Solar + Storage Feasibility Report

Coquille Indian Housing Authority

Garage Building

2678 Mexeye Loop., Coos Bay, Oregon 97420

Conserve **Sol Coast Consulting & Design, LLC** *Create*

243 S 2nd Street, Coos Bay, OR 97420 #541.266.0877 CCB#164208

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Executive Summary:

This Solar + Storage Feasibility Report for the Garage 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 toward 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. The recommendation for development based on transformer limitations, existing and future use of the facilities at the CIHA Garage Building, strengthening of Kilkich grid power quality and reliability and Tribal plans for energy sovereignty, includes 16.96 kWdc of canopy mounted photovoltaics with 19.8 kWh min of battery storage.

Figure 1 Proposed system development for CIHA garage

Study Narrative

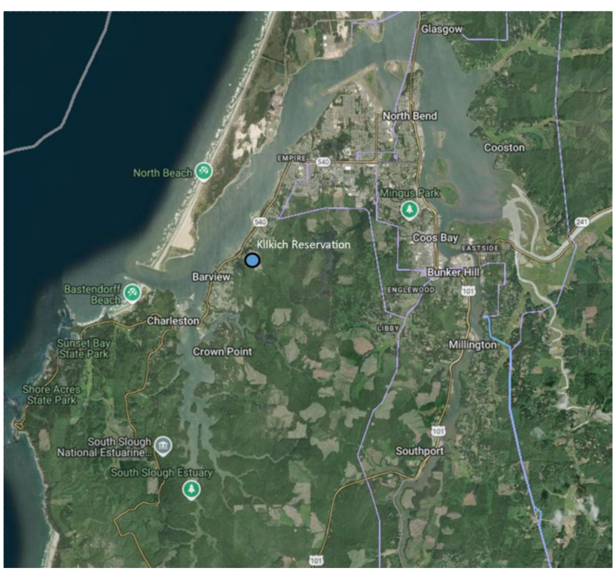
The Coquille Indian Tribe (CIT) flourished in Oregon's southwestern corner for thousands of years, cherishing the bountiful forests, rivers and beaches of a homeland encompassing more than 750,000 acres. But the 19th century's onslaught of European diseases, gold mining and westward expansionism nearly 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.

As a Sovereign Tribal Nation, the Coquille people strive for self-sufficiency and control of their own energy future. The Coquille Indian Tribe's Climate Adaptation Plan outlines strategies for steadily strengthening Tribal energy resilience, embracing aligned opportunities in technology and markets, and building upon previous actions toward energy sovereignty. Aligned opportunities are those that harness clean, renewable resources in ways that respect the land and honor the wisdom of Tribal ancestors, reduce dependence on outside energy sources, and increase economic and environmental sustainability for their people.

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 Kilkich.

Non-residential facilities located at Kilkich 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 Kilkich-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 panels[1]. 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.<u>Energy Usage</u>:

The CIHA Garage Building serves as a space for offices and administration, meeting rooms, and filing for CIHA operations.

240V single phase electricity is delivered to the building through a 50 kVA transformer shared with two other meters and seven customers, including the Office building. Electricity is distributed through the service entrance to a 200A main distribution panel.

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

The CIHA Garage is recognized as a commercial service. Monthly energy Usage records were received for the Garage Building for 2022-2024. The 15 min interval usage for one year (2024) which could provide insight into daily energy and demand patterns is aggregated with the Office and so it is hard to glean what each building's daily usage and demand patterns may look like individually. That information would form the basis for sizing net zero generation and exploration of various battery storage system use cases. This report will make attempts to do so by estimating based on the aggregated data. On average, the office facility uses 9.8 MWh/year with an estimated peak demand of 4 kW.

Fig 1.a below charts energy usage for the Garage meter per Monthly basis for the 2022-2024 calendar years, based on the 4yr monthly usage data provided by Pacific Power.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).

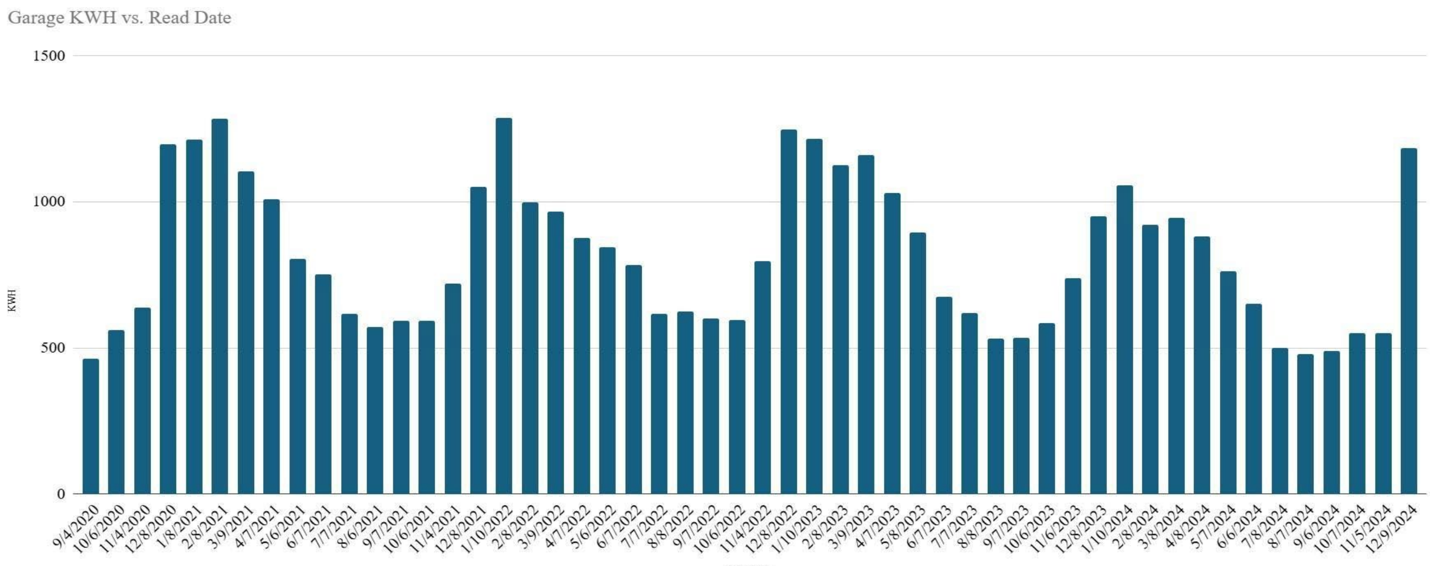

Fig 1.a - CIHA Office Building monthly usage

During the years spanning 2021-2024, the facility used an average of 9.8 MWh/yr. 2022 had the greatest usage of 10.2 MWh over that period. During the winter months energy usage averages between 35-40 kWh per day. Summer days average nearly 20-25kWh/day.

Utilizing the Helioscope solar production design program, it is projected that a solar array totaling 8kWdc could achieve annual Net Zero goals for the facility. A larger 17kWdc array was chosen as the Tribe is more interested in maximizing the amount of power production based on the 50KVA transformer feeding the facility to leverage the design towards the Tribe's long term planning for a campus wide Kilkich VPP & Microgrid.

As a commercially metered building, energy demand can affect the energy bill for the Garage, however, the energy demands at the Garage are small. Using the aggregated usage data provided by Pacific Power, Sol Coast roughly estimated demands to help with understanding battery loads and usage. Operational hours were estimated at 2kW, while non-operational hours averaged 1kW. This demand pattern informs sizing of BESS to provide continuous power to support operations during periods of utility service disruption. Annual average daily peak demand is 3kW with high peaks of up to 4kW occurring in the heating months of Dec-April and peaks dropping to between 2-3kW 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, and cover peak demand loads during periods of grid outage.

2.<u>Solar Resource Assessment</u>:

The CIHA Garage Building is a converted stick framed building with adequate insulation. The composite shingle roof would be able to support the weight of a PV array, however, the roof face with less obstructions and tree shading faces NW and would not have a good solar resource. The SE facing roof would be shaded by trees for much of the morning. No load analysis was performed on the roof, and the structure was not inspected to determine whether and how much weight it could support. It was requested by Tribal members to keep PV arrays off the roofs in general to extend roof life and minimize the complexities of reroofing. A preliminary draft for a solar canopy array was presented to the Task Force and Tribal Council in Fall of 2024, before it was understood that the Office and Garage were separately metered as illustrated in Fig 2.a. Understanding the separation of facilities and utilizing Helioscope solar resource software, it is projected that a solar canopy totaling 8kWdc could achieve annual Net Zero goals for the building as it is now used.

Fig 2.a - Preliminary Solar Siting Concepts

Though much of the grounds surrounding the facility are shaded by trees, the parking lot to the south of the building is open to the south and chosen as a good location for consideration for a solar canopy array. Multiple styles of ground mounted arrays and canopies have been 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 keeping the array off the roof and placing it as a cantilevered canopy on the south side of the building in the parking area (Fig 2.b) . This location offers the most solar gain, and the parking lot could be shared with an array for the CIHA office. (Fig 2.c - combined site plan)

Fig 2.b - Canopy Solar Site Plan

Fig. 2.c - Combined 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.d & e)

Solar Resource (Avg Annual Usage= 9760kWh)	Array kWdc	Avg TSFR	Footprint (square feet)	Winter Prod (kWh/day)	Summer Prod (kWh/day)	Annual Prod (kWh/year)	% of Net Zero (%)
Parking Canopy (5deg tilt / 228deg Azimuth)	17	88.9	852	21.3	99.6	21,100	216.19%

Fig. 2.d - Array Production

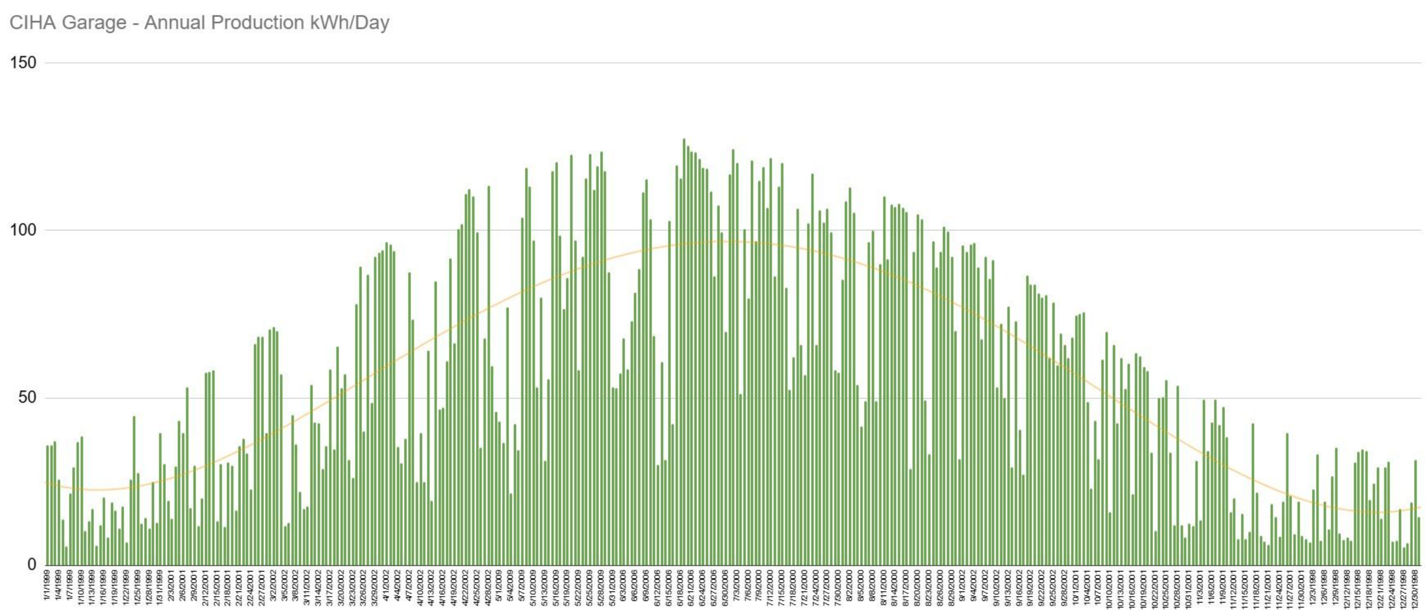

Fig 2.e - Annual kWh/day solar electricity production profile per Helioscope analysis

Selected array designs (Fig 2.f) 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.

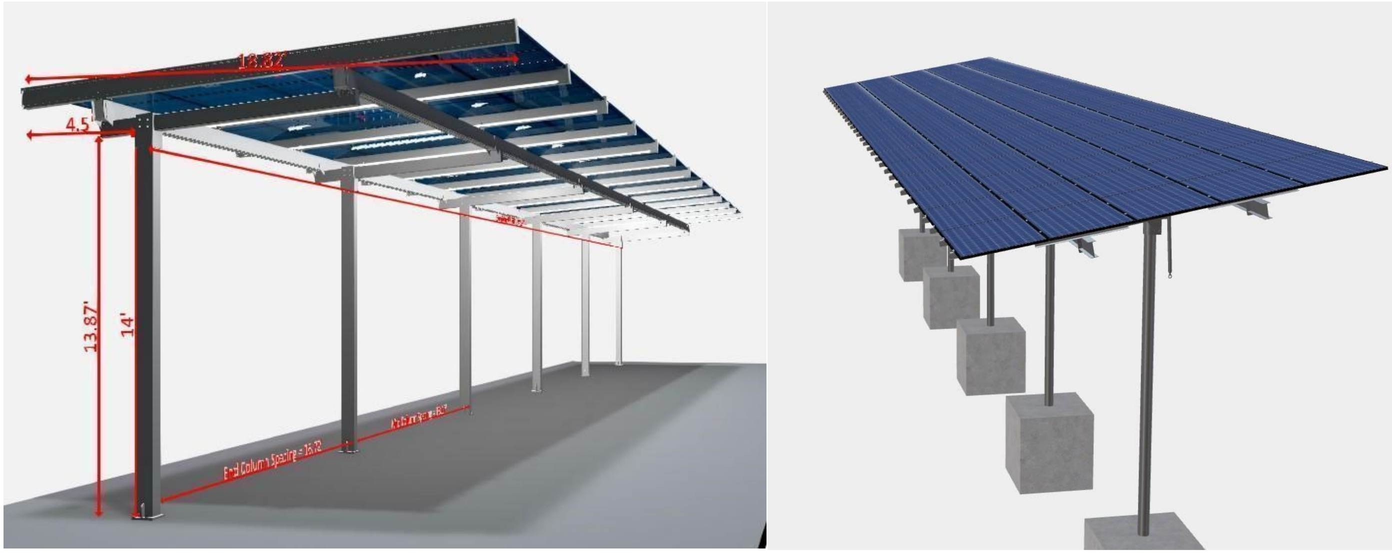

Fig 2.f - Solar Canopy Design based on Infinity Racks (left) and MT Solar (right)

To simplify operations and maintenance, Sol-Ark inverters were chosen as the basis of design for consistency with Sol-Ark 15K inverters previously installed at the CIHA Warehouse facility. Sol-Ark 240V inverters accommodate the electrical architecture at the Garage 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.

Of note is that the Office meter is aggregated with the Garage meter, and there is the potential for cost saving of building a combined larger solar array that could produce power for both buildings. Currently the solar array for the office is intended to be over the same parking area as the array for the Garage. In this situation, at a minimum, the two arrays feed to separate inverters connected to each of the separate Office and Garage load panels and meters. By committing to a larger installation at this site, electrical work and trenching of conduit can be more efficiently combined.

3.<u>Battery Storage Usage</u>:

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. 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 Garage is estimated at 3kW, with an annual average demand of 1kW. The minimum demand is estimated at 0.5kW whenever the facility is not in use. The averages, max, and min were used when calculating storage hours 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 Garage 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 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 an estimated max, peak usage, load of 4kW, a min battery capacity of 16kWh would be required to back up a continuous 4kW load for 4 hrs. A battery capacity of 4kWh would be required to back up 1hr of the same 4kW max peak load. If Monthly demand peaks are averaged, the monthly peak average is 3kW. Backing up this load for 4 hrs would require a min battery capacity of 12kWh. 8hrs of load requires 24kWh. The annual average daily demand is 1kW. A min battery capacity of 4kWh would be required to back up a load of 1kW for 4 hrs. 8kWh of battery capacity for 8 hrs. To cover the minimum continuous load (0.5kW) at the Office 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 panel in the facility has easily accessible breakers to disconnect feed to loads and shed demand. By controlling demand and shedding unnecessary loads, such as the heat pump, water heater, and other large amperage 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 200 amp service panel with a minimum of 16kWh to accommodate 8 hours of occupied service charged with a 17 kWdc PV array.

Demand (kW)	Use Case for Storage	1 hour (kWh)	4 hour (kWh)	8 hour (kWh)	12 hour (kWh)
1	Annual Ave	1	4	8	12
2	Occupied Ave	2	8	16	24
1	UnOccupied Av	1	4	8	12
3	Daily Peak Ave	3	12	24	36
0.5	Minimum	0.5	2	4	6
4	Yearly Peak	**4**	16	**32**	48

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

Equipment Summary:

A Sol-Ark 15K inverter 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 inverter with a maximum continuous output of 15kWac.
- Briggs & Stratton SimpliPHI BESS(or similar) with a minimum nameplate capacity of 16kWh (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. 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.

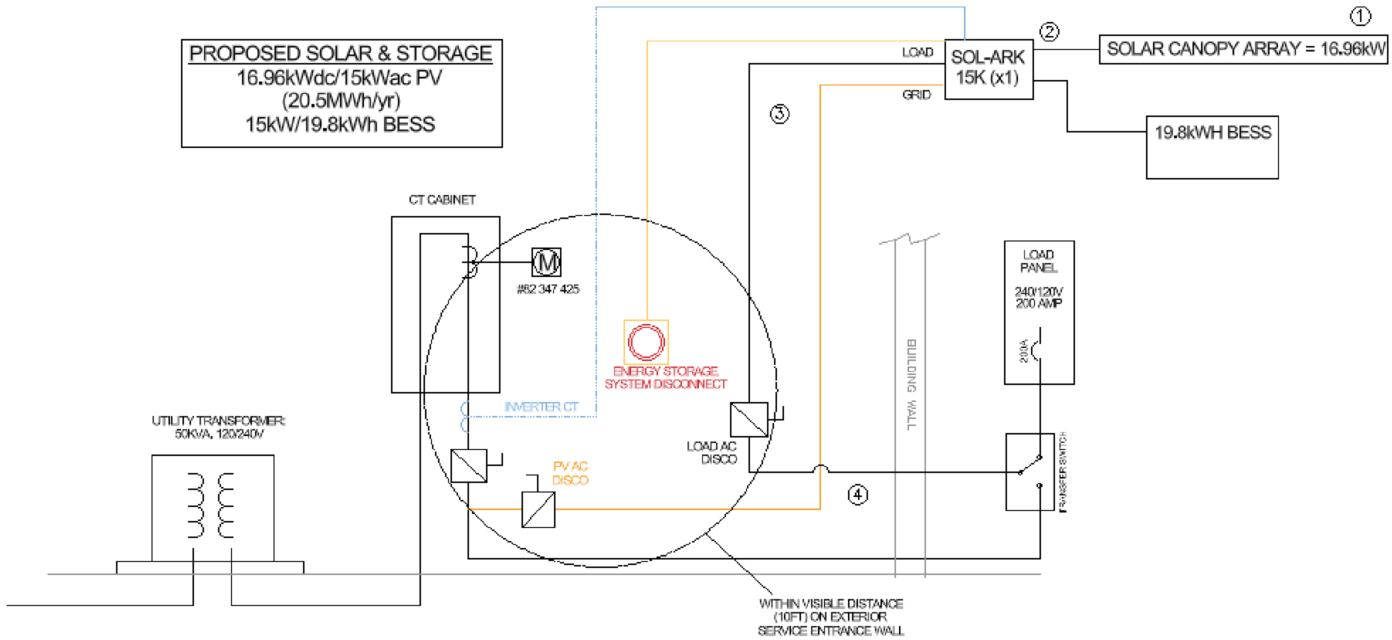

Fig 3.a - Electrical SLD

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 100 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 Garage & Office Solar & Storage Options	Size	Units	PV	Inverter AC size	Units	Inverter	Battery	Racking & Canopy	BOS	Permittin	Engineering	Project Manage	Installation	Total
CIHA Garage Only Solar	**17**	kWdc	$ 8,500	**15**	kWac	$ 7,500		$ 40,800	$ 425	$ 2,500	$ 10,000	$ 7,310	$ 73,100	**$ 150,150**
CIHA Garage Only Storage	**19.8**	kWh					$ 13,860		$ 693	$ 2,500	$ 10,000	$ 723	$ 7,228	**$ 35,003**

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) - Anticipated fifth funding round 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, CIT 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 below 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 Garage & Office Solar & Storage Options	Total	Grid Resilience	Block Grant	Energy Trust of OR	Wattsmart*	OTHER	No BRIC ITC/ Cash**
CIHA Garage Only Solar	$ 150,150		$ -	$ 17,000			$ 66,575
CIHA Garage Only Storage	$ 35,003	$ 25,523		$ 9,480			$ -

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 Garage & Office Solar & Storage Options	Production (MWH/Yr)	Peak Storage (Hr)	Production Value***	Annual O&M****	ROI Cash (Years)
CIHA Garage Only Solar	21		$ 2,741	$ 340	23
CIHA Garage Only Storage		3	$ 534		

Table 4d Simple ROI on a net cash basis

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 system (table 4e):

Year of Operation	1	2	3	4	5	6	7	8	9	10
Cumulative Value	$ 2,935	$ 5,958	$ 9,072	$ 12,279	$ 15,583	$ 18,986	$ 22,490	$ 26,100	$ 29,818	$ 33,648
Year of Operation	11	12	13	14	15	16	17	18	19	20
Cumulative Value	$ 37,592	$ 41,655	$ 45,840	$ 50,150	$ 54,590	$ 59,163	$ 63,873	$ 68,724	$ 73,721	$ 78,868

Table 4e 20 year net system value evaluation

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.<u>Next Steps</u>:

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

- Consider enrollment in PAC Wattsmart program. Currently waiting on Sol-Ark acceptance into Wattsmart program. Wrote letter to PAC encouraging greater acceptance of equipment.
- Finalize locations for inverters, disconnects and batteries consistent with National Electrical Code requirements
- Formalize interconnection request for largest potentially funded system from Pacific Power
- Reserve Energy Trust of Oregon solar and battery storage installation incentives
- Prepare grant applications for 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) Peak Apparent Power (100ms, off-grid)	24,000VA @ 240V 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.

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6.65
kWh

SIMPLIPHI
6.6 BATTERY
WIRE-FREE, STACKABLE DESIGN

BATTERY MODULE SPECIFICATIONS

VOLTAGE	
DC Voltage - Nomimal	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)	≥96%
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

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6.6 Battery

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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" (439.4)
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 Humidty	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" (170.0)
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

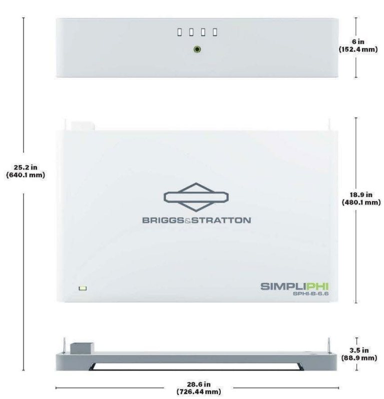
6.65
kWh

SIMPLIPHI
6.6 Battery

BRIGGS&STRATTON
ENERGY SOLUTIONS

Ground Base Specifications	
Per Stack (Up to 3 Batteries)	1
Width (mm)	28.6" (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)	28.9" (734.1)
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, IEC62619

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-LO)	6.65	3.33	6.66	8.3	1.00	130
2 | (SPHI-13.2-LO)	13.3	6.66	10.65	13.3	0.80	208
3 | (SPHI-19.8-LO)	19.95	9.98	13.98	17.5	0.70	273

c UL us LISTED

BRIGGS & STRATTON
POST OFFICE BOX 702
MILWAUKEE, WI 53201 USA

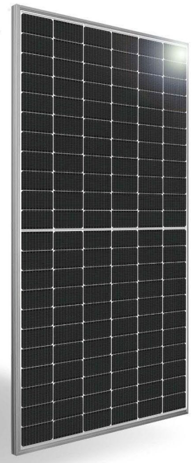
All specifications listed are typical/nominal and subject to change without notice.

Engineered in California, USA. Briggs & Stratton has a policy of continuous product improvement and reserves the right to modify its specifications at any time and without prior notice. Please visit energy.briggsandstratton.com for the latest information.
BS1456 - 7-24-24

SILFAB COMMERCIAL **NTC**

SILFAB SOLAR®

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

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ELECTRICAL SPECIFICATIONS		530		
Test Conditions		STC	BSTC	NOCT
Module Power (Pmax)	Wp	530	578.2	391.3
Maximum power voltage (Vpmax)	V	41.05	41.05	37.76
Maximum power current (Ipmax)	A	12.91	14.08	10.36
Open circuit voltage (Voc)	V	47.74	47.79	43.91
Short circuit current (Isc)	A	13.71	14.96	11.00
Module efficiency	%	22.3%		
Maximum system voltage (VDC)	V	1500		
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 + φ × 135 W/m2, φ = 80 %, AM 1.5 • Electrical characteristics may vary by ±5%.

MECHANICAL PROPERTIES / COMPONENTS	METRIC	IMPERIAL
Module weight	26.2 kg ±0.2 kg	57.8 lbs ±0.4 lbs
Dimensions (H x L x D)	2098 mm x 1133 mm x 35 mm	82.6 in x 44.6 in x 1.4 in
Maximum surface load (wind/snow)*	2400 Pa rear load / 5400 Pa front load	50.1 lb/ft² rear load / 112.8 lb/ft² front load
Hail impact resistance	ø 25 mm at 83 km/h	ø 1 in at 51.6 mph
Cells	132 Half cells - N-Type Silicon solar cell 91 x 182 mm	132 Half cells - N-Type Silicon solar cell 3.58 x 7.16 in
Glass	3.2 mm high transmittance, tempered, DSM antireflective coating	0.126 in high transmittance, tempered, DSM antireflective coating
Cables and connectors (refer to installation manual)	1350 mm, ø 5.7 mm, EVO2 from Staubli	53.1 in, ø 0.22 in (12AWG), EVO2 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 3730 Certified, IEC 62790 Certified, IP68 rated, 3 diodes	

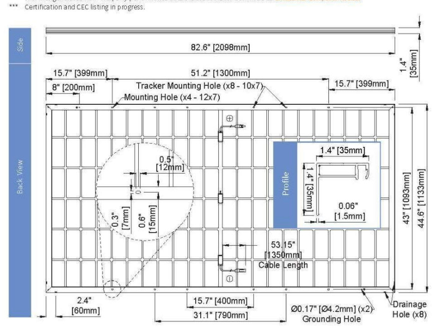
TEMPERATURE RATINGS	
Temperature Coefficient Isc	0.04 %/°C
Temperature Coefficient Voc	-0.24 %/°C
Temperature Coefficient Pmax	-0.29 %/°C
NOCT (± 2°C)	45 °C
Operating temperature	-40/+85 °C

WARRANTIES	
Module product workmanship warranty	25 years**
Linear power performance guarantee	30 years
	≥ 98% end 1st yr ≥ 94.7% end 12th yr ≥ 90.8% end 25th yr ≥ 89.3% end 30th yr

CERTIFICATIONS	
Product	UL 61215***, UL 61730***, CSA C22.2#61730***, IEC 61215***, IEC 61730***, IEC 61701 (Salt Mist Corrosion), IEC 62716 (Ammonia Corrosion), CEC Listing***, UL Fire Rating: Type 1
Factory	ISO9001:2015

SHIPPING SPECS	
Modules Per Pallet:	29 or 29 (California)
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 operating modules.
** 12 year extendable to 25 years subject to registration and conditions outlined under "Warranty" at silfabsolar.com.
PAN files generated from 3rd party performance data are available for download at: silfabsolar.com/downloads.
*** Certification and CEC listing in progress.



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F +1 905.696.0267

Silfab - SIL-530-XM-BIFACIAL 20240829

Garage Net Zero CIHA - Office & Garage 2678 Mexeye Loop, Coos Bay, OR 97420, USA

Project Details

Address	2678 Mexeye Loop, Coos Bay, OR 97420, USA
Owner	Rick Zitzmann
Last Modified	Rick Zitzmann a few seconds ago
Location	(43.3586147, -124.2937702) (GMT -8)

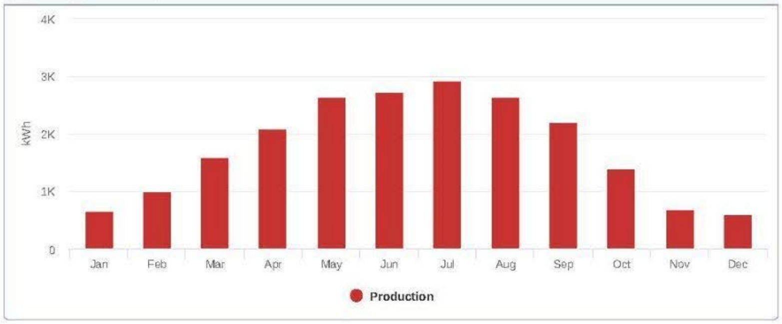
CONSERVE CREATE

System Metrics

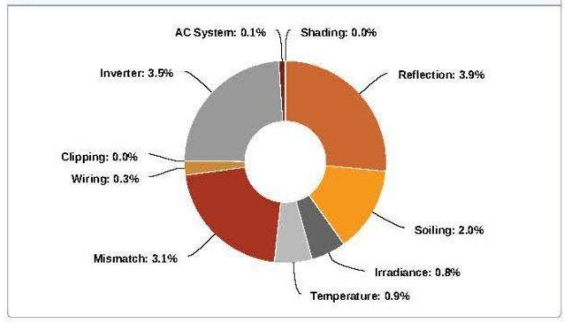
Design	Garage Net Zero
Module DC Nameplate	16.96 kW
Inverter AC Nameplate	15.00 kW Load Ratio: 1.13
Annual Production	21.1 MWh
Performance Ratio	86.2%
kWh/kWp	1,244.1
Weather Dataset	TMY, 10km Grid (43.35,-124.25), NREL (prospector)
Simulator Version	7e4677c281-9ba65ba0f7-d7a3048c80-53548c76f9

Project Location

Energy Consumption



System Loss



Annual Production

	Description	Output	% Delta
Irradiance (kWh/m^2)	Annual Global Horizontal Irradiance	1,393.8	-
	POA Irradiance	1,443.7	3.6%
	Shaded Irradiance	1,443.7	-0.0%
	Irradiance After Reflection	1,387.6	-3.9%
	Irradiance After Soiling	1,359.9	-2.0%
	Total Collector Irradiance	**1,359.9**	**-0.0%**
Energy (kWh)	Nameplate	23,063.3	-
	Output at Irradiance Levels	22,875.0	-0.8%
	Output at Cell Temperature Derate	22,672.2	-0.9%
	Output after Electrical Mismatch	21,969.4	-3.1%
	Optimal DC Output	21,897.7	-0.3%
	Constrained DC Output	21,897.5	-0.0%
	Inverter Output	21,131.1	-3.5%
	Energy to Grid	**21,100.0**	**-0.1%**

Temperature Metrics	
Avg. Operating Ambient Temp	12.8°C
Avg. Operating Cell Temp	19.9°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-N (Sol-Ark)	

Design BOM

Component	Type	Quantity
10 AWG (Copper)	AC Home Runs	1
500 MCM (Copper)	AC Home Runs	1
1 input AC Panels	AC Panels	1
Sol-Ark-15K-2P-N	Inverters	1
SIL-530 XM	Modules	32
10 AWG (Copper)	Strings	4

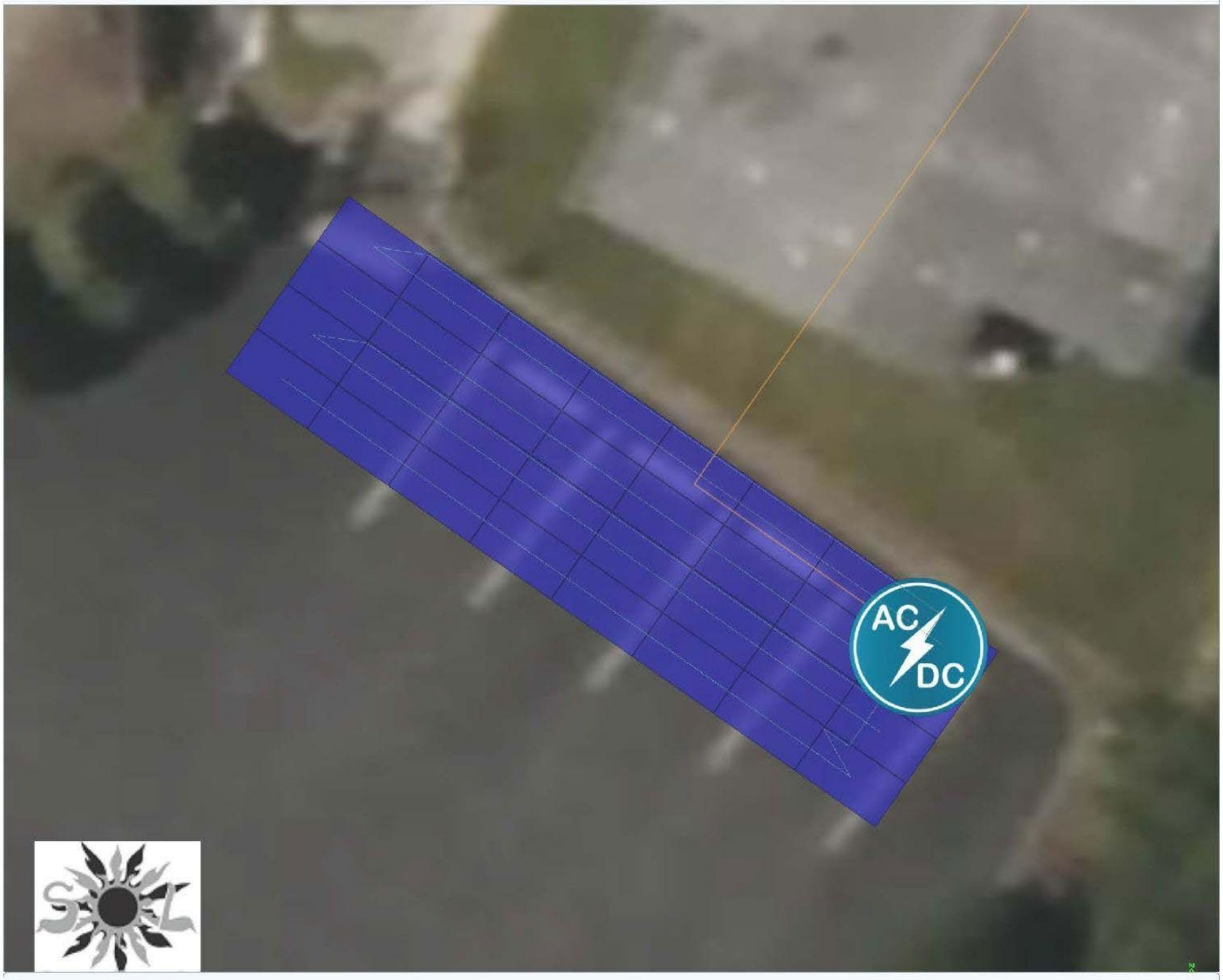
Monthly Shading

Month	GHI (kWh/m^2)	POA (kWh/m^2)	Shaded (kWh/m^2)	Nameplate (kWh)	Grid (kWh)
January	41.5	45.2	45.2	700.3	651.2
February	63.1	67.3	67.3	1,059.2	987.2
March	102.4	107.2	107.2	1,703.1	1,586.0
April	137.0	140.7	140.7	2,253.4	2,082.7
May	176.7	179.0	179.0	2,881.5	2,635.4
June	183.3	185.7	185.7	2,988.1	2,720.1
July	197.0	200.5	200.5	3,232.5	2,927.2
August	176.3	181.1	181.1	2,913.1	2,636.6
September	144.7	151.4	151.4	2,423.2	2,196.2
October	90.3	96.6	96.6	1,527.9	1,401.2
November	44.1	47.6	47.6	742.6	682.7
December	37.5	41.4	41.4	638.3	593.5

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
Parking Canopy	Carport	Landscape (Horizontal)	5°	215°	0.0 ft	1x1	32	32	16.96 kW

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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]
Parking Canopy	5°	215°	32	16.96 kWp	1,443.7 kWh/m^2	21.06 MWh[1]	88.9%	100.0%	88.9%	88.9%
Totals, weighted By kWp			**32**	**16.96 kWp**	**1,443.7 kWh/m^2**	**21.06 MWh**	**88.9%**	**100.0%**	**88.9%**	**88.9%**

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