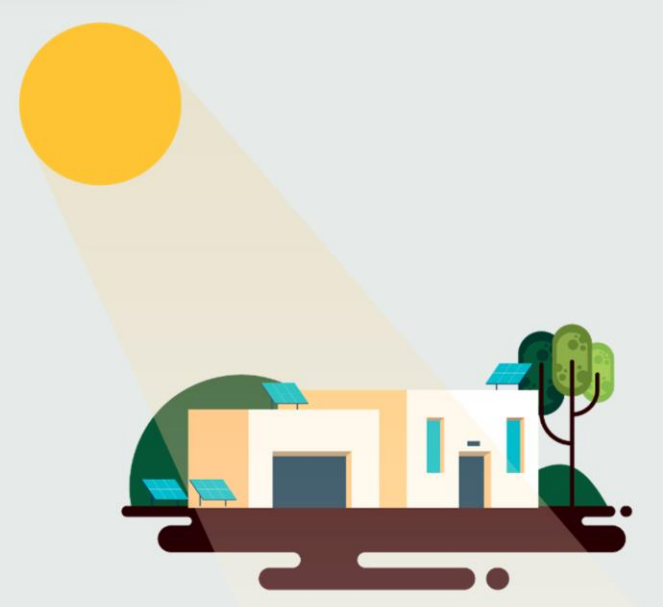
Solar-Powered Community Center For the Detohou Village



EE-492 Renewable Energy Systems

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Date Submitted: May 2nd, 2025

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1.0 Project Overview

1.1 Project Background and Objectives

The selected site for the solar-powered community center lies in central Detohou, directly adjacent to two major local landmarks: the Detohou Primary School and the Detohou District Office. This community center will serve as an existing hub for education, civic services, and community activity, making it a strategic and natural location for shared infrastructure like a multipurpose center.

Detohou Village

This community center located in Detohou, a small rural village situated just outside the historic city of Abomey in the Zou Department of Benin, West Africa. The village lies at approximate coordinates:

Header Data from Weather File

Latitude	7.17	degrees
Longitude	1.94	degrees
Time zone	GMT 1	
Elevation	190	m
Time step	60	minutes

This location offers a balance of proximity to urban infrastructure and services (from Abomey), while maintaining a rural environment where **electricity access is limited or unreliable**. As such, it is well-suited for the implementation of an independent solar PV system.

The location was chosen based on the following considerations:

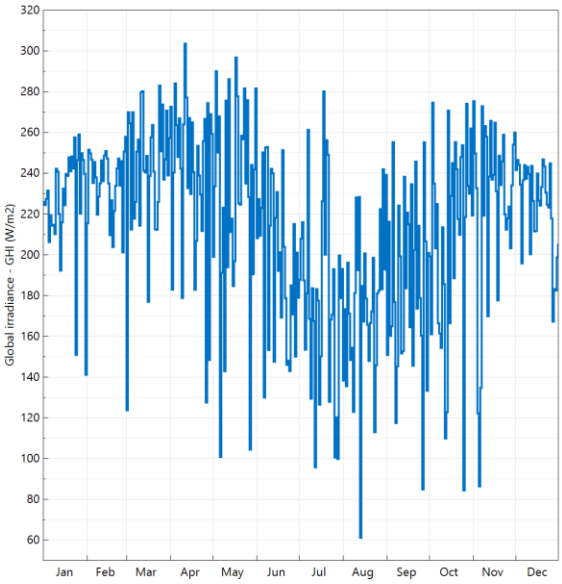
- **Accessibility:** Located along a primary dirt road with easy walking access from surrounding residential clusters
- **Solar Exposure**: The site offers minimal tree cover and a clear southern sky, ideal for solar PV installation

- **Available Land**: The site provides sufficient open space (approx. 4,800 sq. ft.) for both the building footprint and PV array, with room for potential future expansion
- **Off-Grid Need**: While the village is located near a partially electrified zone, the site and surrounding community still experience unreliable or limited grid access, making islanded operation highly appropriate

This location (shown below) allows the center to serve as a bridge between social infrastructure and energy independence for the surrounding population.

2.0 Resource Assessment

The solar resource data (shown below) was obtained from the National Solar Radiation Database (NSRDB) and imported into System Advisor Model (SAM). Based on the weather file used in SAM, the annual solar resource characteristics at Detohou are:



Annual Averages Calculated from Weather File Data

Global horizontal	5.12	kWh/m²/day
Direct normal (beam)	3.25	kWh/m²/day
Diffuse horizontal	2.75	kWh/m²/day
Average temperature	26.1	°C
Average wind speed	1.8	m/s

These values confirm that the location receives **strong and consistent solar radiation** year-round, making it ideal for photovoltaic (PV) energy generation. Based on the GHI value of **5.12 kWh/m²/day**, the site provides an average of ~**5.12 peak sun hours/day**, which was used to size the PV array to meet the community center's energy demands.

3.0 Energy Demand

The energy demand for this project is based on a **working load condition**, where the expected daily usage of the community center defines the system size. The facility is intended to operate under **islanding conditions** (off-grid), meaning all energy must be generated and stored locally.

The load profile includes two primary categories: **LED lighting** and **AC outlets for shared small-device use**. Both load types have been conservatively sized to support daily activities while ensuring overall system efficiency and reliability.

Lighting Load Specifications

- The facility contains 14 energy-efficient LED lights, each rated at 22 watts.
- Thanks to the building's large windows and abundant natural sunlight, artificial lighting will primarily be used in the evening or during overcast days.
- Estimated daily lighting use is 3–4 hours per day.
    - **Total Lighting Load** = 22 W * 14 = 308 W
    - **Estimated Daily Energy Use (lighting)** = 308 W × 3 hours ≈ **0.924 kWh/day(low)**
    - **Estimated Daily Energy Use (lighting)** = 308 W × 4 hours ≈ **1.232 kWh/day(high)**

AC Outlet Load

- The community center includes (25) 240VAC wall outlets for shared use by visitors.
- These outlets will be used for charging phones, radios, flashlights, and other low-wattage electronics.
- Devices are expected to be used intermittently throughout the day, with an estimated cumulative draw based on shared use.
    - **Total Outlet Load = ~250W**
    - **Estimated Daily Energy Use (outlets)** = 250 W × 6 hours ≈ **1.5 kWh/day(low)**
    - **Estimated Daily Energy Use (outlets)** = 250 W × 8 hours ≈ **2.0 kWh/day(high)**

Estimate assumptions

- Typical phone charging (~5–10 W/device)
- 6 to 8 hours of staggered usage across outlets
- Shared responsibility among the community

Daily Energy Demand Summary

Load Type	Load Wattage	Daily Use (hours)	Energy Use (kWh/day)
Lights (14)	308 W	3-4 hours	0.924 - 1.232 kWh
Outlets (25)	~250 W	6-8 hours	1.5 - 2.0 kWh
Totals	**558W**		**~2.424 - 3.232 kWh/day**

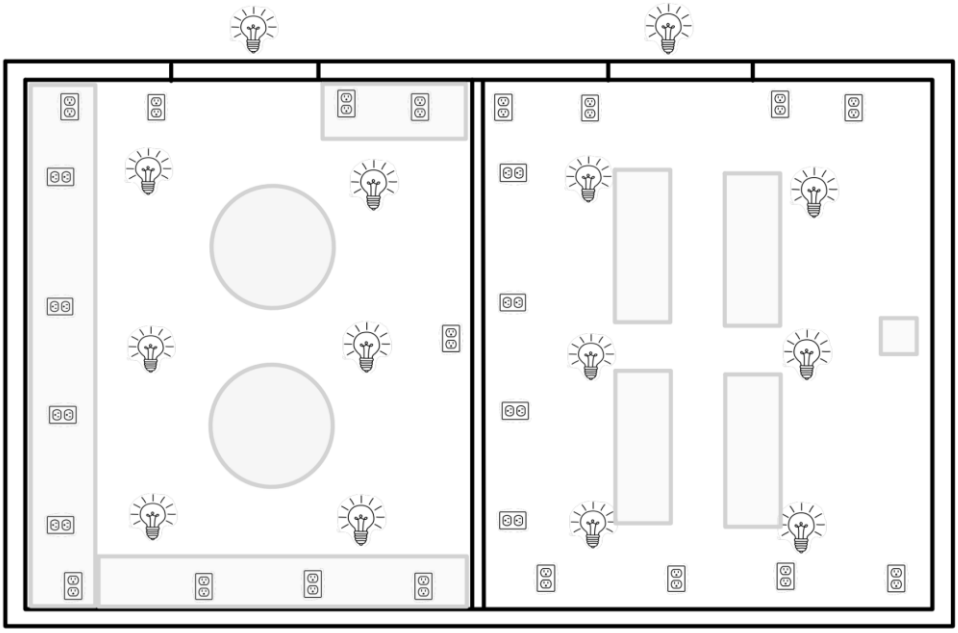
*AC outlet use varies based on community behavior; estimate assumes conservative use of low-power devices.

3.1 Design Considerations

Building Layout and Size

- The community center will measure approximately 60 ft × 80 ft (4,800 sq. ft total).
- The design includes two large rooms:
    - A study room intended for educational purposes, community meetings, and reserved events
    - A main room designed as a casual, multi-use space for relaxing, socializing, and charging devices

The structure (shown below) will be a single-story building with an open layout, optimized for ventilation and daylighting.



Occupancy

- The building is designed to accommodate up to **60 people total**, with 30 people per room, allowing for both small group activities and larger gatherings.
- Seating arrangements include tables and open areas to support group discussions, training workshops, and cultural events.
- The layout ensures flexibility for different community uses throughout the week.

Operating Hours

- Daily usage is expected between **12:00 PM and 8:00 PM**, aligning with typical community activity hours.
- Activities will occur throughout the afternoon and into the evening, including:
    - Study sessions for children after school

- Community workshops or vocational training
- Social events and evening meetings for residents

This schedule ensures that the center supports both youth education and adult engagement.

Lighting Strategy

- The building design incorporates large windows on multiple walls, allowing for abundant natural sunlight to flood the interior during the day.
- Artificial lighting (via 14 energy-efficient LED fixtures) will only be used for 3–4 hours in the evening, primarily during meetings or study hours after sunset.
- This passive daylighting approach helps reduce energy demand, increases sustainability, and enhances user comfort.

4.0 Equipment Matching Selection

The following section details the process used to size and select the photovoltaic (PV) modules, inverter, charge controller, and batteries for the Detohou community center project. All equipment was selected based on load estimates and solar resource conditions specific to the site and aligned with step-by-step procedures from Chapters 3 and 4 of our course material.

4.1 PV Panel and Inverter Selection

Step 1: Load Summary Review

The system is being sized to support a working load of approximately **3.232 kWh/day**. This value was used as the daily energy demand for the purpose of calculating required PV system size.

Step 2: Solar Resource Review

Using the System Advisor Model (SAM), the Global Horizontal Irradiance (GHI) for the Detohou site was found to be:

$$GHI = 5.12\ \frac{kWh/m^2}{day}$$

This value is equivalent to **5.12 peak sun hours (PSH)**, which is used to calculate the system's minimum required generation capacity.

Step 3: PV Array Sizing

To size the PV array, we applied the standard equation from Chapter 4:

$$PVSize(kW) = \frac{EnergyDemand(kWh/day)}{PSH\backslash timesSystem\ Efficiency}$$

Using a **loss factor of 0.75**:

$$PVSize(kW) = \frac{3.232}{5.12 \times 0.75} = \frac{3.232}{3.84} = 0.841kW = 841W$$

To ensure reliability and ease of component matching, we rounded up to a design target of 1 kW.

Step 4: Number of PV panels Calculations (Before Selection)

To meet this 1 kW system target, we considered standard panel sizes (250 W, 330 W, 400 W, etc.). We evaluated how many of each would be required:

- 250 W → 4 modules = 1000 W (exact)
- 330 W → 3 modules = 990 W (efficient)
- 400 W → 3 modules = 1200 W (too large for 1.0 kW target)

We selected the **330 W option** as optimal for efficiency, installation simplicity, and compatibility with standard wiring and mounting practices.

$$Required\ Modules = \frac{841}{330} = 2.548\ OR\ \ 3\ Modules\ Total$$

This confirms that a minimum of 3 PV panels is needed to meet our energy demand. Next, we will be evaluating the electrical characteristics of these panels to ensure compatibility with potential inverters.

Step 5: SAM PV Panel Selection

Selected PV panel: LONGi LR6-60HIH-330M

We reviewed the parameters of several panels available in SAM and selected the LONGi LR6-60HIH-330M based on its suitability for string sizing, inverter matching, and performance efficiency.

Parameter	Value	Justification
Pmax	330.584 W	Aligns with our 841 W minimum when using just 3 modules
Vmp	34.4 V	Ideal for series stringing; keeps string voltage within inverter MPPT
Imp	9.6 A	Well below most inverter MPPT current limits
Voc	41.4 V	Allows up to 11 modules in series before exceeding 480 Vdc max
Isc	10.2 A	Considered in fuse and controller sizing later
Module Eff	19.91 %	High efficiency rating appropriate for limited rooftop area
# of Cell	60	Standard size; compatible with many inverters and mounting solutions

Step 6: Configuration Calculations

We then evaluated how connecting these panels would affect **string voltage and current**, assuming 3 modules connected in series:

Voltage

$$Vmp, string = Vmp \times 3 = 34.4 \times 3 = 103.2V$$

$$Voc, string = Voc \times 3 = 41.4 \times 3 = 124.2V$$

Current

$$I, string = Imp = 9.6A\ (same\ for\ series\ connection)$$

At this point, we hadn't chosen an inverter yet. But from our **calculated string voltage and current**, we now know the inverter we choose would need to support:

Requirement	**Value**
Min MPPT Voltage	$\leq 103.2V$
Max DC Voltage	$\geq 124.2V$
Input Current (min)	$\geq 9.6A$
Power Input	$\geq\sim 990W$

Step 7: SAM Inverter Selection

After selecting the LONGi LR6-60HIH-330M module, we calculated the voltage, current, and power ranges required of an inverter to ensure safe and efficient system operation. Once these electrical values were established, we evaluated inverter options available in SAM that could meet these constraints. We went into SAM's inverter library and filtered for:

- Power rating: 1000–1500 W
- MPPT voltage range: as low as 90–100 V
- Max DC voltage: at least 130 V
- Max input current: ≥ 9.6 A

But most of the small inverters (≤ 1.5 kW) failed to meet one or more of these:

Common Issue	**Result**
MPPT voltage started at 125 V+	❌ Too high for 103.2 V string

Input current limit < 9 A	❌ Too low for 9.6 A string
SAM warning for underutilization	❌ Red/yellow flags in config

Conclusion: No Suitable Inverter Found to conform with our electrical requirement for 3-PV panels.

Despite several attempts, we could not find an inverter in SAM that supported our 3-panels system with low voltage and high current combination.

Step 8: Reevaluating System Design – Inverter Matching with Oversizing

Due to limitations in SAM's inverter library, no inverter under 1500 W was able to satisfy the electrical requirements of our system. Consequently, we pivoted to inverters with higher rated capacities and broader operating windows.

To reestablish a viable inverter selection, we chose the **ABB PVI-3.6-OUTD-S-US-A [240V]** inverter from SAM. This inverter offered the following critical characteristics:

Parameter	Value	Justification
Rated AC Power	3600 Wac	Large enough to accommodate a moderately sized array
Max DC Voltage	480 VDC	Exceeds V_{oc} total of any practical string arrangement
MPPT Voltage Range	100-480 V	Accommodates longer strings compared to low-wattage inverters
Max DC Current	10.9998 A	Accepts a string with current ≤ 10.9998 A
MPPT Inputs	1	Acceptable for a single array setup

This inverter provided the needed voltage flexibility and input current capability to match with a more robust configuration.

Step 9: Adjusted String Sizing – Matching Modules to the ABB Inverter

After selecting the ABB inverter, we reevaluated how many modules would be needed to fully utilize the available capacity while staying within safe voltage and current limits.

New Target System Power:

$$P,target = 3600\ Wac\ (match\ inverter\ rating)$$

Using the previously selected LONGi LR6-60HIH-330M module (330.584 W), we calculated:

$$Number\ of\ Modules = \frac{3600}{330.584} \approx 10.89 = 10\ modules\ (rounded\ down)$$

Using 10 panels in a string connection.

Step 10: Electrical String Configuration

Now that we determined 10 modules were required to meet the inverter's power window and MPPT range, we computed possible string configurations that meet inverter MPPT and safety criteria.

Parameters from Module

Vmp	Voc	Imp	Isc	MPPT Range (Inverter)
34.4 V	41.4 V	9.6 A	10.2 A	100–480 V

String Configuration Goal: Ensure total Vmp falls within 100–480 V, and current does not exceed 10.9998 A.

Option Chosen:

Modules in Series (per string): 10

$$Vmp,\ string = 34.4 \times 10 = 344V$$

$$Voc, string = 41.4 \times 10 = 414V$$

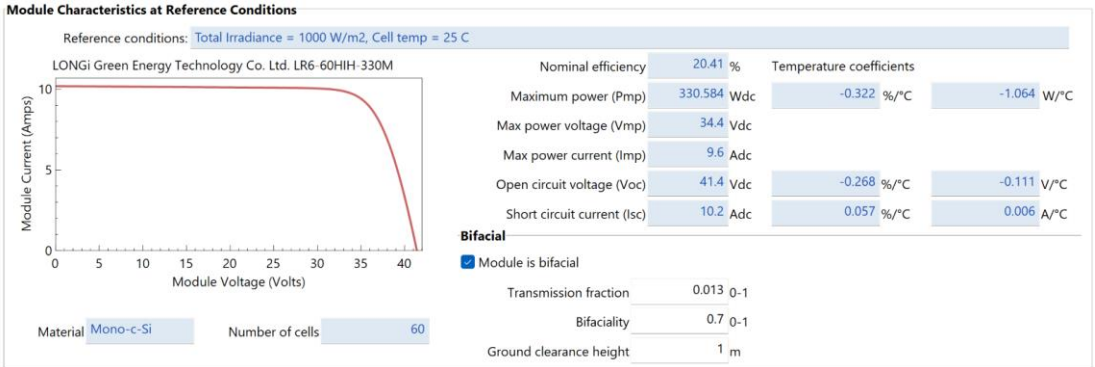
This falls comfortably inside the 100–480 V MPPT range and under the inverter's 480 Vdc max.

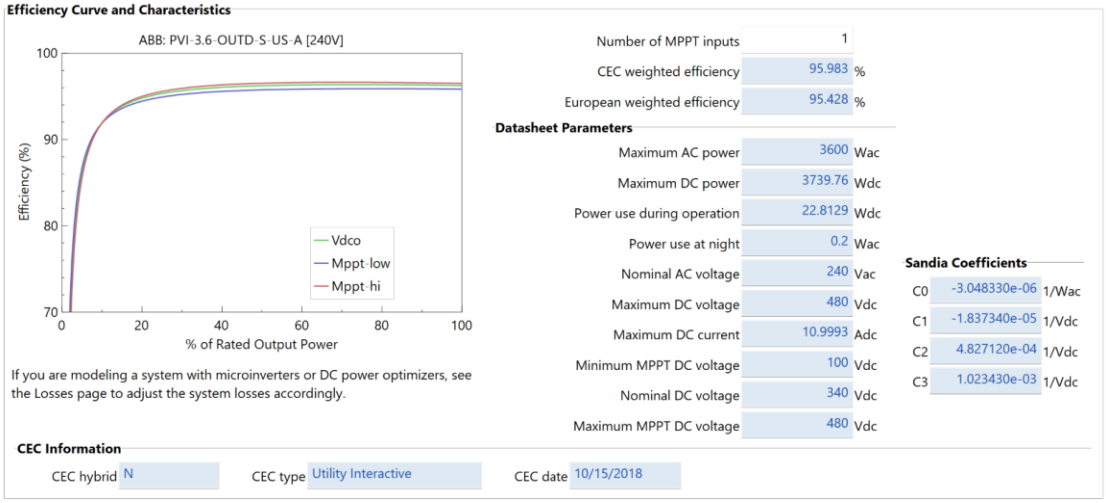
Strings in Parallel: 1

$$I,\ string = 9.6A \text{ (Within inverter limit of 10.9998 A)}$$

SAM Final Design Overview

The images below display our SAM parameters for the PV Panels/Modules and the inverter.





4.2 MPPT Charge Controller Selection

For the charge controller, we chose to select a Maximum Power Point Tracking controller for its efficiency. When selecting the charge controller we considered the following parameters:

Parameter	**Justification**
Max PV Input Voltage	The PV input voltage rating of the charge controller must exceed Voc of the PV string voltage $\geq 450 - 500V$.
Max charge current	Max current the controller can send to the battery.
PV Input Power	Total wattage of the solar array. The controller must support this power level.
Battery Voltage	The controller must be compatible with the battery bank voltage.

For a series connection we will need a charger controller with a max PV Input Voltage greater than or equal to 450V. For the series case, we will use the Victron MPPT 450/100 charge controller.

Charge Controller Parameters	**Value**	**Justification**
Max PV Input Voltage	450V	This value is appropriate for a PV panel array consisting of 10 panels. The string voltage of the array is: $$Voc, string = 41.4 \times 10 = 414V$$
Max Charge Current	100A	Satisfies the required current rating to charge the battery. $$CC = \frac{3.3kW}{48V} = 69A$$

PV Input Power	5,800W @ 48V	This value is slightly oversized to accommodate the total power output from the 10-panel array. $Total\ Power\ =\ 330.584\ \times\ 10\ \approx\ 3.3kW$

4.3 Battery Selection

The final components of our solar panel system are the batteries. For the battery selection we considered the electrical parameters of the inverter and charge controller. Below are the specific parameters we considered:

Parameter	Justification
System Voltage	The battery bank voltage must match the inverter and charger controller voltage.
Battery Capacity	Determines the amount of energy stored in the system. Required cap = Daily energy usage * days of autonomy / DoD

For our system, we need a battery that will store 3.232kWh/day and the battery should be able to supply power for up to 3 days without sun. Based on these parameters, we chose a Lithium Iron Phosphate battery (LiFePO4) for its high efficiency, fast charging capabilities, and its high depth of discharge (DoD) value. Below is the necessary battery storage for the PV System to power the electrical loads in the community center:

$$Battery\ Storage\ =\ \frac{Daily\ Usage\ \times\ Days\ of\ Autonomy}{Usable\ DoD} = \frac{3.2kWh\ \times\ 3}{0.90} \approx\ 11kWh$$

The best option paired with the Victron inverter is the Victron $LiFePO_4$ 48V Smart Battery. This battery is the best choice as it meets all the electrical requirements, and it will integrate easily with the Victron charge controller. At 90% DoD, the total energy that can be stored is:

$$5.12kWh\ \times\ 0.90\ =\ 4.61kWh$$

Therefore, to meet the battery storage requirement of 11kWh, the system will use 3 batteries.

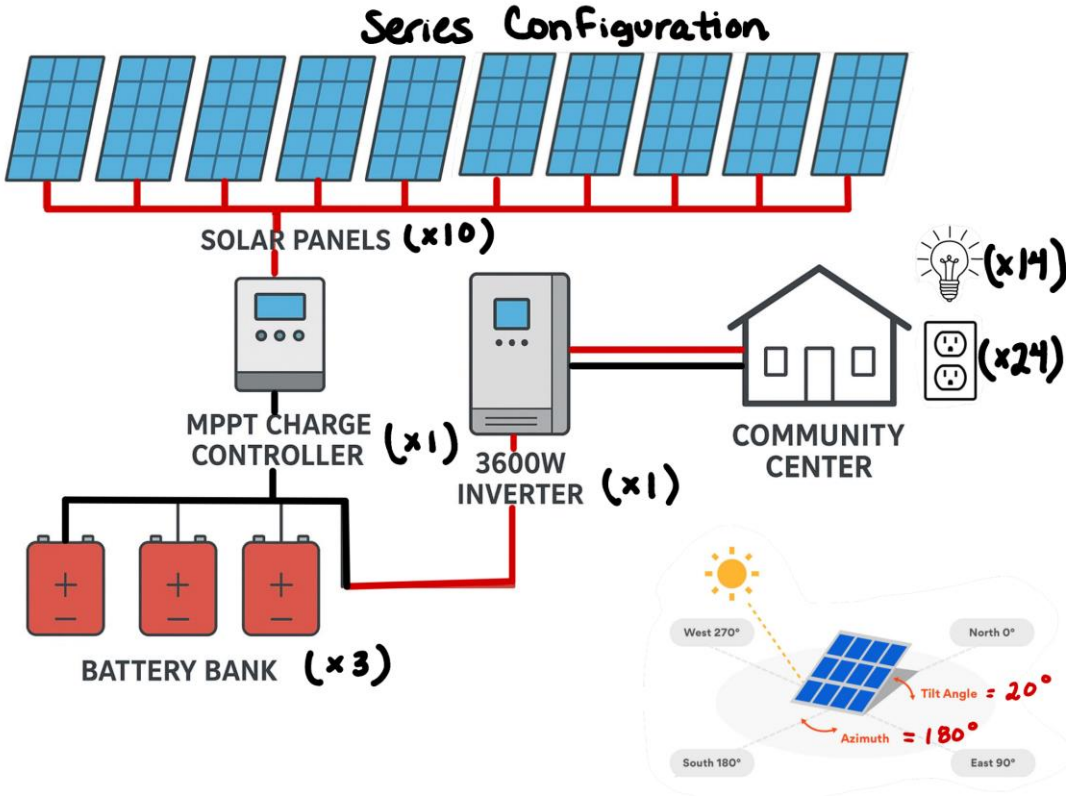
Victron $LiFePO_4$ 48V Smart Battery Specifications

Parameter	Value	Justification
Voltage	48V	This value matches the output voltage rating of the charge controller.
Nominal Battery Capacity	5.12kWh	This value is appropriately sized for our daily storage requirement.
Maximum Charge Current	100A	This value will accommodate the necessary 69A current from the charge controller.

5.0 Layout

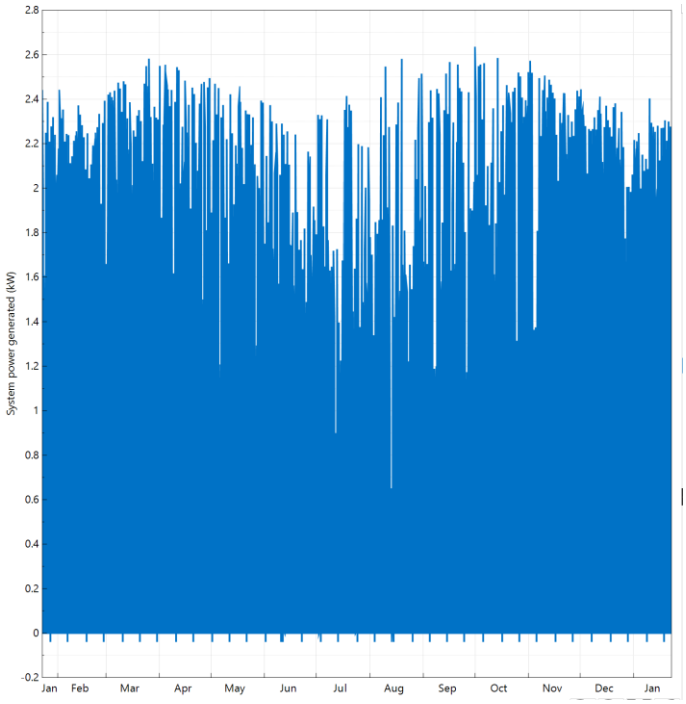
- Number of inverters $\geq \frac{(330.584 \cdot 3)}{3600} = 1$
- Number of parallel $\leq \frac{10.9998}{9.6} = 1$
- $(\frac{100}{34.4} = 2.9) \leq$ Number of series $\leq (\frac{480}{34.4} = 13.95)$

Wiring Solution: 10 panels in series for MPPT1



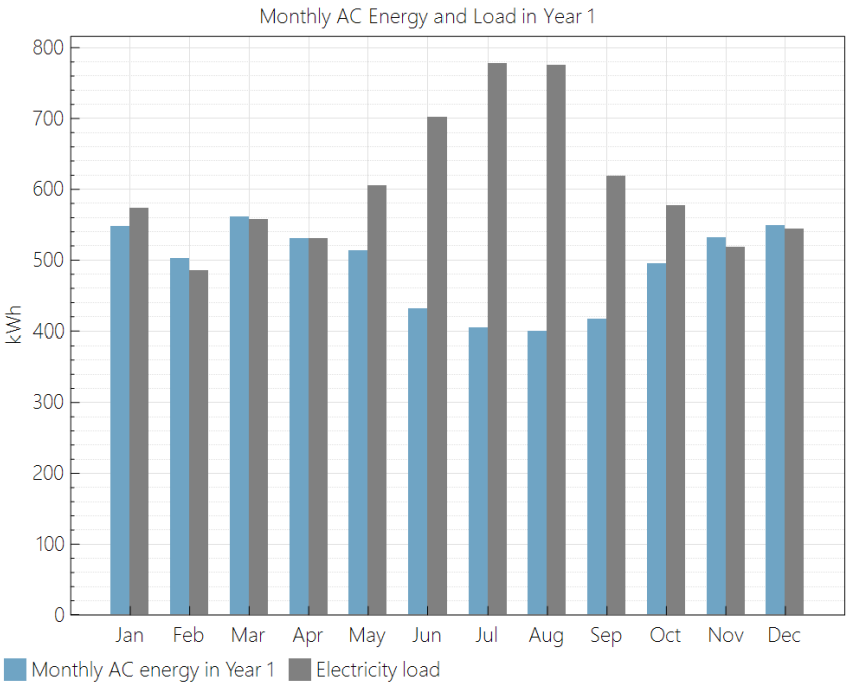
6.0 Production Analysis

System power generated is shown on the following graph.



The weather in Africa is different compared to the United States's weather. Benin experiences a tropical climate with distinct wet and dry seasons. The sunniest months tend to be during the dry season, which runs from November to March. During this period, the Harmattan winds bring dry air, reducing cloud cover and allowing for more sunshine.

In contrast, the wet season, which occurs from April to July and September to October, sees increased cloud cover and rainfall, leading to fewer hours of direct sunlight. In August, Benin does receive a fair amount of sunlight, but it's not the sunniest month of the year. This weather difference is also shown on the following graph.



In our simulation, we chose 10 panels in series to match our load with our generation which is not in accordance with our theoretical calculations for the number of panels.

7.0 Financial Analysis

The following table provides a list of the items needed for the community center project along with their prices. Costs were generated using SAM and by performing hand calculations.

Item	**Quantity**	**Price / Unit**	**Total Cost**
LONGi Green Energy Technology LR6-60HPH 330M Solar Panel	10	In SAM (shown below)	$1,420
ABB PVI-3.6-OUTD-S-US-A [240V] Inverter	1	In SAM (shown below)	$165
Victron Energy 51.2V 100Ah NG Lithium Battery LiFePO4	3	$3,185	$9,555
Victron SmartSolar Charge Controller MPPT 450/100	1	$1,108	$1,108
Cree Lighting SDR 6-inch Round Slim LED Downlight	14	$20	$280
Leviton T5632-W USB Combo Outlet	25	$12	$300
Grand Total			$12,828

SAM Financial Overview

Our financial analysis provided by SAM aligns closely with our calculated present values:

Metric	Value
Annual AC energy in Year 1	5,882 kWh
DC capacity factor in Year 1	16.9%
Energy yield in Year 1	1,483 kWh/kW
Performance ratio in Year 1	0.78
LCOE Levelized cost of energy nominal	0.15 ¢/kWh
LCOE Levelized cost of energy real	0.15 ¢/kWh
Electricity bill without system (year 1)	$1,522
Electricity bill with system (year 1)	$1,009
Net savings with system (year 1)	$513
Net present value	$12,052
Simple payback period	11.3 years
Discounted payback period	11.3 years
Net capital cost	$6,706
Equity	$0
Debt	$6,706

The overall initial investment for the community center project is estimated to be **$12,828.00** USD dollars in total.

To calculate the present worth of the initial investment, the inflation rate, discount rate, and number of years must be considered. Below are the parameters of the calculation.

- Inflation Rate: 3% - Based on historical values
- Discount Rate: 6% - Typical for development of energy projects
- Number of Years: 10 years

Using these values and the initial investment, the present worth value of the community project in 10 years is:

$$PW = P_r \times C_o = \left(\frac{1+i}{1+d}\right)^n = \left(\frac{1+0.03}{1+0.06}\right)^{10} \times 12{,}828.00 = 9{,}634.94$$

Below is a summary of the expected lifetime for the PV system components. The solar panels have an expected lifetime of 25 years while some of the other components have a limited 3-5 year lifespan depending on environmental and operating conditions.

Item	**Warranty (years)**
LONGi Green Energy Technology LR6-60HPH 330M Solar Panel	25
ABB PVI-3.6-OUTD-S-US-A [240V] Inverter	15
Victron Energy 51.2V 100Ah NG Lithium Battery LiFePO4	3
Victron SmartSolar Charge Controller MPPT 450/100	5

Cree Lighting SDR 6-inch Round Slim LED Downlight	5
Leviton T5632-W USB Combo Outlet	2

8.0 External Considerations

- **Wildlife & Habitat**: Site is near existing development (school/government office), minimizing disruption to local ecosystems or sensitive habitats.
- **Historical/Cultural Structures**: No known historical or protected sites are affected by the system installation.
- **Noise & Emissions**: The system is silent and emissions-free, ideal for quiet community environments.
- **Shadow Flicker/Glare**: Minimal risk due to ground-mounted array and open layout with no nearby obstructions.
- **Electrical Integration**: System is off-grid with local AC distribution—no need for high-voltage transmission lines or interconnection infrastructure.
- **Maintenance & Security**: Rural location may lead to dust buildup requiring regular panel cleaning. Theft prevention measures (e.g., fencing or locked enclosures) should be considered.

9.0 References

[1] "Victron Energy SmartSolar MPPT RS," Victron Energy, https://www.victronenergy.com/solar-charge-controllers/smartsolar-mppt-rs-450-tr

[2] "Victron Energy 51.2V 100Ah NG lithium battery lifepo4 – new generation," RV Solar Connections, https://rvsolarconnections.com/shop/batteries/victron-energy-51-2v-100ah-ng-lithium-battery-lifepo4-new-generation/?srsltid=AfmBOoq4qGbeTrhE9oFtPxL-ilSn01n-SpF96WFp42aZBwCFYekJq28tQos&gQT=1

[3] "Victron Energy Lithium NG Batteries," Victron Energy, https://www.victronenergy.com/batteries/lithium-ng-batteries.

Appendix

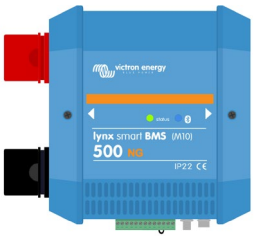
Equipment Data Sheets

12,8, 25,6 & 51,2 Volt Lithium NG batteries

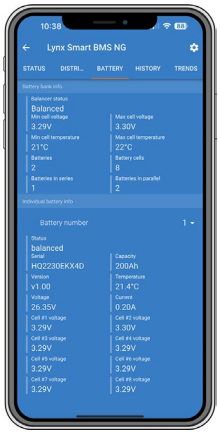
www.victronenergy.com

25,6 V 200 Ah Lithium NG battery

Secured with mounting brackets



Lynx Smart BMS NG 500 A & 1000 A



Complete overview of all battery data via VictronConnect (or a GX device and VRM)

Victron Energy Lithium NG batteries are Lithium Iron Phosphate ($LiFePO_4$ or LFP) batteries available in various capacities with nominal voltages of 12.8 V, 25.6 V and 51.2 V. They can be connected in series, parallel, or a combination of both to create battery banks for system voltages of 12V, 24V, or 48V. A maximum of 50 batteries can be used when configuring a bank with 12V or 24V batteries, while up to 25 batteries can be used with 48V batteries. This allows for a maximum energy storage capacity of 192 kWh with 12V batteries, up to 384 kWh with 24V batteries, and 128 kWh with 48V batteries.

Key features:

Integrated shunt

The battery data (battery voltage, current and temperature) are transmitted to the BMS and evaluated there, i.e. to calculate the state of charge, which can then be read out via VictronConnect or a GX communication centre, or to create and issue specific warnings and alarms.

Automatic setup, monitoring and control via VictronConnect App or a GX device and the VRM Portal

All battery parameters are managed by the BMS automatically. The BMS automatically detects the system voltage and the number of batteries in parallel, series and series/parallel connection. The BMS (from now on Lynx Smart BMS NG 500 A/1000 A, further models to follow) is mandatory and must be purchased separately.

Monitoring and control take place via VictronConnect (every BMS model has Bluetooth), a GX communication centre or the VRM Portal. You can view battery parameters such as cell status, cell voltages, battery current and temperatures in real-time. The battery firmware is automatically updated by the BMS.

Easy bracket mounting

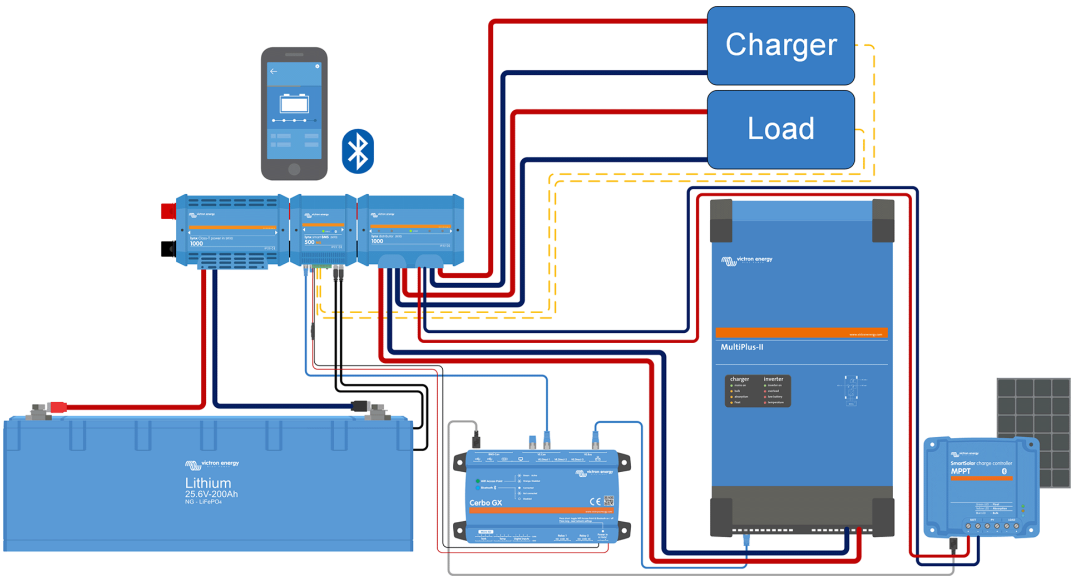
Mounting brackets make the installation easier and ensure that the battery is optimally secured against slipping and tipping over.

Increased ingress protection (IP-rating)

The Lithium NG batteries are effectively sealed against dust and can withstand low-pressure water jets, making them suitable for environments where exposure to dust and water is a concern.

Low self-discharge rate

The self-discharge rate has been significantly improved and is now a maximum of 2 % of the battery capacity per month. A low self-discharge rate contributes to the overall performance, longevity, and reliability of the NG batteries.



Typical system example with Lithium NG battery and Lynx Smart BMS NG

Our Lithium NG batteries have integrated cell balancing and cell monitoring. The cell balancing/monitoring cables can be daisy-chained and must be connected to a Battery Management System (BMS).

Battery Management System (BMS)

The BMS will:

1. Generate a pre-alarm whenever the voltage of a battery cell decreases to less than 3.0 V.
2. Disconnect or shut down the load whenever the voltage of a battery cell decreases to less than 2.8 V.
3. Stop the charging process whenever the voltage of a battery cell increases to more than 3.6 V or when the temperature becomes too high or too low.

See the BMS datasheets for more features.

Battery specification								
VOLTAGE AND CAPACITY	LFP-12,8/100	LFP-12,8/150	LFP-12,8/200	LFP-12,8/300	LFP-25,6/100	LFP-25,6/200	LFP-25,6/300	LFP-51,2/100
Nominal voltage	12,8 V	12,8 V	12,8 V	12,8 V	25,6 V	25,6 V	25,6 V	51,2 V
Nominal capacity @ 25 °C*	100 Ah	150 Ah	200 Ah	300 Ah	100 Ah	200 Ah	300 Ah	100 Ah
Nominal energy @ 25 °C*	1280 Wh	1920 Wh	2560 Wh	3840 Wh	2560 Wh	5120 Wh	7680 Wh	5120 Wh
Capacity loss	(per 100 cycles, @ 25 °C, 100 % DoD): <1 %							
Energy loss	(per 100 cycles, @ 25 °C, 100 % DoD): <1 %							
Round trip efficiency	92 %							
*Discharge current ≤1C								
CYCLE LIFE (capacity ≥ 80 % of nominal)								
80 % DoD	2500 cycles							
70 % DoD	3000 cycles							
50 % DoD	5000 cycles							
DISCHARGE								
Max continuous discharge current (C-rate)	100 A (1C)	150 A (1C)	200 A (1C)	300 A (1C)	100 A (1C)	200 A (1C)	300 A (1C)	100 A (1C)
Max pulse discharge current 10s (C-rate)	200 A (2C)	300 A (2C)	400 A (2C)	600 A (2C)	200 A (2C)	400 A (2C)	600 A (2C)	200 A (2C)
End of discharge voltage	11,2 V				22,4 V			44,8 V
Internal resistance	2 mΩ		1 mΩ		4 mΩ	2 mΩ	1 mΩ	8 mΩ
CHARGE								
Charge voltage	Between 14 V / 28 V / 56 V and 14,4 V / 28,8 V / 56,8 V							
Float voltage	13,5 V / 27 V 54 V							
Max continuous charge current (C-rate)	100 A (1C)	150 A (1C)	200 A (1C)	300 A (1C)	100 A (1C)	200 A (1C)	300 A (1C)	100 A (1C)
Max pulse charge current 10s (C-rate)	200 A (2C)	225 A (1.5C)	400 A (2C)	450 A (1.5C)	200 A (2C)	400 A (2C)	450 A (1.5C)	200 A (2C)
GENERAL								
BMS-es	Lynx Smart BMS NG 500 A / 1000 A (M10 busbars), must be purchased separately							
Cell measurements	Cell voltages and temperatures, battery current							
Battery BMS interface	Male + female cable with M8 circular connector with high-speed digital communication, length 50 cm M8 extension cables are available separately for purchase in various lengths between 1 and 5 meters							
Alarm feature	Pre-alarm contact on BMS							
Bluetooth	In the BMS							
Max batteries per BMS	50 (up to 384 kWh per BMS [3])							25 (128 kWh per BMS [3])
Battery firmware updates	Battery firmware automatically updated by BMS							
Repairable	Yes (cover can be removed with screws)							
OPERATING CONDITIONS								
Operating temperature	Discharge: -20 °C to +50 °C | Charge: +5 °C to +50 °C							
Storage temperature	-45 °C to +70 °C							
Humidity (non-condensing)	Max. 95 %							
Protection class	IP65							
MOUNTING								
Mounting options	Strap or mounting brackets (brackets included)							
Can be placed on their sides	Yes[2]							
OTHER								
Self-discharge rate	≤ 3 % per month @ 25 °C							
Power connection	M8 (threaded inserts and bolts)							
Dimensions (h x w x d) mm	235 x 197 x 160	205 x 250 x 205	235 x 341 x 160	206 x 447 x 205	235 x 341 x 160	235 x 648 x 162	206 x 841 x 205	235 x 648 x 162
Weight (est.)	9 kg	14 kg	19 kg	29 kg	19 kg	37 kg	52 kg	37 kg
STANDARDS								
Safety	Cells: UL1973 UL9540A IEC62619	Cells: UL1973 UL9540A IEC62619 (all three pending)	Cells: UL1973 UL9540A IEC62619	Cells: UL1973 UL9540A IEC62619 (all three pending)	Cells: UL1973 UL9540A IEC62619	Cells: UL1973 UL9540A IEC62619	Cells: UL1973 UL9540A IEC62619(all three pending)	Cells: UL1973 UL9540A IEC62619 (all three pending)
	Battery: IEC 62619 (pending)							
EMC	EN 61000-6-3, EN 61000-6-2							
Automotive	ECE R10-6 (pending)							
Performance	IEC 62620 (pending)							

[1] When fully charged
[2] The lithium battery can be mounted upright and on its side, but not with the battery terminals facing down
[3] Up to 5 BMS-es can be paralleled. For more info, please see this announcement.

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SmartSolar Charge Controller MPPT 150/35 & 150/45

www.victronenergy.com

SmartSolar Charge Controller MPPT 150/35

Bluetooth Smart built-in
The wireless solution to set-up, monitor, update and synchronise SmartSolar Charge Controllers.

VE.Direct
For a wired data connection to a Color Control GX, other GX products, PC or other devices

Ultrafast Maximum Power Point Tracking (MPPT)
Especially in case of a clouded sky, when light intensity is changing continuously, an ultra-fast MPPT controller will improve energy harvest by up to 30 % compared to PWM charge controllers and by up to 10 % compared to slower MPPT controllers.

Advanced Maximum Power Point Detection in case of partial shading conditions
If partial shading occurs, two or more maximum power points may be present on the power-voltage curve.
Conventional MPPTs tend to lock to a local MPP, which may not be the optimum MPP.
The innovative BlueSolar algorithm will always maximize energy harvest by locking to the optimum MPP.

Outstanding conversion efficiency
No cooling fan. Maximum efficiency exceeds 98 %. Full output current up to 40 °C (104 °F).

Flexible charge algorithm
Fully programmable charge algorithm (see the software page on our website), and eight preprogrammed algorithms, selectable with a rotary switch (see manual for details).

Extensive electronic protection
- Over-temperature protection and power derating when temperature is high.
- PV short circuit and PV reverse polarity protection.
- PV reverse current protection.

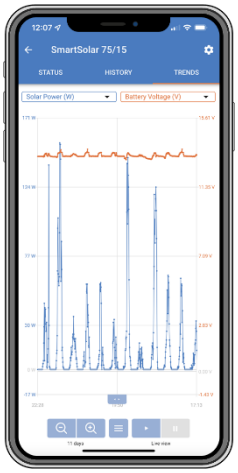
Internal temperature sensor
Compensates absorption and float charge voltage for temperature.

Optional external battery voltage and temperature sensing via Bluetooth
A Smart Battery Sense or a BMV-712 Smart Battery Monitor can be used to communicate battery voltage and temperature to one or more SmartSolar Charge Controllers.

Fully discharged battery recovery function
Will initiate charging even if the battery has been discharged to zero volts.
Will reconnect to a fully discharged Li-ion battery with integrated disconnect function.

Bluetooth sensing Smart Battery Sense

Bluetooth sensing BMV-712 Smart Battery Monitor



SmartSolar Charge Controller	MPPT 150/35	MPPT 150/45
Battery voltage	12 / 24 / 48 V Auto Select (software tool needed to select 36 V)	
Rated charge current	35 A	45 A
Nominal PV power 1a, b)	35 A 12 V: 500 W / 24 V: 1000 W / 36 V: 1500 W / 48 V: 2000 W 45 A 12 V: 650 W / 24 V: 1300 W / 36 V: 1950 W / 48 V: 2600 W	
Max. PV short circuit current 2)	40 A	50 A
Maximum PV open circuit voltage	150 V absolute maximum coldest conditions 145 V start-up and operating maximum	
Maximum efficiency	98 %	
Self-consumption	12 V: 20 mA 24 V: 15 mA 48 V: 10 mA	
Charge voltage 'absorption'	Default setting: 14,4 / 28,8 / 43,2 / 57,6 V (adjustable)	
Charge voltage 'float'	Default setting: 13,8 / 27,6 / 41,4 / 55,2 V (adjustable)	
Charge algorithm	multi-stage adaptive (eight pre-programmed algorithms)	
Temperature compensation	-16 mV / -32 mV / -64 mV / °C	
Protection	PV reverse polarity / output short circuit / over-temperature	
Operating temperature	-30 to +60°C (full rated output up to 40°C)	
Humidity	95 %, non-condensing	
Data communication port	VE.Direct See the data communication white paper on our website	
ENCLOSURE		
Colour	Blue (RAL 5012)	
Power terminals	16 mm² / AWG6	
Protection category	IP43 (electronic components), IP22 (connection area)	
Weight	1,25 kg	
Dimensions (h x w x d)	130 x 186 x 70 mm	
STANDARDS		
Safety	EN/IEC 62109-1, UL 1741, CSA C22.2	
STORED TRENDS		
Data stored	Battery voltage,current and temperature, as well as load output current, PV voltage and PV current.	
Number of days trends data is stored	46	

1a) If more PV power is connected, the controller will limit input power.
1b) The PV voltage must exceed Vbat + 5 V for the controller to start.
Thereafter the minimum PV voltage is Vbat + 1 V.
2) A PV array with a higher short circuit current may damage the controller.

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SD Series

Round & Square Slim LED Downlights - 4", 6", 8"

Rev. Date: V7 12/12/2024

Product Description

The SD Series slim LED downlights offer high-quality customizable light with a CCT selectable switch. The slim downlights are available in 4" and 8" square and 6" round housings to meet the requirements of all can-less applications.

Applications: New construction or retrofit

Performance Summary

Initial Delivered Lumens: 830 to 2,280

Input Power: 12W to 22W

CRI: 90+

CCT: 2700K/3000K/3500K/4000K/5000K Selectable Switch

Limited Warranty†: 5 years for luminaire; up to 5 years for SmartCast® accessories; 1 year for accessories

Lifetime: Designed to last 50,000 hours

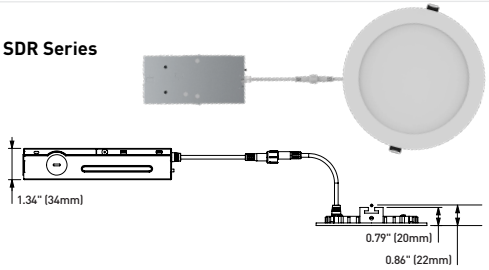
Dimming: Triac/0-10V Dimming to 5%; Compatible with SmartCast® Technology, and Lutron Vive through 0-10V interface

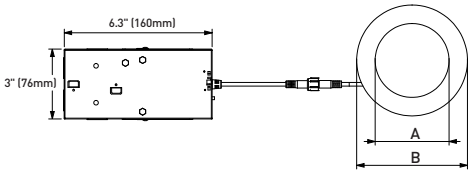
Ceiling mount for easy installation into new construction or retrofit applications

Operating Temperature Range: -25°C to + 40°C (-13° F - +104° F)

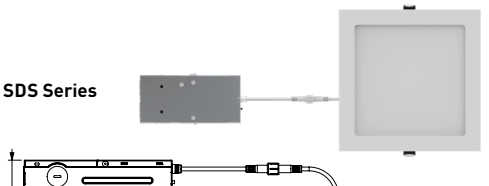
† See https://www.creelighting.com/resources/warranties/ for warranty terms. For SmartCast accessories, consult SmartCast spec sheets for details on warranty terms.

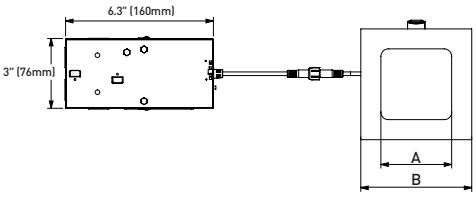
SDR Series





SDS Series





Accessories

Field-Installed

SmartCast® 10V Zone Controller
CSC-ZC-10V-CWC
- Intelligent sensing and control of 0-10V luminaires

Extension Cables
SD-RCE12 (12')
SD-RCE20 (20')

SDS Accessories
Square Trim Kits (Iron w/White, Black & Silver Finishes)
SDS4-WHBLSV (4")
SDS6-WHBLSV (6")

SDR Accessories
Round Trim Kits (Iron w/White, Black & Silver Finishes)
SDR4-WHBLSV (4")
SDR6-WHBLSV (6")
SDR8-WHBLSV (8")

Plate for T-Grid Ceiling
CDR-SDR-TGRID
- 23.7" (602mm) x 11.9" (303mm) plate for use with 6 and 8" SDR downlights
- Optional accessory that provides more substantial structural integrity to ceiling for mounting downlights

Dimensions			
Downlight	"A" Dimension	"B" Dimension	Weight
6" Round	5.1" (129mm)	6.7" (170mm)	1.1 lbs. (520g)
4" Square	3.0" (77mm) Sq.	4.7" (120mm) Sq.	0.9 lbs. (430g)
8" Square	6.9" (176mm) Sq.	8.9" (225mm) Sq.	1.6 lbs. (723g)

Note: Refer to page 2 for recommended ceiling cutout dimensions.

Ordering Information

Example: SDS4-7L-9ACK-TRI10V-WH-UNV

			9ACK		TRI10V	WH	UNV
Family	**Size**	**Lumen Package***	**CRI/CCT**	**Optic**	**Control**	**Finish**	**Voltage**
SDR Round	**6** 6"	**11L** 16W, 1,350 Lumens	**9ACK** 90 CRI, 2700K/3000K/3500K/4000K/5000K - Ships from factory set at 3000K	**Blank** 113° Beam Angle	**TRI10V** Triac/0-10V Dimming to 5%	**WH** White	**UNV** Universal 120-277V"
SDS Square	**4** 4"	**7L** 12W, 830 Lumens	**9ACK** 90 CRI, 2700K/3000K/3500K/4000K/5000K - Ships from factory set at 3000K	**Blank** 113° Beam Angle	**TRI10V** Triac/0-10V Dimming to 5%	**WH** White	**UNV** Universal 120-277V"
SDS Square	**8** 8"	**18L** 22W, 2,070 Lumens	**9ACK** 90 CRI, 2700K/3000K/3500K/4000K/5000K - Ships from factory set at 3000K	**Blank** 113° Beam Angle	**TRI10V** Triac/0-10V Dimming to 5%	**WH** White	**UNV** Universal 120-277V"

* Lumen values at 27K and 30K. Actual lumen output varies depending on CCT. Refer to Initial Delivered Lumens table for specific lumen values.

Product Specifications

CONSTRUCTION & MATERIALS

- Aluminum and iron downlight housing
- Remote mounted iron J-Box connects to downlight with a low voltage cable
- Includes housing clips for easy installation
- Suitable for ceilings 0.59" (15mm) to 0.79" (20mm) thick
- Includes 16" (mm) of cable between downlight and j-box. Extension accessories available

OPTICAL SYSTEM

- Unique combination of optical components achieves a uniform, comfortable appearance while eliminating pixelation and color fringing. This ensures smooth light patterns are projected with no hot spots and minimal striations
- Components work together to optimize distribution, balancing the delivery of high illuminance levels on horizontal surfaces with an ideal amount of light on walls and vertical surfaces.
- Edge-lit LEDs, plastic light guide plate and diffuser lens shields direct view of LEDs
- CCT is adjustable via a switch on the j-box in the field to meet the requirements of numerous applications
- Beam Angle: 113º (included angle between points of 50% of maximum intensity)

ELECTRICAL SYSTEM

- **Power Factor:** > 0.9 at full load and 120V
- **Total Harmonic Distortion:** < 30% at full load
- **Input Voltage:** 120-277V, 50/60hz
- **Dimming:** Triac/0-10V Dimming to 5% compatible with SmartCast® Technology, and Lutron Vive through 0-10V interface
- **Compatible Triac Dimmers:** Lutron TGCL-153P, CTCL-153P, DVCL-153P, MACL-153M; Leviton 6674-P0, 6672-1L, IPL06-10
- Use only lighting controls with neutral connection or controls intended for use with LED fixtures
- **Operating Temperature Range:** -25°C to + 40°C (-13° F - +104° F)

REGULATORY & VOLUNTARY QUALIFICATIONS

- cETLus Listed
- 4" and 8" luminaires are suitable for damp locations for covered ceilings only
- 6" luminaires are suitable for wet locations for covered ceilings only
- Meets NEMA C82.77 standards
- Suitable for insulated (IC) and non-insulated (non-IC) ceilings
- Non-plenum rated
- Requires minimum 90˚C supply conductors
- Meets FCC Part 15, Subpart B, Class A and Class B limits for conducted and radiated emissions
- Meets CA Title 24 JA8 Requirements
- RoHS Compliant. Consult factory for additional details
- **CA RESIDENTS WARNING:** Cancer and Reproductive Harm – www.p65warnings.ca.gov

Electrical Data*

Lumen Package	System Watts 120-277V	Total Current (A)			
		120V	208V	240V	277V
7L	12	0.10	0.08	0.07	0.06
11L	16	0.13	0.09	0.08	0.07
18L	22	0.18	0.12	0.10	0.09

* Electrical data at 25˚C (77˚F). Actual wattage may differ by +/- 10% when operating between 120-277V +/- 10%.

Initial Delivered Lumens*

Lumen Package	2700K/3000K		3500K/4000K/5000K	
	Initial Delivered Lumens*	Efficacy (LPW)	Initial Delivered Lumens*	Efficacy (LPW)
7L	830	69	920	77
11L	1,350	84	1,490	93
18L	2,070	94	2,280	104

* Initial delivered lumens at 25˚C (77˚F). Actual production yield may vary between -10 and +10% of initial delivered lumens.

SD Series Ambient Adjusted Lumen Maintenance[1]

Ambient	Initial LMF	25K hr Reported[2] LMF	50K hr Reported[2] LMF	75K hr Estimated[3] LMF	100K hr Estimated[3] LMF
0˚C (32˚F)	1.05	0.98	0.91	0.84	0.78
5˚C (41˚F)	1.04	0.97	0.90	0.84	0.78
10˚C (50˚F)	1.03	0.96	0.89	0.83	0.77
15˚C (59˚F)	1.02	0.95	0.88	0.82	0.76
20˚C (68˚F)	1.01	0.94	0.87	0.81	0.75
25˚C (77˚F)	1.00	0.93	0.87	0.80	0.75
30˚C (86˚F)	0.99	0.92	0.85	0.78	0.72
35˚C (95˚F)	0.98	0.91	0.83	0.77	0.70
40˚C (104˚F)	0.97	0.89	0.82	0.75	0.68

[1] Lumen maintenance values at 25˚C (77˚F) are calculated per IES TM-21 based on IES LM-80 report data for the LED package and in-situ luminaire testing. Luminaire ambient temperature factors (LATF) have been applied to all lumen maintenance factors.
[2] In accordance with IES TM-21, Reported values represent interpolated values based on time durations that are up to 6x the tested duration in the IES LM-80 report for the LED.
[3] Estimated values are calculated and represent time durations that exceed the 6x test duration of the LED.

Installation

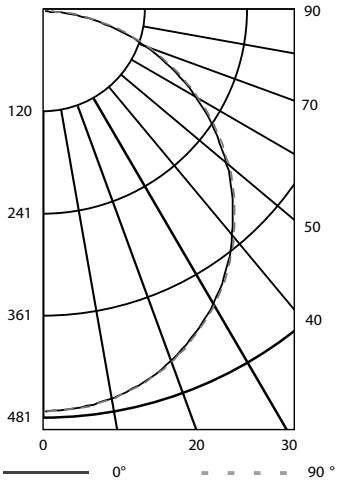
- Quick install system using the housing clip system for easy install into ceiling
- Refer to www.creelighting.com for complete install instructions

Cutout Dimensions

Size	SDR Round Cutout Dimensions	SDS Square Cutout Dimensions
4"	N/A	4-11/32" (110mm) x 4-11/32" (110mm)
6"	6-1/4" (158mm)	N/A
8"	N/A	8-5/16" (211mm) x 8-5/16" (211mm)

Photometry

SDR6-11L-9ACK-TRI10V-WH-UNV (3000K) BASED ON TEST #: PL16908-002A
Luminaire photometry has been conducted in accordance with IES LM-79. IES LM-79 specifies the entire luminaire as the source resulting in a luminaire efficiency of 100%



Coefficients Of Utilization – Zonal Cavity Method

RC %:	80			
RW %:	70	50	30	10
RCR: 0	119	119	119	119
1	109	104	99	95
2	98	90	83	77
3	90	79	71	64
4	82	70	61	54
5	75	62	53	47
6	70	56	47	41
7	65	51	42	36
8	60	46	38	32
9	56	43	34	29
10	53	39	31	26

Effective Floor Cavity Reflectance: 20%

Average Luminance Table (cd/m2)

Vertical Angle	Horizontal Angle		
	0°	45°	90°
45°	27,850	27,915	27,887
55°	26,791	26,805	26,774
65°	25,417	25,382	25,361
75°	23,153	23,131	22,988
85°	19,266	18,940	16,694

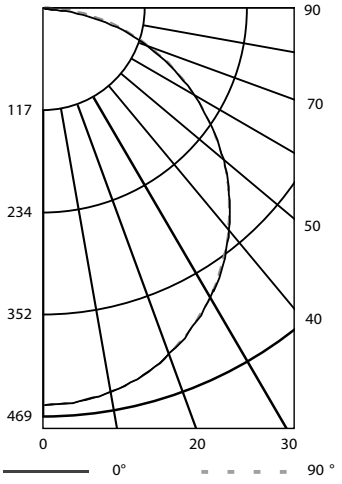
Zonal Lumen Summary

Zone	Lumens	% Lamp	Luminaire
0-30	372.53	N/A	27%
0-40	609.77	N/A	44.2%
0-60	1,078.10	N/A	78.1%
0-90	1,381.11	N/A	100%
0-180	1,381.11	N/A	100%

Reference creelighting.com/products/indoor/downlights/sd-series for detailed photometric data

Photometry

SDS6-11L-9ACK-TRI10V-WH-UNV (3000K) BASED ON TEST #: PL16907-001A
Luminaire photometry has been conducted in accordance with IES LM-79. IES LM-79 specifies the entire luminaire as the source resulting in a luminaire efficiency of 100%



Coefficients Of Utilization – Zonal Cavity Method

RC %:	80			
RW %:	70	50	30	10
RCR: 0	119	119	119	119
1	108	104	99	95
2	98	90	83	77
3	90	79	71	64
4	82	70	61	54
5	75	62	53	47
6	70	56	47	41
7	65	51	42	36
8	60	46	38	32
9	56	43	34	29
10	53	39	31	26

Effective Floor Cavity Reflectance: 20%

Average Luminance Table (cd/m2)

Vertical Angle	Horizontal Angle		
	0°	45°	90°
45°	26,825	26,851	26,975
55°	25,747	25,801	25,962
65°	24,483	24,529	24,741
75°	22,611	22,675	22,865
85°	19,344	18,378	18,166

Zonal Lumen Summary

Zone	Lumens	% Lamp	Luminaire
0-30	361.91	N/A	27%
0-40	591.25	N/A	44.2%
0-60	1,042.72	N/A	77.9%
0-90	1,338.54	N/A	100%
0-180	1,338.54	N/A	100%

Reference creelighting.com/products/indoor/downlights/sd-series for detailed photometric data

Application Reference

SDR

Open Space						
Spacing	**Lumen Package**	**Lumens**	**Wattage**	**LPW**	**w/ft2**	**Average fc**
4 x 4	11L	1,350	16	84	0.96	76
6 x 6	11L	1,350	16	84	0.45	35
8 x 8	11L	1,350	16	84	0.24	19
10 x 10	11L	1,350	16	84	0.16	13

10' ceiling: 80/50/20 reflectances; 2.5' workplane, open room. LLF: 1.0 Initial
Open Space: 50' x 40' x 10'

Corridor Space						
Spacing	**Lumen Package**	**Lumens**	**Wattage**	**LPW**	**w/ft2**	**Average fc**
4' OC	11L	1,350	16	84	0.67	29
6' OC	11L	1,350	16	84	0.45	20
8' OC	11L	1,350	16	84	0.32	14
10' OC	11L	1,350	16	84	0.27	12

10' ceiling: 80/50/20 reflectances; 2.5' workplane, open room. LLF: 1.0 Initial
Corridor Space: 6' x 100' x 10'

SDS

Open Space						
Spacing	**Lumen Package**	**Lumens**	**Wattage**	**LPW**	**w/ft2**	**Average fc**
4 x 4	7L	830	12	69	0.72	47
6 x 6	7L	830	12	69	0.34	22
8 x 8	7L	830	12	69	0.18	12
10 x 10	7L	830	12	69	0.12	8
4 x 4	18L	2,070	22	94	1.32	117
6 x 6	18L	2,070	22	94	0.62	54
8 x 8	18L	2,070	22	94	0.33	29
10 x 10	18L	2,070	22	94	0.22	20

10' ceiling: 80/50/20 reflectances; 2.5' workplane, open room. LLF: 1.0 Initial
Open Space: 50' x 40' x 10'

Corridor Space						
Spacing	**Lumen Package**	**Lumens**	**Wattage**	**LPW**	**w/ft2**	**Average fc**
4' OC	7L	830	12	69	0.50	18
6' OC	7L	830	12	69	0.34	12
8' OC	7L	830	12	69	0.24	9
10' OC	7L	830	12	69	0.20	7
4' OC	18L	2,070	22	94	0.92	45
6' OC	18L	2,070	22	94	0.62	31
8' OC	18L	2,070	22	94	0.44	22
10' OC	18L	2,070	22	94	0.37	18

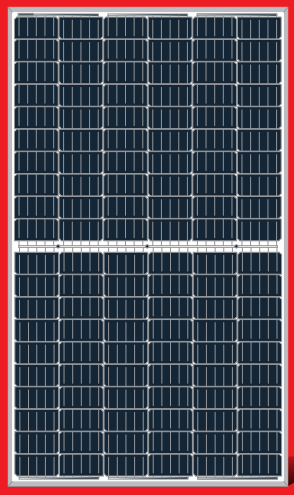
10' ceiling: 80/50/20 reflectances; 2.5' workplane, open room. LLF: 1.0 Initial
Corridor Space: 6' x 100' x 10'

Website: creelighting.com
US: (800) 236-6800 **Canada:** (800) 473-1234

CREE LIGHTING®

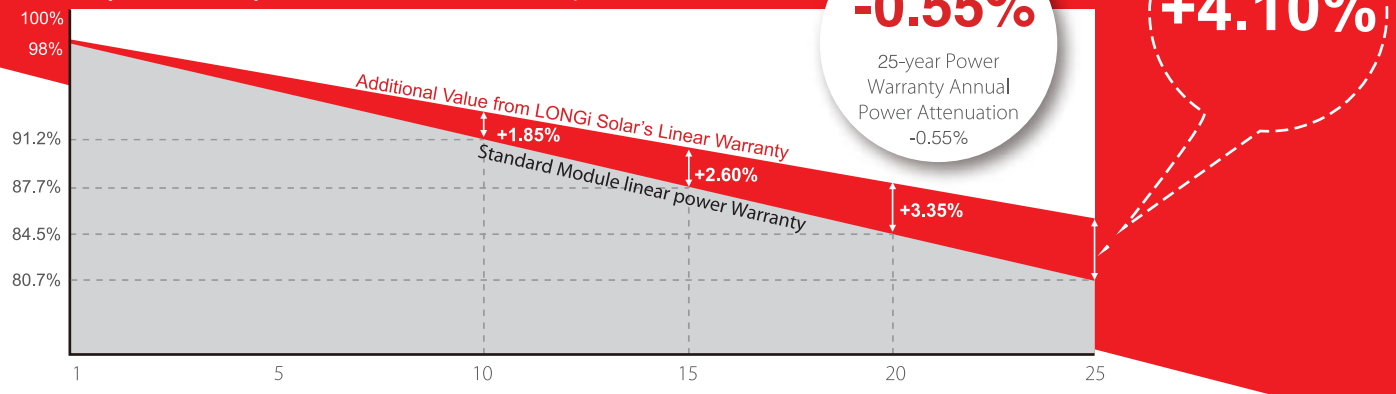
LR6-60HPH
310~330M

Hi-MO 3m



High Efficiency Low LID Mono PERC with Half-cut Technology

12-year Warranty for Materials and Processing;
25-year Warranty for Extra Linear Power Output



Complete System and Product Certifications

IEC 61215, IEC 61730, UL 1703

ISO 9001:2008: ISO Quality Management System

ISO 14001: 2004: ISO Environment Management System

TS62941: Guideline for module design qualification and type approval

OHSAS 18001: 2007 Occupational Health and Safety

* Specifications subject to technical changes and tests.
LONGi Solar reserves the right of interpretation.

Positive power tolerance (0 ~ +5W) guaranteed

High module conversion efficiency (up to 19.7%)

Slower power degradation enabled by Low LID Mono PERC technology: first year <2%, 0.55% year 2-25

Solid PID resistance ensured by solar cell process optimization and careful module BOM selection

Reduced resistive loss with lower operating current

Higher energy yield with lower operating temperature

Reduced hot spot risk with optimized electrical design and lower operating current

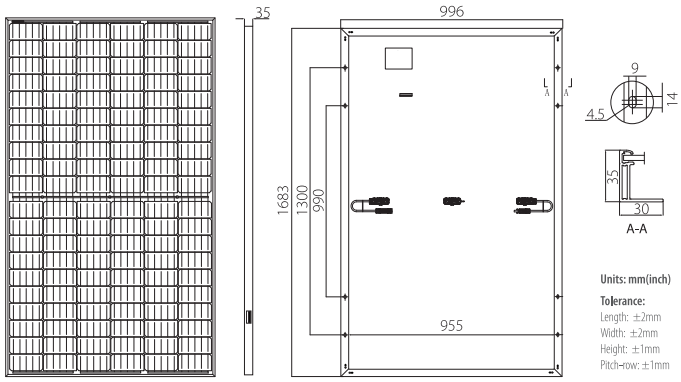
LONGi

Room 801, Tower 3, Lujiazui Financial Plaza, No.826 Century Avenue, Pudong Shanghai, 200120, China
Tel: +86-21-80162606 E-mail: module@longi-silicon.com Facebook: www.facebook.com/LONGi Solar

20200401V11

LR6-60HPH 310~330M

Design (mm)



Mechanical Parameters

Cell Orientation: 120 (6×20)

Junction Box: IP67, three diodes

Output Cable: 4mm², 300mm in length, length can be customized

Glass: Single glass
3.2mm coated tempered glass

Frame: Anodized aluminum alloy frame

Weight: 18.9kg

Dimension: 1683×996×35mm

Packaging: 30pcs per pallet
180pcs per 20'GP
780pcs per 40'HC

Operating Parameters

Operational Temperature: -40℃~+85℃

Power Output Tolerance: 0~+5 W

Voc and Isc Tolerance: ±3%

Maximum System Voltage: DC1500V (IEC/UL)

Maximum Series Fuse Rating: 20A

Nominal Operating Cell Temperature: 45±2℃

Safety Class: Class II

Fire Rating: UL type 1 or 2

Electrical Characteristics

Test uncertainty for Pmax: ±3%

Model Number	LR6-60HPH-310M		LR6-60HPH-315M		LR6-60HPH-320M		LR6-60HPH-325M		LR6-60HPH-330M	
Testing Condition	STC	NOCT	STC	NOCT	STC	NOCT	STC	NOCT	STC	NOCT
Maximum Power (Pmax/W)	310	229.6	315	233.4	320	237.1	325	240.8	330	244.5
Open Circuit Voltage (Voc/V)	40.3	37.7	40.6	37.9	40.9	38.2	41.1	38.4	41.4	38.6
Short Circuit Current (Isc/A)	9.86	7.94	9.94	8.01	10.02	8.08	10.12	8.16	10.19	8.22
Voltage at Maximum Power (Vmp/V)	33.3	30.8	33.7	31.1	33.9	31.3	34.1	31.5	34.4	31.7
Current at Maximum Power (Imp/A)	9.30	7.46	9.36	7.50	9.43	7.56	9.52	7.64	9.61	7.70
Module Efficiency(%)	18.5		18.8		19.1		19.4		19.7	

STC (Standard Testing Conditions): Irradiance 1000W/m², Cell Temperature 25℃, Spectra at AM1.5

NOCT (Nominal Operating Cell Temperature): Irradiance 800W/m², Ambient Temperature 20℃, Spectra at AM1.5, Wind at 1m/S

Temperature Ratings (STC)

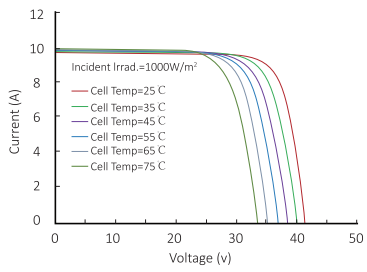
Temperature Coefficient of Isc	+0.057%/℃
Temperature Coefficient of Voc	-0.286%/℃
Temperature Coefficient of Pmax	-0.370%/℃

Mechanical Loading

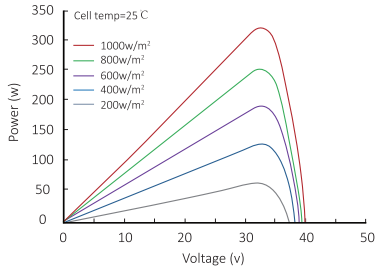
Front Side Maximum Static Loading	5400Pa
Rear Side Maximum Static Loading	2400Pa
Hailstone Test	25mm Hailstone at the speed of 23m/s

I-V Curve

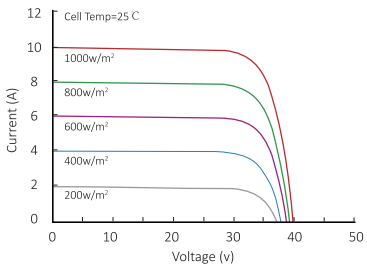
Current-Voltage Curve (LR6-60HPH-320M)



Power-Voltage Curve (LR6-60HPH-320M)



Current-Voltage Curve (LR6-60HPH-320M)



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Tel: +86-21-80162606 E-mail: module@longi-silicon.com Facebook: www.facebook.com/LONGi Solar

T5632-W

3.6A USB Type-A/Type-A Wall Outlet Charger with 15A Tamper-Resistant Receptacles

Combination Duplex Receptacle/Outlet and USB Charger. 15 Amp, 125 Volt, Decora Tamper-Resistant Receptacle/Outlet, NEMA 5-15R. 3.6 Amps, 5VDC, 2.0 Type A USB Chargers. Grounding, Side Wired & Back Wired - White

- SMART - Built-in smart chip recognizes the individual device' s charging requirement to optimize the charge
- POWERFUL – Two high-powered charging ports with 3.6A of charging power
- CONVENIENT – No more searching for charging adapters! Upgrade your existing outlets so you can charge up to two USB powered electronics at once, leaving the outlets free for additional power needs
- EASY - Compact design fits in a standard wallbox and works with Decora and Decora Plus screwless wallplates.

Color : White

UPC Code : 078477683866

Country Of Origin : China

NEMA : 5-15R

Available Colors :

Brown, Black, Gray, Ivory, Light Almond

Technical Information

Electrical Specifications

Amperage : 15 A

Flammability : Rated V-0 per UL 94

Grounding : Grounding

Horsepower Rating : 15A-1/2 HP

Operating Temperature : -10° C to 40°C

Ratings : 15A-125V

Environmental Specifications

Body Material : Thermoplastic

Color : White

Cover Material : Thermoplastic

Flammability : Rated V-0 per UL 94

Operating Temperature : -10° C to 40°C

Strap Material : Steel

Material Specifications

Body Material : Thermoplastic

Color : White

Cover Material : Thermoplastic

Product ID : Stamped on Strap

Strap Material : Steel

Terminal Accom. : 14-12 AWG

Terminal ID : Brass-Hot Black-Hot White-Neutral Green-Gnd

Termination : Back & Side

Torque Range : 14 – 18 in.-lbs

Mechanical Specifications

Amperage : 15 A

Color : White

Grade : Residential /Commercial Specification Grade

Product ID : Stamped on Strap

Terminal Accom. : 14-12 AWG

Terminal ID : Brass-Hot Black-Hot White-Neutral Green-Gnd

Termination : Back & Side

Torque Range : 14 – 18 in.-lbs

Product Features

Amperage : 15 A

Brand : Decora

Standards and Certifications

FCC Part 15 : Class B

Listed : cCSAus

Grade : Residential /Commercial Specification Grade

Grounding : Grounding

Horsepower Rating : 15A-1/2 HP

NEMA : 5-15R

Product Type : Outlet/USB Combo

Ratings : 15A-125V

Type : Type A/A Duplex Receptacle

Voltage : 125 VAC

Wallplate : Not Included

NOM : 057

UL 1310 : Yes

UL 498 : Yes

Warranty : 2-Year Limited

Features and Benefits

- Perfect for use in residential applications such as kitchens, bedrooms and home offices and in commercial applications such as hotels, airports, restaurants and cafes, salons, office cubicles and college dorm rooms
- Smart chip recognizes and optimizes the charging requirements of individual devices
- Tested to withstand over 10,000 insertions.
- Compatible with USB 3.1, 3.0, 2.0, 1.1 devices
- Fits in a standard wallbox, is compatible with standard wallplates and can be multi-ganged with other devices
- Easy to install. Can replace existing outlets
- No data transfer capability
- Compatible with Decora® wallplates and Decora Plus™ screwless wallplates. Wallplate sold separately

Leviton Manufacturing Co., Inc

201 North Service Road, Melville, NY 11747

Telephone: +1-800-323-8920 · FAX: +1-800-832-9538 · Tech Line (8:30AM-7:30PM E.S.T. Monday-Friday): +1-800-824-3005

Leviton Manufacturing of Canada, Ltd.

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Lago Tana 43, Mexico DF, Mexico CP 11290 · Tel.: (+52)55-5082-1040 · FAX: (+52) 5386- 1797 ·

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