

Solar + Storage Feasibility Report



Coquille Indian Housing Authority **Maintenance Building**

831 Miluk Dr., Coos Bay, Oregon 97420



Conserve

Sol Coast Consulting & Design, LLC

Create

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Executive Summary:

This Solar + Storage Feasibility Report for the Maintenance Building at Kilkich Reservation was commissioned on behalf the Coquille Indian Housing Authority, "CIHA" to better understand opportunities for CIHA facilities located on Kilkich Reservation to contribute to the following Coquille Indian Tribe objectives of:

- **Establish Energy Resilience: Reduce disruptions, damage, and recovery time**
- **Strengthen Economic Resilience: Minimize volatility in energy and fuel operating costs**
- **Achieve Energy Sovereignty: Self-sufficiency and control of our energy future**

Access to usage data from the utility was authorized by CIHA and provides the basis for sizing solar production and energy storage in accordance with defined Energy Resilience steps for incremental development:

The utility data provided was used to define and evaluate the following:

- Annual net zero solar production targets,
- Daily, weekly and seasonal peak energy demand thresholds for peak shaving,
- Energy storage requirements for time of use tariff participation,
- Battery storage requirements to support continuous operations during short and long duration utility outages.

Recommendations and proposals for each CIHA facility at Kilkich are designed to leverage readily or potentially available funding for solar plus storage that contributes to local grid reliability , long term planning for net zero energy generation and a campus wide VPP and Microgrid at Kilkich Reservation.

Several project sizes for solar generation and battery storage are identified with planning budgets and operational values calculated. A recommendation for initial development based on transformer limitations, existing use of the facilities at the CIHA Maintenance Building, strengthening of Kilkich grid power quality and reliability and Tribal plans for energy sovereignty, includes 34.98 kWdc of canopy mounted photovoltaics with 39.9 kWh of battery storage.



Figure 1 Proposed system for development at Maintenance Building

Study Narrative

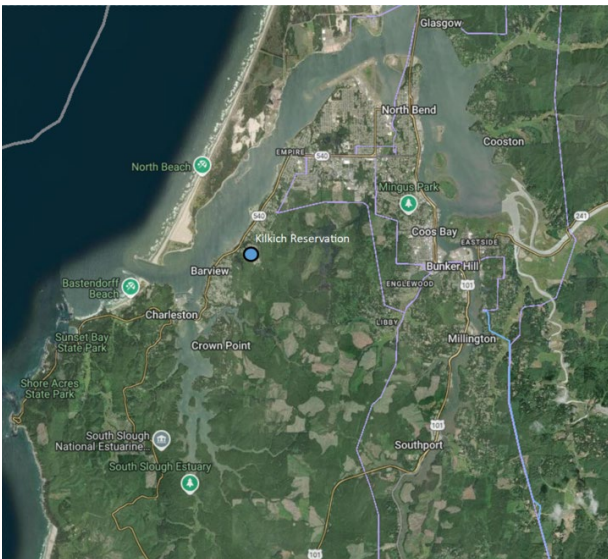
The Coquille Indian Tribe (CIT) flourished in Oregon's southwestern corner for thousands of years, cherishing the bountiful forests, rivers and beaches of a homeland encompassing more than 750,000 acres. But the 19th century's onslaught of European diseases, gold mining and westward expansionism nearly erased the Coquille people. Treaties ceded their homeland to the U.S. government, in exchange for promises that would go unfulfilled. As a result, the ancestral culture nearly went extinct. In 1954, Congress declared the Coquille Tribe "terminated.", but they have endured. Restored to federal recognition in 1989, they are rebuilding their nation.

Today CIT numbers almost 1,200 members and has regained more than 10,000 acres of ancestral homeland. CIT provides education assistance, health care, elder services and (where needed)

housing assistance to their people, while contributing substantially to the surrounding community's economy. Their various enterprises employ about 600 people, and their community fund is the region's leading local source of charitable grants.

Kilkich currently relies on a mix of clean and dirty energy and fuels imported through catastrophe-prone routes and controlled by others. By thoughtfully applying clean energy technology and financial tools to the renewable resources available, CIT plans to sustainably provide for their own energy needs while reducing the burden on the environment and building Tribal wealth. Plan actions that support each of the three goals are organized into phases that cumulatively build upon previous phases of investigation, planning and development. Development of solar and energy storage at Kilkich facilities has been identified as a critical first step and central action for phase one efforts that can ultimately be built upon toward establishment of a Kilkich campus wide micro-grid and virtual power plant.

Currently, electricity is transmitted to Kilkich from PacifiCorp's resource portfolio, across the state and coastal range, to Trust lands where it is then distributed by a feeder serving Kilkich and communities beyond. The distribution system at Kilkich is a closed loop but interconnected to the larger distribution system in a way that does not safely allow for micro-gridding at this time.





Figures 2 - 4 PacifiCorp transmission to Coos Bay and distribution to Killich.

Non-residential facilities located at Killich are operated either by CIT or Coquille Indian Housing Authority (CIHA) with total annual electricity use averaging just over 1 GWh/year based on the most recent three years of usage. A preliminary review of the existing network by PacifiCorp staff suggests that a new master meter could be installed at the entry point on Cape Arago Highway, should suitable conditions be agreed upon between the Tribe and PacifiCorp. Such an agreement and metering upgrade could accommodate a Killich-wide microgrid and virtual power plant configurations. CIT plans to engage Energy Trust of Oregon for microgrid design assistance.

After entering into the Solar + Storage Feasibility Study agreements, Sol Coast conducted site walk-throughs and received additional input from staff to determine solar availability, identification and documentation of electrical service and distribution equipment to determine potential interconnections and size of project, and identification of physical or operational constraints that may affect project feasibility.

A series of workshops were conducted from September of 2024 through April of 2025 with the Climate Resilience Mitigation Task Force and Coquille Indian Tribal Council to present preliminary design concepts and facilitate Task Force and Council feedback on siting, storage and canopy designs. Input received helped to refine design criteria as follows

- Avoidance of undisturbed areas
- Avoidance of visual impacts to culturally significant structures and landscapes
- Consistency of solar and battery storage operating platforms
- Integration of multiple resilience benefits where cost effective including
 - Rainwater harvesting

- Shade and rain cover for parking, gathering and high traffic pedestrian walkways
- Temporary shelter for periods of extended recovery actions

Kilkich water is supplied by the Coos Bay North Bend Water Board which relies on a network of partially functioning backup generators with limited back up fuel supplies. Water security planning and reduction of storm surge flooding in the Kilkich elevations are each priorities for climate adaptation planning. To accommodate the co benefits of water resilience planning, the proposed solar canopy arrays accommodate rainwater capture for redirection from parking lot contamination to rain gardens or storage for treatment and human use. The basis of canopy design also accommodates bi-facial solar panels, which can collect solar energy reflected from below and result in increases of up to 15-20% when compared to mono-facial panels¹. This gain is not included in the production modeling due to the variable nature of ambient reflective surfaces.

The following sections provide facility specific evaluations of:

1. Energy Usage: Utility service, annual & interval energy usage, and peak demand spikes.
2. Solar Resource Assessment: Roof and Ground Mount viability, Total Solar Resource Fraction, Net Zero solar energy requirements
3. Battery Storage: Scenario Analysis for Time of Use (TOU), 8 hour and long duration battery backup of Critical Loads & Whole Building
4. Financial Study: Costs, Incentives, Economic Analysis, and Resource Scenarios for Proposed Designs
5. Next Steps: Recommendations and Considerations for Development

1. Energy Usage:

The CIHA Maintenance Building serves as a shop for fixing equipment & vehicles, parking area for utility vehicles, trailers, and containers, and storage of maintenance materials such as gravel, bark chips, and sand.

240V single phase electricity is delivered to the building through a 25 kVA transformer. Electricity is distributed through the service entrance to two 200A sub-panels. Each sub-panel serves a welder, and multiple other smaller loads, such as lights, outlets, fans, and most importantly a Tsunami Siren.

¹ Purdue University, 2019 [Solar power from 'the dark side' unlocked by a new formula - Purdue University News](#)

Daily energy and demand records received for the Maintenance Building for 2022-2024, and 15 min interval usage for one year (2024) provide insight into daily energy and demand patterns and form the basis for sizing net zero generation and exploration of various battery storage system use cases. The facility uses an average of 13 MWh/year with peak demands of 8 kW.

Fig 1.a below charts energy usage for the Maintenance Building meter per daily basis for the 2024 calendar year, based on the 15 min interval usage data provided by Pacific Power. Daily energy usage peaks during the late fall, winter, and early spring months (Nov-Mar). The middle of the graph illustrates usage during late spring through early fall (Apr-Oct). The regular dips seen in the chart, in particular during spring and summer weekends when the facility is closed and not fully in operation.

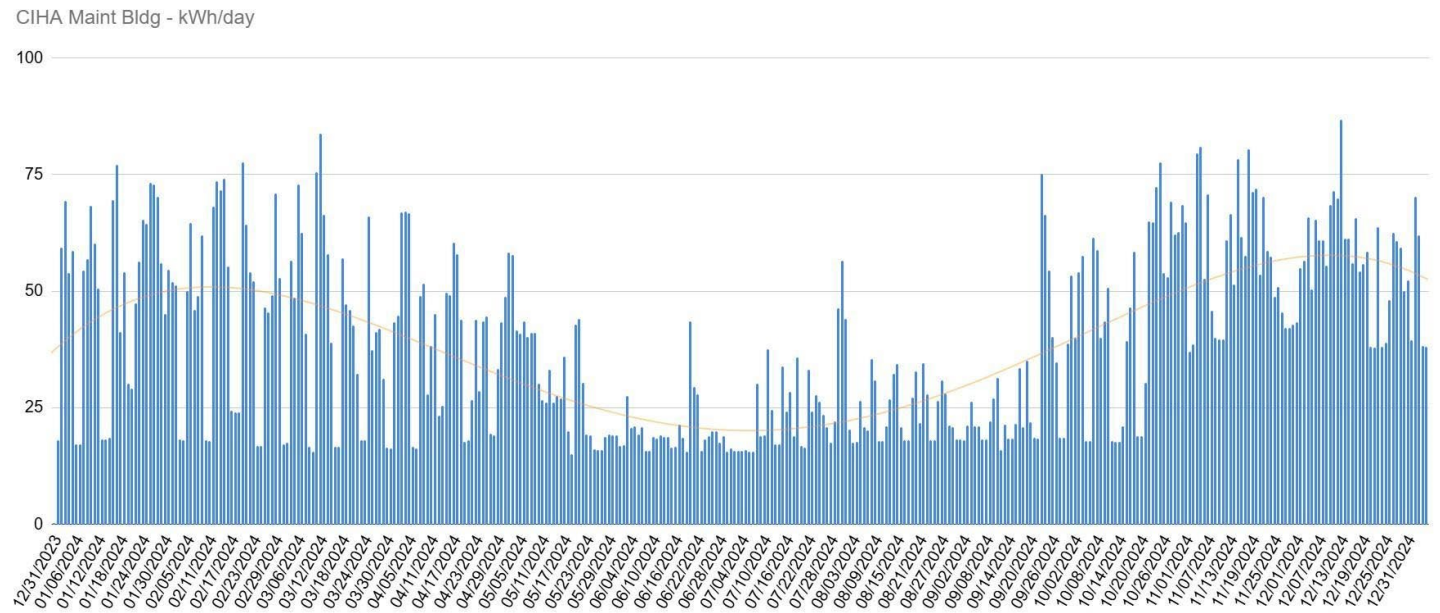


Fig 1.a - Maintenance Building daily use, 2024

During the three years spanning 2022-2024, the facility used an average of 13MWh/yr. 2024 had the greatest usage of 14.1 MWh over that period. During business hours In the winter months energy usage averages between 60-70kWh per day, with spikes near 80kWh. Summer days average nearly 30-35kWh/day with some occasional spikes near 45kWh. There is a minimum daily usage of about 15kWh/day throughout the year. Utilizing the Helioscope solar production design program, it is projected that a solar array totalling 15kWdc could achieve annual Net Zero goals for the facility. A larger 34.98 kWdc array was chosen by the Tribe, as it can be accommodated by the servicing transformer at the Maintenance Bldg, maximizing the power contribution of this array as part of a

campus wide VPP & micro-grid plan at Kilkich. Power fed back to the grid will be derated to protect the smaller 25KVA transformer in coordination with Pacific Power.

Energy demand elevates during the winter months, though time of day did not affect demand. Demand drops after hours of operation through the following morning. Operational hours averaged 4kW, and non-operational hours averaged 2kW. This demand pattern informs sizing of BESS to provide continuous power to support operations during periods of utility service disruption. (ref Fig 1.b) Annual average daily peak demand is 5kW with high peaks of up to 8kW occurring in the heating months of Dec-April and peaks dropping to between 3-4kW from July through October. This demand pattern informs sizing of battery energy storage systems (BESS) designed to supply energy to loads during peak demand periods to shave demand peaks to below utility thresholds.

CIHA Maint Bldg - kW vs read date

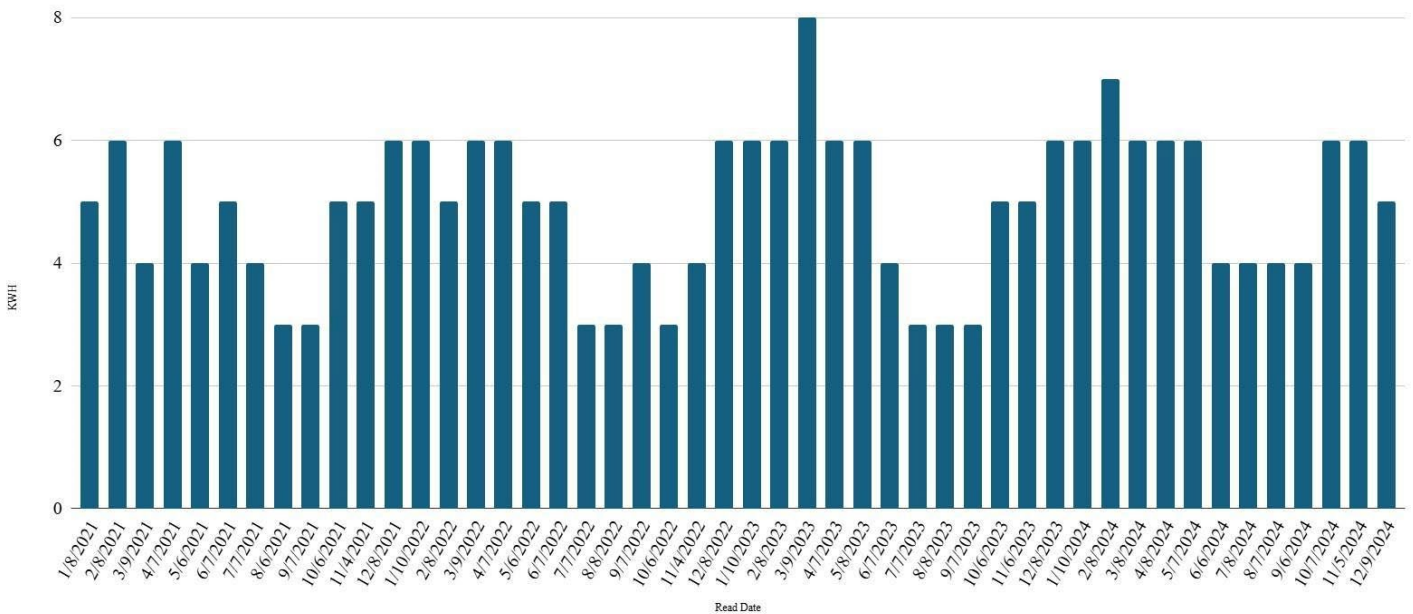


Fig 1.b - Daily peak kW demand by month over 4 years

2.Solar Resource Assessment:

The Maintenance Building is a sheet metal building with little to no insulation. The corrugated metal roof may not be able to support the weight of a PV array. No load analysis was performed, and the structure was not inspected to determine whether and how much weight it could support, as it was requested by tribal members to keep PV arrays off the roofing. Before this was understood, a preliminary draft for a potential roof mounted array was presented to the Task Force and Tribal

Council in Fall of 2024 as illustrated in Fig 2.a. Utilizing Helioscope solar resource software, it is projected that a solar canopy totaling 15kWdc could achieve annual Net Zero goals for the building as it is now used.

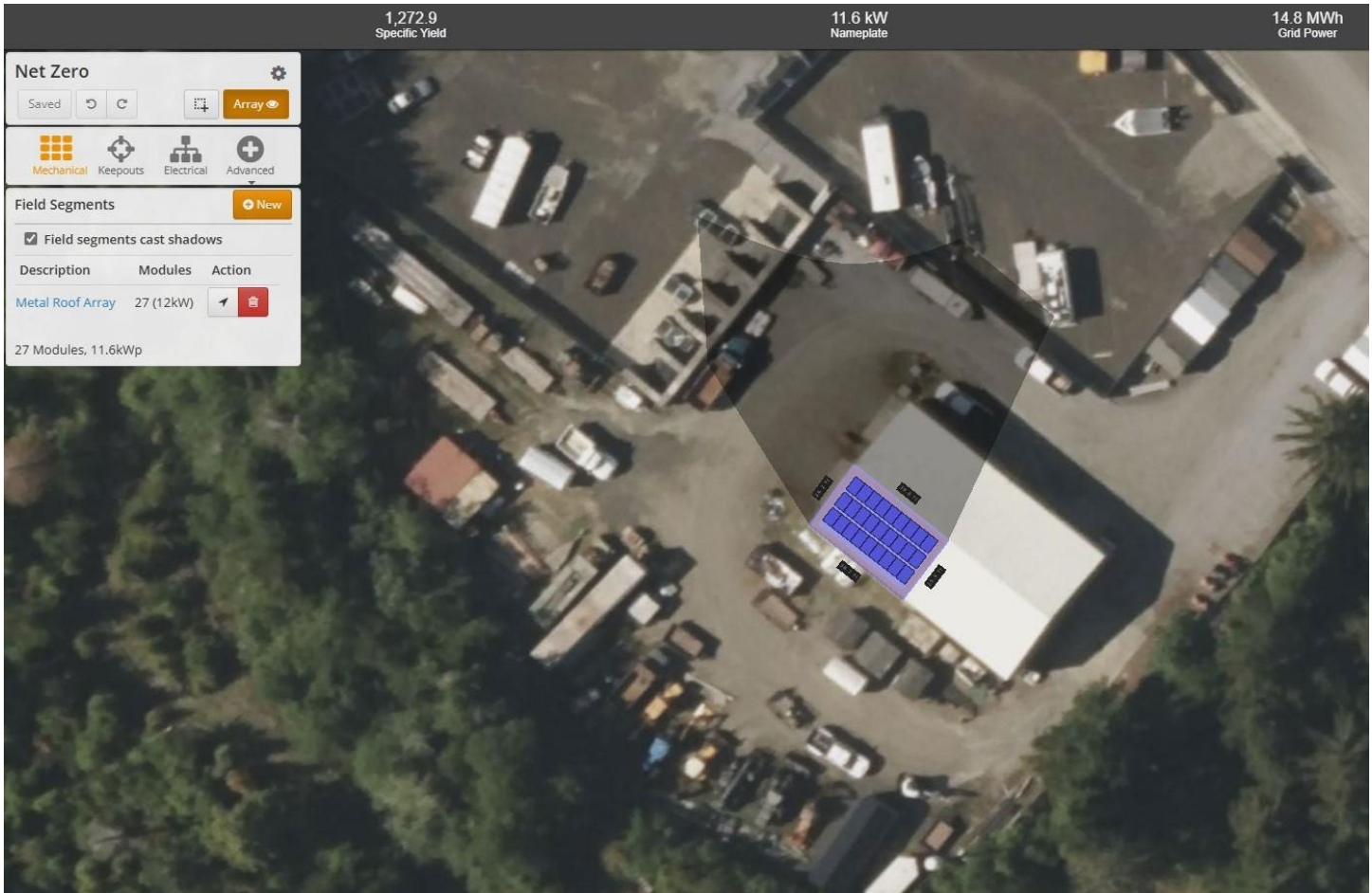


Fig 2.a - Preliminary Solar Siting Concepts

Much of the grounds around the facility are utilized by trucks and vehicles of significant size, and consideration of vehicle flow informed potential location of ground mounted arrays. Multiple styles of ground mounted arrays and canopies were explored, including canopies with front and rear supports, cantilevered canopies, and single axis pole mounted arrays. Based on input from CIHA, evaluation of the impacts of array tilt and orientation on annual generation and identified co-benefits of strategically located and designed solar canopies, the final recommendation for solar arrays was developed. Other factors affecting system size include the size of the utility transformer supplying electrical feed to the facility, and the load carrying capacity of the facility's existing electrical panels. A final solar site plan was determined by keeping the array off the roof and placing it as a cantilevered canopy on the south side of the building. This location keeps the array out of the path of vehicles and offer some cover for storage of vehicles or materials. (Fig 2.b)



Fig 2.b - Canopy Solar Site Plan

Potential solar electricity generation for site locations were assessed using the Helioscope Solar planning tool to evaluate solar electricity production forecasts based on the location, size, tilt and orientation. (Fig 2.c & d) Systems were then sized to accommodate each of the design goals. Additional input from CIHA and CIT staff identified a desire to investigate the potential of a solar array located at CIHA's maintenance building that could contribute to CIT goals for net zero energy generation and battery back up for CIT meters located at the adjacent Warehouse building.

Solar Resource (Avg Annual Usage= 12,920kWh)	Array kWdc	Avg TSFR	Footprint (square feet)	Winter Prod (kWh/day)	Summer Prod (kWh/day)	Annual Prod (kWh/year)	% of Net Zero (%)
Solar Canopy (7deg tilt / 218deg Azimuth)	34.98	89.9	1763	45.4	223.5	43,900	339.78%

Fig. 2.c - Array Production

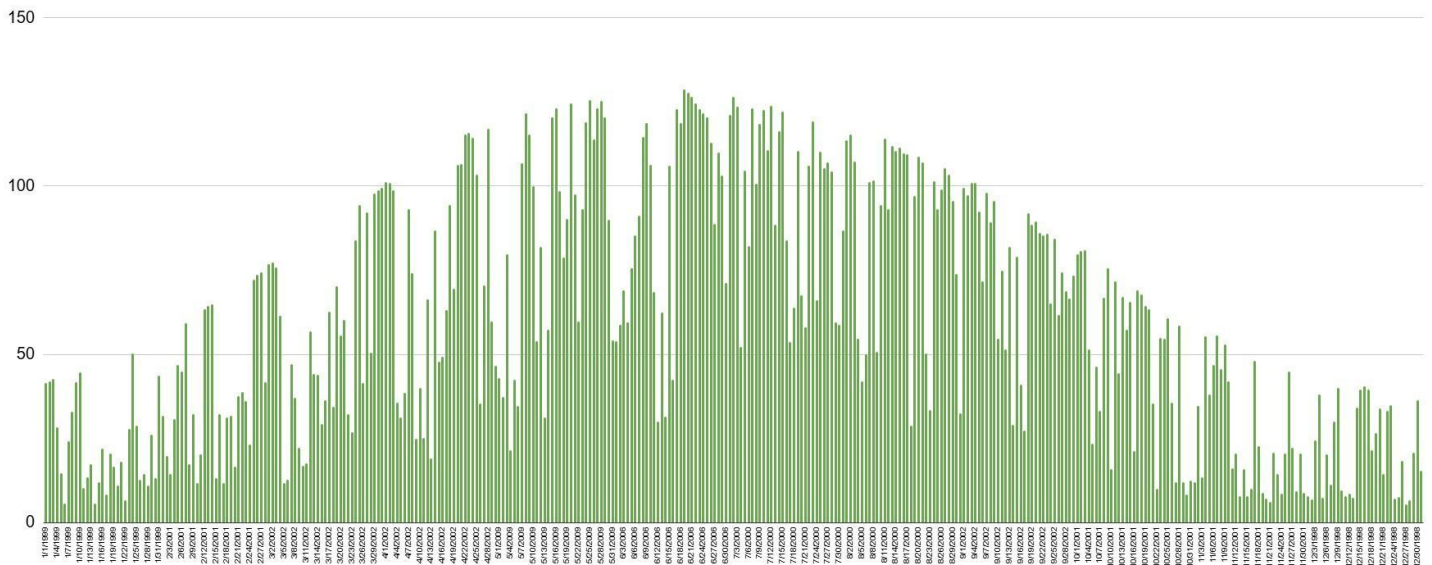


Fig 2.d - Annual kWh/day solar electricity production profile per Helioscope analysis

Selected array designs (Fig 2.e) include a cantilevered canopy, or elevated single axis tilting array. The canopy could be used for vehicle cover, and could additionally provide electrical conduits for future expansion of EV charging infrastructure. Conduit would be trenched from the PV canopy array to the load panel on the opposite North side of the building, or preferably wiring conduit could run along the walls of the building.

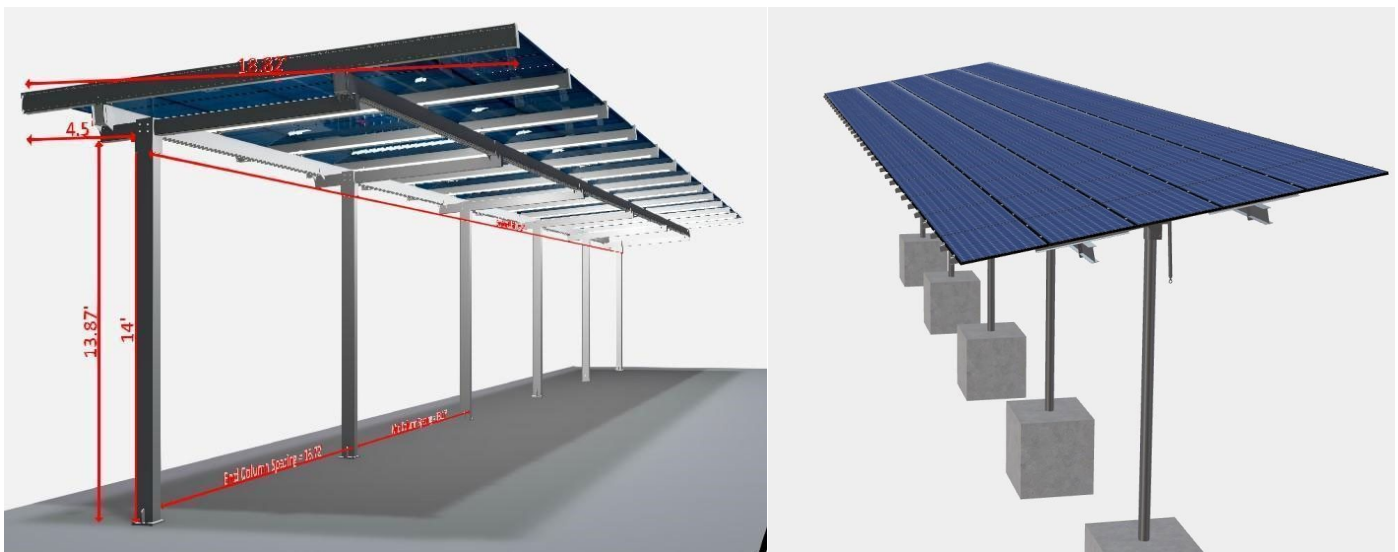


Fig 2.e - Solar Canopy Design based on Infinity Racks (left) and MT Solar (right)

To simplify operations and maintenance, Sol-Ark inverters were used as the basis of design for consistency with Sol-Ark 15K inverters previously installed at the CIHA Warehouse facility. Sol-Ark 15K (240V) inverters accommodate the electrical architecture at the Maintenance Bldg, as well as the BESS use cases identified. The inverters, if located near parking arrays, can accommodate future EV

charging. Inverters placed close to batteries and PV arrays reduce the expense and electricity losses of long runs of connecting wire. Exact location of inverters, safety shut offs, conduits and batteries will be identified by Tribal permitting staff consistent with National Electrical Code requirements.



Fig. 2.f - Equipment Site Plan

3. Battery Storage Usage:

Battery Storage was investigated from multiple usage scenarios including Resilience, Peak Demand Shaving, Time of Use and Demand Response. Resilience and Demand Response have immediate value for CIHA. Peak Demand and Time of Use do not contribute to immediate monetary benefits however both could have future benefits and be considered for potential future utility cost savings and for compatibility within a future Tribal utility or Virtual Power Plant configuration. However, both peak shaving and time of use programming would contribute to local distribution system grid resilience by reducing the frequency and duration of daily and seasonal rolling brown and blackouts anticipated during the winter and high temperature summer seasons for the region.

Resilience backup provides security and resilience against utility outages and service irregularities (service blips, and brownouts). Scenarios include battery backup of Critical Loads for individual load panels, and for whole building backup. There is no onsite generator at the facility to provide backup for facility loads. The lack of generators can be alleviated with a battery energy storage system to provide backup power during grid down scenarios. A small mobile fuel generator could be used to charge batteries at multiple facilities during outages when no solar gain is present. This strategy allows the generator to operate at maximum efficiency for shorter periods and to minimize the expense of multiple, additional permanent generators.

The average daily peak demand at the Maintenance Building is 5kW, with an annual average demand of 2kW. The minimum demand is 0.5kW at all hours of the day whenever the facility is not in use. The averages, max, and min were used when calculating storage hrs for backup loads. Demand patterns inform sizing of battery energy storage systems (BESS) designed to supply energy to loads for peak demand periods during times of grid outage.

Peak Demand Shaving uses BESS to maintain demand peaks below utility thresholds as described in the Energy Usage section. This could apply to the CIHA Maintenance Building as it is commercially metered and would have demand charges; however, the demand is small and, in most instances, would not be large enough to incur significant cost.

In April of 2025, Pacific Power announced their Time of Use program, which offers ratepayers the option to receive a discounted tariff for energy usage during non-peak periods in exchange for an elevated tariff rate for any energy consumed between 5p-9p. This option can be leveraged through using BESS to power loads during Time of Use periods which reduces grid impacts and can result in utility savings. These use cases are of value to the local distribution system which serves Tribal citizen residents and present the potential for future financial benefits to CIHA should they incur electricity costs.

In March of 2025, PacifiCorp was approved to operationalize their “Wattsmart” Battery Program, a demand response program specific for battery energy storage systems in Oregon. The new program offers upfront installation incentives for customers enrolling in the program which grants the utility permission to access customer BESS to balance energy flows during certain conditions for a four

year period. Additional bill credits are applied to the customer annually based on utility usage and battery size. Sol Ark's BESS solutions are currently under consideration for inclusion on the utilities approved BESS list for this program. Other battery systems are also applying for consideration. Participation in the Wattsmart program would leverage utility funding for installation, automate battery storage use optimization to improve power quality and reduce outages to the surrounding neighborhood and contribute workforce experience training toward meeting Tribal microgrid, virtual power plant and energy sovereignty objectives.

Whole Building Back Up battery usage:

Based on a max, peak usage, load of 8kW (Jan 2024), a min battery capacity of 32kWh would be required to back up a continuous 8kW load for 4 hrs. A battery capacity of 8kWh would be required to back up 1hr of the same 8kW max peak load. If Monthly demand peaks are averaged, the monthly peak average is 5kW. Backing up this load for 4 hrs would require a min battery capacity of 20kWh. 8hrs of load requires 40kWh. The annual average daily demand is 2kW. A min battery capacity of 8kWh would be required to back up a load of 2kW for 4 hrs. 16kWh of battery capacity for 8 hrs. To cover the minimum continuous load (0.5kW) at the Maintenance Building for 4hrs requires a battery with a min capacity of 2kWh and adds up to 4kWh for 8 hrs and 6kWh for 12 hrs of coverage.

Some of the best use cases for the whole building back up are Peak Demand Shaving and Time of Use coverage, both can present a financial benefit to CIHA. Another good use for whole building backup, however, occurs during short, but increasingly frequent brief outages, power fluctuations, and brownouts, which contribute to sensitive electrical equipment failures and require manual resets of automated systems.

Critical Load Back Up battery usage:

Using the battery storage to backup only designated critical loads in a specified critical loads panel, extends the amount of hrs a specifically sized battery can provide power to cover those critical loads, as one is minimizing the amount of load the batteries need to support. Dedicated critical loads panels can allow for a smaller specific number of critical loads to be powered by the Solar + Storage system for a longer period of time.

The existing load panels in the facility have easily accessible breakers to disconnect feed to loads and shed demand. By controlling demand and shedding unnecessary loads, CIHA staff could extend BESS supported backup time during prolonged outages. To better understand the actual loading and

real time demand scenarios at each of the distribution panels, Current Transformers (CTs) could be installed on panel feeder lines and left in place to measure and gather interval data on the circuits over time.

Back Up Recommendation:

Sol Coast recommends a full backup of the 2- 200 amp service panels with a minimum of 40kWh to accommodate 8 hours of occupied service with a 35 kWdc PV array.

Demand (kW)	Use Case for Storage	1 hour (kWh)	4 hour (kWh)	8 hour (kWh)	12 hour (kWh)
2	Annual Ave	2	8	16	24
4	Occupied Ave	4	16	32	48
2	UnOccupied Ave	2	8	16	24
5	Daily Peak Ave	5	20	40	60
0.5	Minimum	0.5	2	4	6
8	Yearly Peak	8	32	64	96

Table 3.a - Energy storage requirements for various use cases

Equipment Summary:

Sol-Ark 15K inverters coupled with a compatible LFP battery for the battery backup system were identified and selected as compatible with the facility service, the desired use cases and can be located in designated outdoor spaces. The proposed systems currently include:

- Sol-Ark 15K inverters with a maximum continuous output of 15kW each.
- Briggs & Stratton SimpliPHI BESS(or similar) with a minimum nameplate capacity of 40kWh (See Equipment Data Sheets in Appendix)

This technology is consistent with a previously commissioned solar and storage system installed at Kilkich on the roof of the CIHA Warehouse facility so allows maintenance and operations staff to work with a standard, familiar platform for system monitoring and maintenance. Outdoor battery solutions were deemed preferable and considered, as there is ample outdoor space around the facility. With the Maintenance Building one can also consider putting the BESS inside the building. Indoor battery systems put off a notable amount of heat that can affect sensitive HVAC functions; however, the Maintenance Building does not have HVAC to affect. A decision to place the inverter and battery near the array may also work well, as in that scenario, it can accommodate future EV charging.

An electrical Single Line Drawing was developed to support the utility interconnection request to illustrate the Maintenance Building's current electrical service, the interconnection of inverters and battery storage to the network and behind meter system.

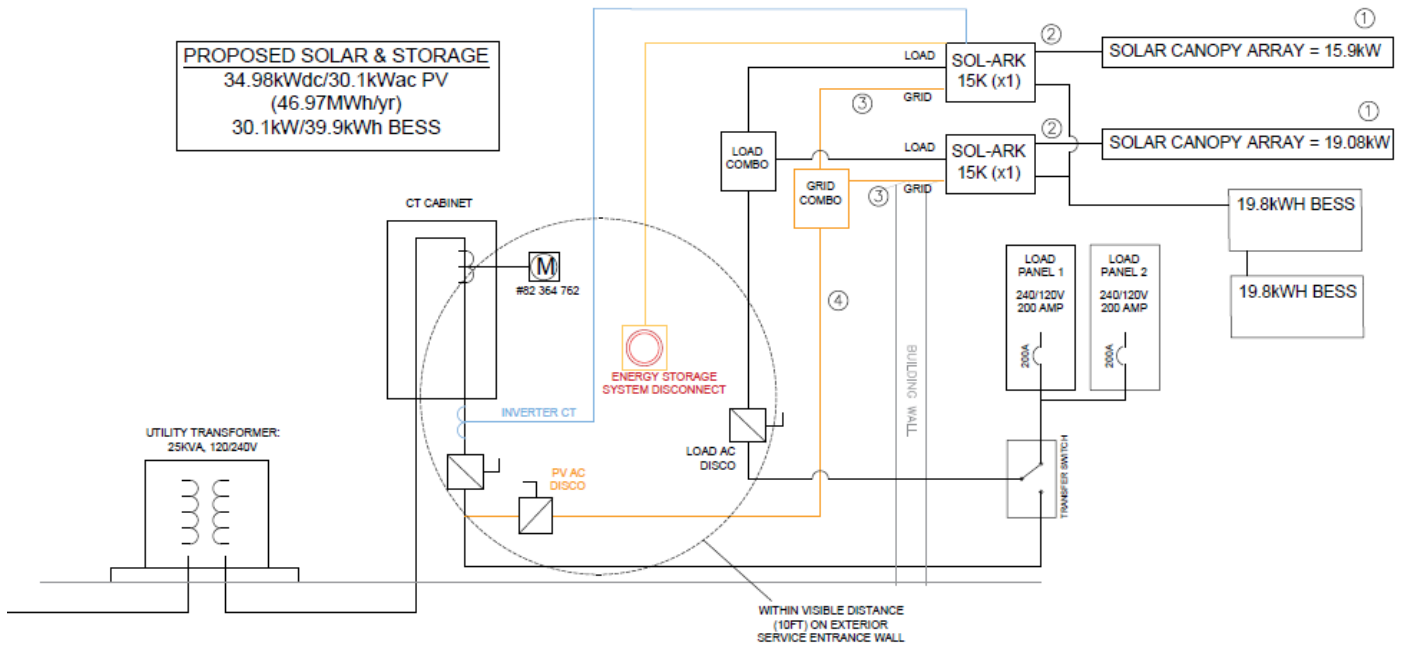


Fig 3.a - Electrical SLD

4. Financial Study:

The pricing for system equipment includes PV modules, canopy structure and related module racking, solar energy inverters, battery storage banks, balance of system components including required disconnects, shutdown devices, distribution block, and load panels. Labor and installation costs were estimated based on system size, design of array and structure, and installation site complexities. Also included in the project cost estimates are fees and labor for permitting, engineering, and project management. Additional costs for trenching to identified canopy locations and any transformer upgrade, as may be required for a 25 kW or larger PV array, are not included. Planning budgets are provided below (table 4a) for full system development and for incremental projects broken down by canopy location and battery bank sizing.

CIHA Maintenance Shop Solar & Storage Options	Size	Units	PV	Inverter AC size	Units	Inverter	Battery	Racking & Canopy	BOS	Permittin	Engineering	Project Manage	Installation	Total
Net Zero Solar	11.6	kWdc	\$ 5,800	15	kWac	\$ 7,500		\$ 27,840	\$ 290	\$ 2,500	\$ 10,000	\$ 4,988	\$ 49,880	\$ 108,813
Net Zero PV Battery Storage	30	kWh					\$ 21,000		\$ 1,050	\$ 2,500	\$ 10,000	\$ 838	\$ 8,375	\$ 43,763
Time of Use Battery Solar	16	kWdc	\$ 8,000	15	kWac	\$ 7,500		\$ 38,400	\$ 400	\$ 2,500	\$ 10,000	\$ 6,880	\$ 68,800	\$ 142,495
Time of Use Battery Storage	20	kWh					\$ 14,000		\$ 700	\$ 2,500	\$ 10,000	\$ 725	\$ 7,250	\$ 35,175
Transformer Max	35	kWdc	\$ 17,500	30	kWac	\$ 15,000		\$ 84,000	\$ 875	\$ 2,500	\$ 10,000	\$ 15,050	\$ 150,500	\$ 295,455
Transformer Max	40	kWh					\$ 28,000		\$ 1,400	\$ 2,500	\$ 10,000	\$ 950	\$ 9,500	\$ 52,350

Table 4a Project development planning budgets

Existing federal, state, public purpose and utility incentives that could affect the financial feasibility of installing solar projects at Kilkich are those with upfront capital development payments (table 4b):

- Energy Trust of Oregon solar and storage incentives are available to support proposed systems but require reservation of the active published incentive rate by an Energy Trust Solar Trade Ally. Incentive rates are published at [Solar: Making Solar Equitable - Energy Trust of Oregon](#) and subject to reduction at any time.
- Environmental Protection Agency (EPA) Grid Resilience Grant – CIT has secured \$500,000 of grant funding for energy storage through EPA’s Grid Resilience Grant fund. The energy storage components presented are eligible for funding through this program.
- WattSmart Program In March of 2025, PacifiCorp was approved to operationalize their Wattsmart Battery Program, a demand response program specific for battery energy storage systems in Oregon. The new program will offer upfront incentives for customers enrolling in the program, which grants the utility permission to use customer-installed battery systems to balance energy flows during certain conditions for a four-year period. Additional bill credits are applied to the customer annually based on utility usage and battery size. The program cap of \$18,000 may be increased based on PacifiCorp project specific authorization.
- Oregon Community Renewable Energy Program (C REP) - Fifth funding round anticipated Q2 2026 for this program that provides competitive funding awards for the planning and development of renewable energy resilience projects serving coastal, rural, remote and Tribal communities.

Other funding streams historically available but currently dependent on proactive policy actions include:

- Federal Emergency Management Agency grants
- Oregon Solar and Storage rebates

Source	Description	Fund	Per	Max	Availability
ETO	Commercial PV	\$0.10	watt	\$10,000	Current
	Battery Storage thru 12/31/2025	\$400	kWh	\$12,000	Current
	Battery Storage starting 1/1/2026	\$300	kWh	\$9,000	1/1/2026
ODOE	Community Renewable Energy Program, resilience project planning			\$100,000	Competitive Award
	Community Renewable Energy Program, resilience development			\$1,000,000	Competitive Award

Pacific Power	Wattsmart Battery Storage, commercial with PV	\$600	kW	\$18,000	Current
	Time of Use Pricing: Non-Peak Hour credit SCH 23	\$0.02532	kWh		Current
	Time of Use Pricing: Non-Peak Hour credit SCH 29	\$0.0169	kWh		Current

Table 4b Summary of funding sources and status as of November 2025

Savings:

Presently, CIHA receives federal entitlement reimbursements for electricity expenses. Accordingly, the financial benefits of energy offsets, Time of Use rate benefits and Peak Shaving will not be captured. However, the potential fiscal impacts of the various solar and BESS configurations under alternate federal reimbursement or tribally owned utility scenarios are estimated based on current energy tariffs and participation in the Time of Use program. The following table (4c) summarizes project costs and the potential for application of currently available incentives and secured grants:

CIHA Maintenance Shop Solar & Storage Options	Total	Grid Resilience	Block Grant	Energy Trust of	Wattsmart*	OTHER	Balance
Net Zero Solar	\$ 108,813		\$ -	\$ 10,000			\$ 98,813
Net Zero PV Battery Storage	\$ 43,763	\$ 31,763		\$ 12,000			\$ -
Time of Use Battery Solar	\$ 142,495		\$ -	\$ 10,000			\$ 132,495
Time of Use Battery Storage	\$ 35,175	\$ 25,695		\$ 9,480			\$ -
Transformer Max	\$ 295,455		\$ -	\$ 10,000			\$ 285,455
Transformer Max	\$ 52,350	\$ 40,350		\$ 12,000			\$ -

Table 4c Summary of system sizes and available funding

A simple return on investment for each system based on system net costs after current Energy Trust of Oregon and PacifiCorp WattSmart incentive rates and application of the Federal ITC with the Tribal lands and U.S. manufacturing bonus was calculated (table 4d):

CIHA Maintenance Shop Solar & Storage Options	Production (MWH/Yr)	Peak Storage (Hr)	Production Value***	Annual O&M****	ROI Cash (Years)
Net Zero Solar	15		\$ 2,013	\$ 232	46
Net Zero PV Battery Storage		6	\$ 382		0
Time of Use Battery Solar	21		\$ 2,705	\$ 320	46
Time of Use Battery Storage		4	\$ 527		0
Transformer Max	46		\$ 5,693	\$ 700	46
Transformer Max		8	\$ 1,152		0

Table 4d Simple ROI on a net cash basis 0% annual increase

To inform the evaluation of the impacts of various funding strategies and the resulting return on investment, the energy less maintenance value of the system was calculated for the first 20 years for the Maintenance Bldg. Canopy Transformer Max system (table 4e):

Year	1	2	3	4	5	6	7	8	9	10
Net Annual Value	\$ 6,145	\$ 6,329	\$ 6,519	\$ 6,715	\$ 6,916	\$ 7,124	\$ 7,337	\$ 7,558	\$ 7,784	\$ 8,018
Year of Operation	1	2	3	4	5	6	7	8	9	10
Cumulative Value	\$ 6,145	\$ 12,474	\$ 18,994	\$ 25,708	\$ 32,625	\$ 39,748	\$ 47,086	\$ 54,643	\$ 62,428	\$ 70,446
Year	11	12	13	14	15	16	17	18	19	20
Net Annual Value	\$ 8,258	\$ 8,506	\$ 8,761	\$ 9,024	\$ 9,295	\$ 9,574	\$ 9,861	\$ 10,157	\$ 10,461	\$ 10,775
Year of Operation	11	12	13	14	15	16	17	18	19	20
Cumulative Value	\$ 78,704	\$ 87,210	\$ 95,971	\$ 104,995	\$ 114,290	\$ 123,864	\$ 133,725	\$ 143,882	\$ 154,343	\$ 165,118

Value is based on 3% annual increase in energy, operations and maintenance costs.

Table 4e 20 year net system value evaluation based on 3% annual increase in energy, operations and maintenance costs.

While not captured in this analysis, the most impactful savings to CIHA and CIT of the proposed system is to the metered facility and the electricity network serving Kilkich Reservation by reducing the frequency and duration of daily or seasonal peak brown or black out events and the resulting loss of life or livelihood endured during those events.

5.Next Steps:

The next steps for pursuing the first phase of development are as follows:

- Consider enrollment in PAC Wattsmart program, pending Sol-Ark acceptance into Wattsmart program.
- Finalize locations for inverters, disconnects and batteries consistent with National Electrical Code requirements.
- Formalize interconnection request for largest potentially funded systems from Pacific Power.
- Reserve Energy Trust of Oregon solar and battery storage installation incentives.
- Prepare grant applications for the balance of funding required.
- Prepare design build scope of work pending funding award.
- Contract for design and construction services.
- Initiate and document expenditures or physical improvements per IRS safe harbor as appropriate.
- Initiate permitting processes for structures and electrical contracting.

Equipment Specifications:

DATASHEET

15K-2P-N

Residential Hybrid Inverter

Inverter Model: **Limitless 15K-LV**
 SKU: **15K-2P**

Input Data (PV)	
Max. Allowed PV Power (STC)	19,500W
Rated MPPT Operating Voltage Range	175 - 425V
MPPT Voltage Range	150 - 500V
Startup Voltage	125V
Max. DC Input Voltage ¹	500V
Max. Operating Input Current per MPPT	26A
Max. Short Circuit Current per MPPT	44A
No. of MPP Trackers	3
No. of PV Strings per MPPT	2
Max. AC Coupled Input	19,200W
Output Data (AC)	
Nominal AC Voltage	120/240V, 120/208V, 220V
Grid Frequency	50 / 60Hz
Real Power, max continuous	15,000W
Max. Output Current	62.5A
Real Power, max continuous (batteries only, no PV)	12,000W (50A @ 240V)
Peak Apparent Power (10s, off-grid)	24,000VA @ 240V
Peak Apparent Power (100ms, off-grid)	30,000VA @ 240V
Max Output Fault Current (5s)	94A with PV, 75A (batteries only)
Max Output Fault Current (100ms)	120A
Max. Grid Passthrough Current	200A
Power Factor Output Range	+/- 0.9 adjustable
Backup Transfer Time	5ms
CEC Efficiency	96.5%
Max Efficiency	97.5%
Design (DC to AC)	Transformerless DC
Stackable	Up to 12 in parallel
Battery Input Data (DC)	
Battery Technologies	Lithium / Lead Acid
Nominal DC Voltage	48V
Operating Voltage Range	43 - 63V
Capacity	50 - 9900Ah
Max. Battery Charge / Discharge Current	275A
Battery Disconnecting Means	200A/pole x 2
Charging Controller	3-Stage with Equalization
Grid to Battery Charging Efficiency	96.0%
External Battery Temperature Sensor (BTS)	Included
Automatic Generator Start (AGS)	2 Wire Start - Integrated
BMS Communication	CANBus & RS485 MODBUS
General Data	
Dimensions (H x W x D)	807 x 494 x 306 mm (31.8 x 19.4 x 12 in)
Weight	61.2 Kg / 135 lb.
Enclosure	IP65 / NEMA 3R
Ambient Temperature	-25~55°C, > 45°C Derating
Noise	< 30 dB @ 25°C (77°F)
Idle Consumption - No Load	90W
Communication and Monitoring	Wi-Fi & LAN Hardware Included
Standard Warranty	10 Years
Protection and Certifications	
Certifications and Listings	UL1741-2010/2018, IEEE1547a 2003/2014, FCC 15 Class B, UL1741SB, CA Rule 21, HECO Rule 14H
PV DC Disconnect Switch - NEC 240.15	Integrated
Ground Fault Detection - NEC 690.5	Integrated
PV Rapid Shutdown Control - NEC 690.12	Integrated
PV Arc Fault Detection - NEC 690.11	Integrated
PV Input Lightning Protection	Integrated
PV String Input Reverse Polarity Protection	Integrated
AC Output Breaker - 200A	Integrated
Surge Protection	DC Type II / AC Type II

1. See Installation Guide for more details on sizing array strings. The highest input voltage is based on the open-circuit voltage of the array at the minimum design temperature.

6.65 kWh



SIMPLI PHI
6.6 BATTERY

WIRE-FREE, STACKABLE DESIGN

BATTERY MODULE SPECIFICATIONS

VOLTAGE	
DC Voltage - Nominal	51.2 VDC
DC Voltage Range	44.8 - 56.8 VDC
Current	
Continuous Discharge Current - Maximum	130 ADC
Continuous Charge Current - Maximum	100 ADC
Maximum Surge Currents and Durations (ADC, sec)	240 ADC, 2 sec / 300 ADC 1 sec
Capacity	
Rated Capacity (Amp-Hours) - Nominal	130
Rated Capacity (Wh) - Nominal	6656
Operational Electrical Specifications	
Self-Discharge Rate (Shutdown/Off)	<.03 %/month
Cycle Life @ 0.75 Charge/Discharge Rate	4500 Cycles at 100% Depth-of-Discharge 6000 Cycles at 80% Depth-of-Discharge
End of Life Capacity	75%
Minimum Round-Trip Efficiency Rating (C/2)	≥94%
Operational Environment	
Charge Temperature	-10°C - 50°C
Discharge Temperature	-20°C - 55°C (Self Curtailment Available With Comm)
Operating Humidity	0% - 95% RH
Storage Environment	
Storage Temperature	-20°C - 55°C for 1 month / -20°C - 45°C for 6 months
Storage Humidity	0% - 95% RH

6.65 kWh

SIMPLI PHI
6.6 Battery



Battery Module Physical Dimensions and Ratings	
Enclosure Material	Powder-Coated Steel
Width - Inches (mm)	28.6" (726.4)
Depth - Inches (mm)	6.7" (170.2)
Height without Tabs - Inches (mm)	17.3" (438.4)
Height with Tabs - Inches (mm)	18.9" (480.1)
Weight (kg)	125 lbs (56.7)
IP Rating	IP 20 (IP 65 when Stacked)
Altitude	≤3000M
Corrosion Resistance Rating	240H
Salt-Fog Rating	240H

BATTERY CONTROLLER SPECIFICATIONS

Stack Information per Stack (Up to 3 Batteries)	1 Required
Maximum Controllers per System	6 - Up to 3 Batteries
Operational Environment	
Operating Temperature	-20°C - 55°C
Operating Humidity	0% - 95% RH
Storage Environment	
Storage Temperature	-20°C - 55°C
Storage Humidity	0% - 95% RH
Inverter Compatibility	
Full Integration	Sol-Ark 8K-2P, 12K-2P, 15K-2P
Non-Communicating	Any 48V Lithium-Supporting Inverter
Communications	
Inverter	CAN Bus, RS-485
EnergyTrak Gateway	CAN Bus
Physical Dimensions and Ratings	
Width (mm)	28.6" (726.4)
Depth (mm)	6.7" (170.2)
Height (mm)	6" (152.4)
Weight (kg)	14 lbs (7.0)
IP Rating	IP 65
Altitude	≤3000M
Corrosion Resistance Rating	240H
Salt-Fog Rating	240H
Enclosure Material	Powder-Coated Steel

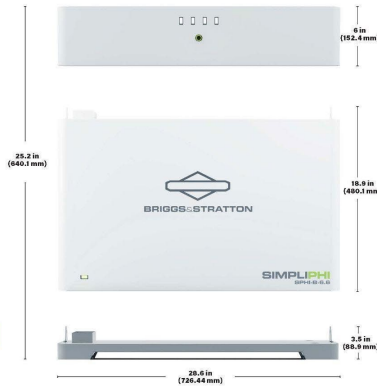
6.65 kWh

SIMPLI PHI
6.6 Battery



Ground Base Specifications	
Per Stack (Up to 3 Batteries)	1
Width (mm)	286" (726.4)
Depth (mm)	6.7" (170.9)
Height with Tabs (mm)	3.5" (88.9)
Height without Tabs (mm)	1.9" (48.3)
Weight (kg)	5 lbs (2.3)

Wall Base Specifications	
Per Stack (Up to 3 Batteries)	1
Width (mm)	289" (7341)
Depth (mm)	5.5" (139.7)
Height with Tabs (mm)	3.5" (88.9)
Height without Tabs (mm)	1.5" (38.1)
Weight (kg)	12.4 lbs (5.6)



STACKED SPECIFICATIONS

Stack Information	
Maximum Modules per Stack	3
Maximum Batteries per System	18 (6 Stacks of 3 - 119 kWh)
Full Stack Dimensions	H: 60.4" x W: 28.6" x D: 6.7"
Certifications	UL 9540 Edition 3, UL 9540A, UL1973, UL 1998 + 991, UN 38.3, UN 3480, IEC62819

Battery Module Specifications						
# of Battery Modules	Capacity (kWh)	Charge Power (kW)	Discharge Power (kW)	Surge (kW, 10s)	C-Rate	Discharge Current (A)
1 (SPHI-6.6-L0)	6.65	3.33	6.66	8.3	1.00	130
2 (SPHI-13.2-L0)	13.3	6.66	10.65	13.3	0.80	208
3 (SPHI-19.8-L0)	19.95	9.98	13.96	17.5	0.70	273



BRIGGS & STRATTON
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SILFAB COMMERCIAL NTC

SIL-530 XM
BIFACIAL



NEXT-GENERATION N-TYPE CELL TECHNOLOGY

- Improved Shade Tolerance
- Improved Low-Light Performance
- Increased Performance in High Temperatures
- Efficient Bifacial Energy Yield
- Enhanced Durability
- Reduced Degradation Rate
- 25-Year Product Warranty/ 30-Year Performance Warranty



SILFABSOLAR.COM



ELECTRICAL SPECIFICATIONS		STC	80°C	NOCT
Test Conditions		STC	80°C	NOCT
Module Power (Pmax)	Wp	530	518.2	393.3
Maximum power voltage (Vpmax)	V	43.05	41.05	37.76
Maximum power current (Ipmax)	A	12.91	14.08	10.36
Open-circuit voltage (Voc)	V	47.74	47.29	43.91
Short-circuit current (Isc)	A	13.71	14.50	11.00
Module efficiency	%	22.3%		
Maximum system voltage (VDC)	V		1000	
Series fuse rating	A		30	
Power Tolerance	Wp		0 to +10	
Bifaciality Factor	%		80±5	

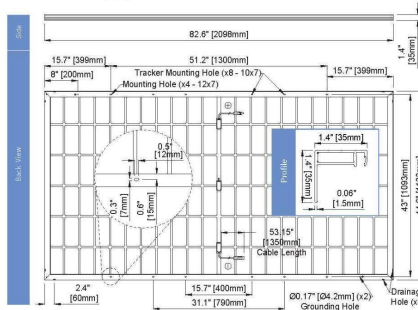
Performance conditions: Measurement tolerance ±3% - Standard Test Conditions (STC): 1000 W/m², AM 1.5, Temperature 25 °C - Nominal Operating Cell Temperature (NOCT): 800 W/m², AM 1.5 - Bifacial Standard Test Conditions (BSTC): 1000 W/m², q = 133.40/m², q = 80%, AM 1.5 - Electrical characteristics may vary by ±5%.

MECHANICAL PROPERTIES / COMPONENTS	METRIC	IMPERIAL
Module weight	26.2 kg (58.2 lb)	57.9 lbs (26.4 kg)
Dimensions (H x L x D)	2098 mm x 1333 mm x 35 mm	82.6 in x 52.4 in x 1.4 in
Maximum surface load (wind/snow)*	2400 Pa rear load / 5400 Pa front load	50.1 lb/ft ² rear load / 119.2 lb/ft ² front load
Hail impact resistance	Ø 25 mm at 83 km/h	Ø 1 in at 51.6 mph
Cells	132 Half cells - H-Type Silicon solar cell 91.3 x 93.8 mm	132 Half cells - H-Type Silicon solar cell 3.63 x 3.70 in
Glass	3.2 mm high transmittance, tempered, DDM anti-reflective coating	0.126 in high transmittance, tempered, DDM anti-reflective coating
Cables and connectors (refer to installation manual)	1350 mm, Ø 7.7 mm, EVG2 from Staubli	53.1 in, Ø 0.31 in (0.24WG), EVG2 from Staubli
Backsheet	High durability, superior hydrolysis and UV resistance, multi-layer dielectric film, Fluorine Free clear PV Backsheet	
Frame	Anodized Aluminum (Silver)	
Junction Box	UL 3750 Certified, IEC 62760 Certified, IP69 rated, 3 diodes	

TEMPERATURE RATINGS	WARRANTIES	
Temperature Coefficient Isc	0.04 %/°C	Module product workmanship warranty
Temperature Coefficient Voc	-0.24 %/°C	Linear power performance guarantee
Temperature Coefficient Pmax	-0.23 %/°C	35 years**
NOCT (± 2°C)	45 °C	≥ 89% end 1st yr
Operating temperature	-40/+45 °C	≥ 84% end 10th yr
		≥ 80.8% and 15th yr
		≥ 80.3% end 30th yr

CERTIFICATIONS	SHIPPING SPECS	
Product	UL 61215***, UL 61730***, CSA C22.2 No. 1310***, IEC 61215***, IEC 61730***, IEC 61701 (Salt Mist Corrosion), IEC 62716 (Ammonia Corrosion), CEC Listing***, UL Fire Rating: Type I	Modules Per Pallet: 28 or 29 (California)
Factory	ISO9001:2015	Pallets Per Truck: 24 or 23 (California)
		Modules Per Truck: 696 or 667 (California)

* ▲ Warning: Read the safety and installation manual for mounting specifications and before handling, installing and opening modules.
 ** 12 year extendable to 25 years subject to registration and conditions outlined under "warranty" at silfab.com/downloads.
 *** File files generated from 3rd party performance data are available for download at: silfab.com/downloads.
 Certification and CEC listing in progress.



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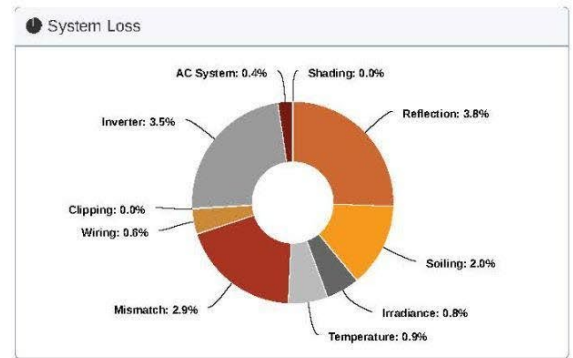
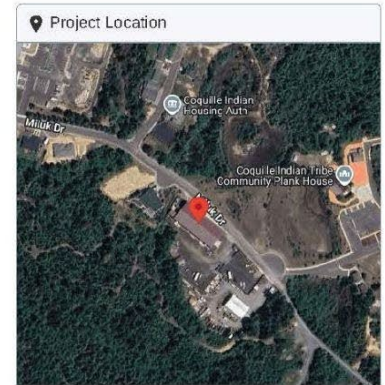
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Design 1 CIHA - Maintenance Building 801 Miluk Dr, Coos Bay, OR 97420, USA

Project Details	
Address	801 Miluk Dr, Coos Bay, OR 97420, USA
Owner	Rick Zitzmann
Last Modified	Rick Zitzmann 2 minutes ago
Location	(43.35746559999999, -124.2935022) (GMT -8)



System Metrics	
Design	Design 1
Module DC Nameplate	34.98 kW
Inverter AC Nameplate	30.00 kW Load Ratio: 1.17
Annual Production	43.9 MWh
Performance Ratio	86.0%
kWh/kWp	1,255.0
Weather Dataset	TMY, 10km Grid (43.35,-124.25), NREL (prospector)
Simulator Version	79734d1cbb-7fd9de9ac5-30e202bdba-652e340d02



Annual Production			
	Description	Output	% Delta
Irradiance (kWh/m ²)	Annual Global Horizontal Irradiance	1,393.8	-
	POA Irradiance	1,459.5	-4.7%
	Shaded Irradiance	1,459.5	-0.0%
	Irradiance After Reflection	1,404.0	-3.8%
	Irradiance After Soiling	1,375.9	-2.0%
	Total Collector Irradiance	1,375.9	-0.0%
Energy (kWh)	Nameplate	45,123.8	-
	Output at Irradiance Levels	47,740.0	-0.8%
	Output at Cell Temperature Derate	47,291.7	-0.9%
	Output after Electrical Mismatch	45,937.9	-2.9%
	Optimal DC Output	45,662.4	-0.6%
	Constrained DC Output	45,654.9	-0.0%
	Inverter Output	44,056.7	-3.5%
	Energy to Grid	43,900.4	-0.4%
Temperature Metrics			
	Avg. Operating Ambient Temp	12.8°C	
	Avg. Operating Cell Temp	20.0°C	
Simulation Metrics			
	Operating Hours	4,645	
	Solved Hours	4,645	
	Pending Hours	-	
	Error Hours	-	

Condition Set												
Description		Condition Set 1										
Weather Dataset		TMY, 10km Grid (43.35,-124.25), NREL(prospector) (download)										
Solar Angle Location		Meteo Lat/Lng										
Transposition Model		Perez Model										
Temperature Model		Sandia Model										
Temperature Model Parameters	Rack Type	a	b	Temperature Delta								
	Fixed Tilt	-3.56	-0.08	3.0°C								
	Flush Mount	-2.81	-0.05	0.0°C								
	East-West	-3.56	-0.08	3.0°C								
	Carport	-3.56	-0.08	3.0°C								
Soiling (%)	J	F	M	A	M	J	J	A	S	O	N	D
	2	2	2	2	2	2	2	2	2	2	2	2
Irradiation Variance		5.0%										
Cell Temperature Spread		4.0°C										
Module Binning Range		-2.5% to 2.5%										
AC System Derate		0.50%										
Component Characterizations	Type	Component							Characterization			
	Module	SiL-530 XM (Silfab)							Spec Sheet Characterization, PAN			
	Inverter	Sol-Ark-15K-2P (Sol-Ark)							Spec Sheet			

Design BOM		
Component	Type	Quantity
10 AWG (Copper)	AC Home Runs	2
500 MCM (Copper)	AC Home Runs	1
2 Input AC Panels	AC Panels	1
Sol-Ark-15K-2P	Inverters	2
SIL-530 XM	Modules	66
10 AWG (Copper)	Strings	10

Monthly Shading					
Month	GHI (kWh/m ²)	POA (kWh/m ²)	Shaded (kWh/m ²)	Nameplate (kWh)	Grid (kWh)
January	41.5	46.4	46.4	1,486.7	1,381.9
February	63.1	68.8	68.8	2,235.0	2,079.5
March	102.4	108.8	108.8	3,568.7	3,319.1
April	137.0	141.8	141.8	4,687.2	4,320.3
May	176.7	179.6	179.6	5,963.2	5,429.9
June	183.3	186.3	186.3	6,186.7	5,608.9
July	197.0	201.6	201.6	6,704.7	6,045.8
August	176.3	182.6	182.6	6,058.6	5,465.1
September	144.7	153.5	153.5	5,072.6	4,583.5
October	90.3	98.7	98.7	3,225.0	2,951.3
November	44.1	48.8	48.8	1,573.4	1,446.7
December	37.5	42.7	42.7	1,362.0	1,268.4

Design Wiring Zone			
Description	Combiner Poles	String Size	Stringing Strategy
Wiring Zone	-	4 - 10	Along Racking

Design Render



Field Segments

Description	Racking	Orientation	Tilt	Azimuth	Intrarow Spacing	Frame Size	Frames	Modules	Power
Solar Canopy	Carport	Landscape (Horizontal)	7°	218°	0.0 ft	1x1	66	66	34.98 kW



Design 1 CIHA - Maintenance Building, 801 Miluk Dr, Coos Bay, OR 97420, USA

Shading Heatmap



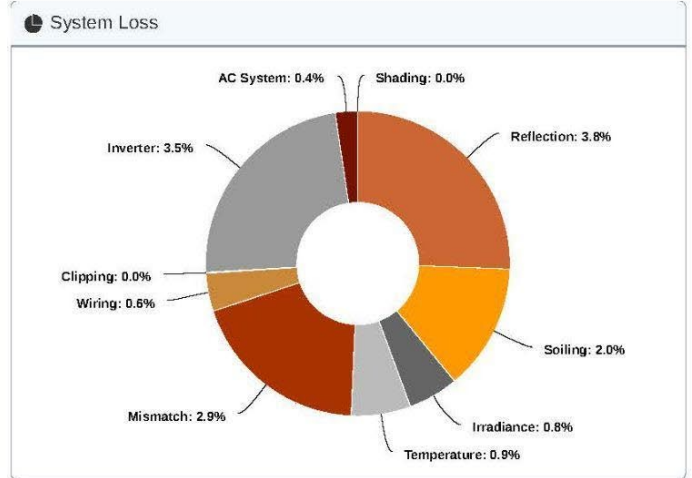
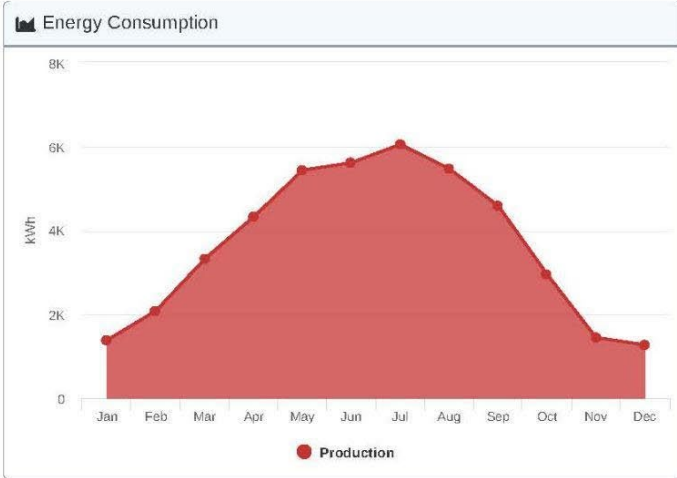
Shading by Field Segment

Description	Tilt	Azimuth	Modules	Nameplate	Shaded Irradiance	AC Energy	TOF ²	Solar Access	Min TSRF ²	Avg TSRF ²
Solar Canopy	7°	218°	66	34.98 kWp	1,459.5 kWh/m ²	43.90 MWh ¹	89.9%	100.0%	89.9%	89.9%
Totals, weighted By kWp			66	34.98 kWp	1,459.5 kWh/m ²	43.90 MWh	89.9%	100.0%	89.9%	89.9%

¹approximate, varies based on inverter performance
²based on location Optimal POA Irradiance of 1,624.1 kWh/m² at 35.2° tilt and 183.9° azimuth



Design 1 CIHA - Maintenance Building, 801 Miluk Dr, Coos Bay, OR 97420, USA



Solar Access by Month

Description	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Solar Canopy	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Solar Access, weighted by kWp	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
AC Power (kWh)	1,381.9	2,079.5	3,319.1	4,320.3	5,429.9	5,608.9	6,045.8	5,485.1	4,583.5	2,951.3	1,446.7	1,268.4