventh least densely populated (2.43 people/mi^2). According to 2022 Census data, more than half of Wallowa County's population lives in its four incorporated cities:

- Enterprise: pop. 2,172 (also the County Seat)
- Joseph: pop. 1,048
- Wallowa: pop. 724
- Lostine: pop. 381

Wallowa County's CESP Leadership Team recognized the need for energy resilience at the county level very early on in the CESP process highlighting the elevated risks as an "end-of-the-line community". The County regularly experiences extreme weather conditions affecting access to external goods and services and it is especially prone to seasonal risks from extreme cold and wildfires. Community leaders have historically sought to provide resilience at fire departments and hospitals using fossil-fuel generators or solar plus storage. The CESP found that there is a need to expand resilience to other critical facilities across the county, including community shelters, medical facilities, municipal water/wastewater systems, emergency services, fuel providers, and grocery suppliers.

The CESP set a vision for the County to demonstrate and develop energy resilience through best practices of conservation, efficiency, and increased renewable energy resources. To support this plan, the project efforts focused on highlighting and outlining local renewable generation and the aggregation of available assets and resources. Conservation and efficiency will be critical steps in the development of the final resilience plan, but are outside the scope of this specific effort.

With input from Wallowa County leadership, WRCEP provided an initial list of microgrid critical loads and resources and expressed a strong preference for renewable energy sources. Additionally, WR and other key stakeholders identified potential host sites for biomass generation, hydroelectric generation, and large-scale solar PV. Site selection for largescale generation requires a thoughtful and detailed approach to consider a range of impacts such as environmental, historic preservation, and viewsheds.

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[2] US Census Bureau, "QuickFacts: Oregon," https://www.census.gov/quickfacts/fact/table/OR/PST045219.

[3] National Association of Counties, "County Explorer," https://explorer.naco.org/.

3 Wallowa County Resilience Corridor Evaluation

A resilience corridor architecture was identified as having maximum potential for achieving the county-wide resilience goals. The architecture would establish community microgrid hubs in Wallowa, Enterprise, and Joseph to support emergency services and other critical services in the event of a large-scale, long duration power outage. As envisioned, a combination of facility-level microgrids would support the development of electrical distribution feeder-level microgrids, which would, in turn, help establish a multi-feeder microgrid serving loads in all three communities. This facilitates a robust set of redundant community energy systems, that will assuredly allow Wallowa County to endure and rapidly recover from adverse events.

This section of the report assesses ten distinct microgrid scenarios developed during this planning project. The first subsection provides an overview of the Wallowa County Resilience Corridor's major physical features. The next three subsections correspond to technical, economic, and regulatory reviews. The information developed in these reviews informs technoeconomic modeling, which in turn results in design options.

3.1 Corridor Overview

Figure 2 provides a visual overview of the Resilience Corridor developed from the GIS resource. All maps developed as part of this project are available in Appendix 7.2. As shown, the Wallowa Valley is served by a transmission line (orange) which feeds five distribution circuits. Each roughly correlates with a town, as follows:

- **Circuit 5W28 (red):** serves Wallowa
- **Circuit 5W26 (green):** serves Eastern Enterprise and Lostine
- **Circuit 5W15 (blue):** serves downtown Enterprise
- **Circuit 4W8 (purple):** serves Enterprise and Joseph and feeds 5W21
- **Circuit 5W21 (pink):** primarily serves Joseph and is fed by 4W8

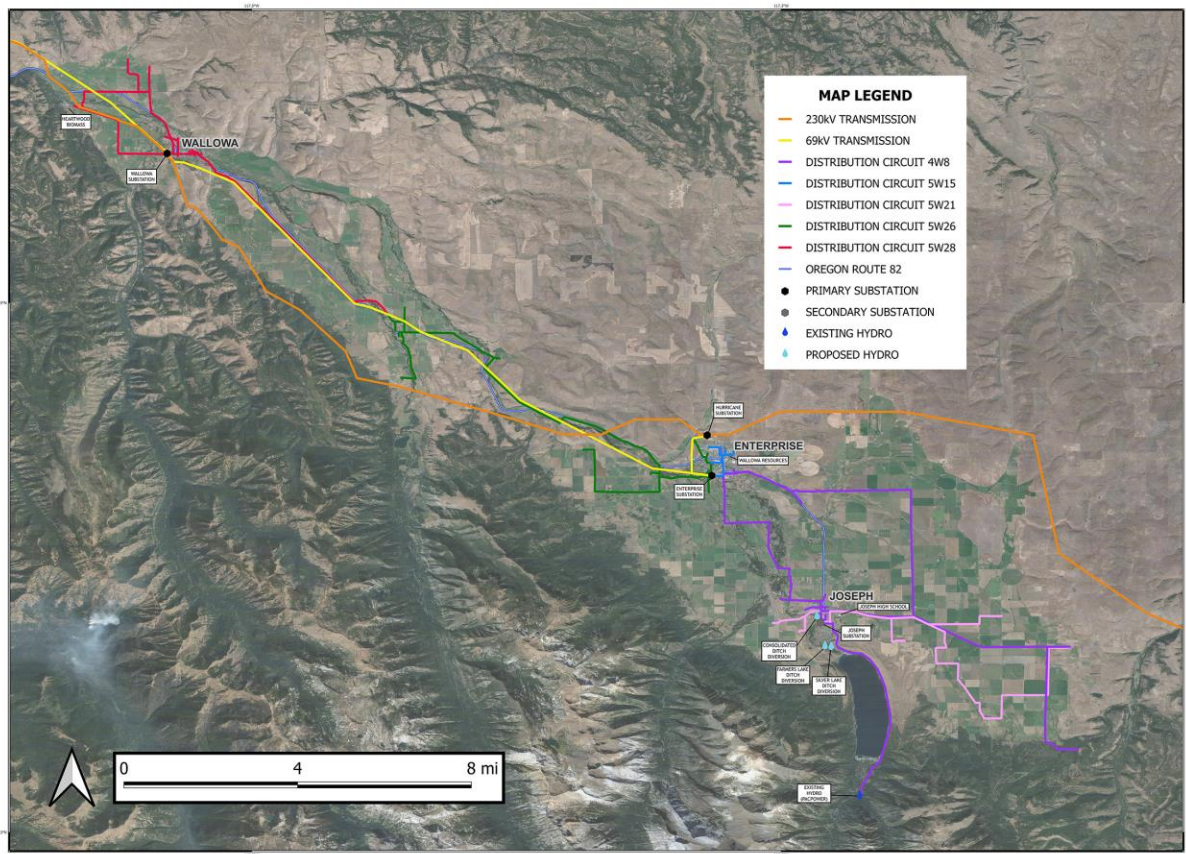

Figure 2: Wallowa County Resilience Corridor overview

The work developed and evaluated a total of ten microgrid scenarios. These include the following.

- **(3) Facility-level microgrids:** Three scenarios represent facility-level microgrid hubs at critical facilities in Wallowa (Heartwood Biomass), Enterprise (the Doug McDaniel Stewardship Center), and Joseph (Joseph High School). The scenarios consider solar, batteries, and generators. These microgrids would provide anchor project support for the development of feeder-level microgrids.
- **(3) Partial Feeder-level microgrids:** Partial feeder-level microgrid scenarios were evaluated for Wallowa, Enterprise, and Joseph that would only power critical loads defined by the community stakeholders. These roughly 50 loads, over the three communities, would be serviced by newly wired distribution circuits. The scenarios consider using biomass at Heartwood Biomass, PV, battery energy storage, and hydro at Wallowa Lake. In the event of an outage, these circuits would be given priority for repair if required. It is understood that these circuit configurations require additional study and planning with electric utility, Pacific Power.
- **(3) Feeder-level microgrids:** A total of three full existing feeder-level microgrid scenarios were evaluated for Wallowa, Enterprise, and Joseph. The scenarios included resources from Heartwood Biomass, hydroelectric at Wallowa Lake, and various solar PV and battery energy storage systems distributed along the feeder circuit. The benefit of this configuration is it would not require installing new distribution circuits. This savings may however be offset by the need to support a larger load. This configuration, like the partial feeder configuration, will require a study by Pacific Power.
- **(1) Whole Community microgrid:** A single scenario would provide power to all five distribution circuits, effectively acting as a backup system for the entire Wallowa Valley. Large-scale, grid-tied energy projects are built out that operate nominally in a grid-tied mode and supply generation during islanded (emergency) operations. This scenario defines an upper limit for generation needs and construction cost.

3.2 Technical Review

The technical analysis began with the sourcing of available data from the facilities and utilities of interest within the project. Complete data was not available for all elements of analysis. Gaps were filled by developing data using the methodology described in Section 3.2.1. The load data served as the foundation for the exploration of suitable technologies and architectures in parallel with the regulatory review to develop the technoeconomic modeling for this planning project.

3.2.1 Load Data Analysis and Development

To simulate the Wallowa County Resilience Corridor modeling scenarios, interval load curves were developed to define energy usage across the circuits of interest (see Appendix 7.3.4). Wallowa County is covered by five distribution feeders across three substations; all of which have a different spread of residential and commercial energy consumers. To approximate the individual feeder loads' seasonal variations in electric consumption, NREL's ComStock[4] and ResStock[5] were used in conjunction with supplied monthly billing data. Using these data, total aggregated annual consumption and peak demand were estimated for each feeder and validated using substation-level data supplied by Pacific Power.

3.2.1.1 Approximating Residential and Commercial Loads using ComStock and ResStock

Monthly billing data was supplied for ≈90% of the city-owned municipal loads within the county, and ≈60% if including non-city owned critical loads. City-owned critical loads included lift stations and pump houses, as well as fire stations and police/911-dispatch centers. Non-city owned critical loads included privately owned gas stations, grocery stores and hospitals. For unknown loads, per-building assumptions were developed based on similar facilities within the county that were then scaled using metrics such as population ratio or building area, depending on the information supplied. The methodology also used the average annual consumption grouped

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[4] ComStock, Commercial Building Stock Load Curves: https://comstock.nrel.gov/

[5] ResStock, Residential Building Stock Load Curves: https://resstock.nrel.gov/

by customer type from Pacific Power data shared in the "Wallowa County Energy Use" spreadsheet provided by WRCEP[6] to estimate unknown loads of a given customer type. Information gathered during a site visit and from Google Maps Street View was used to inform the development of 15-minute interval load curves for unknown facilities. This informed ComStock heating fuel type and building type to model load variations throughout a typical meteorological year.

Load curves for residential buildings on a distribution feeder were divided into two categories: year-round residents, and buildings that primarily only experience loads during the seasonal influx of tourist visitors to the Wallowa Lake and the general Wallowa-Whitman National Forest. Specifically, buildings in Joseph located around Wallowa Lake were used to estimate this seasonal behavior. GIS mapping was used to count the number of expected seasonal homes located around Wallowa Lake in Joseph, OR. Aggregated load curves from ResStock were used to account for load diversification. Although residential homes primarily utilize heating oil, wood stoves or propane for space heating during winter, 20% of homes were assumed to be electrically heated to further diversify the aggregated load when adding up to each feeder line from the substation. These diversified ResStock load curves were then normalized and rescaled to match the annual consumption per resident based on 2021 data from the Wallowa County Energy Use spreadsheet.

Figure 3 demonstrates how year-round residential and seasonal residential loads each contributed to Circuit 5W21 over the course of a year. Figure 3 shows an aggregated view of all residential loads on the circuit.

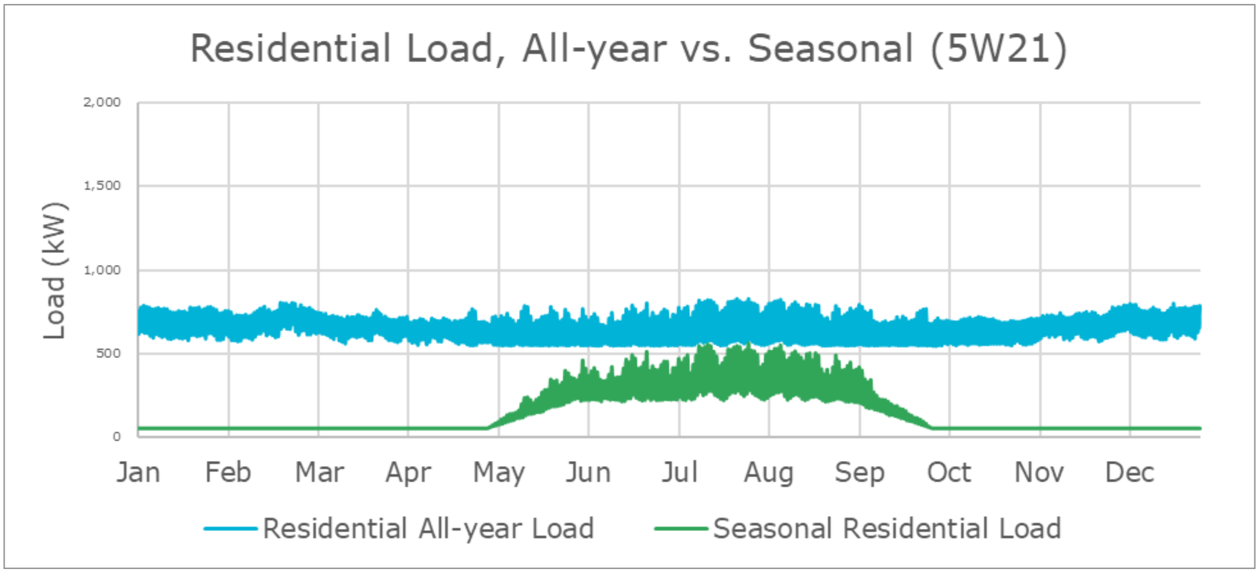

Figure 3: Residential loads, all-year vs. seasonal (5W21)

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[6] See "Wallowa County Energy Use 2016-2021.xlsx"

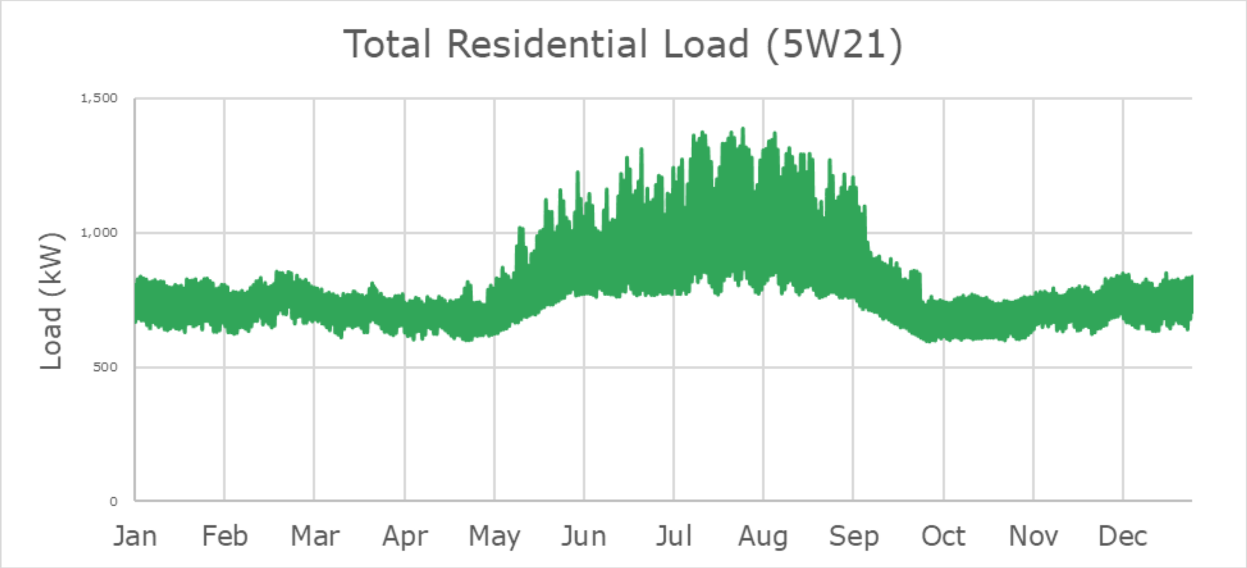

Figure 4: Total residential load (5W21)

The average annual consumption for unknown residential and commercial buildings for Wallowa County was estimated using 2021 data from the Wallowa County Energy Use spreadsheet. This document includes total customer counts and annual consumption in kWh, grouped by building type (commercial, industrial, irrigation, public lighting and residential). This information was used to estimate annual consumption of 11.8 MWh per residential home, and an annual consumption of 26.2 MWh per commercial building (see Table 1). There is uncertainty as to which feeder includes industrial, irrigation and public lighting. These values have been absorbed by commercial and residential estimates when using GIS to count building types.

Once an estimate for individual load curves was established, all loads summed up on a 15-minute interval basis and shown individually for each of the 5 feeders. A typical meteorological year was assumed to determine an aggregate load curve for each feeder, including total annual consumption (kWh) and peak demand (kW). The calculation summed to an annual consumption of 80 GWh. 2021 data from Pacific Power showed 84.6 GWh for the Enterprise operating area; however, this data included Minam and North & South Pallette, which contribute to approximately 4.4% of the county's population. These loads are outside of the Wallowa Resilience Corridor and were therefore eliminated from the total feeder estimated annual consumption. Scaling Pacific Power's provided usage by the 4.4% results in annual consumption of 80.9GWh, which is within 1% of the 80 GWh estimate modeled and validates the load curves developed as shown in Figure 4.

Table 1: Average Annual Consumption from PacPower, 2021

Building Type	Annual Usage (kWh)	Circuit Customer Count	Average Annual Usage per customer (kWh)
Commercial	26,399,868	1,008	26,190
Industrial	1,427,630	20	71,382
Irrigation	7,831,781	265	29,554
Public Lighting	262,989	6	43,832
Residential	48,654,719	4,140	11,752
Total	**84,576,987**		
Adjusted Total*	**80,870,180**		
Predicted Total	**80,018,100**		

**Excludes 4.38% from Minam and North/South Pallette*

Table 2 illustrates the load model's peak demand are in close agreement with the measured data and the modeled annual usage in the final column. Residential and commercial counts per feeder were not available for this work, so these counts were grouped in an optimized arrangement to minimize the deviation from peak demand as supplied by Pacific Power. An additional diversification factor of 1.5 was applied to the residential curves to reach these peak demand values more accurately.

Table 2: Pacific Power Substation Data for Wallowa Valley

Location	Utility Feeder	Circuit Customer Count[7]	Feeder SCADA (Y/N)	Feeder Load Peak (Summer)[8]	Modeled Peak Demand	Peak Demand % Delta	Feeder Capacity (Summer)[9]	Modeled Annual Usage[10]
Wallowa	5W28	882	N	2.1 MW	2.05 MW	+2%	6.7 MW	12.6 GWh
East Enterprise[11]	4W8 +5W21	1480	N	7.6 MW	7.9 MW	-3%	9.8 MW	37.0 GWh
Downtown Enterprise	5W15	942	N	2.5 MW	2.6 MW	-4%	9.8 MW	13.9 GWh
West Enterprise	5W26	1083	N	2.7 MW	2.8 MW	-3%	9.8 MW	16.5 GWh
Southern Joseph	5W21	849	N	2.5 MW	2.7 MW	-7%	6.2 MW	13.5 GWh

3.2.1.2 Simulation Load Development Summary

Table 3 through Table 6 describe the developed load profiles for the ten different microgrid scenarios modeled across five feeders within the Wallowa Valley. This includes loads for individual facility-level microgrids, partial feeder-level microgrids serving all critical facilities' loads for each town, a theoretical full feeder-level microgrid configuration, and multiple feeders for community-level microgrid analysis.

Table 3: Wallowa (circuit 5W28) simulation inputs

Location	Microgrid Topology	Annual Usage	Peak Load
Heartwood Biomass	Facility	1.1GWh	0.4MW
Wallowa Downtown Critical Facilities	Partial feeder	2.9GWh	0.7MW
Wallowa Whole Community	Whole feeder	12.6GWh	2.1MW

Table 4: Enterprise (circuit 5W15) simulation inputs

Location	Microgrid Topology	Annual Usage	Peak Load
Wallowa Resources Hub	Facility	320MWh	80kW
Enterprise Critical Facilities	Partial feeder	1.15GWh	408kW
Enterprise Whole Feeder	Whole feeder	13.9GWh	2.6MW

Table 5: Enterprise/Joseph (circuits 4W8 and 5W21) simulation inputs

Location	Microgrid Topology	Annual Usage	Peak Load
Joseph High School	Facility	432MWh	169kW
Joseph Critical Facilities	Partial feeder	2.1GWh	500kW
Joseph Whole Feeder	Whole feeder	37GWh	7.8MW

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[7] October 15, 2021 Re: UM2198- PacificCorp's Oregon Distribution System Plan: https://www.pacificorp.com/content/dam/pcorp/documents/en/pacificorp/energy/dsp/2021_PacifiCorp_Oregon_Distribution_System_Plan_Report_Part1.pdf

[8] Spreadsheet in reference to OPUC Docket UM2000 filename 'OregonUM2000InterconnectionData' received 4/7/23.

[9] Ibid

[10] Usage is estimated, not metered (partially metered from monthly bills supplied)

[11] Feeder also serves northern Joseph, and the Joseph substation. To reduce confusion: Loads on 5W21 are <u>not</u> double counted for 4W8.

Table 6: Community microgrid (all 5 circuits) simulation inputs

Location	Microgrid Topology	Annual Usage	Peak Load
Entire Wallowa Valley (all 5 feeders)	Community microgrid	80GWh	14.6MW

3.2.1.3 Individual Critical Facilities Load Estimates

Baseline load data was created for each of the local resilience hub anchor projects. The methodology used for each individual facility is described in the following sections.

3.2.1.3.1 Heartwood Biomass

The Heartwood Biomass facility served by circuit 5W28 has two meters: one for the chipper and another for packing/shipping areas. These loads have similar annual usage (kWh) but have different peak demands. To match monthly usage to the billing data supplied, a typical warehouse was used to calculate an annual consumption of 1.1 GWh and a peak demand of 360 kW. The load profile generated is shown in Figure 5.

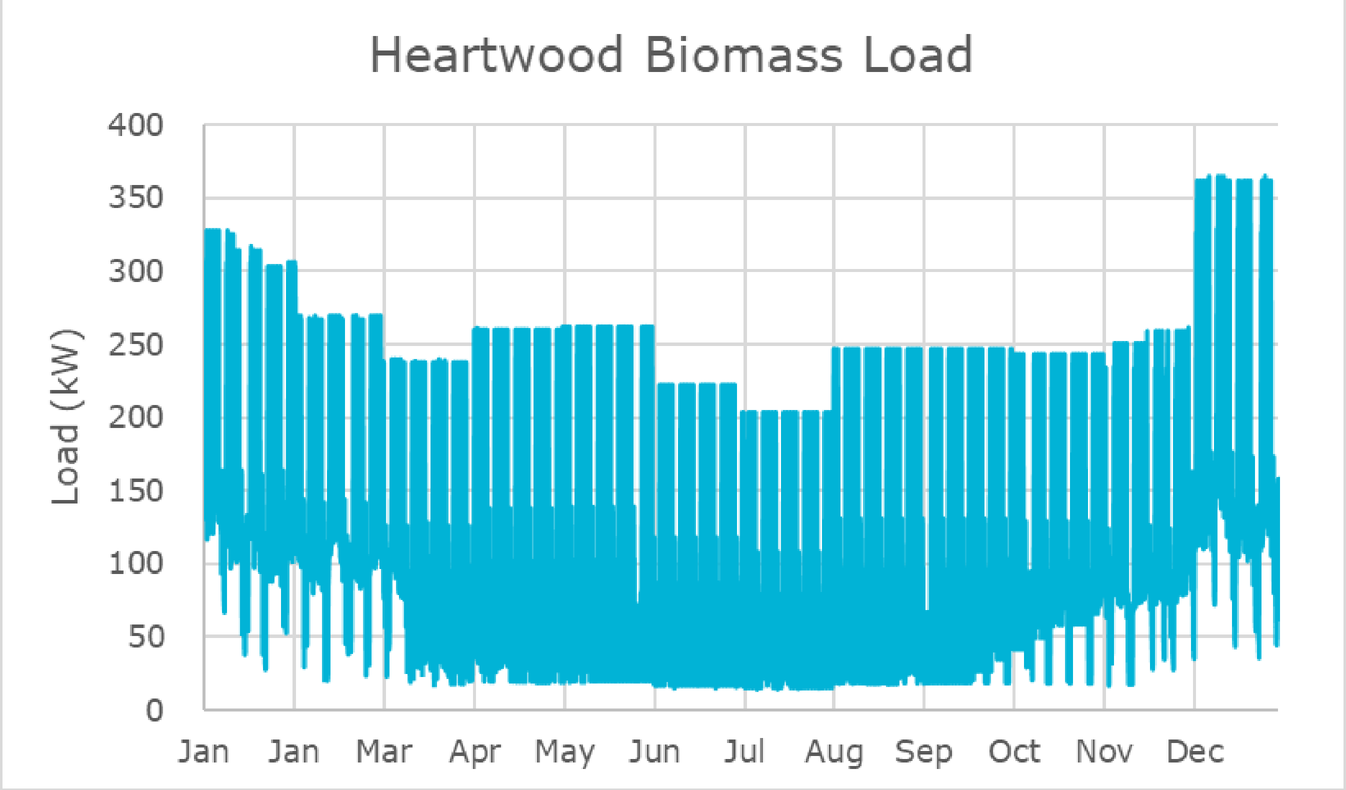

Figure 5: Heartwood Biomass load

3.2.1.3.2 Joseph High School

Joseph High School has five different meters which, when combined, form a typical annual load curve that aligns with Comstock's Secondary School building type. Higher accuracy was obtained by re-scaling to reduce seasonal fluctuations between peak and trough to match the monthly billing data more closely. For this facility, annual consumption is 432 MWh with a peak demand of 169 kW. Monthly usage is shown in Figure 6. Figure 7 provides the annual load profile.

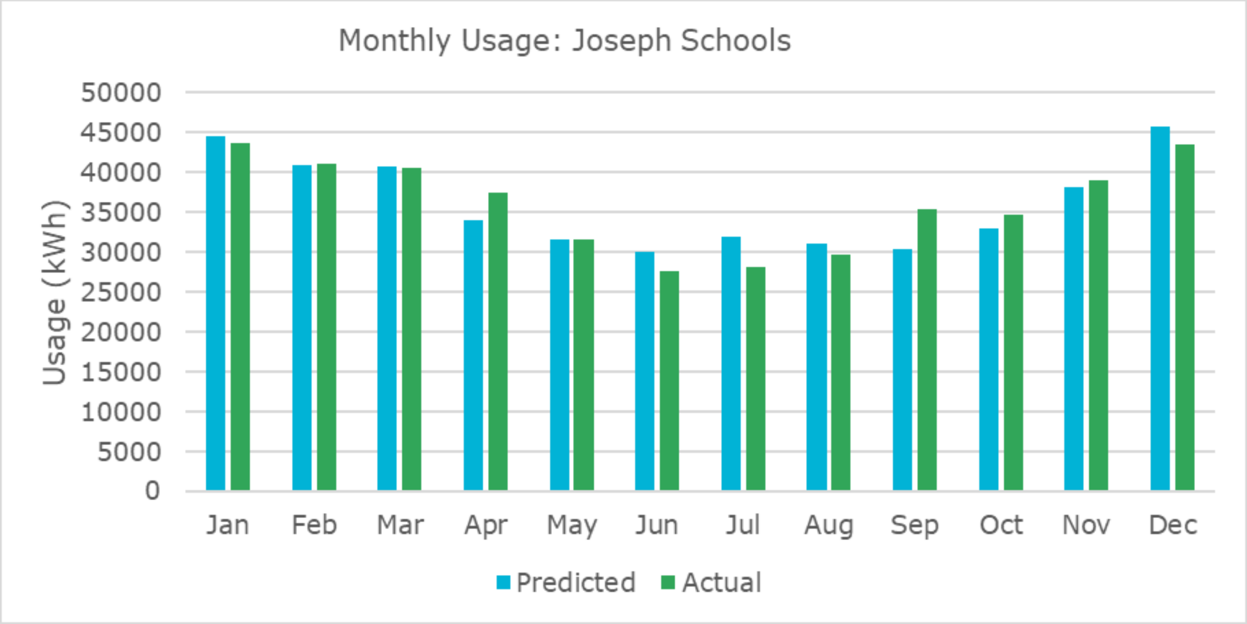

Figure 6: Joseph High School monthly usage

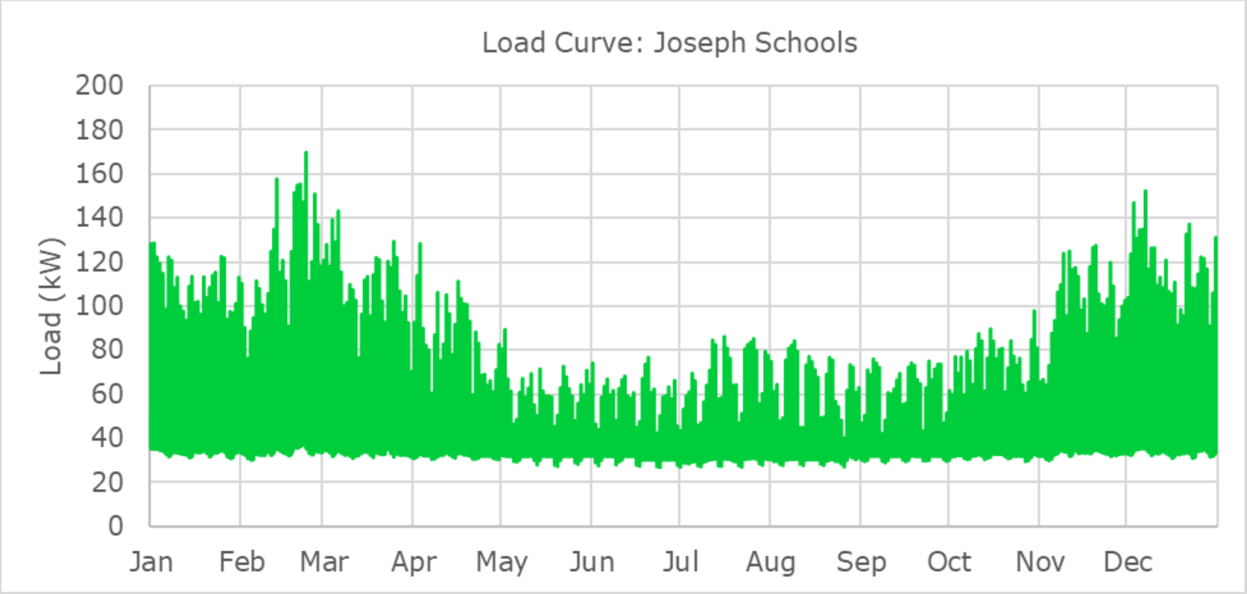

Figure 7: Joseph High School load curve

3.2.1.3.3 Wallowa Resources

The Wallowa Resources complex, housed in the Doug McDaniels Stewardship Center, has two meters, each with solar connected. To model this facility, Comstock's medium office load curve was utilized. It was scaled to match the provided billing data and account for the installed solar capacity as well as the electric vehicle charging station, connected to the main distribution panel via a 200A breaker. July is an outlier with a 38% discrepancy. However, the annual energy demand between predicted and measured data has a delta of -1% over the course of the year. The peak demand from the bills has a maximum in September (106 kW), but otherwise the combined peak demand from each meter is close to the estimated value of 80 kW with a summed annual consumption of 320 MWh. Monthly usage is shown in Figure 8. Figure 9 provides the annual load curve used in the simulations.

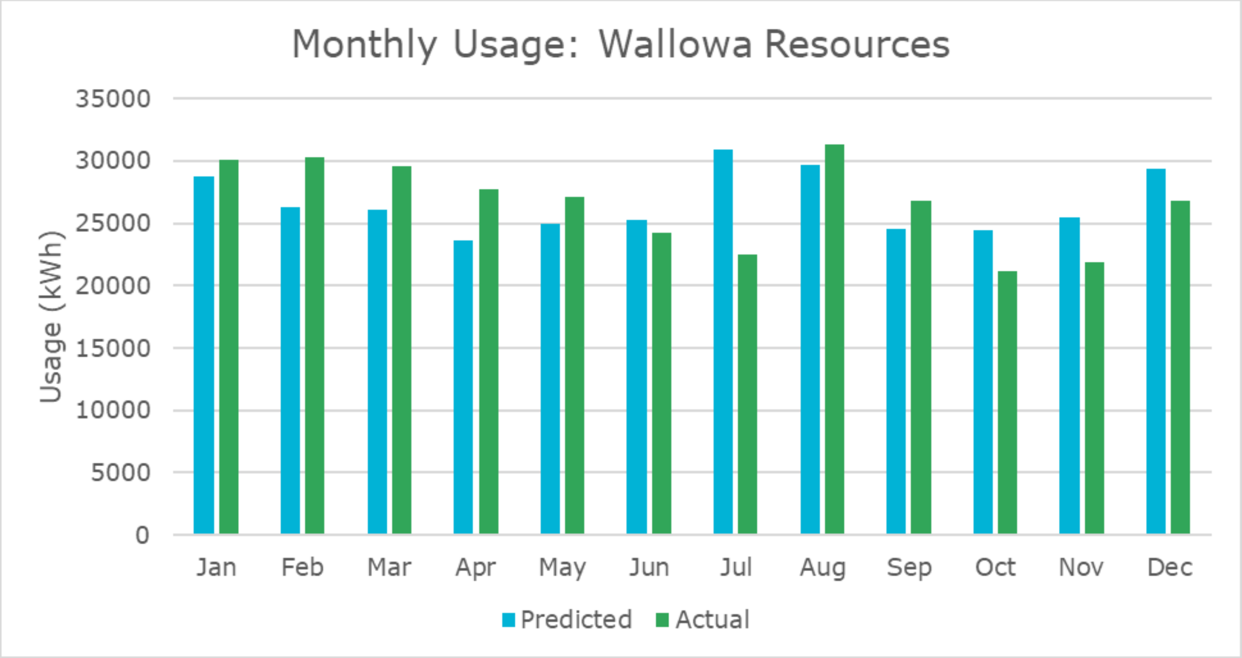

Figure 8: Doug McDaniel Building monthly usage

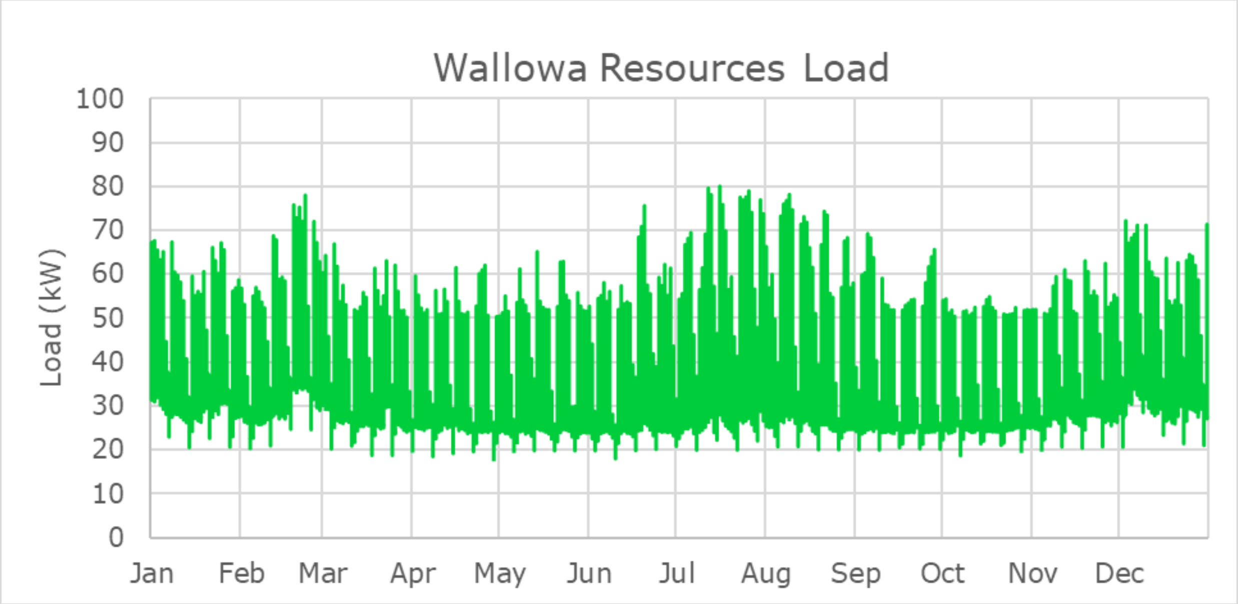

Figure 9: Doug McDaniel Building load curve

3.2.1.4 Hydroelectric Power Considerations

This project included both new and existing hydropower plants as part of the modeling. McMillen Engineering supplied projected hourly interval data for energy generated from hydropower for Scenarios 2F Crossflow, 2SFC, and 2C Crossflow. Together, these generate an annual total of 6.2 GWh. The existing Wallowa Falls Hydroelectric Project operated by Pacific Power was incorporated into the modeling. The project was assumed to produce 5.1GWh annually based on the 2017 licensing estimate and was assumed to provide a flat baseline load profile for the modeling. This data was used to offset the 4W8 feeder consumption, as well as considering the offset it supplies for the entire Wallowa Valley circuit. Installing hydropower significantly offsets the load in the summertime and, to a lesser extent, reduces the overall load during the rest of the year. Figure 10 shows how the combined hydropower projects reduce load on circuit 4W8 (which includes circuit 5W21). Figure 11 shows the effect of hydropower against all five circuits.

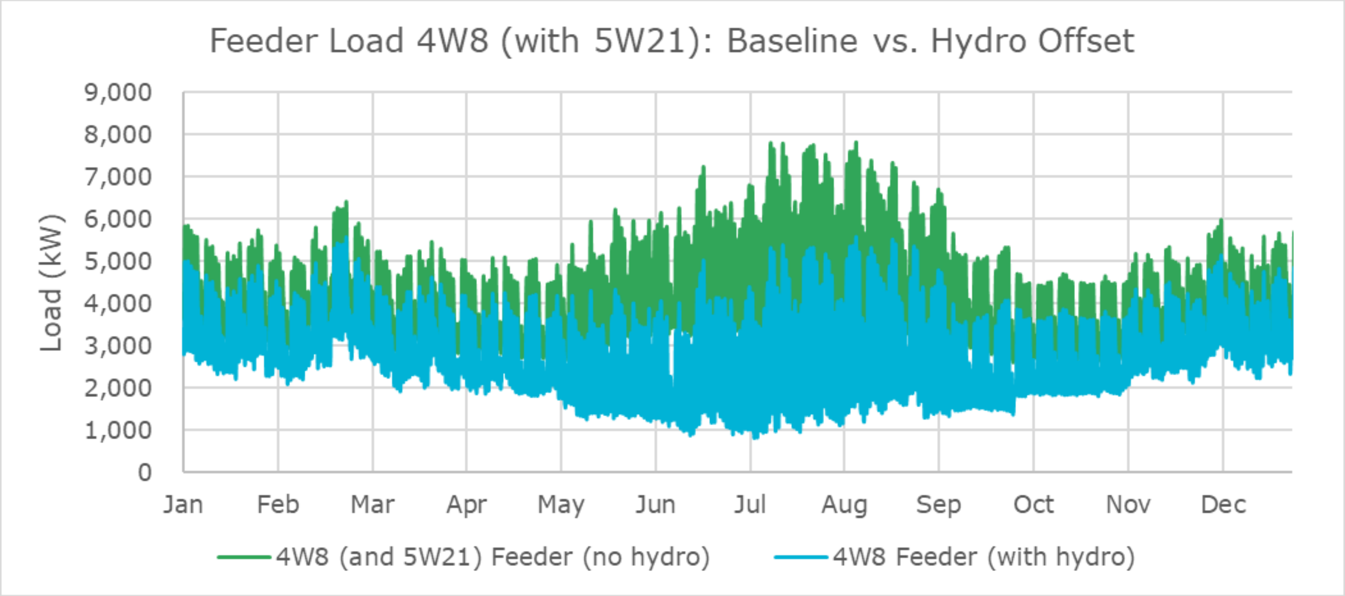

Figure 10: Feeder load 4W8 (with 5W21): baseline vs. hydro offset

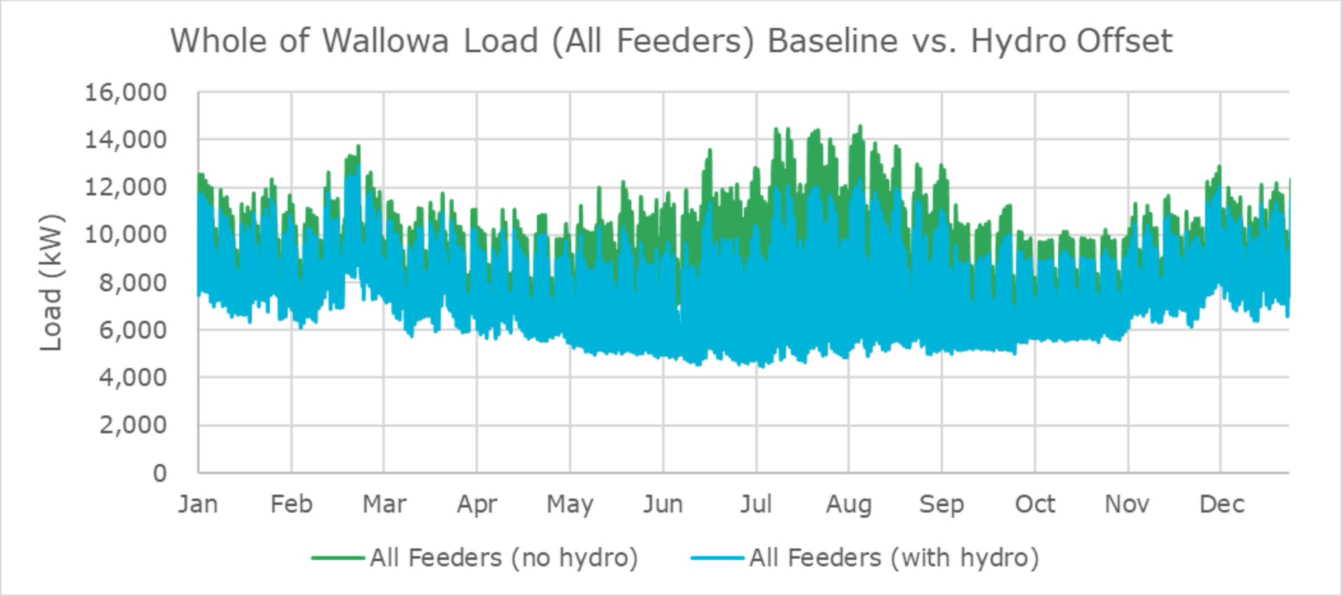

Figure 11: Whole of Wallowa load (all feeders): baseline vs. hydro offset

3.2.2 Technologies Considered

An analysis of potential energy fuel sources was conducted to identify suitable technology types for study. The results of the analysis are shown in Table 7.

Table 7: Analysis of Fuel Sources

Energy Fuel Source	Analysis Result
Solar Photovoltaic	Selected for study
Wind	Not selected (technically infeasible)
Hydro	Selected for study
Tidal/Wave	Not selected (fuel unavailability)
Geothermal	Not selected (fuel unavailability)
Biofuels	Selected for study
Diesel	Selected for study
Propane	Selected for study
Natural Gas	Not selected (fuel unavailability)
Hydrogen	Not selected (fuel unavailability)
Nuclear	Not selected (currently not viable/legal)

The analysis revealed five primary fuel sources for consideration: biomass, hydro, photovoltaic solar (PV), propane, and diesel. Battery energy storage systems (BESS) were also considered. Each performs a complimentary role in the various microgrid system topologies designed for analysis.

3.2.2.1 Asset Classes

This plan utilizes three classifications of energy assets for system architectures.

- **Signature assets:** These include small hydropower and biomass combined heat and power (CHP). Both are treated as non-flexible, baseload sources of generation. The hydropower is dependent on defined irrigation flows, where biomass generation is constrained by the wood gasification process which limits ramp rates and on/off cycling.
- **Anchor assets:** These are effectively small power plants—blocks of controllable resources that operate at the feeder-level. They include larger-scale PV, BESS, and rotating machine generation.
- **Distributed assets:** These are typically smaller distributed energy resources (DERs) such as PV, BESS, and rotating machine generation. They may be located at a resilience hub (i.e., Heartwood Biomass, Doug McDaniel Building, Joseph High School) or elsewhere on a given feeder.

3.2.2.2 Biomass

Biomass gasification for heat and power generation is an advancing technology still in the initial stages of microgrid-scale commercialization. Most of the technical, regulatory and market challenges associated with the technology are specific to the biomass gasification process itself. The Wallowa community would provide an ideal host environment for a site given its access to woody biomass, its partnership with the Heartwood Biomass mill, and its history in forest management.[12] The provided basis of design specifies a 2MW Syncraft gasification plant that is paired with two 1MW Jenbacher J420 CHP generators. Gasification process stages are directly integrated with the gas engine as an integrated plant.

For all but the year's peak load hours, the 2MW plant sizing exceeds the needs of the distribution feeder serving Wallowa (5W28). The simulated design assumes a routine export of power through the Wallowa substation. The

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[12] US Forest Service Wood Energy Utilization Support Program, "Woody Biomass Gasification Technology and Market Update", December 2022. Study profiles a range of biomass plant system technology types and systems sizes deployed by European companies.

plant output would step down to 1MW when the feeder is islanded. This operating provision is required because the biomass plant is not capable of flexibly adjusting its output or operating in a load-following mode.

The plant would require approximately 705kg of dry biomass per MWh of electrical output with a feedstock of ½" to 2" non-contaminated, dry woodchips. This equates to roughly 5000 tons/year of dry chip. Thermal power (at 90° C) is roughly 1.4 times that of electrical power. The thermal load would be the Heartwood Biomass plant itself. Heat would be delivered to the plant for kiln drying, space heating, and other needs. The economic use of heat would likely need to be scaled up to meet the output of the biomass plant. Other process byproducts include biochar—an agricultural supplement which provides a carbon sequestration function and possible revenue.

An option for smaller, community-scale, biomass was identified in the course of this plan. All Power Labs is a US-based manufacturer of small 25kW biomass generator units. While the product was not an ideal fit for any of the microgrid scenarios, it is profiled in the Appendix Section 7.5.1 for future consideration.

3.2.2.3 Hydropower

To investigate the potential for local hydro power in Wallowa County, Boise-based McMillen Corp. ("McMillen") performed a study on behalf of Wallowa Resources and Wallowa Lake Irrigation District (WLID). McMillen is designing the rehabilitation of the non-power-producing dam at the mouth of the Wallowa River. Any hydropower project whose penstock emerges from this dam and extends to a nearby irrigation diversion will be contingent on the completion of the rehabilitation. That contingency, coupled with the complexity of permitting, engineering and construction, predisposes the timeline for a hydropower project to lag other projects detailed in this plan.

McMillen released its draft hydropower report in September of 2023[13] and intends to issue a finalized report in early 2024. The report models a selection of power house opportunities using seasonal flows from three irrigation canals diverted from Wallowa River. The scenarios are named for the canals they serve—Farmers Ditch, Silver Lake Ditch, and Consolidated Ditch. The construction of one hydro plant would not prevent the construction of other plants. The modeling assumed the construction of all three of the McMillen powerhouse scenarios: the Farmers Ditch scenario (2F), the Silver Lake Ditch scenario (2SFC)) and the Consolidated Ditch scenario (2C). A similar hydro plant existed in the vicinity of the Consolidated Ditch powerhouse nearly one hundred years ago. The new penstock could follow the same historic right-of-way from the Wallowa Lake Dam into the town of Joseph. A brief technical summary is provided in Table 8.

Table 8: Hydropower technical summary

Scenario	Capacity (MW)	Energy (MWh)	Average Efficiency (%)	Capacity Factor (%)
Alt 2F Crossflow	0.2	394	91	23
Alt 2SFC	0.4	1,170	92	33
Alt 2C Crossflow	1.4	4,658	87	38
Totals	**2.0**	**6,222**	**88**	**36**

At the time of this project, McMillen had vetted the feasibility of cross-flow turbines (in lieu of traditional Kaplan or Francis turbine types) for Options 2F and 2C. McMillen provided a generation spreadsheet documenting the output from the turbines[14], which shows constant efficiencies that exceed traditional turbines in capturing energy from fluctuating flows. Scenario 2C provides a constant 250kW of generation in the irrigation off-season (between October 1 and April 30). The net effect of this power production has accounted for in the load profiles discussed in Section 3.2.1.4.

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[13] WallowaLake_Hydropower_DraftFeasibilityReport_Rev1

[14] Wallowa Hydro Alternatives Generation for ProtoGen_R1

3.2.2.4 Solar Photovoltaics (PV)

PV modules are organized into arrays that can be mounted on the ground, on a rooftop, or installed as canopy systems. Solar energy is an abundant energy source with a fuel source that is free, which makes it advantageous for resilience applications. However, because sunlight is an intermittent resource, energy storage is required to make the energy flexible in many microgrid architectures. For the plan solar PV was modeled at all three facility microgrids (Heartwood Biomass, the Doug McDaniel Building, and the Joseph High School). Additional opportunities were also identified for existing and prospective PV projects that could support feeder-level microgrids. PV was modeled as an anchor asset for the feeder-level and community microgrids using a single-axis tracker and an inverter loading ratio of 1.5. Higher dc:ac ratios help to increase capacity factors and lower interconnection sizes. The exception was the Wallowa feeder, which was modeled as a fixed-tilt system (due to its smaller size) with an azimuth specific to Heartwood Biomass (due to the mountain to the west of the array).

3.2.2.5 Battery Energy Storage Systems (BESS)

Battery energy storage systems play a critical role in microgrids due to their ability to address the inherent intermittency of renewable sources. Solar power generation is dependent on weather conditions and daylight availability which leads to fluctuations in energy production. In the context of a microgrid, batteries help to bridge the gap between periods of excess generation and high demand. BESS enables the capture and storage of surplus solar energy during peak production times, ensuring a continuous and reliable power supply when sunlight is scarce. Batteries can also serve as grid-forming assets and/or function as a buffer, providing electrical stability to the microgrid by smoothing out fluctuations in addition to providing generator smoothing functionalities if required. Lithium-ion was selected as the modeled battery technology. This chemistry is ideal for microgrids because of its high energy density, efficient charge/discharge capabilities, and extended cycle life. BESS was modeled at all three facility-level microgrids and as an anchor asset for the feeder-level and community microgrids.

3.2.2.6 Rotating Machine Generation

Fossil fuel generators play a crucial role in microgrids by providing a reliable source of backup power when renewable sources are unavailable. Their ability to quickly respond to fluctuations in demand ensures continuous energy supply, enhancing the overall resilience and reliability of microgrid operations. Rotating machine generation is characterized as either "baseload," i.e., typically running at full capacity, or "dispatchable," i.e., load-following. The designs utilized diesel or propane generators as dispatchable resources. Operation is limited to providing only the highest value, back-up energy when energy is scarce from other resources, e.g., during low solar periods. This form of generation may ultimately be replaced by small biomass, hydrogen, or other firm sources of clean energy as they become commercially viable. Rotating machines were modeled at all three facility-level microgrids and as an anchor asset for the feeder-level and community microgrids.

3.2.3 Microgrid Topologies Modeled

US DOE defines microgrids as follows:

> "A microgrid is a group of interconnected loads and distributed energy resources that acts as a single controllable entity with respect to the grid. It can connect and disconnect from the grid to operate in grid-connected or island mode."[15]

Microgrid topology describes the way in which a microgrid's constituent parts are interrelated or arranged—the chosen architecture. For example, microgrids can serve a single facility, a group of facilities (e.g., a campus), a distribution feeder in an electrical distribution system, or even multiple interconnected feeders (i.e., in a community microgrid). The topologies considered for Wallowa County include single facility microgrids, partial and full feeder microgrids, and community microgrids. The scope of each system can be viewed independently or as part of a nested arrangement, with smaller systems serving as functional components in a larger system. In this arrangement, facility level microgrids are constituent members of a feeder microgrids, which in turn are constituent members within a full community microgrid. The concept is illustrated in Figure 12.

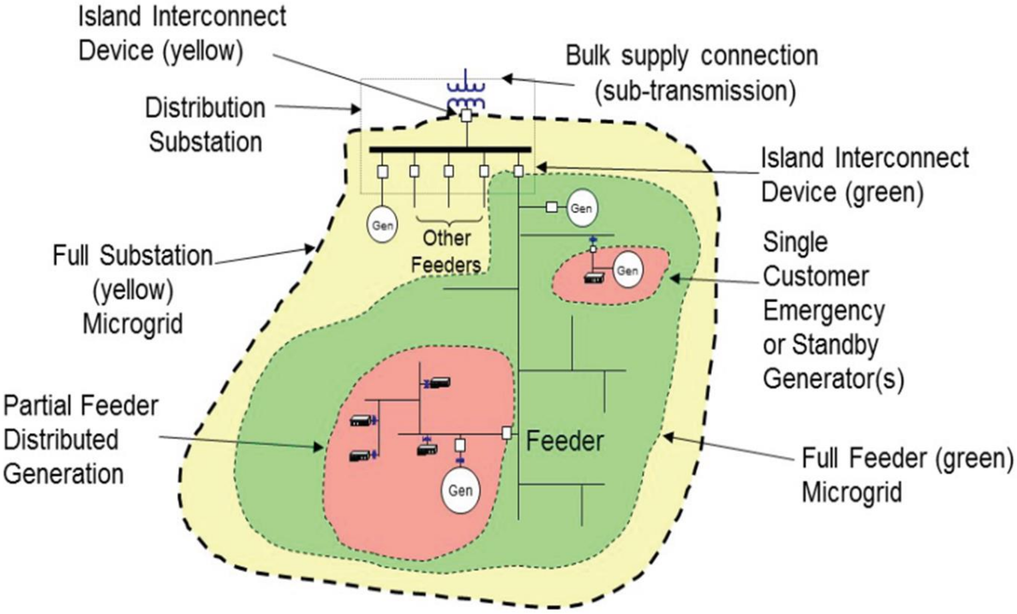

Figure 12: Common Microgrid Architectures (EPRI, 2016)

3.2.3.1 Facility-Level Topology

Single facility microgrids generally serve local loads behind a single point of common coupling with the grid. These systems maintain the highest degree of resilience due to their lack of dependence on aerial lines. A single-facility microgrid was designated to serve as a resilience hub for each of the towns: Heartwood Biomass in Wallowa, the Doug McDaniel Building in Enterprise, and Joseph High School in Joseph. During islanded operations, these systems would isolate themselves from the utility at the meter and self-generate their respective power needs.

3.2.3.1.1 Wallowa Facility-Level Microgrid: Heartwood Biomass

Heartwood Biomass site plays a unique role in this planning project. As a critical community resource that provides firewood for home heating, it appears in multiple models. It is modeled as a *facility* microgrid with the capability to provide its own electrical needs with the generator functioning as a distributed asset. It is also

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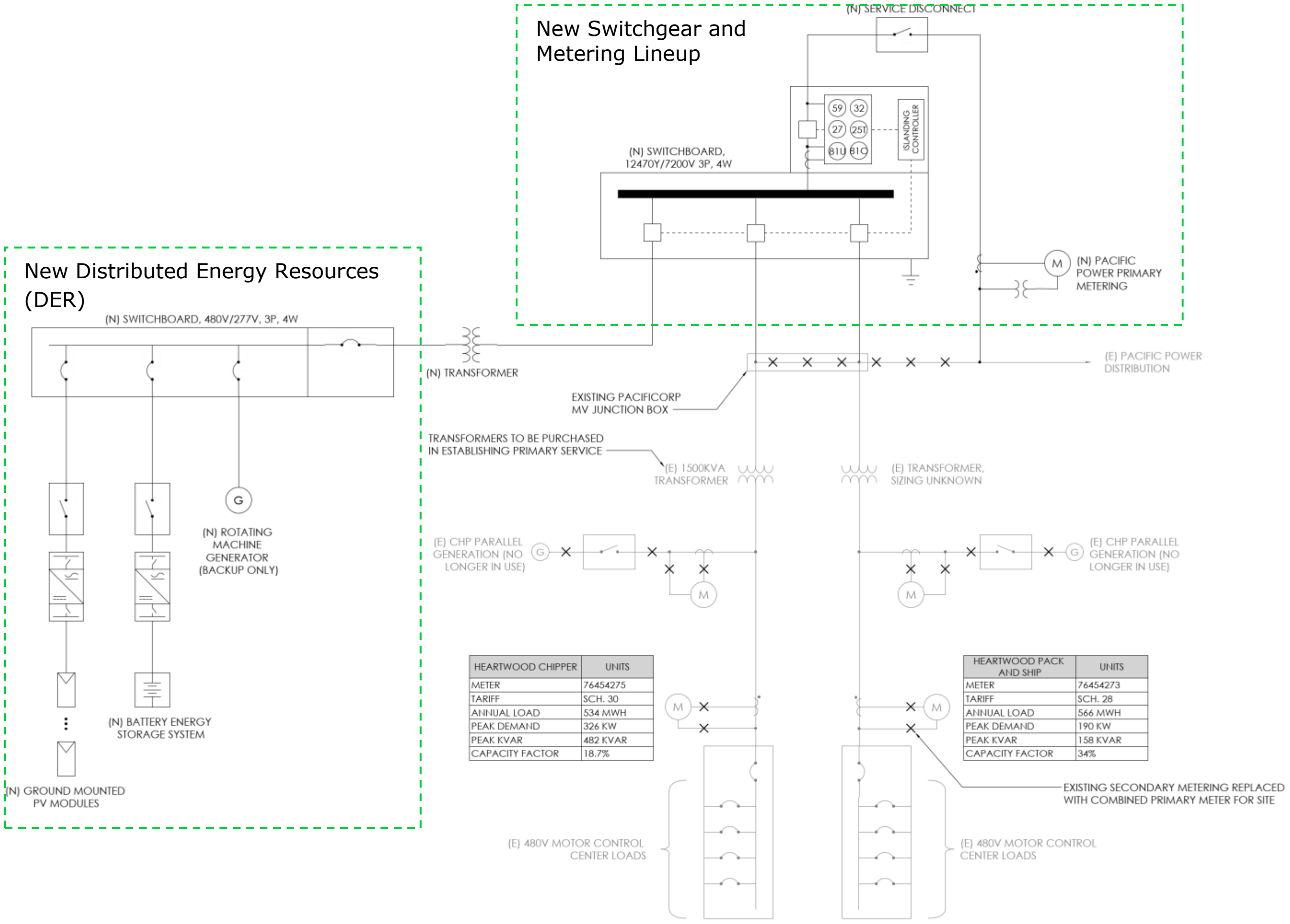
[15] Definition developed by the US DOE Microgrid Exchange Group

modeled as the bulk generator for the Wallowa feeder microgrid (as a hybrid biomass and solar and storage plant) in the anchor asset configuration.



HEARTWOOD CHIPPER	UNITS
METER	76454275
TARIFF	SCH. 30
ANNUAL LOAD	534 MWH
PEAK DEMAND	326 KW
PEAK KVAR	482 KVAR
CAPACITY FACTOR	18.7%

HEARTWOOD PACK AND SHIP	UNITS
METER	76454273
TARIFF	SCH. 28
ANNUAL LOAD	566 MWH
PEAK DEMAND	190 KW
PEAK KVAR	158 KVAR
CAPACITY FACTOR	34%

Figure 13: Heartwood Biomass facility-level single line diagram

The open field south and west of the site's buildings is utilized for ground-mounted solar in both scenarios. Both microgrids are large enough to spur the creation of a new primary metered utility service. Each requires a behind-the-meter consolidation of the site's two existing services (chipper and pack & ship) to support the creation of a unified backup system as shown in Figure 13.

3.2.3.1.2 Enterprise Facility-Level Microgrid: Doug McDaniel Building

The Doug McDaniel Building is an important community building and ideal location for an Enterprise resilience hub. Two stakeholders involved with the microgrid project—Wallowa Resources and the Energy Trust of Oregon—have offices in the building, as well as several other community facing organizations. There is 57kWdc of existing solar on the building that can be integrated into a microgrid alongside new resources.

The existing electrical system will require investment and upgrades to accommodate a microgrid architecture. The multiple utility services to the building will require upgrades and consolidation and the main utility transformer feeding the neighboring buildings is not conducive to industrial power systems with its current configuration (high-leg delta 240V). Upgrades considered in the simulated design include:

- A utility service and transformer upgrade
- A full replacement of the building's main switchboard

- A new low voltage circuit extending the full length of the building to serve loads currently provisioned from a separate service at the east side of the building.[16]

Due to the size of the building load, relative to the roof capacity, a solar canopy is recommended for the northern parking area. This would facilitate *full* building back-up and avoid the need for critical load partitioning. The canopy presents a good opportunity to install EV changing stations at a central location in Enterprise.

3.2.3.1.3 Joseph Facility-Level Microgrid: Joseph High School

The Joseph High School site was chosen as a candidate resilience hub. Its suitability was confirmed when scheduled building upgrades were discussed during a site visit. The district plans to completely re-roof all building roofs (to standing seam metal roofing), transition the heating systems from stove oil to propane and plans are underway to integrate a generator—not to power the whole facility—but to cover wintertime heating. Effective coordination with the district's energy planning and construction activities would be a priority in pursuing this microgrid.

The school has five metered electrical services with a main account making up 92% of the total load. The main building was the focus of the simulation. Supporting the other site meters would likely become cost prohibitive because of the complexity of combining services. The aggregative load was simulated in the model to capture the full site load and include a margin for future school load growth.

The high school has a selection of roof surfaces ideal for solar. Due to net metering capacity limits, the solar generation potential exceeds the building's annual load. For this reason, neither the harder to integrate roofs nor a potential canopy system for the western parking lot were considered as part of the simulated design.

3.2.3.2 Feeder-level Topology

Feeder microgrids involve intentional islanding at the substation feeder breaker. Once the breaker is opened, the feeder is energized by assets. Each feeder microgrid will have one or two large anchor assets that play the role of a highly controllable, bulk generator. The anchor projects are shown in the drawings but do not reflect a specific site location. The anchor projects would be supplemented by other DERs on the feeders. Some of these supplemental DERs already exist while others represent development opportunities, e.g., residential solar. Together, they will reflect a continuum of controllability, ownership structures, and system types.

The Wallowa Resilience Corridor contains a total of five distribution circuits. Three feeder microgrids were studied, one of which serves two circuits.

- **Wallowa (Circuit 5W28):** This feeder microgrid is based on the Wallowa Substation. Included are PV, BESS and rotating machine generation at Heartwood Biomass, along with the associated 2MW wood gasification plant.
- **Downtown Enterprise (Circuit 5W15):** This feeder microgrid is based on the Enterprise Substation. Included are PV and BESS at the Doug McDaniels Building and an anchor asset of PV, BESS, and rotating machine generation.
- **Enterprise/Joseph (Circuits 4W8 and 5W21):** This feeder microgrid is based on the Enterprise Substation and would serve Circuit 4W8 as well as circuit 5W21, which it feeds. The former runs east of Joseph and has significant capacity for potential energy projects (as it currently serves Pacific Power's 1.1MW hydro, and once served an 8MW hydro plant southeast of Joseph). Included are PV and BESS at Joseph High School, four hydropower plants (one existing and three new), and an anchor asset of PV, BESS, and rotating machine generation.

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[16] The east side building service represents approximately 15% of the total building load.

3.2.3.3 Community Microgrid Topology

The community microgrid involves intentional islanding of Enterprise and Wallowa substations from their respective transmission feeder breakers. Once the breakers are opened, the substations at Wallowa, Enterprise, and Joseph are electrically isolated from the transmission system. In this model, additional assets are deployed that enable the microgrid to support all five feeders described in Section 3.2.3.2.

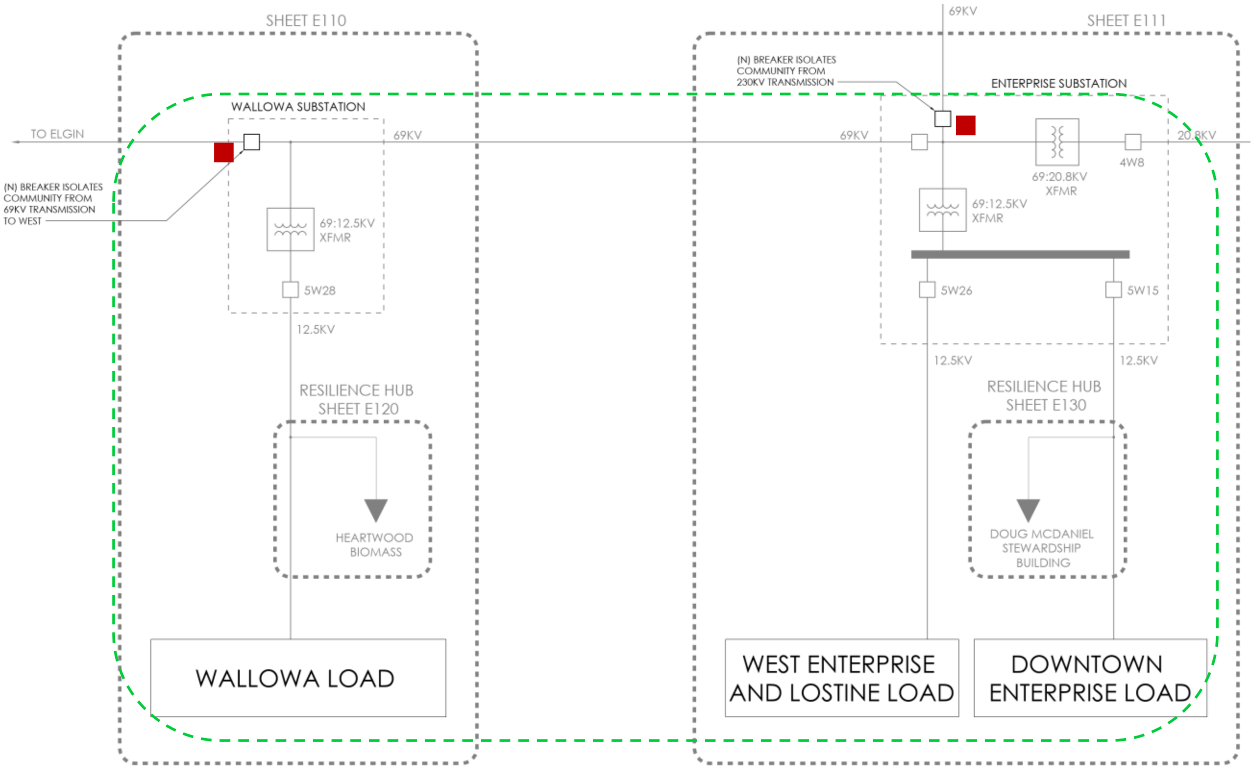

Figure 14: Community-level microgrid SLD excerpt

Figure 14 shows the electrical distribution area that would be covered by the anchor assets in the community-level microgrid architecture. The red boxes illustrate the transmission breakers that would open to enable the sharing of distributed resources via the 69kV line that runs between the Wallow and Enterprise substations.

3.2.3.4 Partial Feeder Microgrid Topology

The partial feeder microgrid is an important topology to understand and consider. As compared to facility-level and full feeder microgrids, a partial feeder system is more dependent on specific geographic circumstance.

The layout of the distribution system must be considered in relation to the location and distribution of critical assets. The distribution of sites can lead to a wide number of permutations and conceivable electrical boundaries. Given that the price to re-configure utility systems can be cost-prohibitive, design ideas should *not* be considered in the abstract. Partial feeder microgrids are most attractive where critical facilities are tightly clustered. Ideally, they are clustered without being interspersed with non-critical loads.

The initial design directive for a partial feeder topology typically relies on the identification of a cluster of critical loads. One cluster that appears promising is the Enterprise medical complex. The complex was identified during the planning project given the presence of critical resources and multiple existing PV systems.

The planning did not identify other attractive geographic clusters that inclined toward a partition of the distribution system. The planning simulated the generating capacity needed to serve all critical resources, on a feeder, as a construct to help maximize community resilience. The simulation should not suggest such a system is technically recommended as a means to serve widely dispersed critical assets without significant study and input from Pacific Power.

A partial feeder system offers the promise of integrating larger, centralized generation, and sharing facility-level resources between sites. It would utilize and segment utility infrastructure to create an island-able system. For example, a feeder might be segmented via an upstream ('head' recloser) and a downstream ('tail' recloser).

Where non-critical assets are distributed *inside* the sectionalized area—and they cannot be supported with the backup generation available—they would need to be disconnected at the onset of an outage or connected to a different circuit. Disconnection of sites or recircuiting can be where complexity and costs start to multiply. The cost of a medium voltage breaker (a recloser)—to establish controlled electrical isolation—is upwards of $50k to $100k installed. This will require additional input from Pacific Power to determine the cost impact.

At the residential level, it could be achieved through the connect-disconnect collar of an AMI smart meter. These meters would need to be procured and networked in the utility system for the specific purpose. For larger loads, a more customized disconnection would need to be designed specific to each facility. Smart metering can be justified for other reasons. Yet deploying systems specifically designed to remove electrical service in the case of an outage is unlikely to be popular with customers and could present regulatory challenges related to discrimination.

These challenges can be seen in Figure 15 which shows the Enterprise distribution circuit 5W15 with the loads identified as critical marked by blue squares. To effectively operate the partial feeder system design, all other loads (customers) would need to be disconnected from the distribution network in an emergency scenario while maintaining circuit continuity across approximately six distribution branches to reach each of the dispersed critical infrastructure facilities. There is no clustering of the critical loads to enable a head or tail isolation solution for any of the distribution branches.

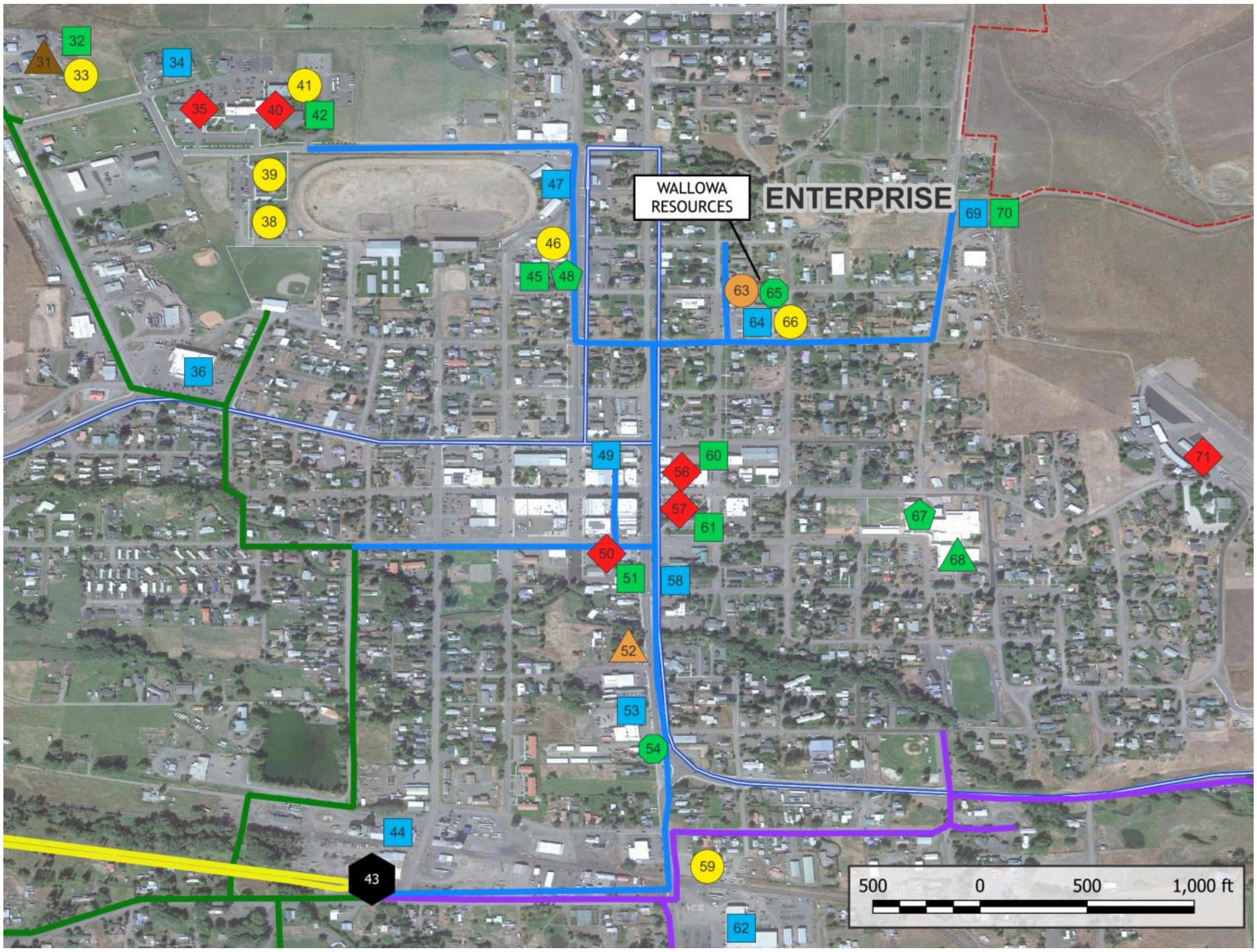

Figure 15: Enterprise Circuit 5W15 critical load distribution map

Disconnection of non-critical loads is an obstacle to the partial feeder topology. Another consideration relates to deploying critical power through the aerial distribution system. The full feeder microgrid is exposed to similar weather-related hazards. However, with a focus on critical assets, the partial feeder topology is more obligated to harden aerial infrastructure. It typically does this via 'undergrounding' the circuits. It is another cost adder that might be considered part and parcel of the topology. Facility-level systems (traditional diesel generation or PV/BESS powered, or both) are not exposed to these hazards. A multitude of independent smaller systems can often be a much more cost-effective solution when considered against the cost of re-circuiting utility infrastructure underground.

3.2.4 Pacific Power Interconnection Context

This planning project established the geographic topology of transmission and distribution systems serving Wallowa County as shown in Figure 2 and the supporting map set available in Appendix 7.2. Existing system conditions are the foundation of the proposed feeder-level scenario architectures. The infrastructure was visualized in the accompanying GIS drawings, which correlate critical infrastructure with electrical infrastructure. During this process, it became apparent that the local environment for distributed energy resources (DER) was constrained. Pacific Power's load and interconnection data illustrate a bottleneck as the aggregate of DER nears, or exceeds, the circuit's minimum daytime load (MDL).

As DER capacity approaches the circuit's MDL, it indicates increased potential for reverse power flow on the distribution system. This is a common technical screening method because it typically results in emergent voltage, thermal, and protection issues, which trigger more detailed studies and potential system upgrades for new DER capacity. Given Pacific Power's anti-islanding policy[17], one salient outcome to DER developers is the prescription of the often cost-prohibitive direct transfer trip (DTT) upgrade. Local stakeholders mentioned that DER restrictions have emerged at the residential level; it is notable that the bottleneck for DER is occurring at roughly 7% DER penetration of the annual regional load.[18]

The system constraint is directly relevant to the planning of facility and feeder level microgrids. The new resources would operate in both grid-connected and islanded modes. The challenges of microgrid implementation overlap with the transition to a higher penetration DER grid—specifically, the need to address the current bottleneck. Improvements would include new distribution system monitoring, metering and analytics; physical reinforcements to line equipment and substations; extensive use of DER control functions, communications, energy management systems (EMS) and microgrid controllers—all of which will need to be explored further and coordinated when considering system upgrades and microgrid implementations.

3.3 Regulatory Review

This section characterizes the regulatory context for the Wallowa Resilience Corridor.

3.3.1 Regulatory Overview

The Wallowa Resilience Corridor is served by Pacific Power ("PacPower"), a vertically integrated, investor-owned utility (IOU) and PacifiCorp subsidiary that is regulated by Oregon Public Utilities Commission (OPUC). Pacific Power's territory encompasses most of Wallowa County except for small carveouts in the County's northwest (served by Umatilla Electric Cooperative) and extreme northeast (served by cooperative Clearwater Power Company)[19]. Its service territory also extends into northern California and southeastern Washington.

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[17] See section 3.1.1.7 of Pacific Power's DER Policy: https://www.pacificpower.net/content/dam/pcorp/documents/en/pp-rmp/customer-generation/Facility_Interconnection_Requirements_for_Distribution.pdf and no. 3 under Part 1 of Schedule 126 (Community Solar Program Interconnection and Power Purchase)

[18] Based on an annual regional usage of 80GWh. 5MW of aggregated, installed DER nameplate capacity with a 1100 kW rated/kWh annual conversion efficiency equates to 5.5GWh of annual DER generation (this assumes all DER is PV). See Pacific Power interconnection data source in Appendix.

[19] https://www.oregon.gov/energy/energy-oregon/pages/find-your-utility.aspx

Residential electric customers do not have access to retail electric choice programs. However, Oregon's Electric Restructuring Law of 1999 mandated that utilities provide all nonresidential consumers the ability to purchase electricity from a Public Utility Commission-certified electricity service supplier (ESS) other than their current utility.[20] The program is known as Direct Access. Pacific Power offers both small and large businesses the ability to choose from an approved ESS under Direct Access as well as a proprietary market-based option called Daily Market Flux. Additionally, non-demand business customers and those with a demand of less than 30kW can enroll in Pacific Power's Blue Sky renewable energy or Time of Use plans.[21]

3.3.1.1 Public Utility Definition

To better understand what authority Pacific Power and the cities have, this planning project undertook a high-level review of relevant state laws. Specifically, the authority to take certain actions under ORS 221.420(2)(b), it is necessary to ensure that Pacific Power falls within the term "public utility". ORS 221.420(1) provides the definition for "public utility", stating that it is the same definition used in ORS 757.005. ORS 757.005(1)(a) defines "public utility" as "(A) Any corporation, company, individual, association of individuals, or its lessees, trustees or receivers, that owns, operates, manages or controls all or a part of any plant or equipment in this state for the production, transmission, delivery or furnishing of heat, light, water or power, directly or indirectly to or for the public, whether or not such plant or equipment or part thereof is wholly within any town or city; or (B) Any corporation, company, individual or association of individuals, which is party to an oral or written agreement for the payment by a public utility, for service, managerial construction, engineering or financing fees, and having an affiliated interest with the public utility."

Breaking down this definition and applying it to Pacific Power, under ORS 221.420(2)(b), Pacific Power would qualify as a "public utility". It is a company that owns equipment in Oregon that is used for the production and transmission of power. It falls perfectly under section A of the definition in ORS 575.005. Given this, ORS 221.420 (2)(b) enables a city to 'Require any public utility, by ordinance or otherwise, to make such modifications, additions and extensions to its physical equipment, facilities or plant or service within such city as shall be reasonable or necessary in the interest of the public and designate the location and nature of all additions and extensions, the time within which they must be completed, and all conditions under which they must be constructed.' This seems to imply that the cities within the corridor could require Pacific Power to recircuit, update or otherwise make modifications to the electric distribution system. It's also possible that an ordinance may not be needed. A 12/19/23 letter from Pacific Power indicated they would be willing to work with the county in support of their resilience goals. However, the cost of any modification would accrue to the cities or county. WR and the County will need to seek formal legal advice to fully vet the ideas in this section.

3.3.1.2 Remote Load Control Considerations for Partial Feeder Scenarios – AMI Metering

As a public utility under Oregon law, doing business in the state implicates an incredible number of other laws as well. In events when there is not enough power to supply to all customers and locations connected to the grid with electricity, it is technically possible for advanced metering infrastructure (AMI) to be used to determine what circuits will receive the power that is available. AMI allows for remote access and control of metered loads on circuits, allowing them to be turned off and on without needing to be physically present. In theory this would allow Pacific Power to control what areas or customers would receive power during a disruption. However, they do not have the authority to arbitrarily decide who will get electricity.

According to ORS 757.325, "No public utility shall make or give undue or unreasonable preference or advantage to any particular person or locality or shall subject any particular person or locality to any undue or unreasonable prejudice or disadvantage in any respect". This law could potentially make Pacific Power apprehensive about agreeing to power certain areas during disruptions. There is also a history of cases involving individuals and utilities that implicate this law and one in particular that points to the challenges associated with utilizing AMI

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[20] 1999 Oregon Laws Chapter 865

[21] https://www.pacificpower.net/savings-energy-choices/business/oregon-direct-access.html

infrastructure to selectively disconnect customers. Most of the cases revolve around disparate rates, but the law is vague to include many kinds of potential discrimination, including access to service.

> 'Prejudice' and 'disadvantage' are not defined in the statute. The provision has been taken to prohibit unreasonable differences in area rates.[22] Other jurisdictions, interpreting substantially similar statutes, conclude that their main purpose is to eliminate discrimination in service or rates in order to ensure quality of treatment among all customers. Implicit in all these interpretations is a term of comparison. A particular person or locality must be treated differently from other, similarly situated persons or localities in order to establish violation of the statute. To constitute a violation, the disparate treatment must also, of course, be undue or unreasonable.[23]

From the Chase Gardens case, the court states that the main purpose of 757.325 is to "eliminate discrimination in service...". It follows logically that choosing certain locations to receive power during disruptions is likely discriminating against those other locations. The key here though, is that discrimination also must be "undue or unreasonable". Pacific Power stated in their letter from December 2023, that they choose to reenergize certain circuits during disruptions based on cooperation from local emergency operations teams and the type of disruption and emergency. This most likely means that they are attempting to power critical facilities, like hospitals and evacuation points, first in the wake of an emergency.

This form of emergency preference for reenergization is unlikely to be considered "undue or unreasonable". Most people are likely wanting their own power back first but realize that it might be more beneficial to have the hospitals have power first, especially during an emergency. However, powering certain locations purely based on contracts and promises could in theory easily open those not receiving power to feel as if they are being discriminated against for one reason or another. At this point, it would be likely that the utility is liable under ORS 757.325 for the disparate access to service. One can foresee this becoming a legal battle for Pacific Power, as the terms are not defined and there is no clear precedent on this issue specifically. They would make their case that it's allowed, and the PUC would likely side with the public. To avoid this long and expensive process, arbitrarily selecting locations to reenergize would be disfavored by the utility. They could make legal arguments to allow for it, but it would likely not be worth it and are likely to just keep preference for emergency locations. The definition of emergency location would have to be carefully prescribed within the community.

This sentence from their letter however, "If the desire is to provide specific service to individual customer loads that do not have a dedicated circuit, it may require a redesign of our system to allow for these dedicated services," indicates that it may be technically feasible. The next sentence though is a bit of a check on that as they state that this change to the system still must respect local, state, and national regulation and law, which is their "primary concern". It appears that they are trying to say that even if it is technologically feasible, to have these resources be used to energize certain loads not just certain circuits is possible in theory but will most likely run into serious legal implications.

3.3.2 Interconnection Rules Review

Oregon provides three primary interconnection channels to develop distributed generation projects. Net Metering is available to "customer-generators" who co-locate generation at an existing facility and service. Projects can qualify for net metering in Oregon Administrative Rules (OAR) Section 860 up to 2MW in size. Other projects smaller than utility-scale, but directly connected to the distribution or transmission system, are categorized as small generation facilities. These projects can range in size up to 10MW. Finally, Oregon has a

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[22] *American Can Co. v. Davis*, 28 Or App [207, 559 P2d 898] (1977)

[23] *Chase Gardens v. Oregon Public Utility Commission, 131 Ore. App. 602*

separate set of rules for its Community Solar Program. These projects are further distinguished as either "small" (25-360kW) or "large" (up to 3MW).[24]

3.3.2.1 Net Metering

Net metering for customer generation currently falls under Pacific Power tariff Schedule 135.[25] Customers are granted the full retail rate for energy consumption, and meter aggregation is possible but limited to those meters on the customer facility. For example, the meter aggregation arrangement is seen at the Doug McDaniel building where solar on a separate service is credited to the dominant load meter on-site. The older 10kW system at the Doug McDaniel building is registered to a now-inactive feed-in tariff pilot program under Schedule 136.

3.3.2.2 Small Generator Interconnection

Small generator interconnection rules are provided under Division 82. These facilities are procedurally separate from the net metering rules in Division 39 but are treated similarly in terms of utility screening and review. There is OPUC activity underway to consolidate and simplify the two rule sections into a single document. Small Power Production facilities are a category of Small Generator projects that qualify as cogeneration and production facilities under PURPA. These facilities need to be compliant with both Division 82 and 29.

3.3.2.3 Community Solar

Pacific Power's Community Solar Program (CSP) currently falls under Pacific Power tariff Schedule 126,[26] which specifies eligibility criteria, interconnection procedures, and purchase agreement. CSP projects can only be interconnected when they have a capacity that, combined with all other interconnected and requested generation in the local area, is less than 100 percent of minimum daytime load (MDL) as determined by Pacific Power. In the absence of MDL, Pacific Power reserves the right to use 30 percent of peak load.

3.4 Economic Review

This section details the cost projections that were used in the technoeconomic modeling process including modeled tariff rates and costs. Also provided are potential funding opportunities for the project. These funding opportunities are matched up with potential projects in the "opportunity matrix."

3.4.1 Modeled Tariff Rates

Heartwood Biomass was modeled at Pacific Power rate 30 (General Service Large Nonresidential 201 KW to 999 KW Delivery Service) while both Joseph High School and the Doug McDaniel Building were modeled using rate 28 (General Service Large Nonresidential 31 KW to 200 KW Delivery Service).

3.4.2 Technoeconomic model inputs and pricing methodology

This section outlines the assumptions used for the technoeconomic modeling process. It describes the cost assumptions used for the model inputs which are primarily based on indicative pricing methodologies. Indicative pricing is the first stage necessary in the modeling process as the model uses accurate pricing recommendations which represent a broad range of system and technology implementation sizes. Each subsection describes the origin of the indicative pricing values, as well as defines the fixed and variable pricing. For example, with a PV system, inverter prices are fixed on a per inverter unit value, but the pricing of the array is based on a dollar-per-Watt value that can be used to derive the capital expenditure requirement for any system size that results from the model optimization.

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[24] See Secretary of State OAR statute: Division 39 – Net Metering Rules, Division 82 – Small Generator Rules, Division 88 – Community Solar Program Rules (https://sos.oregon.gov/Pages/index.aspx)

[25] https://www.pacificpower.net/content/dam/pcorp/documents/en/pacificpower/rates-regulation/oregon/tariffs/rates/135_Net_Metering_Service_Optional_for_Qualifying_Customers.pdf

[26] See https://www.pacificpower.net/content/dam/pcorp/documents/en/pacificpower/rates-regulation/oregon/tariffs/rates/126_Community_Solar_Program.pdf

Please note that initial feasibility studies utilize indicative budget pricing. These values represent rough order of magnitude (ROM) expenses to define the model parameters for system optimization. Pricing refinement is expected to be performed after all systems and paths forward have been identified in subsequent phases of project development. E.g. once a project or portfolio of projects is identified to proceed into the next phase, detailed quotations and proposals should be solicited to refine pricing as well as identify value engineering (VE) opportunities. Capacity studies and interconnection applications should be pursued to further develop and refine the expected implementation costs and utility reinforcement expenses necessary for project development.

Table 9 and Table 10 summarize the primary input values utilized in the technoeconomic model. Discussion of how these inputs were derived or utilized is further discussed in subsequent sections with a detailed discuss of each asset type in Section 3.4.2.5.

Table 9: Model input summary scenarios 1-5

Scenario Number	1	2	3	4	5
Scenario Name	HEARTWOOD BIOMASS	WALLOWA CRITICAL LOADS	WALLOWA FEEDER 5W28	DOUG MCDANIEL	ENTERPRISE CRITICAL LOADS
Model Assumptions					
Outage Duration Modeled	2 weeks	Indefinite Island	Indefinite Island	2 weeks	Indefinite Island
Cash Flow Model	Cash	Cash	Cash	Cash	Cash
Reinvestment Strategy	Lump Sum	Lump Sum	Lump Sum	Lump Sum	Lump Sum
Incentives in Model	30% ITC on all	30% ITC on all	30% ITC on all	30% ITC on all	30% ITC on all
Utility Export Profile	Net Metered with Self-Consumption	Self-Consumption	Unlimited Export	Net Metered with Self-Consumption	Self-Consumption
Utility Tariff in Model	Schedule 30	N/A	N/A	Schedule 28	N/A
PV Size Limitation (kW)	2800	2800	2800	186	N/A
Project Lifetime (Years)	20	20	20	20	20
Annual PV Energy (%)	70%	70%	18%	75%	70%
Infrastructure					
Microgrid Controller	$ 125,000.00	$ 250,000.00	$ 250,000.00	$ 125,000.00	$ 250,000.00
Controller Fixed OPEX ($/year)	$ 10,000.00	$ 20,000.00	$ 20,000.00	$ 10,000.00	$ 20,000.00
Infrastructure (Site Level Building)	$ 350,000.00			$ 350,000.00	
Infrastructure (Site Level for Utility)		$ 250,000.00	$ 250,000.00		$ 250,000.00
Technology					
PV (Rooftop) Unit Cost ($/kWdc)				$ 2,450.00	
PV (Canopy) Unit Cost ($/kWdc)				$ 4,500.00	
PV (Ground Mount) Unit Cost ($/kWdc)	$ 1,830.00	$ 1,830.00	$ 1,830.00		$ 1,750.00
PV Inverter Cost ($/kW)	$ 59.00	$ 59.00	$ 59.00	$ 60.00	$ 59.00
PV Inverter Lifetime (years)	10	10	10	10	10
PV Fixed OPEX ($/kWdc/Month)	$ 1.25	$ 1.25	$ 1.25	$ 1.25	$ 1.25
BESS Unit Cost ($/kWh)	$ 740.00	$ 724.00	$ 724.00	$ 740.00	$ 724.00
BESS Inverter Cost ($/KW)	$ 106.00	$ 106.00	$ 106.00	$ 106.00	$ 106.00
BESS Fixed OPEX ($/kWh/Month)	$ 1.50	$ 1.50	$ 1.50	$ 1.50	$ 1.50
BESS Lifetime (years)	10	10	10	10	10
BESS Charging Eff/Charging Rate	95%/0.5	95%/0.5	95%/0.5	95%/0.5	95%/0.5
BESS Discharging Eff/Discharging Rate	95%/0.5	95%/0.5	95%/0.5	95%/0.5	95%/0.5
Max SOC/Min SOC/Emer SOC	100%/20%/5%	100%/20%/5%	100%/20%/5%	100%/20%/5%	100%/20%/5%
Diesel Gen-set Unit Cost ($/KW)		$ 434.00	$ 434.00		$ 434.00
Diesel Gen-set Unit Cost ($ lump sum)	$ 150,000.00			$ 50,000.00	
Diesel Gen-set Lifetime (years)	15	15	15	15	15
Diesel Gen-set OPEX ($/kW/year)	$ 4.00	$ 4.00	$ 4.00	$ 4.00	$ 4.00
Diesel Fuel Cost ($/gallon)	$ 5.00	$ 5.00	$ 5.00	$ 5.00	$ 5.00
Biomass Generator ($ lump sum)			$ 10,000,000.00		
Biomass Fixed OPEX ($/year)			$ 200,000.00		
Hydro Unit Cost (sum of 2FSC Scenario)					
Hydro Fixed OPEX ($/year)					

Table 10: Model input summary scenarios 6-10

Scenario Number	6	7	8	9	10
Scenario Name	ENTERPRISE FEEDER 5W15	JOSEPH HIGH SCHOOL	ENTERPRISE/ JOSEPH CRITICAL LOADS	ENTERPRISE/JOSEPH FEEDER 4W8	WALLOWA FULL COMMUNITY MICROGRID
Model Assumptions					
Outage Duration Modeled	Indefinite Island	2 weeks	Indefinite Island	Indefinite Island	Indefinite Island
Cash Flow Model	Cash	Cash	Cash	Cash	Cash
Reinvestment Strategy	Lump Sum	Lump Sum	Lump Sum	Lump Sum	Lump Sum
Incentives in Model	30% ITC on all	30% ITC on all	30% ITC on all	30% ITC on all	30% ITC on all
Utility Export Profile	Self-Consumption	Net Metered with Self-Consumption	Self-Consumption	Self-Consumption	Self-Consumption
Utility Tariff in Model	N/A	Schedule 28	N/A	N/A	N/A
PV Size Limitation (kW)	N/A	N/A	N/A	N/A	N/A
Project Lifetime (Years)	20	20	20	20	20
Annual PV Energy (%)	70%	70%	60%	60%	50%
Infrastructure					
Microgrid Controller	$ 250,000.00	$ 125,000.00	$ 250,000.00	$ 250,000.00	$ 750,000.00
Controller Fixed OPEX ($/year)	$ 20,000.00	$ 10,000.00	$ 20,000.00	$ 20,000.00	$ 60,000.00
Infrastructure (Site Level Building)		$ 200,000.00			
Infrastructure (Site Level for Utility)	$ 500,000.00		$ 250,000.00	$ 750,000.00	$ 1,500,000.00
Technology					
PV (Rooftop) Unit Cost ($/kWdc)		$ 2,250.00			
PV (Canopy) Unit Cost ($/kWdc)					
PV (Ground Mount) Unit Cost ($/kWdc)	$ 1,750.00		$ 1,750.00	$ 1,750.00	$ 1,750.00
PV Inverter Cost ($/kW)	$ 59.00	$ 59.00	$ 59.00	$ 59.00	$ 59.00
PV Inverter Lifetime (years)	10	10	10	10	10
PV Fixed OPEX ($/kWdc/Month)	$ 1.25	$ 1.25	$ 1.25	$ 1.25	$ 1.25
BESS Unit Cost ($/kWh)	$ 722.00	$ 740.00	$ 724.00	$ 724.00	$ 724.00
BESS Inverter Cost ($/KW)	$ 106.00	$ 106.00	$ 106.00	$ 106.00	$ 106.00
BESS Fixed OPEX ($/kWh/Month)	$ 1.50	$ 1.50	$ 1.50	$ 1.50	$ 1.50
BESS Lifetime (years)	10	10	10	10	10
BESS Charging Eff/Charging Rate	95%/0.5	95%/0.5	95%/0.5	95%/0.5	95%/0.5
BESS Discharging Eff/Discharging Rate	95%/0.5	95%/0.5	95%/0.5	95%/0.5	95%/0.5
Max SOC/Min SOC/Emer SOC	100%/20%/5%	100%/20%/5%	100%/20%/5%	100%/20%/5%	100%/20%/5%
Diesel Gen-set Unit Cost ($/KW)	$ 434.00		$ 434.00	$ 434.00	$ 434.00
Diesel Gen-set Unit Cost ($ lump sum)		$ 90,000.00			
Diesel Gen-set Lifetime (years)	15	15	15	15	15
Diesel Gen-set OPEX ($/kW/year)	$ 4.00	$ 4.00	$ 4.00	$ 4.00	$ 4.00
Diesel Fuel Cost ($/gallon)	$ 5.00	$ 5.00	$ 5.00	$ 5.00	$ 5.00
Biomass Generator ($ lump sum)					$ 10,000,000.00
Biomass Fixed OPEX ($/year)					$ 200,000.00
Hydro Unit Cost (sum of 2FSC Scenario)				$ 32,089,000.00	$ 32,089,000.00
Hydro Fixed OPEX ($/year)				$ 60,000.00	$ 60,000.00

3.4.2.1 Capital Expenditures (CapEx)

In the energy space, capital expenditures, sometimes referred to as "overnight costs," are the initial investment required to build an energy asset. The technoeconomic modeling performed used an up-front, lump-sum, cash model. This model derives the full cash-equivalent integration price prior to any incentives or grant opportunities, meaning the CapEx shown is a budget to purchase all equipment and pay for full installation of the systems. This provides a means to determine the value of any construction loans or other financial vehicles used in the development of the projects. Rebates, grants, and other incentives are calculated *after* first evaluating the full overnight cost.

This section describes two CapEx components: fixed costs and scalable costs. Additionally, technology investments such as PV, biomass, BESS, and hydropower were modeled as either continuous technologies or discrete technologies.

3.4.2.1.1 Continuous technologies:

Generation or energy storage technologies which are continuously variable in the model. They are scaled during the optimization calculations to satisfy the models' targets most efficiently, such as resilience, the capacity to meet the demands of the load profile with a target renewable fuel mix, decreases in greenhouse gas emissions (GHG), future load growth, or economic drivers.

3.4.2.1.2 Discrete technologies:

Generation or energy storage assets that are entered into the technoeconomic model with a prescribed size. The is often due to the dependence of the asset on physical infrastructure or existing conditions, such as any existing DER, or the physical limitations of a waterway to support a hydro-electric generation installation.

3.4.2.2 Fixed Costs

Fixed capital costs are non-energy investments to implement the microgrid. These costs include required improvements to the site or utility distribution systems, as well as control systems. Estimates were developed for both facility-level microgrid and the feeder-level microgrid models. The estimates were developed for microgrid controllers based on previous controller integrations for similar scale projects. The infrastructure reinforcement or interconnection estimates were based on comparable existing projects as well as research conducted into the impact studies performed and published for the region. An example of the impact studies used in this research are available in Appendix 7.3.5.

Fixed costs for the facility-level microgrids are shown in Table 11.

Table 11: Fixed costs for the three facility-level microgrids

Fixed Cost Description	Heartwood Biomass	Doug McDaniel Bldg.	Joseph High School
Microgrid Controller ($)	125,000	125,000	125,000
Interconnection ($)	350,000	350,000	200,000
Total ($):	475,000	475,000	325,000

Microgrid controller costs were assumed to include new fiber runs and communications infrastructure. The modeled interconnection upgrades break down as follows:

- **Heartwood Biomass**: utility upgrades, purchase of transformers, reconfiguration of primary service, and medium voltage equipment.
- **Doug McDaniel Building**: large utility upgrades including new transformer, demolition of existing switchboard, installation of new gear with isolation device and smart breakers, and a long circuit run from the west to the east side of the building.
- **Joseph High School**: utility interconnection upgrades.

Fixed costs for the feeder-level microgrids are shown in Table 12. The modeling assumed that the total cost of microgrid controllers and interconnection upgrades for all three feeder-level microgrids would be equal to the cost to build out the entire five-circuit community microgrid (due to efficiencies of scale).

Table 12: Fixed costs for the feeder-level and community microgrids

Fixed Cost Description	Feeder 5W28 (Wallowa)	Feeder 5W15 (Downtown Enterprise)	Feeder 4W8 (Joseph and Enterprise)	All five circuits (Community Microgrid)
Microgrid Controller ($)	250,000	250,000	250,000	**750,000**
Interconnection ($)	250,000	500,000	750,000	**1,500,000**
Total ($):	**500,000**	**750,000**	**1,000,000**	**2,250,000**

Microgrid controller costs were assumed to include new fiber runs, communications infrastructure, and utility controls. Interconnection costs were assumed to cover utility upgrades required for the anchor project of each feeder-level microgrid. These costs were based on typically project interconnection cost percentages and research conducted in local impact studies including those found in Appendix 7.3.5. Importantly, these scenarios do not account for broader utility upgrades which will be required. The scope of these upgrades will need to be developed in cooperation with Pacific Power and other emergent facts.

3.4.2.3 Scaling Costs

Scaling costs were input to the simulation model on a $/kW basis for PV, inverters, and biomass, a $/kWh basis for BESS, and a unit cost for hydropower projects. Diesel generators were considered on a unit cost basis for facility-level microgrids and on a $/kW basis for the facility-level and community microgrids. Table 13 shows scalable costs as modeled for the three facility-level microgrids.

Table 13: Scalable costs for the three facility-level microgrids

Scalable Cost Description	Heartwood Biomass	Doug McDaniel Building	Joseph High School
Rooftop PV system costs ($/kW)		2,450	2,250
Canopy PV system costs ($/kW)		4,500	
Ground PV system costs ($/kW)	1,830		
PV inverters ($/kW)	59	60	59
BESS ($/kWh)	740	740	740
BESS inverters ($/kW)	106	106	106
Diesel generators ($)	150,000	50,000	90,000

Scalable costs for the feeder-level and community microgrids are shown in Table 14.

Table 14: Scalable costs for the feeder-level and community microgrids

Scalable Cost Description	Feeder 5W28 (Wallowa)	Feeder 5W15 (Downtown Enterprise)	Feeder 4W8 (Joseph and Enterprise)	All five circuits (Community Microgrid)
PV system costs ($/kW)	1,830	1,750	1,750	1,750
PV inverters ($/kW)	59	59	59	59
BESS ($/kWh)	724	722	724	724
BESS inverters ($/kW)	106	106	106	106
Diesel generators ($/kW)	434	434	434	434
Biomass plant ($/kW)	5,000			
Hydropower ($)			32,089,000	32,089,000

3.4.2.4 Operating Expenditures (OpEx)

Ongoing operating expenditures (OpEx) are considered separately from CapEx in the form of an annual estimate. These costs pay for labor and materials required to operate the microgrid and perform scheduled maintenance. Also included are costs associated with refreshing perishable equipment over the lifetime of the project such as PV inverters and batteries. OpEx costs are marginal compared to CapEx, and assume that a third-party provider performs the O&M. The O&M cost estimate is not discounted with grants or government incentives. Facility-level microgrid OpEx are shown as modeled in Table 15.

Table 15: OpEx for the three facility-level microgrids

OpEx Description	**Heartwood Biomass**	**Doug McDaniel Building**	**Joseph High School**
PV (\$/kW$_{dc}$/mo.)	1.25	1.25	1.25
BESS (\$/kWh/mo.)	1.5	1.5	1.5
Generator (\$/kW/year)	4	4	4
Controller (\$/year)	10,000	10,000	10,000

Feeder-level and community microgrid OpEx are shown as modeled in Table 16.

Table 16: OpEx for the three feeder-level and community microgrids

OpEx Description	**Feeder 5W28 (Wallowa)**	**Feeder 5W15 (Downtown Enterprise)**	**Feeder 4W8 (Joseph and Enterprise)**	**All five circuits (Community Microgrid)**
PV (\$/kW$_{dc}$/mo.)	1.25	1.25	1.25	1.25
BESS (\$/kWh/mo.)	1.5	1.5	1.5	1.5
Biomass (\$/kW/year)	100			
Generator (\$/kW/year)	4	4	4	4
Hydropower (\$/year)			60,000	60,000
Controller (\$/year)	20,000	20,000	20,000	60,000

3.4.2.5 Costs Discussion

This section provides asset-specific discussion about CapEx and OpEx assumptions for the technologies implemented in the technoeconomic modeling.

3.4.2.5.1 Technology Assets Costs

This section describes the generation and energy storage technologies used in technoeconomic modeling. They are broken into two categories, continuous technologies, and discrete technologies as discussed in Sections 3.4.2.1.1 and 3.4.2.1.2.

3.4.2.5.1.1 Photovoltaics (PV)

PV systems were both continuous and discrete technologies in the modeling. Existing PV arrays were input at their discrete sizes, and in some instances were input as discrete assets to maximize renewable energy production within the microgrid system based on the physical aspects of the site, e.g. the ground mount array at Hartwood Biomass. For feeder level systems, a continuous sizing methodology was utilized to meet the load and resilience requirements of the simulation. The model uses optimization algorithms which optimize the expenses of the assets against the project goals such as percentage of energy from renewables, greenhouse gas emissions, outage duration, utility pricing tariffs, net metering rules, import and export limitations, as well as capacity constraints.

The pricing used for the PV systems in this plan were based on quotes received for similar systems in similar locations. Additionally, these indicative prices were confirmed by a local installation professional currently working in the region.

3.4.2.5.1.2 Battery Energy Storage Systems (BESS)

Battery energy storage systems were modeled as variable continuous technologies with their sizing optimized to serve the goals of the microgrid architecture. The energy storage system can serve to provide PV energy at night from an array sized large enough to overproduce during the daytime such that there is excess energy to carry the loads throughout the night. BES systems are also utilized in many modeling scenarios to provide an energy sink in self-consumptions models or provide generator smoothing or utility tariff optimization such as peak shaving or time-of-use arbitrage.

The models utilized lithium chemistry technologies and industry pricing metrics developed through historical quotations and confirmed with a local system integrator. The systems were sized to utilize 100% of the battery's maximum state of charge (SOC) with a minimum SOC of 20% during normal operations and the ability to utilize down to 5% SOC in emergency conditions. The model assumes a full replacement of the BESS cells at year ten, so reserve capacity considerations are not built into the model. Integrators bidding on projects based on this report should assume energy usage profiles up to the full 100% energy rating, in kWh, of the BESS sizes. Considerations for cell degradation should be accounted for in quoted O&M agreements or performance contracts in line with the warranted service life of the system. A conservative charge and discharge rate (C-rate) for lithium chemistry was utilized in the models to mitigate cell degradation over the life of the modeled systems. The C-rate used in the models was 1/2C or C/2.

Operational expenses for the BESS (OpEx) were based on regular monitoring and testing intervals performed by an operations and maintenance contractor program. Cell replacement and the costs of maintaining energy capacity was not included in the pricing as the models implemented a full replacement value at year ten.

3.4.2.5.1.3 Diesel Generator Pricing

The models implemented diesel generators to support the primary PV-BESS microgrid. For the feeder and partial feeder system models the generators were optimized as variable continuous assets to support the resilience goals. These generators were priced at $434.00/kW which is inclusive of all material, labor, design, and installation CapEx. OpEx was set at $4/kW/year to cover typical maintenance and exercise operation. The fuel price used for diesel was $5/gallon.

The single facility projects used more specific unit-based pricing for the smaller generators as shown in model input Table 9 and Table 10.

3.4.2.5.1.4 Biomass Generator (Wood Gasification)

The biomass wood gasification plant modeled on feeder 5W28, located at Heartwood Biomass was modeled with an integration cost of $5,000/kW or $10MM for the 2MW plant as estimated by the proposing integrator, Syncraft. OpEx for the plant included in the model was $200,000 per year. During normal grid-connected operations, it was assumed that the biomass system would be exporting power to Pacific Power. During islanded operations on the feeder-level microgrid, one engine would need to be shut down due to these engines not being designed to ramp up and down in a load-following mode and the full 2MW would exceed the feeder's load. Syncraft has communicated that a full-time plant employee is not required. In that case, this budget can be considered in aggregate for indirect supervision, feedstock loading, and other miscellaneous operational functions.

The model assumed a zero cost for the woodchip feedstock to fuel the biomass plant. Discussions with project stakeholders and Heartwood Biomass concluded that the woodchips necessary to fuel the facility are an as-available, for profit product that can be sold at market value. Dependent on the level of refinement or size of the feedstock, the estimated fuel price sold at market rate would be approximately $60/ton. Heartwood produces approximately 20,000 tons of chips per year, and the 2MW plant would need 10,000 tons per year to operate. At market rate, this would be $600,000 per year in fuel expenses. Combined with the operations and maintenance expenses of the plant, the $500k in OpEx would make the facility economically inviable. Therefore, the system was modeled as utilizing a zero-cost waste product fuel. While wood chips can be sold into a market, the market is volatile and there is not an off-taker agreement in place for the full volume of chips always produced by the facility. There are other possible revenue sources worth exploring further that could significantly increase the value of the plant. They include biochar sales and the value of the thermal from the engine. As is the case here, Heartwood would provide free or discounted chips but receive thermal output at no cost for its operations.

Effective year-round use of thermal output is the key to making the economics work the best. For this reason, it may be worth considering locating the biomass facility closer to the community where a district thermal system could be implemented, or a complimentary business could site operations.

3.4.2.5.1.5 Hydro

The CapEx and OpEx of the Hydropower projects provided by McMillen are shown below in Table 17.[27] CapEx figures include a contingency budget and were modeled for the Wallowa Resilience Corridor as-is. OpEx was reduced to $60,000 for the modeling, with the rationale that a) most of the provided OpEx accounts for supervision of the dams, which will be covered by Wallowa Lake Irrigation District (WLID), and b) electrical supervision will be provided through the microgrid control and operations systems.

Table 17: Hydropower CapEx and OpEx breakdown as provided by McMillen

Scenario	CapEx	OpEx
Alt 2SFC	6,251,000	76,000
Alt 2F Crossflow	6,180,000	36,000
Alt 2C Crossflow	19,659,000	204,000
Totals	**32,090**	**316,000**

Per McMillen, Scenario 2C (Consolidated Ditch) assumed that property rights would be more complex and costly compared scenarios 2SFC (Silver Lake Ditch) and 2F (Farmers Ditch).[28] Scenario 2C also did not score well for constructability, as the penstock required for a powerhouse at Consolidated Ditch would require extensive excavations that are prone to difficult site conditions. This option also has fish/environmental concerns. It is important to note that McMillen provides a 50-year life cycle cost estimate in their report Appendix, whereas this report considers a 20-year project horizon. In that sense, the long-term advantage of the projects is not fully reflected in the modeling.

3.4.3 Project Structures

3.4.3.1 Net Metering

Oregon's net metering program was established under ORS 757.300 in 1999. It mandates all utilities, including investor-owned entities, public utility districts, municipalities, and cooperatives, to enable customers to finance and install renewable generation on their premises for offsetting energy purchases. Residential installations can have a renewable project of up to 25kW, while commercial installations can go up to 2MW. During billing periods where the utility supplies more kilowatt-hours (kWh) to the customer site than received from the on-site renewable project, the customer is invoiced for each kWh-based charge along with standard monthly fees. Conversely, if the customer exports more kWh to the utility than is received, the kWh credit is carried over for a period of up to 12 months. Any surplus remaining at the end of this 12-month period is allocated to customers enrolled in the public utility's low-income assistance programs. This provision effectively limits economic benefits of net metering to purely offsetting annual load.

3.4.3.2 Community Solar

The Oregon Community Solar Program (CSP) was established under ORS 860-088 in 2016 and is administered by the Public Utility Commission. To be approved, Community Solar projects must demonstrate ownership of 50 percent or more of the project's nameplate capacity, have a minimum subscription of five persons, and not

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[27] See "WallowaLake_Hydropower_DraftFeasibilityReport_Rev1"

[28] Ibid.

exceed 3MW in capacity. Projects must be located in the service territory of an Oregon electric utility, and at least 10 percent of the capacity must benefit low-income residential customers. No single participant can own or subscribe to more than 40 percent of the project or exceed the retail electricity customer's average annual consumption. For eligible CSP projects that are certified (or exempt from certification) as a PURPA qualifying facility (QF), Pacific Power will enter into a purchase agreement for energy upon request by a project manager. Once operational, Pacific Power will collect program participation fees from Participants under Schedule 127 on behalf of the Project Manager and pay the Program Administrator monthly for each kWh of unsubscribed energy at a calculated as-available rate.

3.4.3.3 Power Sales

3.4.3.3.1 Small-Scale Renewable (SSR) RFP

Oregon state law requires that, by the year 2030, at least 10 percent of the aggregate electrical capacity of all electric companies that make sales of electricity to 25,000 or more retail electricity consumers in the state must be composed of electricity generated by one or both of the following sources:

- Small-scale renewable energy projects with a generating capacity of 20MW or less that generate electricity utilizing a type of energy described in ORS 469A.025; or
- Facilities that generate electricity using biomass that also generate thermal energy for a secondary purpose.[29]

To meet this requirement, Pacific Power initiated (and then paused) a small-scale request for proposals. The program is eligible only for renewable energy sources under Oregon’s Renewable Portfolio Standard (RPS) statute, and as such, excludes behind-the-meter, energy storage, microgrids, demand response, and other energy related infrastructure. Projects must have a minimum size of 3MW to ensure Energy Imbalance Market eligibility, although smaller resources and CBRE projects may be considered separately. The program would utilize a standard form power purchase agreement (PPA) contract based upon a modified pro forma PPA from PacifiCorp’s 2022 all source RFP. As of August 2023, PacifiCorp announced that it will develop an SSR RFP website that will be added to its Request for Proposals website, and shared that it would separately consider an asset purchase of 3-20MW projects.[30]

3.4.3.3.2 PURPA QF

A project that meets the requirements of a qualifying facility (QF) under the Public Utility Regulatory Policies Act (PURPA) could be entitled to sell its output to Pacific Power at the latter’s avoided cost, as determined by Oregon PUC.

3.4.3.3.3 Bilateral PPA

PacPower expressed that it would be open to purchasing power under a standard, bilaterally negotiated, power purchase agreement.

3.4.3.3.4 Community Green Tariff

Pacific Power has proposed to assist in developing a Community Green Tariff implemented by Enrolled House Bill 2021 and is still in the early stages of implementation. Essentially, the program allows communities to identify resources for achieving local renewable targets. The local community then pays for the project(s) through increased rates. Pacific Power stated that if enough customers opt out of the green tariff, then the community is responsible for any additional costs. This measure is intended to prevent the risk of unfairly shifting costs to communities that do not directly benefit from the project—a point which was emphasized in the

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[29] ORS § 469A.210(2)

[30] https://www.pacificpower.net/content/dam/pcorp/documents/en/pacificorp/energy/cep/CEP_Engagement_Series_August_Meeting.pdf

letter received from Pacific Power relating to utility partnerships. Renewable projects may then be developed by the community, third-party entities, or Pacific Power. The letter referenced is available in Appendix 7.3.5.

3.4.4 Funding opportunities

Through conversations with WRCEP and ETO, a list of potential funding opportunities was identified for projects within the Wallowa Resilience Corridor. The funding opportunities are divided into utility programs, state opportunities, and federal opportunities. This section provides a summary and overview of each. An opportunity matrix was developed that maps potential development projects to these funding opportunities.[31]

3.4.4.1 State Funding Opportunities

3.4.4.1.1 Community Renewable Energy Program (CREP) grants

Max award: up to $100,000 for a planning grant or up to $1 million for construction grants

The Community Renewable Energy Program (CREP)[32] was established under Oregon HB 2021, allocating $50 million to the Oregon Department of Energy (ODOE) for community renewable energy and resiliency initiatives. This program supports projects related to renewable energy generation systems, including solar, wind, energy storage systems, and microgrid technologies. Eligible applicants for funding include Oregon tribes, public bodies such as municipalities or counties, and consumer-owned utilities. The program provides $1 million for project development, covering 50% of eligible costs for renewable projects and 100% for energy resilience projects.

3.4.4.2 Federal Funding Opportunities

3.4.4.2.1 BOR WaterSMART Grants

Max award: up to $5 million

The Bureau of Reclamation's (BOR) WaterSMART Grants[33] provide 50/50 cost sharing grants to entities with water and power delivery authority, such as irrigation and water districts, states, and tribes. The funds are distributed for the construction of hydropower energy projects as well as water conservation and water supply reliability efforts. There are three funding groups which provide funds ranging from $500 thousand to $5 million, depending on the size of the project and the time needed for construction.

3.4.4.2.2 DOE Community Energy Innovation Prize

Max award: up to $1.5 million (split among grand prize winners)

This prize is offered through the DOE and its Office of Energy Efficiency and Renewable Energy. Funding is available for the various stages of project creation and construction. Funds are available for the concept phase, the progress phase, and the impact phase. The concept and progress phases each have awards of $100k, and the impact phase has awards of $10k. There is also a pool of $1.5 million available for all grand prize winners to be awarded at the end of all the phases. This program is available to most projects that support clean renewable energy and bottom-up solutions to sustainable development. States and private entities are eligible to apply for funds under this program.

3.4.4.2.3 DOE Distributed Energy Systems (DES) Demonstrations Program

Max award: up to $25 million

The Distributed Energy Systems Grant[34] provides funds for projects that demonstrate that aggregated and coordinated distributed energy resources (DERs) can provide reliable, predictable grid services for a wide range

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[31] See "DER Opportunity Matrix.xlsx"

[32] https://www.oregon.gov/energy/Incentives/Pages/CREP.aspx

[33] https://www.usbr.gov/watersmart/weeg/

[34] https://www.energy.gov/oced/funding-notice-distributed-energy-systems-demonstrations-program

of system configurations. The program is looking to fund 2-4 projects at $10-$25 million each, with each award required to provide a minimum of 50% non-federal cost share.

3.4.4.2.4 DOE Energy Improvements in Rural or Remote Areas (ERA) Technical Assistance Grants

Max award: up to $100 million

The County will most likely be eligible to apply for funding through the US Department of Energy's Energy Improvements in Rural or Remote Areas (ERA) program. The program was funded under the Bipartisan Infrastructure Law and is being administered by the Office of Clean Energy Demonstrations. The two opportunities highlighted below are indicative of the types of projects this program will fund. The first has closed and the second will close soon; however, similar funding opportunity announcements (FOAs) are expected to be announced on a rolling basis through 2026.

3.4.4.2.4.1 DE-FOA-0002970

This FOA has two topic areas:

- **Community-scale demonstrations** that use one or more clean energy technologies that advance resilience and provide other benefits to one or more rural remote communities.
- **Large-scale demonstrations** that benefit multiple communities, either through a single installation that benefits multiple rural or remote communities, or through a series of installations with similar complementary characteristics across multiple communities.

A summary of the funding opportunity is provided below in Table 18.

Table 18: DE-FOA-0002970 Summary

Topic Area No.	Topic Area Title	Anticipated Number of Awards	Anticipated Cost Share per Award		Total Anticipated Fed Share
			Award Size (Fed Share)	Applicant Share[2]	
1	Community-Scale Demonstrations	4-8	$5M – $10M	$1M - $2M	$40M
2	Large-Scale Demonstrations	3-20	$10M – $100M	$2M - $20M	$260M
Notes:	1. Total anticipated under this FOA. 2. Fifty percent (50%) non-federal cost share			**Total[1]**	**$300M**

3.4.4.2.4.2 DE-FOA-0003045

This FOA has one topic area for proposals that implement community-driven clean energy projects of at least $500,000 and at most $5 million, using one or more clean energy technologies that improve reliability and/or resilience of energy systems, reduce energy poverty, or improve environmental performance of energy generation in a rural or remote community. A summary of the funding opportunity announcement (FOA) is provided below in Table 19.

Table 19: DE-FOA-0003045 Summary

Topic Area No.	Topic Area Title	Anticipated Number of Awards	Anticipated Cost Share per Award		Total Anticipated Fed Share
			Award Size (Fed Share)	Applicant Share[2]	
1	Community-Driven Clean Energy Projects	10-100	$500K-$5M	$0	$50M
Notes:	1. Total anticipated under this FOA. 2. This FOA does not require applicant cost share.			**Total[1]**	**$50M**

3.4.4.2.5 DOE GRIP Grant

Max award: up to $250 million

The Grid Resilience and Innovation Partnerships (GRIP) Program[35] was created under the Bipartisan Infrastructure Law which provided $10.5 billion in funds for the Grid Deployment Office to award for projects that improve grid flexibility or resilience. GRIP grants include three separate categories, two of which are applicable to Wallowa County—the Grid Resilience Utility and Industry Grants ($2.5 billion) and Grid Innovation Grants ($5 billion). The Resilience grants are available to electric grid operators, electricity generators, and electricity storage operators, whereas the Grid Innovation grants are for states, local governments, and PUCs. The funds available for the Resilience grant are a 100% match for the funds spent on the project in the previous three years.

3.4.4.2.6 EPA Climate Pollution Reduction Grants Program (CPRG)

Max award: up to $500 million

The EPA's Climate Pollution Reduction Grants Program[36] (CPRG), authorized by the Inflation Reduction Act, makes funds available for eligible applicants to implement greenhouse gas reduction projects and programs. Eligible applicants include states, municipalities, tribes, and air pollution control agencies. There are two phases of the program: a planning phase and an implementation phase. $250 million is available for planning grants and $4.6 billion is available for implementation of projects. To be eligible for the implementation grants, the applicant must have received planning funds first. For states, the EPA predicts providing individual grants of between $2 million and $500 million.

3.4.4.2.7 FEMA BRIC Grants

Max award: up to $50 million

The Federal Emergency Management Agency's (FEMA) Building Resilient Infrastructure and Communities (BRIC) Grant provides funds for projects that are aimed at community resiliency for states, territories, and tribes. A total of $112 million is available in state/territory allocations with a maximum of $2 million each. An estimated total of $701 million is available for a national competition, with a maximum federal share of $50 million per project.[37] Local governments are considered sub-applicants and must instead submit applications to their state; they must also have a FEMA-approved state or tribal Hazard Mitigation Plan (HMP) in place by the application deadline.

3.4.4.2.8 Investment tax credits

Non-fossil fuel-based generating and storage resources are eligible under the Inflation Reduction Act (IRA) for a range of incentives. The most important of these is the Investment Tax Credit (ITC). The ITC can be claimed against PV systems, energy storage and even the costs of microgrid controllers and interconnection infrastructure. Historically, monetizing investment tax credits has required a project investor who has sufficient tax appetite, often resulting in the need for a project investor. This IRA changed this requirement with its "elective pay" (often called "direct pay") provision. Direct pay allows tax-exempt and governmental entities to receive a payment equal to the full value of tax credits for building qualifying clean energy projects[38].

The ITC for projects greater than 1MW is structured with a base value of 6% of qualifying costs. In addition to this, project-specific adders are available: the use of prevailing wage labor, domestic materials, energy community status, and income status, for a total incentive of up to 70%. This structure is shown in Table 20[39].

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[35] https://www.energy.gov/gdo/grid-resilience-and-innovation-partnerships-grip-program

[36] https://www.grants.gov/search-results-detail/350252

[37] https://www.fema.gov/grants/mitigation/building-resilient-infrastructure-communities/before-apply

[38] https://www.whitehouse.gov/cleanenergy/directpay/

[39] Adapted from https://www.epa.gov/green-power-markets/summary-inflation-reduction-act-provisions-related-renewable-energy.

Projects of less than 1MW qualify for a base tax credit of 30% with no wage and apprenticeship requirement.

Table 20: Inflation Reduction Act ITC Summary (Projects Greater than 1MW)

Technology	**Base Credit**	**Prevailing Wage and Apprenticeship**	**Domestic Content**	**Energy Community**	**Low Income**	**Range of Total Incentives Available**
Solar Technology	6%	24%	10% of material costs	10%	10% or 20%	**6%-70%**
Standalone Energy Storage Systems						**6%-70%**
Microgrid Controller					N/A	**6%-50%**
Interconnection Property						**6%-50%**

The modeling assumed that eligible property in the Wallowa Resilience Corridor would qualify for 30% ITC on all PV and BESS assets. The model utilizes the ITC credit to calculate economic returns and optimizations. However, the value of the ITC is <u>not</u> represented as a reduction to upfront overnight costs or project CapEx as it is an incentive received by the owner and not typically applied directly to project implementation expenses such as construction loans. This value captures the base credit for systems under 1MW and the base credit plus prevailing wage adder for projects greater than 1MW. Given the difficulty of sourcing and tracking the provenance of equipment, the Domestic Content adder was not included. The Wallowa Resilience Corridor is not located in a statutorily defined Energy Community.[40] While Wallowa and Joseph are both located at the edges of a statutorily defined Low Income Census Tract, Enterprise is not.[41] To simplify the modeling, the low-income adder was not modeled.

It is important to note that IRS guidance is not finalized on all points, and that there is a potential for forthcoming updates that could change the current picture. For more information, visit the IRA page on the IRS's website.[42]

3.4.4.2.9 USDA REAP

Max award: up to $500,000 (for energy efficiency improvements) or $1 million (for renewable energy systems), or loan guarantees of up to 80% of a project's eligible costs

The United States Department of Agriculture's Rural Energy for America Program (REAP)[43] provides loan financing and grant funding to agricultural producers, rural small for-profit businesses, co-ops, and tribal businesses in rural areas (populations of 50k or less). The program aims to support the purchase or installation of renewable energy systems (RES) and energy efficiency improvements (EEI) projects. REAP grants cover up to 50% of total eligible project costs. Grant awards range from $1,500 to $500,000 for EEI projects, and $2,500 to $1,000,000 for RES projects. REAP guaranteed loans are provided through lending institutions. These loans can finance up to 75% of a project's total eligible costs with an 80% guarantee.

3.4.4.2.10 USFS Community Wood Grant

Max award: up to $1.5 million

The United States Forest Service (USFS) Community Wood Grant[44] provides funds for the installation of thermally led community wood energy systems or for the expansion or construction of an innovative wood product facility. Generally, each award is up to a maximum of $1 million to pay for up to 35% of total capital

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[40] https://arcgis.netl.doe.gov/portal/apps/experiencebuilder/experience/?id=a2ce47d4721a477a8701bd0e08495e1d
[41] https://experience.arcgis.com/experience/12227d891a4d471497ac13f60fffd822
[42] https://www.irs.gov/inflation-reduction-act-of-2022
[43] https://www.rd.usda.gov/inflation-reduction-act/rural-energy-america-program-reap
[44] https://www.fs.usda.gov/science-technology/energy-forest-products/wood-innovation

costs. In special situations an award of $1.5 million for up to 50% of total capital costs would be considered, however, details on these special awards are not provided.

3.4.4.2.11 USFS Wood Innovation Grant

Max award: up to $500,000, or up to $1 million for wood energy systems greater than 5MW

The USFS Wood Innovation Grant[45] directs funds for the purchase and installation of stationary wood products or wood energy equipment. The maximum award is generally $300,000, but the USFS may consider up to $500,000 in certain circumstances. Funding up to $1 million is available for stationary wood energy systems with an output of more than 5MW. Applicants must contribute matching funds equal to 100% of the requested funds, a 1:1 match.

3.5 Technoeconomic Modeling

This section describes the technoeconomic modeling process and outcomes. This process is a methodology for evaluating the economic performance of a technology against the project baseline inputs, the volume of a technology implemented, and against alternative or competing technologies. It is performed in a manner to encompass cost-benefit, cost-effectiveness, and benefit-cost analyses.

The process balances generation with load to iteratively define system configurations that are optimized for goals such as resilience, sustainability, or revenue.

Assumptions were developed about facility loads, electricity costs, existing assets, fixed and scalable microgrids costs, and others as discussed in the preceding sections. These assumptions were input into a cloud-based modeling platform called XENDEE, which runs millions of simulations to solve for a least-cost solution that is responsive to resilience and economic constraints or can be tailored to solve for other optimizations such as load covered, percent renewables, or emissions reductions goals. The modeling was used to define a range of microgrid configurations corresponding to ten scenarios that meet the objectives set out in Section 1 of this report.

3.5.1 Procedure

Conceptual designs were first developed for each of the anchor facilities: Heartwood Biomass, the Doug McDaniel Building, and Joseph High School. This includes PV, energy storage, microgrid controllers, and interconnection costs. Simulations were then conducted to define configurations capable of sustaining a full two-week utility outage. The two-week outage is significant because it emulates a steady-state, longer-term back-up system. The outage is simulated to occur at the time of highest seasonal loads.

The facility microgrids typically include as much solar generation as can fit within the site's geography[46]. That is true so long as the sizing does not become *inefficient* in serving load (either grid-connected or islanded). The battery sizing scales linearly with PV sizing to support a simulated, 2-week resilience period for the entire load at the site. Where PV is unable to meet load (directly or indirectly through the battery), the system purchases utility power (while grid-connected) or utilizes rotating machine generation (while islanded).

All facility level systems were assumed to operate in self-consumption mode, i.e., they do not export to the grid. Multiple design exercises were conducted to identify the breakpoint at which increasing PV size relative to BESS capacity begins to significantly increase curtailment. These breakpoints were identified visually by analyzing a scatter plot of system design configurations. Exceeding the breakpoint to meet 100% of loads using only renewable energy is technically feasible but leads to extremely poor economic performance because it requires overbuilding PV, BESS, or both. Energy demand during these edge cases is best served by rotating

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[45] https://www.fs.usda.gov/science-technology/energy-forest-products/wood-innovation

[46] The study relied on satellite imagery to identify an architectural capacity limit. A more thorough roof survey would be needed as part of a permitted design.

machine generation. This PV sizing exercise identified the percentage of demand to be met by renewable generation within the models.

Additional simulation was performed for varying degrees of utility export. See the tables provided in the Appendix[47]. Oregon's interconnection policy is undergoing an overhaul which ultimately will provide a formal process to interconnect limited and non-export systems.[48]

For feeder-level microgrid scenarios, the generation assets are sized to meet annual load on a perpetual basis. The optimization began by including signature baseload assets—the biomass plant and the hydro plant. From there, PV and battery sizing were increased in steps until an inflection point is reached. That condition was characterized either by high PV curtailment in the summer months or a resource adequacy shortfall in the dark days of winter. Dispatchable, rotating machine generation was included in the model to address these inefficiencies. The role was analogous for facility-level and feeder-level microgrids.

3.5.2 Modeling Outcomes

A total of 85 simulations were run which resulted in the ten optimized scenarios below. Table 21 through Table 23 represent the perspective of a single feeder circuit. Each table shows three design options: a single-facility microgrid for the identified resilience hub, a partial feeder microgrid that serves only critical loads on the circuit, and a whole feeder microgrid that serves all loads on the feeder circuit.

Results for the Wallowa feeder (5W28) are shown in Table 21. For this feeder, all three topologies were modeled to require that 70% of generation come from renewable resources (PV in this case). As can be seen, the 2MW biomass at Heartwood Biomass is only considered for the whole feeder topology. This scenario assumes that the biomass plant is typically grid-connected and exporting energy to Pacific Power, and that the plant runs at half-capacity (i.e., only one of the 1MW engines is operating) during islanded microgrid operations.

Table 21: Wallowa (5W28) Microgrid Scenarios

	PV		BESS	Genset	Biomass		CapEx	OpEx	CO2
Microgrid Description	**kWdc**	**MWh**	**kWh**	**kW**	**kW**	**MWh**	**$MM**	**$k**	**% red.**
1 Heartwood Biomass	1,200	785	1000	350			3.76	47.4	66.60
2 Partial Feeder	2,380	2,135	2,500	1,000			7.51	104.7	n/a†
3 Whole Feeder	2,600	3,452	2,600	1,000	1,800	16,467	18.02	309.8	n/a†

† feeder circuits were modeled in islanded mode and do not have a baseline emission value for comparison

Results for the Downtown Enterprise feeder (5W15) are shown in Table 22. For this feeder, all three topologies were modeled to require that 75% of generation come from renewable resources (again, PV). As shown, this feeder has no "signature" assets, i.e., biomass or hydro.

Table 22: Enterprise (5W15) Microgrid Scenarios

	PV		BESS	Genset	CapEx	OpEx	CO2
Microgrid Description	**kWdc**	**MWh**	**kWh**	**kW**	**$MM**	**$k**	**% red.**
4 Doug McDaniel Building	285	249	450	100	1.82	22.8	72.80
5 Partial Feeder	906	845	1000	500	3.19	53.6	n/a†
6 Whole Feeder	10,600	10,132	15,300	1,800	33.28	462.4	n/a†

Results for the Joseph/Enterprise feeder (4W8 and 5W21) are shown in Table 23. Joseph High School was modeled to require that 70% of generation be provided by PV. For the feeder-level scenarios, this requirement

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[47] See: "Master System Sizing.xlsx"

[48] See current draft of OPUC UM2111 proceedings: 23-319.pdf (state.or.us)

was lowered to 60%. The whole feeder scenario assumes construction of hydropower at Wallowa Lake—identified by McMillen. The existing 1.1MW Wallowa Falls Hydroelectric Project operated by Pacific Power was also incorporated into the modeling. The whole feeder scenario assumed that the plants are typically grid-connected and run at their full capacity during islanded microgrid operations.

Table 23: Joseph/Enterprise (4W8+5W21) Microgrid Scenarios

	PV		BESS	Genset	Hydro		CapEx	OpEx	CO2
Microgrid Description	**kWdc**	**MWh**	**kWh**	**kW**	**kW**	**MWh**	**$MM**	**$k**	**% red.**
7 Joseph High School	449	314	500	200			1.87	26.5	66.90
8 Partial Feeder	1630	1,310	1,000	500			4.54	64.5	n/a[†]
9 Whole Feeder	17,100	15,905	18,700	4,000	1,800[*]	6,222	81.30	689.1	n/a[†]

**2,900kW, including Wallowa Falls Hydroelectric Project*

Table 24 shows the perspective of a Community Microgrid that services all five distribution circuits across the Wallowa Valley. Scenario 10 shows how much *total* generation and energy storage would be required across the feeders to enable the multi-feeder microgrid to operate independently of Pacific Power's transmission system. This configuration would be capable of supporting area loads indefinitely. Noticeably, constructing all three feeder microgrids independently would result in overbuilding rotating machine generation by 1MW. This is also reflected in OpEx.

Table 24: Community Microgrid Scenario (feeders above + 5W26)

	PV		BESS	Genset	Hydro		Biomass		CapEx	OpEx
Microgrid Description	**kWdc**	**MWh**	**kWh**	**kW**	**kW**	**MWh**	**kW**	**MWh**	**Million 2024$**	
10 Community Microgrid	42,700	35,393	40,900	6,000	1,800[*]	6,222	2,000	16,467	158.49	1.72

**2,900kW, including Wallowa Falls Hydroelectric Project*

Table 25 provides a summary and total of all the partial feeder scenarios combined, scenarios 2, 5, and 8. It should be reinforced here that the CapEx included in the budget <u>excludes</u> any distribution and/or transmission system reinforcement or coordination which would be required to facilitate this implementation as discussed in Sections 3.2.3.4 and 3.3.1.2.

Table 25: Partial feeder scenarios summary

	PV		BESS	Genset	CapEx	OpEx
Microgrid Description	**kWdc**	**MWh**	**kWh**	**kW**	**$MM**	**$k**
2 (5W8) Partial Feeder	2,380	2,135	2,500	1,000	7.51	104.7
5 (5W15)(Partial Feeder	1,070	831	1,000	500	3.19	53.6
8 (4W8+5W21) Partial Feeder	2,070	1,790	1,000	500	4.54	64.5
Total	**5,520**	**4,756**	**4,500**	**2,000**	**15.24**	**222.8**

3.6 Analysis

An analysis was made assessing the performance of each microgrid design against the relevant goals set forth in Wallowa County’s Community Energy Strategic Plan which can be found in Appendix 7.3.6. Results of this analysis are shown in Table 26. The whole community microgrid (Scenario 10) can supply 90% of the entire county’s critical infrastructure with a 2-week energy resilience. Another option to achieve this same goal is to build out all three of the partial or full feeder solutions.

To achieve a renewable energy generation capacity mix of greater than 10% of the county load, any one of the full feeder scenarios is capable of doing this alone. The partial feeder scenarios primarily only introduce smaller DER co-located at critical infrastructure to serve their local loads. All combined the partial feeder DER is only capable of increasing the renewable energy generation capacity by 6.91%.

Table 26: Analysis of Modeling Results

		Microgrid Scenarios										
		Wallowa			Enterprise			Joseph			All	Partials
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**2,5,8**
Local Renewable Energy Development	Increase county renewable generation capacity to 10% of total county power consumption by 2030. (% Increase)	1.14	3.10	28.92	0.36	1.21	14.71	0.46	2.60	32.13	84.33	6.91

4 Key Findings

This section summarizes several key findings that came out of the regulatory, economic, and technical analyses performed for the Wallowa County Resilience Corridor.

4.1.1 Biomass

The biomass plant consists of two 1MW generators that are not capable of load-following and are therefore best considered as "baseload" generators. At 2MW, the plant is an oversized asset relative to the loads at Heartwood Biomass, which has a peak load of 360kW as modeled. Oregon's net metering rules effectively limit the economic opportunity for behind-the-meter generation to offsetting load. As such, the combination of PV and BESS with rotating machine generation is a much better fit for the facility-level microgrid.

The biomass plant is too large to support the partial feeder microgrid scenario, which has a modeled peak load of 729kW. The asset would be more economically viable if allowed to export to Pacific Power's system, but it could not provide resilience for either the facility-level or partial-feeder scenarios. It is only when the full feeder microgrid is considered that the plant is capable of providing baseload capacity, operating at the full rated 2MW when connected to the distribution grid.

4.1.2 Hydropower

This report considered the construction of 1.8MW of new hydropower at Wallowa Lake and the integration of 1.1MW from the Wallowa Falls Hydroelectric Project for a total hydropower generating capacity of 2.9MW. These projects have tremendous value as renewable energy resources, but their scale makes it difficult to unlock their resilience value. This plan found that the hydro was too large for the partial feeder scenario on circuits 4W8 (and its subcircuit 5W21), which has a base load of 73.72kW with a peak load of 339kW. However, the full feeder microgrid, with its base load of 2.6MW and peak load of 7.8MW, could utilize the full capacity of the hydropower projects. It should be noted that the hydropower projects' development timeline may be hard to align with development of the Wallowa County Resilience Corridor.

4.1.3 CESP goal alignment

Wallowa County's Community Energy Strategic Plan set a vision to increase the energy resilience of the region through conservation, efficiency, and greater implementation of renewable forms of energy. Table 26 illustrates that community level resiliency can only be met with full feeder-level microgrids are all three partial feeder solutions. However, each of the scenarios modeled creates a positive impact towards the goals set in the vision. Each anchor project can be utilized to begin incremental progress towards the full community-wide resilience goal and microgrid architecture while providing increased resilience for the community in which it is located as well as a nexus of education and experience towards the vision.

4.1.4 Available subsidies

The analysis identified a range of potential funding opportunities. At the state level, the most significant of these are Community Renewable Energy Program (CREP) grants, which provide up to $100,000 for a planning grant or up to $1 million for construction of qualifying projects. In addition to these, eleven different funding opportunities and subsidies were identified at the federal level. These include the investment tax credit, specific opportunities for hydro and biomass, and other grants focused on sustainability, resilience, and innovation. The federal government is actively looking to fund projects like those identified in this plan. Moving forward, writing for federal grants should be a major focus of the project team whether for a portfolio of anchor projects to build from, or for a full buildout plan for the complete resilience corridor.

4.1.5 Project structures

Energy resilience requires significant investments in energy infrastructure. In many jurisdictions, there are revenue opportunities that encourage the development of DER infrastructure, which can help to offset the cost of resilience-focused investments. The work identified four such opportunities:

- **Net-metering:** Oregon's net-metering provisions allow for up to 25kW for residential systems and 2MW for commercial systems, but do not allow for customers to be compensated for generation in excess of their load. Resulting in the modeling of projects which were sized for self-consumption.
- **Community solar:** Oregon's community solar program allows numerous customers to engage in a collective solar project to offset their energy consumption, similar to net metering.
- **Power sales:** Renewable energy projects under 20MW may be eligible to bid into Pacific Power's upcoming small-scale renewable RFP. Alternatively, a PURPA QF may qualify to make sales to Pacific Power. Finally, the utility is open to bilaterally negotiated PPA contracts.
- **Community green tariff:** This program empowers communities to develop local renewable energy projects and pay for them through increased rates. There is a potential risk that if enough community members opt-out, the community could be stuck with the bill.

The selection of any project structure will be dependent on determination of governance, ownership, management, prior to the selection of an appropriate implementation strategy.

4.1.6 Interconnection challenges

The plan reveals a congested distribution system for Distributed Energy Resources (DER) development, as highlighted in Section 0. The bottleneck created by many of the circuits already nearing the Minimum Daytime Load (MDL) capacity limits the opportunity for building microgrid infrastructure with DER. The challenges of integrating higher penetration renewables will need to be navigated in both a regulatory manner with the utility and infrastructure stakeholders as well as via considerate DER designs crafted to enable additional future renewable penetration as the microgrid infrastructure continues to be built out.

These challenges have been considered in the designed architectures and systems in this plan. The smaller community hubs have all been designed up to a self-consumption limit, however future phases of microgrid implementation should look to increase the renewable resources to serve load expansion via smart switching infrastructure between co-located critical microgrid infrastructure. Early planning of smart metering and controls will ease the integration across new and existing infrastructure as system expansion aims to implement partial and full feeder level scenarios while working towards a complete resilience corridor vision. It will be critical to engage Pacific Power early and often on this topic.

4.1.7 Limitations

This plan has several important limitations:

- **Utility costing:** The Wallowa County Resilience Corridor, as proposed, will absolutely require broader utility upgrades. The scope of these upgrades will need to be developed in cooperation with Pacific Power and a cost estimate should be developed amongst the stakeholders to better define the magnitude of these expenses.
- **Load data:** Full interval data was not available during the duration of this planning for distribution level circuits. Therefore, a methodology was tailored to the conditions and executed using industry-accepted best practices and partial data to estimate feeder loads. Even significant deviations from these modeled loads are unlikely to have an impact on the general recommendations for PV system size or microgrid topology, but changes could affect the recommended BESS or generator sizes. Further development of any of the defined projects will be best served by the collection of interval loads.
- **PV capacity:** The PV system layouts were designed using satellite imagery and field observations. The PV system sizing is an accurate approximation of capacity, but another iteration, ideally with aerial photogrammetry, would need to be conducted to define a true maximum theoretical siting capacity.
- **Structural capacity:** The location of rooftop PV assumes that the Doug McDaniel building and Joseph High School are structurally capable of supporting the equipment.
- **Plan goals:** The goal and scope of this plan was not to achieve investment-grade costs or construction documentation, but to highlight what is possible, the magnitude of the project and

opportunities available, and to inform big-picture thinking and the course of immediate next steps and action items. While the design concepts presented are fundamentally solid, they would require additional detailed engineering refinement before they could be constructed.

5 Recommendations

This section provides recommended next steps for Wallowa Resources to consider in pursuit of achieving the goals and vision set out in the Community Energy Strategic Plan to achieve energy resilience by developing either a portfolio of projects aligned with the vision or developing the resources, assets, and stakeholder support to advance the Wallowa County Resilience Corridor.

5.1 Approach

Building out the Wallowa County Resilience Corridor is a highly complex, multi-year effort. WRCEP and the County will need to strike a balance between advancing smaller projects and the larger vision, with a "meet in the middle" mindset.

- Pursuing further development of the smaller facility-level microgrids at Heartwood Biomass, the Doug McDaniel building, and Joseph High School. These are compelling projects and add to the big-picture strategy.
- Continue to market and develop the bigger concept to build excitement, fluency, and experience among stakeholders and to gain buy-in.
- Be flexible. Energy technologies, topologies, and the utility business are all evolving quickly. The next step may depend on which aspect of the project is funded.

5.2 Grant funding

Grant funding will play a significant role in developing the corridor. The federal government is actively seeking opportunities to fund projects that bring together innovation, sustainability, and resilience at this scale. As an immediate next step, WRCEP should identify, prioritize, and begin the grant writing process. See Section 3.4.4 for relevant funding opportunities.

5.3 Engage Pacific Power

It is critically important to continue to engage the utility as part of advancing the resilience corridor. Pacific Power has offered an informal review process that identifies any obvious upgrade requirements or capacity issues on its system related to the development of a given project. The cost of the review is $300. More work will need to be done to refine the project concepts and identify next steps, but this option should absolutely be leveraged as soon as possible to inform an iterative design process and stakeholder support.

5.4 Stakeholder Considerations

Stakeholder engagement is critical to overall success. WRCEP will need to continue engagement by sharing the results of this planning and eliciting input on scenarios and sequencing of activities. This feedback should be used to continually refine messaging that addresses their concerns while affirming the plan's economic, social, and environmental benefits.

6 Conclusion

This report is the output of a county scale microgrid resilience corridor planning project. The County must balance its resilience and sustainability goals against capital costs, economic outcomes, technical limitations, and regulatory constraints. All while giving due consideration to its organizational mandates and stakeholder input. The results show that, among the options analyzed, the partial distribution feeder circuit community microgrid configuration provides a strong starting point for engaging Pacific Power. As information and costing for utility circuit redesign is gathered, it may become necessary to evolve to a full feeder circuit as a cost savings measure.

There will be a tradeoff between the cost to recircuit a critical facility's feeder or building additional generation and storage resources to support the full load of an existing circuit. Additionally, the three facility microgrid projects are staged for further development in parallel with exploring the feeder level community microgrid scenarios. Success in building any one of the three smaller projects will build momentum for the overall vision.

Given the scale and complexity of the projects, more input is required to refine the options and move into construction. Building a project or a portfolio of feeder-level projects at scale will require experienced teams and significant stakeholder support and participation. This plan defined a flexible technical end goal that is achievable incrementally and iteratively as funding and details are identified and refined. The critical path requires:

4) Engaging Pacific Power to develop the scope and budgetary cost estimates of required distribution system upgrades. First for the partial feeder, and potentially for the full feeder options.
5) Pursuing a strategic approach to simultaneously gather feedback and cost implications for recircuiting for the partial feeder option and to conduct a cost benefit analysis against the full feeder option, considerate of available funding and long-term goals.
6) Securing funding for professional services (legal representation, technical experts, and project financing) to begin project implementation.

7 Appendix

7.1 Drawings

7.2 Maps

7.2.1 Full Map.pdf

7.2.2 Wallowa and Heartwood Biomass.pdf

7.2.3 Enterprise.pdf

7.2.4 Joseph.pdf

7.2.5 Lostine.pdf

7.3 Supporting Documents

7.3.1 Master System Sizing.xlsx

7.3.2 Wallowa County Energy Use 2016-2021.xlsx

7.3.3 DER Opportunity Matrix.xlsx

7.3.4 Load Summary.xlsx

7.3.5 PP Wallowa Energy Plan Follow Up Letter Dec 2023.pdf

7.3.6 WC CESP.pdf

7.4 Impact Studies

7.4.1 OCS5FT Tier 2 Wallowa County 360kW Report.pdf

7.4.2 OCS6SIS 1.04MW SIS Report.pdf

7.4.3 OCS10SIS 1.875MW out of Enterprise.pdf

7.4.4 OCS011 700kW SIS Report (Green Hill).pdf

7.5 Supplemental materials

This section offers additional discussion and examples related to the planning project and report.

7.5.1 Small Biomass Alternative

Only one known US manufacturer of biomass gasification equipment was identified: All Power Labs (APL). The APL product is manufactured on a smaller scale (the 25kW, Power Pallet PP30) and has a proven deployment record across the developing world. The technology is worth further investigation, and potential piloting, but does not fit well into the microgrid scenarios established for this plan. Similar to most biomass applications, establishing a usable sink for process heat is a key to high efficiency and project viability. The McDaniel Building utilizes wood pellet boilers. Joseph High School has plans in development for a new propane system. Designing and integrating the PP30 into a building's space heating system would be a challenge, but the resource has the potential to address a critical weakness of PV and BESS-based microgrids. This unit can provide dispatchable electricity in the darkest days of winter, while providing building heat when it is most needed.[49]

A test simulation was performed for the McDaniel building to establish a potential use case. The simulation confirmed that paralleling two PP30 would remove the need for a diesel generator. The woody biomass feedstock requirements are similar to those of the Syncraft system. The APL representative reported that customers receive roughly 1kWh per 1kg of dry biomass feedstock.

The expectation is that the system would require a high degree of operational oversight and that OpEx would be significant. Between that fact and the winter-time heating needs, it appears reasonable to assume that seasonal operation for buildings is the appropriate use case, combined with stand-by support for the islanded microgrid use case. While the system was not included in the report, it was raised here to highlight a potential future opportunity with small biomass.

7.5.2 Pacific Power distribution system planning map

Below is an example of a Pacific Power distribution system planning map that was used as a data source to establish GIS mapping for this project.

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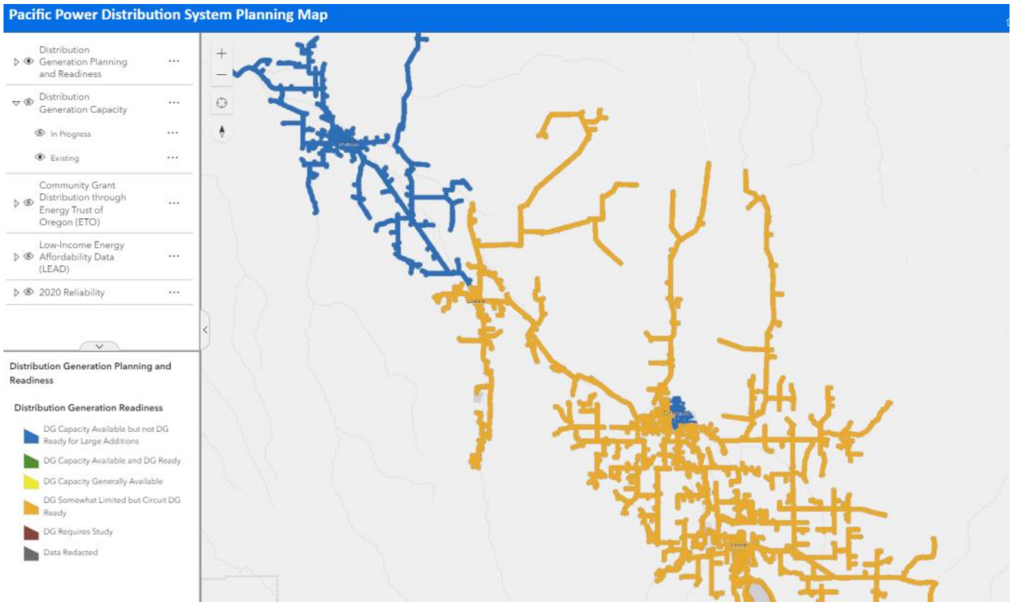
[49] APL's sales rep clarified that due to the design of the gasifier holding tank, the system can dynamically throttle output and follow load (down to roughly 10-20% of rated output). See website product details https://www.allpowerlabs.com/pp30-power-pallet



7.5.3 Another data point on local congestion

As described in its documentation for community solar rate schedule 126, there is a distinction made between an Energy Resource Interconnection Study (ERIS) and a Network Resource Interconnection Service (NRIS). The ERIS study is the traditional distribution level screening and study process, while the NRIS is an informational and "zoomed out" view.

> *"Enterprise is part of the Walla Walla transmission bubble, which currently has insufficient network load (at peak) to absorb any additional generation. Therefore, to deliver the aggregate of generation in the local system to the aggregate of load (the NRIS study scope), construction of a new 230 kV transmission line from the Enterprise area system to the Yakima area system (where the generation could be absorbed) may be required, at a minimum. The new 230 kV line would interconnect Hurricane substation with Wine Country substation in the vicinity of Grandview, Washington. The new 230 kV line would be approximately 160 to 185 miles, depending on the line route. Upgrades at both Hurricane and Wine Country substations would be required to tie in the new line. The transmission provider's high level estimate for this transmission line is $185,000,000."*[50]

7.5.4 Community Solar Eligibility

As part of Oregon's PUC docket UM2000, Pacific Power publishes loading details on substation feeders, and utilization as part of UM1910. These spreadsheets include non-binding data and are understood as a high-level characterization of the system. Snapshot data from Pacific Power on their feeders is reproduced in table format below. Because none of the Wallowa County feeders is supported by Pacific Power SCADA, minimum daytime loading measurements are extrapolated based on manually measured peak measurements at the feeder breaker. This exhibit is provided to show DER constraints in Wallowa County and circuit capacities documented in drawings.

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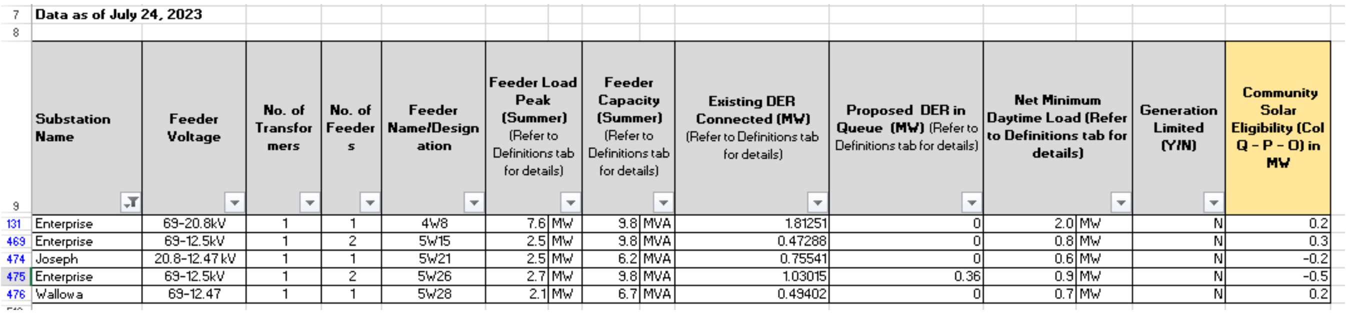
[50] Copied from APPENDIX 2: INFORMATIONAL NETWORK RESOURCE INTERCONNECTION SERVICE ASSESSMENT, OCS011 Impact Study for Fleet Development, LLC CSPQ011 Green Hill Solar 2, downloaded from: http://www.oasis.oati.com/ppw/index.html



Data as of July 24, 2023

	Substation Name	Feeder Voltage	No. of Transformers	No. of Feeders	Feeder Name/Designation	Feeder Load Peak (Summer) (Refer to Definitions tab for details)		Feeder Capacity (Summer) (Refer to Definitions tab for details)		Existing DER Connected (MW) (Refer to Definitions tab for details)	Proposed DER in Queue (MW) (Refer to Definitions tab for details)	Net Minimum Daytime Load (Refer to Definitions tab for details)		Generation Limited (Y/N)	Community Solar Eligibility (Col Q - P - O) in MW
131	Enterprise	69-20.8kV	1	1	4W8	7.6	MW	9.8	MVA	1.81251	0	2.0	MW	N	0.2
469	Enterprise	69-12.5kV	1	2	5W15	2.5	MW	9.8	MVA	0.47288	0	0.8	MW	N	0.3
474	Joseph	20.8-12.47 kV	1	1	5W21	2.5	MW	6.2	MVA	0.75541	0	0.6	MW	N	-0.2
475	Enterprise	69-12.5kV	1	2	5W26	2.7	MW	9.8	MVA	1.03015	0.36	0.9	MW	N	-0.5
476	Wallowa	69-12.47	1	1	5W28	2.1	MW	6.7	MVA	0.49402	0	0.7	MW	N	0.2