SOLAR EPC

100 kWp with battery storage

INDICATIVE QUOTATION AND ENGINEERING REFERENCE

REFERENCE ONLY - SUBJECT TO FORMAL CONFIRMATION. This pre-survey estimate preserves the original quantities, unit selling prices and quotation reference. Supplier purchase prices, the roof, point of connection and contract-specific taxes require confirmation. It is not an approved design, signed offer, compliance certificate or outage-backup commitment.

QUANG ANH ELECTRICAL CONSTRUCTION COMPANY LIMITED

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REFERENCE ONLY - SUBJECT TO FORMAL CONFIRMATION

PRE-SURVEY ESTIMATE

Quotation reference: QAC-SOL-EST-20261104-D338CDA1 | Date: 04/11/2026

Dear Customer,

Project: Solar power system

Location: project site to be confirmed

Indicative quotation based on the available information. The scope and technical solution will be confirmed after the site survey and design review.

CONFIGURATION AND SCOPE

Required: 100.00 kWp | Planned installation: 100.48 kWp DC | 90 kW AC | DC/AC 1.116

157 LONGi Solar LR7-72HVH-640M modules; 3 Sungrow SG30CX-P2 inverters

9 strings; 17-18 modules/string. Module area 424.1 m²; entered gross roof area 800.0 m².

Standard package | Supply and installation items are listed in the detailed table.

Quotation value (VND)

Total before VAT	1,655,530,580
VAT scenario - 10%	165,553,058
Total including VAT	1,821,083,638

English edition: 05 Nov 2026. The original reference and pricing snapshot are retained. VAT is a scenario; the applicable rate is confirmed under the contract/invoice.

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1. Detailed supply and installation BOQ

87 priced lines. Original item codes, quantities, unit selling prices and line amounts are retained. VND values exclude VAT unless explicitly stated.

ID	Material / work item	Specification / scope	Unit	Qty	Unit price (VND)	Amount (VND)
	I. MAIN EQUIPMENT					625,853,250
1	LONGi Solar LR7-72HVH-640M photovoltaic module	640 Wp · 2382x1134x30mm	module	157	2,831,738	444,582,866
2	Sungrow SG30CX-P2 grid-connected inverter	30 kW AC · 400 V · 3-phase · 3 MPPT	set	3	41,319,254	123,957,762
3	Sungrow Logger1000A/B data logger - preliminary selection	Sungrow · Data acquisition and monitoring. Export-control capability depends on the confirmed configuration.	set	1	22,016,099	22,016,099
4	RS485 shielded twisted-pair cable, 2 × 0.75 mm²		m	90	35,861	3,227,490
5	RJ45 Cat6 UTP Ethernet patch lead, 1.5 m		piece	2	95,246	190,492
139	Bidirectional power meter/transducer at the point of connection	Bidirectional power measurement for control at the point of connection.	piece	1	7,208,142	7,208,142
140	PCC metering CT/VT scope - voltage level and diagram require confirmation	Metering scope. Confirm the CT/VT configuration against the approved diagram.	lot	1	14,546,837	14,546,837
141	Export-control integration and response/loss-of-signal testing	Export-limiting integration and interlock testing to the confirmed design.	lot	1	5,332,644	5,332,644
142	Network infrastructure, auxiliary power and monitoring enclosure - scope to be finalised	Additional monitoring infrastructure depends on the actual layout. Configuration requires confirmation.	lot	1	4,790,918	4,790,918
	II. MOUNTING STRUCTURE / ALUMINIUM MATERIALS					57,276,036
6	Standing-seam/cliplock roof clamps and fastening bolts		set	332	29,920	9,933,440
7	Extruded aluminium rail, 4.35 m long	Chiko	length	88	400,145	35,212,760
8	Aluminium rail splice with stainless-steel M8 bolts		set	70	23,831	1,668,170

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ID	Material / work item	Specification / scope	Unit	Qty	Unit price (VND)	Amount (VND)
9	Mid clamps for 30 mm module frames, including bolts, nuts and washers	Chiko	set	296	14,318	4,238,128
10	End clamps for 30 mm module frames, including bolts, nuts and washers	Chiko	set	36	14,290	514,440
11	Earthing clip for mid clamps	Chiko	set	296	14,318	4,238,128
12	Earthing conductor clamp with stainless-steel M8 bolt	Chiko	set	18	29,771	535,878
14	DC cable clips suited to the outer diameter of 6 mm² PV cable	Chiko	set	314	2,978	935,092
	III. DC CABLES / DC ACCESSORIES					46,657,309
17	Solar DC cable, 6 mm², 1500 VDC - black	Leader DC-6-BK · Single-core PV cable; 1 core; 1,500 VDC; UV-resistant.	m	720	30,330	21,837,600
18	Solar DC cable, 6 mm², 1500 VDC - red	Leader DC-6-RD · Single-core PV cable; 1 core; 1,500 VDC; UV-resistant.	m	720	30,330	21,837,600
19	DC connector pair matching the equipment manufacturer's brand/series	Leader · Connectors from a matching brand/series compatible with the equipment.	pair	18	38,903	700,254
20	Outdoor DC protective conduit - diameter and material to be selected	CVL	m	144	13,346	1,921,824
21	DC protective-conduit connector - to match conduit diameter	CVL	set	18	8,890	160,020
22	Black UV-resistant cable ties, 5 × 200, pack of 500	KST	pack	1	66,669	66,669
23	Black UV-resistant cable ties, 5 × 300, pack of 250	KST	pack	2	66,671	133,342
	IV. AC SWITCHBOARDS / MSB BLOCKS / ACBs / MCCBs					41,153,338

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ID	Material / work item	Specification / scope	Unit	Qty	Unit price (VND)	Amount (VND)
26	Solar enclosure - IP rating, Form and dimensions to be confirmed	Enclosure only; circuit breakers and busbars are listed separately.	piece	1	9,013,135	9,013,135
27	Copper busbars, fabrication, N/PE supports and accessories	Copper busbars, fabrication, supports and N/PE accessories.	assembly	1	4,581,878	4,581,878
28	Control fuses, 3 × 5 A, with holders		Set of 3	1	133,366	133,366
29	R-Y-B phase indicator lamps		piece	3	50,012	150,036
30	AC collector-panel multifunction meter with kWh function - model to be confirmed	Selec · Operational metering at the AC switchboard; it does not replace the control meter at the PCC.	piece	1	3,912,670	3,912,670
32	Solar MSB metering CT, 200/5 A, class 0.5S	Omega CT-200/5A class 0.5S	piece	3	389,602	1,168,806
33	Switchboard auxiliary-circuit protection - rated current to be selected	Omega	piece	1	1,001,572	1,001,572
34	Switchboard temperature sensor		piece	1	556,041	556,041
35	Switchboard ventilation fan		piece	2	1,338,925	2,677,850
36	AC SPD - Type, Uc, Up, In/Imax and coordination to be confirmed	Himel	set	1	3,912,670	3,912,670
37	Solar MSB main MCCB, 400 VAC, 160 A	Mitsubishi NF250-HV 3P 160A · Icu/Ics must suit the prospective short-circuit current at the installation point.	piece	1	6,753,571	6,753,571
38	Inverter-branch MCCB, 400 VAC, 63 A	Mitsubishi NF125-CV 3P 63A · Icu/Ics must suit the prospective short-circuit current at the installation point.	piece	3	2,430,581	7,291,743
	V. LV AC CABLES / BUSDUCT / ACCESSORIES					94,220,444
39	Inverter cable, CXV 4C-16 mm² (3P+N, separate PE)	CADIVI · Cu/XLPE/PVC · 0.6/1 kV	m	75	376,151	28,211,325
40	Main cable, CXV 1C-70 mm², 1 parallel runs per phase and neutral	CADIVI · Cu/XLPE/PVC · 0.6/1 kV	m	140	351,873	49,262,220

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ID	Material / work item	Specification / scope	Unit	Qty	Unit price (VND)	Amount (VND)
41	Main PE cable, CXV 1C-35 mm², 0.6/1 kV	CADIVI · Cu/XLPE/PVC · 0.6/1 kV	m	35	181,934	6,367,690
43	Copper cable lug, 70 mm² - main cable	CU-LUG-70	piece	8	38,896	311,168
44	Cable-lug connection bolts - size to suit the equipment terminals	Cadivi	set	8	22,225	177,800
45	Copper cable lug, 16 mm² - inverter phase	CU-LUG-16	piece	18	11,112	200,016
46	Copper cable lug, 16 mm² - inverter PE	CU-LUG-16	piece	6	11,112	66,672
47	70 mm² cable-lug insulating boot - red	Cadivi BOOT-70	piece	2	6,667	13,334
48	70 mm² cable-lug insulating boot - blue	Cadivi BOOT-70	piece	2	6,667	13,334
49	70 mm² cable-lug insulating boot - yellow	Cadivi BOOT-70	piece	2	6,667	13,334
50	Main neutral cable-lug insulating boot, 70 mm²	Cadivi BOOT-70	piece	2	6,667	13,334
51	16 mm² cable-lug insulating boot - red	Cadivi BOOT-16	piece	6	6,669	40,014
52	16 mm² cable-lug insulating boot - blue	Cadivi BOOT-16	piece	6	6,667	40,002
53	16 mm² cable-lug insulating boot - yellow	Cadivi BOOT-16	piece	6	6,667	40,002
54	16 mm² cable-lug insulating boot - PE colour	Cadivi BOOT-16	piece	6	6,667	40,002
55	Inverter PE cable, 1C-16 mm² Cu/XLPE/PVC, 0.6/1 kV	CADIVI · Cu/XLPE/PVC · 0.6/1 kV	m	75	85,985	6,448,875
56	AC cable protective conduit - diameter to suit cable size and fill	CVL	m	24	50,036	1,200,864
57	AC protective-conduit connector - to match conduit diameter	CVL	set	6	20,001	120,006
60	String labels and DC/AC warning labels		piece	48	5,001	240,048

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ID	Material / work item	Specification / scope	Unit	Qty	Unit price (VND)	Amount (VND)
61	DC/AC cable glands for inverters and switchboards		piece	25	50,038	1,250,950
63	Main-route copper PE cable lugs and insulating boots, 35 mm²	MAIN-PE-LUG-BOOT-35	piece	2	21,390	42,780
134	Copper inverter-neutral cable lug, 16 mm²	CU-LUG-16	piece	6	11,112	66,672
135	Inverter neutral cable-lug insulating boot, 16 mm²	BOOT-N-16	piece	6	6,667	40,002
	VI. CABLE TRAYS / LADDERS / WALKWAYS					172,804,672
64	Cable tray, 100 × 50 × 1.5 mm, including cover, connectors and bolts		m	34.8	215,401	7,495,955
65	Galvanised cable tray, 200x75x1.5 mm, including cover and connectors		m	14.5	430,430	6,241,235
66	Galvanised cable tray, 400x75x1.5 mm, including cover and connectors		m	8.7	777,445	6,763,772
67	AC cable-tray/ladder route - dimensions pending cable arrangement		m	110	819,779	90,175,690
78	Self-drilling screws with umbrella nuts, 2.5 cm long, fixing platforms and trays to aluminium rails		con	360	1,787	643,320
79	Walkway/access platform, 360 mm wide, 1.5 mm galvanised steel		m	60	547,732	32,863,920
81	Cable-tray supports, threaded rods and purlin clamps		set	86	144,082	12,391,052
84	Walkway/platform supports		set	41	101,483	4,160,803
85	Walkway/platform splices and connection accessories		set	24	77,481	1,859,544
144	Additional cable-tray/ladder accessories pending route take-off	Accessories follow the actual routes. Confirm the detailed list.	lot	1	10,209,381	10,209,381

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ID	Material / work item	Specification / scope	Unit	Qty	Unit price (VND)	Amount (VND)
	VII. EARTHING					4,051,281
143	Additional earthing/equipotential-bonding scope pending survey and design	Indicative scope. Earthing quantities and the solution require confirmation after the survey.	lot	1	4,051,281	4,051,281
	X. LABOUR AND INSTALLATION EQUIPMENT					132,541,497
111	Labour for frames, modules, access platforms, cable trays and mechanical structures		person-hour	319	110,279	35,179,001
112	Labour for cable installation, electrical terminations and earthing		person-hour	130	120,801	15,704,130
113	Roof lifting equipment		shift	1	7,562,932	7,562,932
114	Freight and delivery		trip	1	6,293,703	6,293,703
136	Site technical management and supervision	QuangAnhcons	engineer-day	23	1,557,898	35,831,654
137	Safety supervision for work at height	QuangAnhcons	person-day	23	1,091,550	25,105,650
138	Mobilisation, site organisation and clearance	QuangAnhcons	visit	1	6,864,427	6,864,427
	XI. DOCUMENTATION / REGULATORY WORK / TESTING					31,202,173
115	Review of input documents, Solar project procedures and connection checklist	EPC scope as listed. Third-party inspection/review fees are confirmed separately.	engineer-hour	10	313,278	3,132,780
116	Roof-structure survey/document review and coordination of existing-condition images/layouts	EPC scope as listed. Third-party inspection/review fees are confirmed separately.	engineer-hour	32	314,991	10,079,712
117	Preliminary engineering/SLD/layout, installation method, occupational safety and QA/QC	EPC scope as listed. Third-party inspection/review fees are confirmed separately.	engineer-hour	29	314,757	9,127,953
118	Testing, commissioning, internal acceptance and as-built/handover documentation	EPC scope as listed. Third-party inspection/review fees are confirmed separately.	engineer-hour	32	276,929	8,861,728

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ID	Material / work item	Specification / scope	Unit	Qty	Unit price (VND)	Amount (VND)
	XIV. ENERGY STORAGE					449,770,580
170	LFP storage module, 5.12 kWh - compatible model to be confirmed	Capacity and power follow the storage configuration. Manufacturer, model and compatibility require confirmation.	set	13	26,805,882	348,476,466
171	Bidirectional battery converter and BMS interface	Bidirectional converter. Confirm configuration, phase count and BMS compatibility. Backup operation applies only when the complete backup scope is selected.	set	2	39,529,412	79,058,824
172	PCS AC route, PE/N cables, terminations and installation	AC route, PE/N conductors, terminations and installation to the confirmed design.	m	40	92,647	3,705,880
177	Enclosure and DC/AC protection external to the PCS	Enclosure and protection external to the PCS; excludes the PCS and the separately listed transfer equipment.	set	2	3,705,882	7,411,764
178	Battery-module links, DC cables and BMS interface	Battery links, DC cables and BMS interface for a compatible configuration.	set	13	617,647	8,029,411
173	Small storage-system integration, configuration and testing	BMS/control configuration and safety testing.	system	1	3,088,235	3,088,235
	Total before VAT					1,655,530,580
	VAT scenario - 10%					165,553,058
	Total including VAT					1,821,083,638

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2. Assumptions, commercial conditions and exclusions

PRE-SURVEY ESTIMATE

APPLIED PARAMETERS

Roof elevation: 10 m. Budget assumption. This is ground-to-roof elevation. Defaults, where not entered, are 4 m for a house, 10 m for a factory and 0 m for a yard. These are not standard heights or frame elevations. Wind loading and lifting require separate checks.

One-way DC route per string: 80 m. Estimated from the selected route. One-way length = roof elevation + horizontal run + roof run. Do not double it here; the two DC polarities are counted separately. Enter measured routes when available.

Roof coverage factor: 70%. Entered parameter, subject to verification. 70% is a preliminary layout scenario, not a substitute for the layout, fire-safety clearances or shading analysis.

Cold cell temperature: 0 °C. Budget assumption. Confirm the minimum cell temperature using site climate data and manufacturer instructions.

Hot cell temperature: 70 °C. Budget assumption. 70 °C is a scenario value. Cell temperature requires a model covering irradiance, wind and mounting conditions.

AC-current allowance: 1.00 times. Budget assumption. Use the manufacturer's maximum AC current for Ib and follow its circuit-breaker instructions. Do not treat 1.25 as a universally mandatory IEC AC factor.

Anchor spacing: 1.20 m. Budget assumption for material quantities only. Confirm wind loading, roof zones, purlin/anchor capacity, spans and rail layout.

Basic rail/clamp mass: 3 kg/m². Budget assumption. Basic rails/clamps only; selected steel frames, reinforcement and bases are counted separately in the mass check. Structural capacity has not been verified.

Productivity factor: 85%. Budget assumption. The internal productivity allowance has not been calibrated against site records.

Cliplock metal roofing, 3-phase supply. Base pricing includes modules, grid-connected inverters, ordinary module rails/clamps/feet and the listed materials and installation, assuming the existing structure is suitable. Elevated frames, foundations, reinforcement, BESS and a new substation are included only when selected and priced separately.

BESS: 13 units; 66.56 kWh nominal; 56.91 kWh AC; 20 kW; SOH 100%. The modular storage budget uses a separate AC-coupled PCS. The battery, PCS, BMS models and backup functionality require manufacturer confirmation. The durations below are energy-balance estimates, not a commitment to supply loads during outages.

REQUIREMENTS AND PROPOSAL BASIS

Location: Ho Chi Minh City (simulation scenario; replace with the actual surveyed site); factory/commercial premises; Solar and evening battery use; 3-phase supply; cliplock metal roof/site.

Equivalent consumption 9000 kWh/month; daytime share 75%; 55.44 kWh/day shifted through storage.

User-selected capacity

Regional QAC scenario; no site-specific simulation

Sensitivity range under the stated assumptions, not a confidence interval or guaranteed generation. It does not resolve model-specific inverter clipping, individual roof orientations or weather on the outage day.

Confirm usable area, roof orientation/pitch, shading, structural capacity, anchors and site-specific regulatory/fire-safety requirements.

Confirm the PCC, permitted capacity, cable routes, protection, export conditions and valid equipment prices.

Scenario energy yield: 130,624-170,816 kWh/year.

QUOTATION CONDITIONS

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Scope: supply and installation of items with quantities in the table; grid-connected self-consumption. Storage is included as configured and in the priced lines.

Outage backup: a design to supply loads during grid outages is not included. Energy-shifting BESS does not automatically provide backup operation.

Point of connection: 1 Solar switchboards are expected to connect to the LV system within the selected scope. Confirm hosting capacity and short-circuit current on site.

Quantities: based on the configuration and assumed routes. Confirm after the survey, module layout and installation design. Agree scope changes in writing.

Exclusions: cliplock metal roofing, 3-phase supply. Base pricing covers modules, grid-connected inverters, ordinary module rails/clamps/feet and the materials and installation listed in the table, assuming the existing structure is suitable. Elevated frames, foundations, reinforcement, BESS and a new substation are included only when selected and priced separately. Unpriced items, new fire-fighting or direct-strike lightning systems and third-party fees outside the table are excluded.

Technical basis: formulas and results are provided in the calculation annex. References include TCVN 7447-7-712:2019, TCVN 2737:2023, IEC 62548-1 and IEC 62446-1. This preliminary configuration does not replace an approved design.

Taxes and validity: unit prices exclude VAT. VAT is provisional at the stated rate and is applied under the contract/invoice. Prices are reconfirmed when the order is placed.

Schedule: agreed after the survey, scope definition, supply confirmation and installation conditions.

Payment (EPC/installation): milestones and percentages are agreed by both parties in the contract.

Warranty: subject to the policies for the exact equipment models and the installation terms agreed in the contract.

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Indicative schedule: 59 working days, including 24 site days. Monday-Saturday calendar; holidays and outage windows are not deducted. This is not an execution commitment.

Preliminary results use the entered information and displayed assumptions. A survey, design verification and written confirmation of prices/scope are required before ordering or installation. This is not an approved design or a backup-supply commitment. Current legal obligations still apply.

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3. Electrical calculations with substituted values

Actual DC nameplate capacity

Formula: $P_{DC} = N_{module} \times P_{module}/1{,}000$ (kWp). **Substitution:** 157 × 640 / 1,000 = **100.48 kWp DC**.

Inverter capacity and DC/AC ratio

Formula: $r = P_{DC} / P_{AC}$. **Substitution:** 100.48 / 90 = **1.1164 times**.

Module surface area and usable roof area

Assumed formula: $A_{module} = N \times L \times W$. **Substitution with an example module measuring 2.382 × 1.134 m:** 157 × 2.382 × 1.134 ≈ **424.09 m² of module surface**. Actual roof area must also allow for clearances, maintenance access, walkways and shading exclusion zones. This area calculation does not certify the roof's structural capacity.

Indicative AC current for checking the electrical arrangement

Ba pha: $I \approx P/(\sqrt{3} \times U_{LL} \times \cos\varphi)$. With 90 kW, 400 V and assumed $\cos\varphi = 0.99$: $I \approx 90 \times 1{,}000/(\sqrt{3} \times 400 \times 0.99) \approx$ **131.2 A**. Select circuit breakers and cables using manufacturer Imax, corrected Iz, installation conditions, voltage drop and prospective short-circuit current. This preliminary current is not sufficient on its own for procurement.

Formula: $E_{load} = P_{backup} \times t$; $E_{battery,nominal} \approx E_{load}/(f_{SOC} \times \eta_{discharge})$. Training example, not a project input: 2 kW demand × 3 hours = 6 kWh AC. If fSOC = 0.8 and discharge efficiency = 0.92, preliminary nominal capacity is approximately 8.15 kWh. If the catalogue already states AC usable kWh, do not deduct SOC/efficiency again.

Complete preliminary calculation annex

DC capacity

PDC = (Nmod × PSTC) / (1000)

2. Result: 100.480 kWp

Datasheet module · Preliminary result

Nominal AC capacity

PAC = Ninv × PAC,unit

2. Result: 90.000 kW

Inverter datasheet. This is not kWh generation or the actual output at every moment. · Preliminary result

DC/AC ratio

rDC/AC = (PDC) / (PAC)

2. Result: 1.116 times

Target 1.25; clipping simulation required · Preliminary result

Module area

APV = Nmod × l × b

2. Result: 424.087 m²

Dimensions for the exact model · Preliminary result

Module mass

MPV = Nmod × mmod

2. Result: 4474.500 kg

Datasheet weight; excludes people, stored materials, wind, water and mounting frames · Preliminary result

PV dead load over the module area

qPV = ((MPV + Mrail + Msteel + Vfoundation × 2400) × g) / (1000 × APV)

2. Result: 0.133 kPa

Preliminary mass includes the selected steel/frame and bases; concrete density is assumed at 2,400 kg/m³. An average load does not replace concentrated anchor/foot loads, wind loads or roof/foundation structural verification. · Preliminary result

Ponding load

qw = hmm × 0.00980665

2. Result: Additional data required

Illustrative additional load; 0 means not entered, not confirmation that the risk is absent · Ponding depth not entered

Rainwater drainage

Qrain = (C × i × Aroof) / (3600)

2. Result: Additional data required

Flow continuity. Confirm rainfall intensity, catchment area, slope and drainage cross-section. · Additional data required

Outlet count for the entered drainage capacity

Noutlet = ⌈(Qrain) / (qoutlet)⌉

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2. Result: Additional data required

Not calculated without rainfall intensity i and outlet capacity q. · Additional data required

Water per cleaning cycle

Vw = APV × vw

2. Result: 848.173 L

Entered operating allowance; it does not automatically change the water-system material scope · Preliminary result

Cleaning-water flow rate

Qw = (Vw) / (1000 × th)

2. Result: 0.212 m³/h

Pump head = elevation + losses + nozzle pressure. Flow alone does not select the pump. · Preliminary result

Cold-string Voc

Uoc,cold = Nmax × Uoc × [1 + |βVoc| × (25 − Tmin)] × 1.03

2. Result: 1045.378 V

Inverter limit; the 3% reserve is a design assumption · Preliminary result

Hot-string Vmp

Ump,hot = Nmin × Ump × [1 + βVmp × (Tmax − 25)]

2. Result: 638.740 V

Provisional Vmp coefficient −0.34%/°C; manufacturer confirmation required · Preliminary result

DC cable length per polarity

LDC,+ = LDC,− = Nstr × Lavg

2. Result: 720.000 m

Measured or assumed route: 80 m · Preliminary result

DC voltage drop

ΔuDC = (2 × Imp × ρ × L) / (S × Ump,hot) × 100%

2. Result: 1.355 %

STC Imp, rho=22.5 Ω·mm²/km and hot-string Vmp. Check bifacial current, Iz and connectors against manufacturer requirements. · Preliminary result

AC branch - Iz

Iz = Iz,tab × kT × kg × nparallel

2. Result: 68.432 A

Cu XLPE reference ampacity for installation methods C/F with 3 loaded conductors. Confirm cable arrangement and neutral loading. · Preliminary result

AC branch - voltage drop

ΔuAC ≈ (√3 × Ib × ρ × L) / (S × nparallel × ULL) × 100%

2. Result: 0.764 %

Preliminary resistance-only calculation; it does not replace Rcosφ+Xsinφ or short-circuit checks · Preliminary result

Main AC route - Iz

Iz = Iz,tab × kT × kg × nparallel

2. Result: 166.712 A

Cu XLPE reference ampacity for installation methods C/F with 3 loaded conductors. Confirm cable arrangement and neutral loading. · Preliminary result

Main AC route - voltage drop

ΔuAC ≈ (√3 × Ib × ρ × L) / (S × nparallel × ULL) × 100%

2. Result: 0.734 %

Preliminary resistance-only calculation; it does not replace Rcosφ+Xsinφ or short-circuit checks · Preliminary result

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Installation-phase person-hours

Hinstall = Hbase,mount + Hstructure + HBESS + HTX

2. Result: 343.000 person-hours

Includes base installation labour and selected additional work. These are person-hours, not elapsed hours. · Preliminary result

Electrical person-hours

H = ⌈(Hbase) / (ηlabor)⌉

2. Result: 130.000 person-hours

Cables, connectors, inverters, switchboards and earthing · Preliminary result

Installation-phase working days

Dinstall = ⌈(Hinstall) / (Ncrew × hday)⌉

2. Result: 8.000 working days

Additional installation person-hours are included. Confirm the actual sequence and crews. · Preliminary result

Electrical working days

Delec = ⌈(Helec) / (Nelec × hday)⌉

2. Result: 9.000 working days

Electrical crew of 2 · Preliminary result

AC overload protection

Ib ≤ In ≤ Iz; I2 ≤ 1.45 × Iz

2. Result: Additional data required

Protection-selection relationships. Check IEC 60364, circuit-breaker characteristics and manufacturer instructions. The calculator has not verified I2, disconnection times, Icu/Ics or selectivity. · Additional data required

PE thermal withstand

SPE ≥ (√(Ifault2 × t)) / (k)

2. Result: Additional data required

Adiabatic method within its applicable scope. Fault current, clearing time and the correct material/insulation factor k are required. There are insufficient data for a conclusion. · Additional data required

Logger count by control domain

Ld = min {L ∈ ℕ, L ≥ 1 : Ndev,d + c(L − 1) ≤ 30L}; Nlogger = ∑ Ld

2. Result: 1.000 units

Manufacturer limit of 30 devices. Allowance for downstream loggers is a topology assumption. Cascading, response time and the actual number of switchboards/PCCs are not confirmed. · Preliminary result

Module upper-edge elevation above ground

Htop = Hroof + c + l × sin θ

2. Result: 10.610 m

The entered roof elevation is at the lower module-row edge; one portrait module is assumed. Do not infer total building height from floor count. · Preliminary result

Frame and reinforcement steel mass

Madded = Mframe + Mreinforcement

2. Result: 0.000 kg

Sum the selected steel items without counting the base rails/clamps again. Allowances support budgeting only; structural drawings are required. · Preliminary result

Base and foundation mass

Mfoundation = Vfoundation × ρconcrete

2. Result: 0.000 kg

Concrete density 2,400 kg/m³. Volumes follow the allowance for each mounting arrangement. Concentrated loads and ground conditions have not been checked. · Preliminary result

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Wind, anchor and structural-capacity checks

Ed ≤ Rd

2. Result: Additional data required

Site coordinates, wind zone/terrain, height, roof dimensions, edge/corner zones, materials, purlins, connections and ground conditions are required. Structural capacity cannot be inferred from kg/m² alone. · Additional data required

Required battery capacity before rounding

Enom,required = (EAC,required) / (SOH × ΔSOC × ηdischarge)

2. Result: 64.844 kWh

Where nominal capacity is entered, use the entered kWh directly. Do not divide cabinets/modules into fractional units or substitute round-trip efficiency for discharge efficiency. · Preliminary result

Required storage power

Preq = Pentered

2. Result: 6.930 kW

For backup, starting kVA is used as a conservative kW threshold. The model's kVA and overload capability have not been verified. Check P and S separately when selecting equipment. · Preliminary result

Usable AC battery energy

EAC = Enameplate × SOH × ΔSOC × ηdischarge

2. Result: 56.910 kWh

Depends on initial SOC and remaining capacity. Model-specific auxiliaries and losses are not yet deducted. · Preliminary result

LFP storage module, 5.12 kWh - compatible model to be confirmed

Nbattery = ⌈max((Enom,req) / (Eunit); (Preq) / (Punit))⌉

2. Result: 13.000 set

Priced in whole modules. Planning allowance of 2.56 kW continuous per module is not a manufacturer commitment for an exact model. Industrial cabinets are not divided into fractional units. · Preliminary result

Bidirectional battery converter and BMS interface

NPCS = ⌈max((Preq) / (PPCS,unit); (Nbattery) / (8))⌉

2. Result: 2.000 set

Budget for a 10 kW, 3-phase unit, AC-coupled separately from the grid-connected PV. Manufacturer/model, bank limits, battery voltage and BMS compatibility are not yet confirmed. Do not connect the battery directly to the PV inverter. · Preliminary result

PCS AC route, PE/N cables, terminations and installation

LAC = NPCS × Lbranch

2. Result: 40.000 m

Metres of complete route, including PE/N as designed. Budget rate from small-system BOS. Cross-sections, circuit count, protection and actual lengths require confirmation. · Preliminary result

Enclosure and DC/AC protection external to the PCS

Nitem = NPCS

2. Result: 2.000 set

Protection and enclosure external to the PCS. Check battery voltage, DC current, isolation and Icu/Ics. The PCS and backup transfer equipment are separate BOQ items.

Battery-module links, DC cables and BMS interface

Nitem = Nbattery

2. Result: 13.000 set

Accessories outside the module price. Check the manufacturer's included cables to avoid duplicate procurement. Integrated PCS/BMS are not counted again. · Preliminary result

Small storage-system integration, configuration and testing

Nsystem = 1

2. Result: 1.000 system

Safety, BMS and control testing to the approved manufacturer configuration. Outage transfer time is not guaranteed. · Preliminary result

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Horizontal projection of the modules

Ahorizontal = APV × cos θ

2. Result: 417.640 m²

Geometric relationship only; it does not determine clearances, shading or generation. · Preliminary result

Installation person-hours including additional scope

Htotal = Hbase,mount + Hbase,elec + Hstructure + HBESS + HTX

2. Result: 473.000 person-hours

Selected structural, BESS and substation labour is included in the schedule. Its allocation to the installation phase is an allowance; the actual crews must be agreed. · Preliminary result

Module mass per module area

mA = (MPV) / (APV)

2. Result: 10.551 kg/m²

Uses the data for the displayed option. Confirm actual dimensions and layout. · Preliminary result

Usable roof area

Ausable = max(0; Agross − Aexcluded) × kslope

2. Result: 800.000 m²

Uses the data for the displayed option. Confirm actual dimensions and layout. If the input is a horizontal roof projection and modules follow the roof, k = 1/cos(roof pitch); otherwise k = 1. · Preliminary result

Ancillary area and clearances

Aaccess = max(0; Aroof − APV)

2. Result: 375.913 m²

Uses the data for the displayed option. Confirm actual dimensions and layout. · Preliminary result

Annual energy - low scenario

Eyear = round(PDC × Ylow; 0)

2. Result: 130624.000 kWh/year

Energy scenario based on the displayed inputs and assumptions. Hourly PV/demand has not been simulated here and generation is not guaranteed. · Preliminary result

Annual energy - high scenario

Eyear = round(PDC × Yhigh; 0)

2. Result: 170816.000 kWh/year

Energy scenario based on the displayed inputs and assumptions. Hourly PV/demand has not been simulated here and generation is not guaranteed. · Preliminary result

Average daily PV energy

EPV,day = round((PDC × Y) / (365.25); 2)

2. Result: 412.650 kWh/day

Energy scenario based on the displayed inputs and assumptions. Hourly PV/demand has not been simulated here and generation is not guaranteed. · Preliminary result

Average daily electricity consumption

Eload,day = (Emonth × 12) / (365.25)

2. Result: 295.688 kWh/day

Energy scenario based on the displayed inputs and assumptions. Hourly PV/demand has not been simulated here and generation is not guaranteed. · Preliminary result

Evening energy to be supplied through the battery

Eshift = Eload,day × (1 − fday) × fnight

2. Result: 55.441 kWh

Energy scenario based on the displayed inputs and assumptions. Hourly PV/demand has not been simulated here and generation is not guaranteed. · Preliminary result

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Entered target capacity

Ptarget = Pentered

2. Result: 100.000 kWp

User-selected value. Installed capacity also depends on whole-module counts, the roof and the electricity supply. · Preliminary result

Battery-throughput limit from PV surplus

Eshift,max = round(min(Eshift; max(0; EPV,day − Eload,day × fday) × 0.9); 2)

2. Result: 55.440 kWh

Energy scenario based on the displayed inputs and assumptions. Hourly PV/demand has not been simulated here and generation is not guaranteed. · Preliminary result

N: quantity; P: power; U: voltage; I: current; S: conductor cross-section (mm²); L: one-way length (m); ρ = 0.0225 Ω·mm²/m in voltage-drop calculations; g = 9.80665 m/s²; β: temperature coefficient per 1/°C; ⌈x⌉: round up to an integer; ∑: summation. The AC calculations consider resistance, without a complete reactance and power-factor calculation. E: energy (kWh); M: mass (kg); V: volume (m³); A: area (m²); H: person-hours or height (m), according to the calculation; θ: module tilt; α: design solar-elevation angle. S denotes apparent power (kVA) in transformer/UPS calculations and cross-section (mm²) in cable calculations. SOC/SOH/η/k are dimensionless ratios.

Structures, elevated frames and foundations: not selected or priced. Structural, wind, anchor and foundation drawings and an existing-condition survey are required.

BESS and backup: BOQ lines 170, 171, 172, 177, 178, 173. Confirm models, BMS/PCS, cables and protection, demand on each phase, fire safety, transfer time and current prices.

New substation: not selected or priced. Confirm the connection agreement, MV route, short-circuit design, civil work and utility scope.

STANDARDS AND REFERENCE DOCUMENTS

TCVN/IEC documents are standards, not automatically QCVN technical regulations. Mandatory application depends on legal references and project scope. The algebraic formulas below are not verbatim clauses. Legal/design compliance has not been confirmed for a specific project. Check Decree 58/2025, as amended by Decree 243/2026, and local construction, land and fire-safety requirements.
Ground-mounted yard systems do not automatically fall under rooftop-Solar procedures; do not assume that a 2 m threshold exempts them from permits.

TCVN 7447-7-712:2019 | Low-voltage PV installations
https://tieuchuan.vsqi.gov.vn/tieuchuan/view?sohieu=TCVN+7447-7-712%3A2019

IEC 62548-1:2023 + AMD1:2025 | PV-array design, DC wiring, protection and earthing
https://webstore.iec.ch/en/publication/110893

IEC 60364-5-52 / IEC 60364-5-54 | Conductors, derating and PE; check the contractually selected edition
https://www.electrical-installation.org/enwiki/General_method_for_cable_sizing

IEC 62446-1:2016 + AMD1:2018 | Documentation, inspection and commissioning of grid-connected systems
https://webstore.iec.ch/en/publication/63726

TCVN 2737:2023 | Loads, actions and combinations; structural documentation required
https://tieuchuan.vsqi.gov.vn/tieuchuan/view?sohieu=TCVN+2737%3A2023

TCVN 4474:1987 | Building drainage; actual rainfall and hydraulic data required
https://tieuchuan.vsqi.gov.vn/tieuchuan/view?sohieu=TCVN+4474%3A1987

IEC 62930:2017 | PV DC cable requirements
https://webstore.iec.ch/en/publication/28067

QCVN 18:2021/BXD | Construction safety; determine the project's applicable scope
https://congbao.chinhphu.vn/van-ban/thong-tu-so-16-2021-tt-bxd-36401/39129.htm

QCVN 06:2022/BXD + Amendment 1:2023 | Fire safety; check scope, building type and alterations
https://congbao.chinhphu.vn/van-ban/thong-tu-so-09-2023-tt-bxd-40285/46763.htm

Decree 243/2026/ND-CP | Amendments concerning Decree 57/2025 and Decree 58/2025; prepare a project-specific register
https://vanban.chinhphu.vn/?docid=218605&pageid=27160

IEC 63027:2023 | DC arc detection/interruption equipment; this does not establish a universal installation obligation
https://webstore.iec.ch/en/publication/27362

IEC 62116:2014 | Anti-islanding testing; this is different from zero-export control
https://webstore.iec.ch/en/publication/6479

IEC 61727:2004 | PV-grid interface; confirm the specific connection requirements
https://webstore.iec.ch/en/publication/5736

IEC 61724-1:2021 | PV performance monitoring; it does not prescribe one logger per 4 inverters
https://webstore.iec.ch/en/publication/65561

Sungrow Logger1000A/B UM Ver125-202604 | Sections 2.4, 5.3, 5.5, 5.6, 10.14: device limits, cables, PoC metering and cascading; not a pricing standard
https://info-support.sungrowpower.com/product-materials/b341b802-6161-4601-b5b2-c616244973cc.pdf

TCVN 14499-5-2:2025 | Safety of grid-integrated electrochemical EES. This TCVN adopts IEC 62933-5-2:2020, not the later IEC 2025 edition. Check the edition cited by the project.

https://tieuchuan.vsqi.gov.vn/tieuchuan/view?sohieu=TCVN+14499-5-2%3A2025

IEC 62619:2022 | Safety of lithium cells and batteries for industrial/stationary applications; verify certificates for the exact model.
https://webstore.iec.ch/en/publication/64073

IEC 62933-5-1:2024 | Risk assessment and safety of grid-integrated energy storage.
https://webstore.iec.ch/en/publication/72239

IEC 62933-5-2:2025 | Lifecycle safety of the complete electrochemical BESS, beyond certification of the individual battery.
https://webstore.iec.ch/en/publication/68297

IEC 62933-5-4:2026 | Safety test methods for lithium BESS; check test evidence for the configuration.
https://webstore.iec.ch/en/publication/67442

LONGi Solar LR7-72HVH-640M
https://static.longi.com/LR_7_72_HVH_640_670_M_30_30_and_15_Scientist_BGV_02_20250313_EN_1e80b0045b.pdf

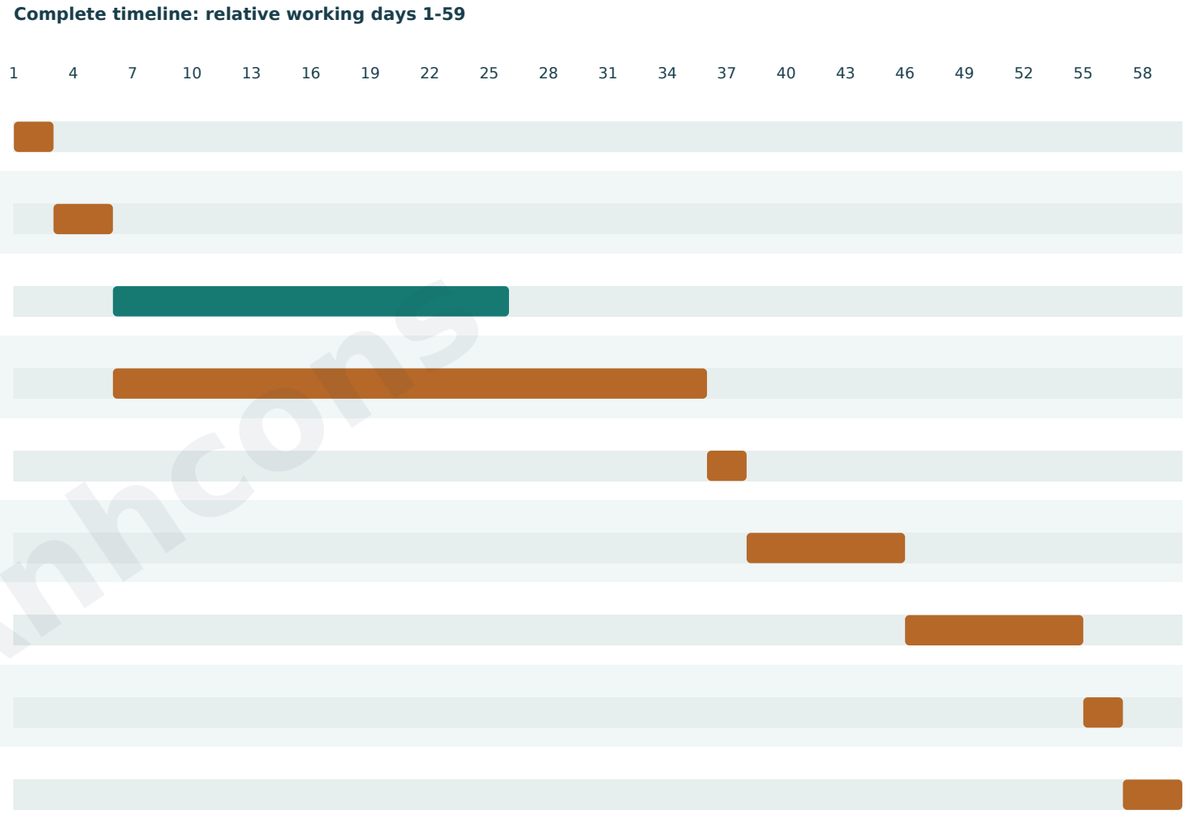
Sungrow SG30CX-P2
https://info-support.sungrowpower.com/cms/af994f1d-bb0d-408a-b310-6ad732402c99/GUID-25D7DF3A-AC5A-4DDE-AE7D-B02E6AE8DB3C_1_en-US_PDF%20(%E4%BA%A7%E5%93%81%E4%BF%A1%E6%81%AF%E8%AE%BE%E8%AE%A1%E9%83%A8_%E5%9F%BA%E7%A1%80%E7%89%88)_1789440969930_compressed.pdf

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4. Baseline implementation schedule

59 relative working days, Monday-Saturday, 8 hours/day. Day 1 starts after scope and implementation conditions are agreed. Dates, supplier lead times, grid/owner approvals, outage windows and site method statements require confirmation.

WBS	Task	Days	Start	Finish	FS	Resources
1	Survey, scope confirmation and roof data	2	1	2	-	Per method statement
2	Design, coordination and material approval	3	3	5	1	Per method statement
3	Awaiting grid-connection / owner confirmation	20	6	25	2	Per method statement
4	Procurement, fabrication and delivery	30	6	35	2	Per method statement
5	Mobilisation and site preparation	2	36	37	3,4	Per method statement
6	Frames, modules, cable trays and walkways	8	38	45	5	Per method statement
7	Cable installation, terminations, switchboards and earthing	9	46	54	6	Electrical crew of 2
8	Testing, commissioning and acceptance	2	55	56	7	Per method statement
9	As-built records, handover and site clearance	3	57	59	8	Per method statement



Brown: critical path. Green: float. FS: finish-to-start. No resource levelling or public-holiday adjustment.

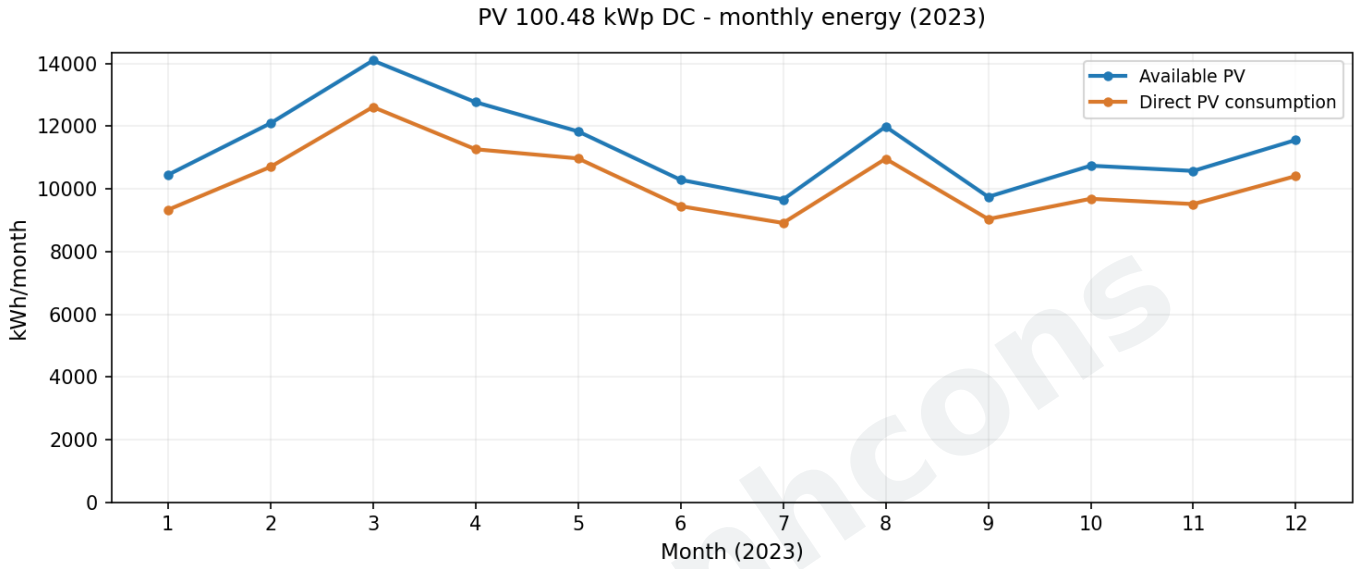
The backward/forward CPM calculations are editable in the English Excel Schedule sheet. This plan is a baseline for discussion; it is not a delivery commitment.

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5. Monthly generation and direct consumption

Illustrative Ho Chi Minh City (10.8231 N, 106.6297 E), 10-degree south-facing array, crystalline silicon, ERA5 2023 via JRC PVGIS 5.3. DC 100.48 kWp; assumed AC limit 90 kW. PVGIS system-loss input 14%, applied once. No additional PR deduction. Not measured site data or a generation guarantee.

This PV-to-load model does not simulate battery charging, discharge, SOC, usable capacity, efficiency, power limits or backup operation.

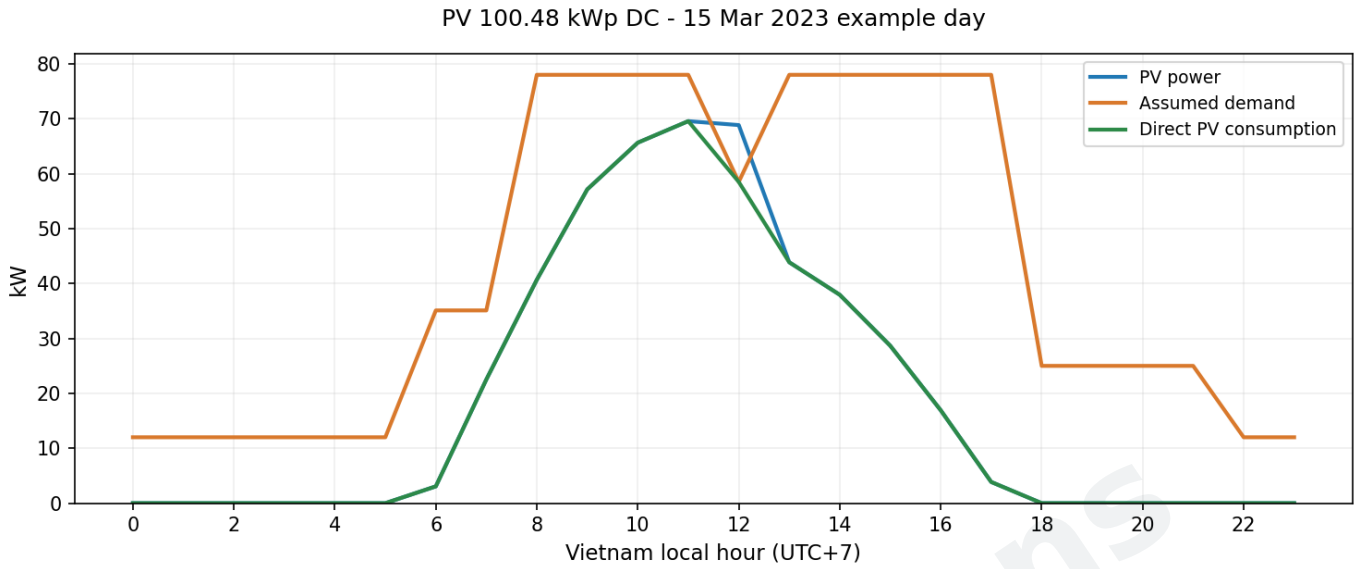


Month	Available PV (kWh)	Direct PV (kWh)	PV surplus (kWh)	Demand (kWh)
1	10,447.26	9,332.01	1,115.25	28,157.30
2	12,094.56	10,702.24	1,392.32	25,792.80
3	14,099.14	12,614.68	1,484.46	28,872.90
4	12,770.35	11,266.83	1,503.52	27,107.50
5	11,837.63	10,974.32	863.31	28,872.90
6	10,291.18	9,448.61	842.58	27,846.20
7	9,663.03	8,913.42	749.62	28,134.20
8	11,988.80	10,962.62	1,026.18	28,872.90
9	9,747.11	9,038.04	709.06	27,846.20
10	10,741.71	9,685.53	1,056.17	28,134.20
11	10,575.24	9,516.45	1,058.79	27,846.20
12	11,562.53	10,410.90	1,151.63	28,134.20

Available PV total in the source model window: 135,818.54 kWh. Monthly values shown to two decimals may differ slightly from the full-precision annual sum. Direct consumption is calculated per source hour before aggregation, not MIN of monthly totals.

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Representative 24-hour curve



15 Mar 2023 example day. PV self-consumption is the lesser of available PV and assumed demand for each source time step. Surplus is assumed curtailed under zero export. No surplus-sale revenue is assumed.

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Assumed demand: 24 local-hour values

Local hour	Monday-Saturday (kW)	Sunday (kW)
00:00	12.000	12.000
01:00	12.000	12.000
02:00	12.000	12.000
03:00	12.000	12.000
04:00	12.000	12.000
05:00	12.000	12.000
06:00	35.100	12.000
07:00	35.100	12.000
08:00	78.000	12.000
09:00	78.000	12.000
10:00	78.000	12.000
11:00	78.000	12.000
12:00	58.500	12.000
13:00	78.000	12.000
14:00	78.000	12.000
15:00	78.000	12.000
16:00	78.000	12.000
17:00	78.000	12.000
18:00	25.000	12.000
19:00	25.000	12.000
20:00	25.000	12.000
21:00	25.000	12.000
22:00	12.000	12.000
23:00	12.000	12.000

Method, equations and limits

$P_{self}(t) = \min(P_{PV,AC}(t), P_{load}(t))$; $E_{self} = \Sigma P_{self}(t) \times \Delta t$; $P_{surplus}(t) = \max(P_{PV,AC}(t) - P_{self}(t), 0)$. Grid import = $\max(P_{load} - P_{self}, 0)$. $\Delta t = 1$ hour.

11:00 illustrative/mean slot: PV 69.566 kW; demand 78.000 kW; direct PV 69.566 kW. min(69.566, 78.000) × 1 h = 69.566 kWh.

Source: https://re.jrc.ec.europa.eu/api/v5_3/seriescalc?lat=10.8231&lon=106.6297&startyear=2023&endyear=2023&pvcalculation=1&peakpower=100.48&loss=14&angle=10&aspect=0&mountingplace=building&raddatabase=PVGIS-ERA5&outputformat=json

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Source snapshot SHA-256: 39f33f982b1bc457d14c7e19307f13ca92e4cd1cc7cbf4e4088f527df1432c72

6. Standards, technical checks and acceptance

The references below were reviewed on 05 Nov 2026. They include Decree 58/2025, as amended by Decree 243/2026, current electrical-safety regulations and fire-safety requirements for the building type. Applicable procedures depend on the connection diagram, responsible entity and operating mode; they cannot be inferred solely from the capacity label or inverter voltage. Selected standards and mandatory regulations have different scopes. This is a pre-survey reference configuration, not confirmation of compliance at a specific site.

Before implementation, finalise the connection diagram, roof/anchor/wind checks, protection coordination, fire-safety scope and applicable notification/registration or other procedures. A list of standards alone does not certify that the configuration meets every requirement of a particular project.

Read the connection and surplus-electricity sale conditions.

Decree 58/2025/ND-CP, as amended by Decree 243/2026/ND-CP

Identify self-generation/self-consumption arrangements and procedures for the project, responsible entity and connection point.

https://vanban.chinhphu.vn/?classid=2629&docid=218762&pageid=27160

Decree 243/2026/ND-CP

Surplus-electricity provisions and related amendments. This self-consumption estimate does not assume revenue from surplus sales.

https://vanban.chinhphu.vn/?classid=1&docid=218605&pageid=27160

QCVN 25:2025/BCT; Circular 41/2025/TT-BCT

Electrical safety. Check the actual work and operating scope.

https://vbpl.moj.gov.vn/TW/Pages/vbpq-toanvan.aspx?ItemID=179103

Decree 105/2025/ND-CP, as amended by Decree 347/2026/ND-CP

Fire-safety duties depend on building type and alterations. Storage requires a separate assessment.

https://xaydungchinhsach.chinhphu.vn/nghi-dinh-347-2026-nd-cp-sua-doi-4-nghi-dinh-ve-khoa-hoc-cong-nghe-phong-chay-chua-chay-an-ninh-trat-tu-phong-chong-te-nan-xa-hoi-bao-luc-gia-dinh-119260908161503549.htm

QCVN 06:2022/BXD and Amendment 1:2023

Fire safety for buildings and structures. Check the building type and the scope of alterations.

https://moc.gov.vn/vn/Pages/ChiTietVanBan.aspx?TypeVB=2&vID=5126

TCVN 7447-7-712:2019

Low-voltage PV electrical installations.

https://tieuchuan.vsqi.gov.vn/tieuchuan/view?sohieu=TCVN+7447-7-712%3A2019

IEC 60364-7-712:2025

Check PV installation design against the selected edition.

https://webstore.iec.ch/en/publication/65748

IEC 62548-1:2023 + AMD1:2025

PV-array design, DC wiring, protection and earthing; it does not replace the complete BESS design.

https://webstore.iec.ch/en/publication/110893

TCVN 11855-1:2017

PV documentation, inspection and testing within the standard's scope.

https://tieuchuan.vsqi.gov.vn/tieuchuan/view?sohieu=TCVN+11855-1%3A2017

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TCVN 2737:2023

Loading, wind and load combinations. Roofs, anchors and structures require a separate survey and calculation.

https://tieuchuan.vsqi.gov.vn/tieuchuan/view?sohieu=TCVN+2737%3A2023

• Before installation: check drawings, weatherproofing details, exact model catalogues, work-at-height safety and electrical isolation.

• Before energisation: check string polarity, open-circuit voltage, insulation, earthing, AC/DC continuity, protection settings and export-limiting status.

• Before handover: as-built records, testing/energisation records, monitoring configuration, maintenance instructions and equipment warranties.

Provenance and numerical control

Source Vietnamese Product #54763; native English Product #55154. Reference QAC-SOL-EST-20261104-D338CDA1. 87 BOQ lines; line extension = quantity × unit selling price, rounded half-up to whole VND; VAT scenario 10%. All source commercial notes and the preliminary engineering annex are retained in English.

Original PDF SHA-256: dfebeb895f0a3a857507c65aa32370f72a035d17a3f5340ed9b1dda883cf30cf
Original Excel SHA-256: 25f6bb26060ca5ee58ecb5ad505436eb9c11007c491c82d09cd14e4e1b6c0ef4

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