

How much energy will it harvest?

Energy prediction for the 6.5 kWp home system in Tasai, Chiang Rai | 10 × LONGi Hi-MO X10 650 W | Solis 10 kW hybrid inverter | 11 October 2026

6.5 kWp System size	~26 kWh Average day	~32.6 kWh Clear cool-season day	~9,400 kWh First year
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Drone view of the installation: two arrays of five modules each on a flat concrete roof slab.

Summary

The system is 10 LONGi Hi-MO X10 back-contact modules of 650 W, arranged as two rows of five on tilted galvanized-steel frames above the flat concrete roof of the carport, facing south at about 16°. The array is rated 6.5 kWp and feeds a Solis 10 kW single-phase hybrid inverter, one row on each MPPT input. In Chiang Rai conditions it should deliver about 26 kWh on an average day and about 9,400 kWh in its first year, peaking near 5.0–5.5 kW around noon on a clear day. The inverter passes all of it and leaves room to add panels and a battery later.

1. The installation

Item	Detail
Site	Home in Tasai, Chiang Rai; flat concrete roof of the carport
Modules	10 × LONGi Hi-MO X10, LR7-72HVV-650M, 650 W
Array rating	6.5 kWp
Layout	2 rows × 5 modules, portrait; each row is one string
Module area / weight	About 27 m ² and 285 kg in total, before the steel frame
Mounting	Raised, tilted galvanized-steel frames anchored to the concrete slab
Tilt and direction	About 16° toward the south, close to the optimum for Chiang Rai
Inverter	Solis 10 kW single-phase hybrid, S6-EH1P-L-PLUS series, 2 MPPT; no battery yet
Access	Clear walkway between the two rows

Why a flat slab works well

- No penetrations through roof tiles, so there is no leak risk on the main house roof.
- Tilt and direction are set by the frame, not dictated by a roof pitch, so the rows face south at the angle we chose.
- The raised frame lets air move behind the modules, so they run cooler and produce slightly more than modules fixed flat to a metal roof.
- Cleaning and inspection are easy and safe, with a walkway between the arrays.

Points to watch

- **Row-to-row shading.** The front row can shade the lower edge of the rear row when the sun is low: early morning, late afternoon and around December.
- **Trees.** The palms and garden trees beside the roof are close to the nearest row and will grow. Shade on a few cells pulls down the whole string, so they need regular trimming.
- **Power pole and overhead lines.** They cast long, thin shadows at the street corner. The loss is small but worth checking on the monitoring curve.
- **Dust.** Rain washes the modules at this tilt, but in the dry season dust builds up; cleaning in February–April pays back.

2. The modules

Figures from the LONGi LR7-72HVV datasheet for the 650 W model, at standard test conditions.

Parameter	Value	What it means here
Maximum power	650 W (tolerance 0 to +3%)	10 modules = 6.5 kWp
Module efficiency	24.1%	High output from a small roof area
Open-circuit voltage (Voc)	53.90 V	About 270 V for a string of 5
Voltage at maximum power (Vmp)	44.56 V	About 223 V for a string of 5
Current at maximum power (Imp)	14.59 A	Within the inverter limit of 21 A per input
Short-circuit current (Isc)	15.29 A	Well within the inverter limit; sets cable, fuse and breaker ratings
Power temperature coefficient	-0.26% per °C	About 9% loss at a 60 °C cell, against about 12% for ordinary modules
Size and weight	2,382 × 1,134 × 30 mm, 28.5 kg	About 10.6 kg per m ² on the frame
Power warranty	30 years: under 1% in year 1, then 0.35% a year	88.85% of rated power left at year 30

3. The inverter

Figures from the Solis S6-EH1P(3-10)K-L-PLUS datasheet for the 10 kW model. It is a single-phase hybrid inverter with two independent MPPT inputs, a backup output, a generator input and a port for a low-voltage (40–60 V) battery.

Inverter limit	Datasheet value (10 kW)	This array (5 modules per string)	Result
Maximum input voltage	500 V	About 278 V open-circuit on a cold 10 °C morning	OK
MPPT voltage range	90–435 V	About 223 V at 25 °C, about 200 V with hot modules	OK
Start-up voltage	90 V	Reached soon after sunrise	OK
Maximum current per input	21 A	14.59 A	OK
Maximum short-circuit current	48 A per MPPT	15.29 A	OK
Rated AC output	10 kW	About 5.0–5.5 kW at the noon peak	OK
Maximum usable PV input	16 kW	6.5 kWp	OK

Stringing

- **Two strings of five, one per MPPT.** This is how the system is wired, and it is the only correct arrangement for this inverter. Each row works independently, so shade on one does not pull down the other.
- **Never ten in series.** Ten modules give 539 V open-circuit, above the inverter's 500 V maximum, and would damage it.
- **Operating point.** The strings run at 200–223 V, below the inverter's 330 V rated voltage but well inside its MPPT range. Efficiency is slightly lower here than at rated voltage, which is allowed for in the prediction.

Headroom for later

- **No clipping.** The array peaks at about half the inverter's 10 kW output, so every kilowatt-hour the panels make passes through. Maximum inverter efficiency is 96.2%.
- **More panels.** The inverter can use up to 16 kW of PV and has two string inputs on each MPPT. A second string of five matching modules could be added to each row's MPPT, doubling the array to 13 kWp without changing the inverter.
- **A battery.** None is fitted yet. The inverter accepts any 40–60 V battery. PV-to-battery charging is 95.3% efficient and discharge 93.8%, so stored energy comes back at about 89%.

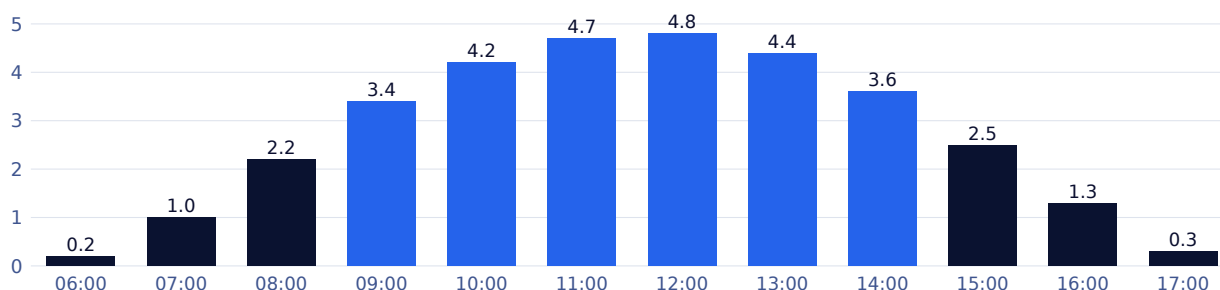
4. Predicted energy harvest

A well-sited array in northern Thailand delivers about 4.0 kWh per kWp per day over the year, roughly 1,450 kWh per kWp annually, after temperature, inverter, cable and dust losses. Applied to 6.5 kWp facing south at 16°:

Period	Energy
Average day	~26 kWh
Clear cool-season day	~32-33 kWh
Overcast rainy-season day	~12-17 kWh
Average month	~785 kWh
First year	~9,400 kWh

Through a clear day

kWh in the hour starting



Hourly energy on a clear cool-season day, total about 32.6 kWh. Blue bars mark 09:00–15:00, when about 77% of the day's energy arrives.

Peak output around noon should be about 5.0–5.5 kW. The array rarely reaches its full 6.5 kW rating because hot modules lose roughly 9% at midday, with further small losses in cables and the inverter. The 10 kW inverter passes all of it.

Through the seasons

Season	Conditions	Effect on harvest
November–February	Clear skies, cool modules	Best days of the year; low sun makes row and tree shading worst
March–April	Strongest sun, heat and burning-season haze	Haze and dust take 5–15% off; clean the modules
June–September	Cloud and rain	Average falls to about 3.0–3.5 kWh per kWp per day (20–23 kWh); rain keeps modules clean

Over the system life

Year	Annual energy	Share of year 1
1	~9,400 kWh	100%
10	~9,050 kWh	96%
20	~8,750 kWh	93%
30	~8,400 kWh	89%

Following the warranty curve, the system should produce roughly 265,000 kWh over 30 years.

5. Basis and limits of this prediction

- **Method:** typical solar yield for Chiang Rai applied to the installed array, with the module and inverter figures taken from the manufacturer datasheets in the appendices. It is an estimate, not a site simulation or a measurement.
- **Not included:** shading from the trees, the power pole or the front row on the rear one. Heavy shade can cut the figures noticeably.
- **Expected accuracy:** about $\pm 10\%$ on the annual figure; single days vary far more with weather.
- **How to check it:** compare with the daily and monthly totals in SolisCloud. A clear day well below about 30 kWh points to shade, dust or a fault worth investigating.

Appendices

- **Appendix A:** LONGi Hi-MO X10 LR7-72HVVH 630–650M module datasheet (2 pages).
- **Appendix B:** Solis S6-EH1P(3-10)K-L-PLUS hybrid inverter datasheet (2 pages).

The manufacturer datasheets follow this page unaltered.

Hi-MO X10 Explorer

LR7-72HVH 630~650M

- Suitable for Distribution Market
- Highest efficiency with the best energy generation performance
- TaiRay wafer & BC technology enhances high product reliability
- Smart manufacturing & LONGi product lifecycle standards deliver exceptional product quality

15

15-year Warranty for
Materials and Processing

30

30-year Warranty for Extra
Linear Power Output

Complete System and Product Certifications

IEC 61215, IEC 61730, UL 61730

ISO9001:2015: ISO Quality Management System

ISO14001: 2015: ISO Environment Management System

ISO45001: 2018: Occupational Health and Safety

IEC62941: Guideline for module design qualification and type approval

LONGi



Hi-MO X10 Explorer

LR7-72HVH 630~650M

24.1%
MAX MODULE
EFFICIENCY

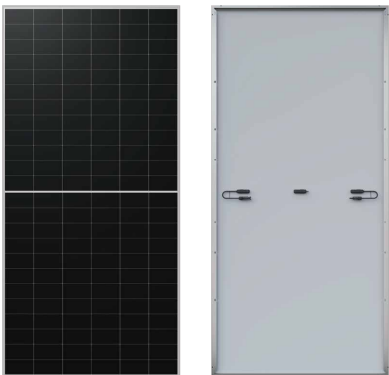
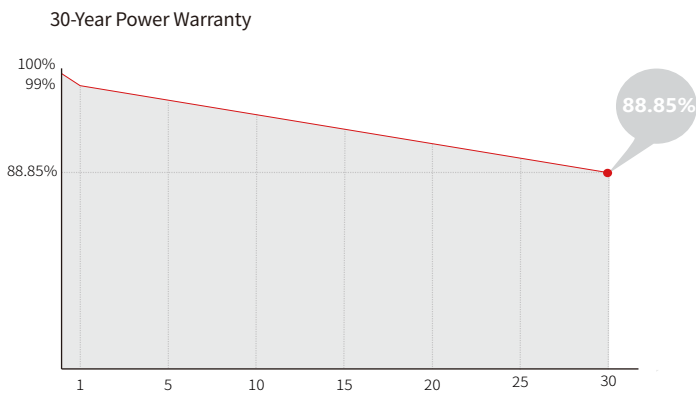
0~3%
POWER
TOLERANCE

<1%
FIRST YEAR
POWER DEGRADATION

0.35%
YEAR 2-30
POWER DEGRADATION

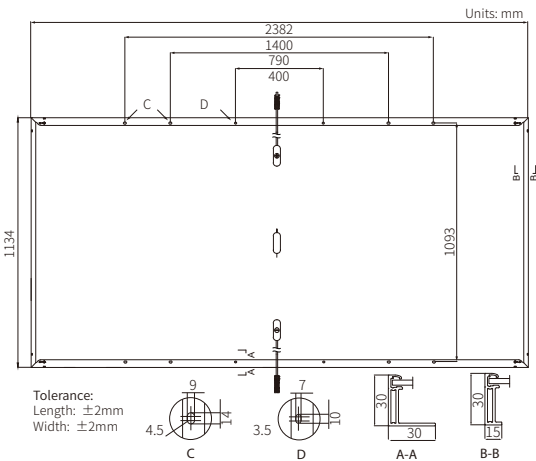
BC-CELL
LOWER OPERATING
TEMPERATURE

Additional Value



Mechanical Parameters

Cell Orientation	144 (6×24)
Junction Box	IP68, three diodes
Output Cable	4mm ² , +400, -200mm/±1400mm length can be customized
Glass	Single glass, 3.2mm coated tempered glass
Frame	Anodized aluminum alloy frame
Weight	28.5kg
Dimension	2382×1134×30mm
Packaging	36pcs per pallet / 144pcs per 20' GP / 720pcs per 40' HC



Electrical Characteristics	STC : AM1.5 1000W/m² 25°C				NOCT : AM1.5 800W/m² 20°C 1m/s				Test uncertainty for Pmax: ±3%			
	LR7-72HVH-630M		LR7-72HVH-635M		LR7-72HVH-640M		LR7-72HVH-645M		LR7-72HVH -650M			
	Testing Condition		STC	NOCT	STC	NOCT	STC	NOCT	STC	NOCT		
	Maximum Power (Pmax/W)		630	480	635	483	640	487	645	491	650	495
	Open Circuit Voltage (Voc/V)		53.50	50.84	53.60	50.94	53.70	51.04	53.80	51.13	53.90	51.23
	Short Circuit Current (Isc/A)		14.97	12.02	15.05	12.09	15.13	12.15	15.21	12.22	15.29	12.28
	Voltage at Maximum Power (Vmp/V)		44.16	41.96	44.26	42.06	44.36	42.15	44.46	42.25	44.56	42.35
	Current at Maximum Power (Imp/A)		14.27	11.44	14.35	11.50	14.43	11.56	14.51	11.63	14.59	11.69
	Module Efficiency(%)		23.3		23.5		23.7		23.9		24.1	

Operating Parameters

Operational Temperature	-40°C ~ +85°C
Power Output Tolerance	0 ~ 3%
Maximum System Voltage	DC1500V (IEC)
Maximum Series Fuse Rating	25A
Nominal Operating Cell Temperature	45±2°C
Protection Class	Class II
Fire Rating	IEC Class C

Mechanical Loading

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

Temperature Ratings (STC)

Temperature Coefficient of Isc	+0.050%/°C
Temperature Coefficient of Voc	-0.200%/°C
Temperature Coefficient of Pmax	-0.260%/°C



Specifications included in this datasheet are subject to change without notice.
LONGi reserves the right of final interpretation. (20240927 V01 Draft)

3-10K

SOLARATOR SERIES

Experience Uninterrupted Power with Solis Energy Storage Inverters

S6-EH1P(3-8)K-L-PLUS**S6-EH1P(9-10)K-L-PLUS(21A)**

Single Phase | Low Voltage



- Supports PV input up to 160% of the inverter's rated DC power, maximising solar utilisation
- Supports up to 21A PV input current, compatible with future higher-power PV modules
- 200% overload for 10s in off-grid mode, ensuring stable startup of motors, water pumps and air conditioners
- Seamless on/off-grid switching in under 10ms, guaranteeing an uninterrupted power supply
- More battery options, compatible with any battery (between 40V-60V)
- Supports existing PV grid-tied power connection for export control and off-grid use
- Multiple methods of generator connection and auto control, enabling flexible local deployment
- Support max 6 units in parallel, expanding system capacity
- Smart Load management, extending backup time for critical loads
- Customizable battery backup level for uninterrupted power
- Supports PV-only off-grid operation, reducing upfront costs
- SolisCloud: Smart remote control, AI optimisation, and instant troubleshooting - all in one platform
- 7-inch industrial-grade LCD screen, providing a larger, user-friendly interface for local operation
- Ingress protection IP66, for operation in harsh conditions

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DATASHEET

Models	3K	3.6K	4.6K	5K	6K	8K	9K(21A)	10K(21A)
Input DC (PV side)								
Recommended max. PV array size	6 kW	7.2 kW	9.2 kW	10 kW	12 kW	16 kW	18 kW	20 kW
Max. usable PV input power	4.8 kW	5.76 kW	7.36 kW	8 kW	9.6 kW	12.8 kW	14.4 kW	16 kW
Max. input voltage	500 V							
Rated voltage	330 V							
Start-up voltage	90 V							
MPPT voltage range	90 - 435 V							
Max. input current	16 A / 16 A					32 A / 32 A	42 A / 42 A	
Max. current per DC input	16 A						21 A	
Max. short circuit current	20 A / 20 A					40 A / 40 A	48 A / 48 A	
MPPT number / Max. input strings number	2 / 2						2 / 4	
Battery								
Battery type	Li-ion / Lead-acid							
Battery voltage range	40 - 60 V							
Max. charge / discharge current	70 A	80 A	105 A	112 A	135 A	190 A	200 A	210 A
Number of battery port / Number of BMS port	1 / 1							
Communication	CAN / RS485							
Output AC (Grid side)								
Rated output power	3 kW	3.6 kW	4.6 kW	5 kW	6 kW	8 kW	9 kW	10 kW
Max. apparent output power	3 kVA	3.6 kVA	4.6 kVA	5 kVA	6 kVA	8 kVA	9 kVA	10 kVA
Rated grid voltage	L/N/PE, 220 V / 230 V							
Rated grid frequency	50 Hz / 60 Hz							
Rated grid output current	13.7 A / 13.1 A	16.4 A / 15.7 A	20.9 A / 20 A	22.8 A / 21.8 A	27.3 A / 26.1 A	36.4 A / 34.8 A	40.9 A / 39.1 A	45.5 A / 43.5 A
Power factor	> 0.99 (0.8 leading - 0.8 lagging)							
THDi	< 3%							
Input AC (Grid side)								
Max. input power	4.6 kW	5.5 kW	6.4 kW	7 kW	8.8 kW	11 kW	13.2 W	14.3 W
Input voltage range	187 - 253 V							
Max. input current	21 A	25 A	29 A	32 A	40 A	50 A	60 A	65 A
Output AC (Back-up)								
Rated output power	3 kW	3.6 kW	4.6 kW	5 kW	6 kW	8 kW	9 kW	10 kW
Max. apparent output power	2 times of rated power, 10 s							
Back-up switch time ^①	< 10 ms							
Rated output voltage	L/N/PE, 220 V / 230 V							
Rated frequency	50 Hz / 60 Hz							
Rated output current	13.7 A / 13.1 A	16.4 A / 15.7 A	20.9 A / 20 A	22.8 A / 21.8 A	27.3 A / 26.1 A	36.4 A / 34.8 A	40.9 A / 39.1 A	45.5 A / 43.5 A
Max. AC passthrough current	35 A	35 A	40 A	40 A	40 A	50 A	60 A	65 A
THDv (@linear load)	< 2%							
Input AC (Generator side)								
Max. input power	3 kW	3.6 kW	4.6 kW	5 kW	6 kW	8 kW	9 kW	10 kW
Rated input current	13.7 A / 13.1 A	16.4 A / 15.7 A	20.9 A / 20 A	22.8 A / 21.8 A	27.3 A / 26.1 A	36.4 A / 34.8 A	40.9 A / 39.1 A	45.5 A / 43.5 A
Rated input voltage	L/N/PE, 220 V / 230 V							
Rated input frequency	50 Hz / 60 Hz							
Efficiency								
Max. efficiency	96.2%							
EU efficiency	96.1%							
BAT charged by PV / AC max. efficiency	95.3% / 93.9%							
Battery discharged efficiency	93.8%							
Protection								
Surge protection	Yes							
Output over current protection	Yes							
Insulation resistance monitoring	Yes							
Residual current detection	Yes							
Integrated PV switch	Yes							
DC reverse-polarity protection	Yes (PV only)							
Protection class / Over voltage category	I / II (PV and BAT), III (MAINS and BACKUP and GEN)							
Integrated AFCI 2.0	Optional							
Anti-islanding protection	Yes							
General Data								
Dimensions (W × H × D)	335 × 560 × 253 mm							
Weight	23 kg					23.5 kg	23.8 kg	
Inverter topology	Non-isolated (PV), Isolated (Battery)							
Self-consumption	< 40 W							
Operating temperature range	-25 ~ +60°C							
Relative humidity	0 - 100%							
Ingress protection	IP66							
Noise emission (typical)	< 40 dB(A)					< 65 dB(A)		
Cooling concept	Natural cooling					Intelligent redundant fan-cooling		
Max. operation altitude	3000 m							
Grid connection standard	NRS 097-2-1, IEC 62116, IEC 61727, IEC 60068, IEC 61683, EN 50530, EN 50549-1, MEA, PEA, NBR 16149, NBR 16150, G98, G99, CEI 0-21, NTS 631 TypeA							
Safety / EMC standard	IEC/EN 62109-1/-2, EN 61000-6-2/-3							
Features								
PV connection	MC4 connector							
Battery connection	Terminal Block							
AC connection	Terminal Block							
Display	7.0" LCD display & Bluetooth + APP							
Communication interface	Standard: WIFI+LAN+Bluetooth, CAN-BMS, CAN-Parallel×2, RS485-Meter, RS485, DRM, DI, DO×2; Optional: 4G							

① From On-Grid Mode to Off-Grid Mode: For a single inverter system, switchover time <10ms.

For a parallel system which consists of up to 6 inverters, switchover time <20ms.

If customer wishes to connect more than 6 inverters in parallel, please contact Solis Technical Team.