



Solar Energy for Sustainable Solution

Solar ESS Co. Ltd.

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PRODUCTION & CONSUMPTION ANALYSIS • SolisCloud data 1-21 Oct 2026

Ban Doo Chiangrai: machine days vs days without the machine

Small factory in Ban Du, Chiang Rai • Solis S6-EH3P20K-H 20 kW three-phase hybrid inverter, 20 kWp PV, no battery • zero-export (no sell-back to PEA) • supplying house 1 only since 1 Oct 2026

~70% of October consumption happens on the 6 machine days	~83% of PEA purchases are made on machine days	~90% of the lost solar is on days without the machine	20% vs 60% solar share of load: machine day vs normal day
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1. Key finding

The two kinds of day have opposite problems. On **machine days** (every Wednesday and Saturday) the site uses far more power than the array can make: the machine draws 57–62 kW against 12–13 kW of PV, so the site still buys about 180 kWh from PEA even when the inverter runs at full output. On **days without the machine** it is the reverse: daytime load is only ~6 kW, the export limit holds the inverter down to that, and about half of the available solar is thrown away.

The machine days drive the electricity bill, but the **recoverable solar sits on the other days**. That is where the fixes in this report are aimed.

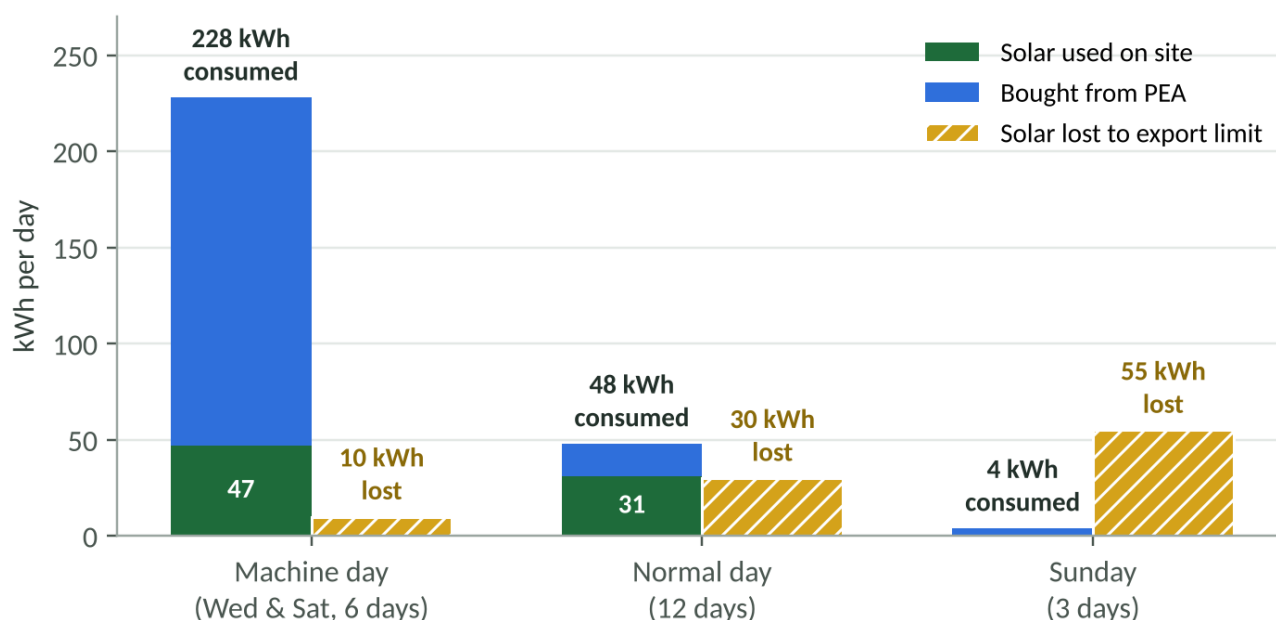


Figure 1 – Average energy per day by day type, 1-21 Oct 2026. Solar lost = clear-sky potential (~60 kWh/day) minus actual production, held back by the zero-export limit.



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2. Side-by-side comparison

Per day (1-21 Oct)	Machine days (6)	Normal days (12)	Sundays (3)
Site consumption	~230 kWh (180-282)	~48 kWh (30-69)	3-5 kWh
Solar produced	~50 kWh	~30 kWh	~0 kWh
Bought from PEA	~180 kWh	~17 kWh	~4 kWh
Exported (leak)	< 3 kWh	1-2 kWh	0
Solar share of load	~20%	~60%	0%
Inverter at full output	~3.7 h	~1.4 h	0 h
Inverter curtailed	~3.7 h	~6.0 h	barely starts
Solar lost vs ~60 kWh potential	~10 kWh	~30 kWh	~55 kWh
Grid cost at 4.7 THB/kWh	~850 THB	~80 THB	~20 THB

Consumption and PEA purchases per day type are derived from the monthly totals (93.6 kWh/day used, 62.1 kWh/day bought) and the per-phase purchase data; they reconcile with the reported totals to within about 1%.

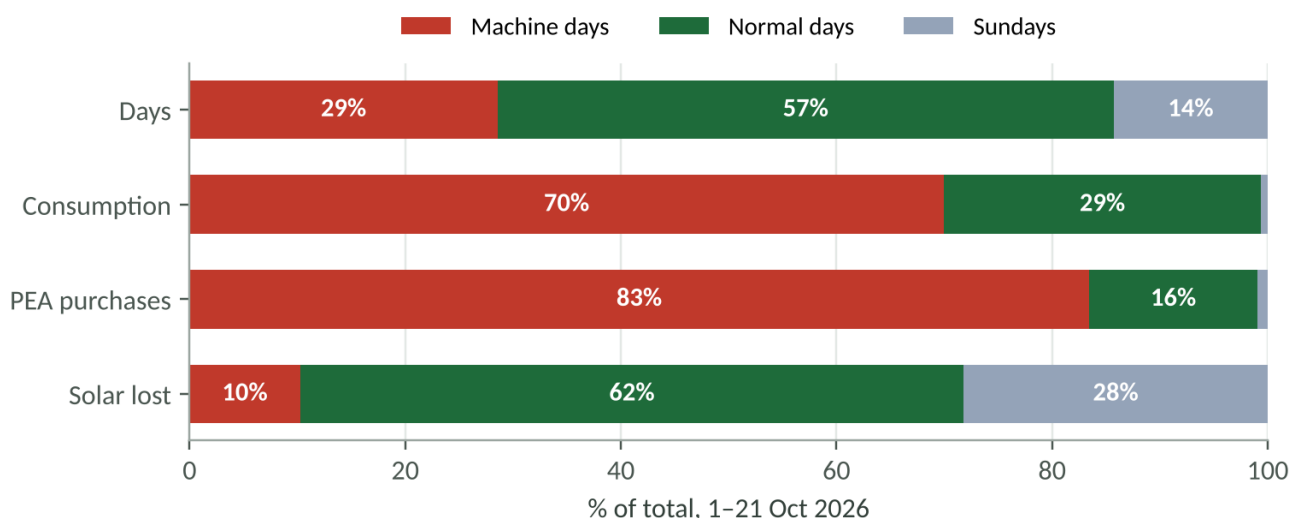


Figure 2 - Share of days, consumption, PEA purchases and lost solar by day type, 1-21 Oct 2026.

What the comparison shows

- **Six days make the bill.** Machine days are 29% of the days but about 70% of the energy used and 83% of the power bought. The machine alone used 937 kWh in October – about 156 kWh per run day.
- **Solar cannot cover the machine.** At 57-62 kW the machine is about 5× the array's peak. Even in full sun solar covers only a fifth of it. More panels or a battery will not change this materially.
- **Normal days and Sundays waste the most.** Over a 30-day month the ~850 kWh lost (~ 4,000 THB) splits roughly 60% normal days (~510 kWh), 28% Sundays (~235 kWh) and only 10% machine days (~85 kWh).

Data and method: SolisCloud monitoring: daily data 1-21 Oct 2026 and inverter per-phase 5-minute data 25 Sep – 21 Oct 2026. Day types: machine days = Wed 7, 14, 21 and Sat 3, 10, 17 Oct; Sundays = 4, 11, 18 Oct; normal days = the other 12. Potential production assumes ~3.5 peak sun hours for Chiang Rai (~60 kWh/day clear sky). Correction to the 21 Oct Thai report (Rev02): Section 2 lists 15 normal days for 1-21 Oct; the correct count is 12. Analysis by Solar ESS Co. Ltd.



3. What a typical day looks like

The two profiles below are **illustrative models** built from the reported averages (load levels, run times, inverter start time and the 21 Oct 5-minute data). They are not measured traces, but they reproduce the daily totals closely and show where the energy is lost.

Day without the machine

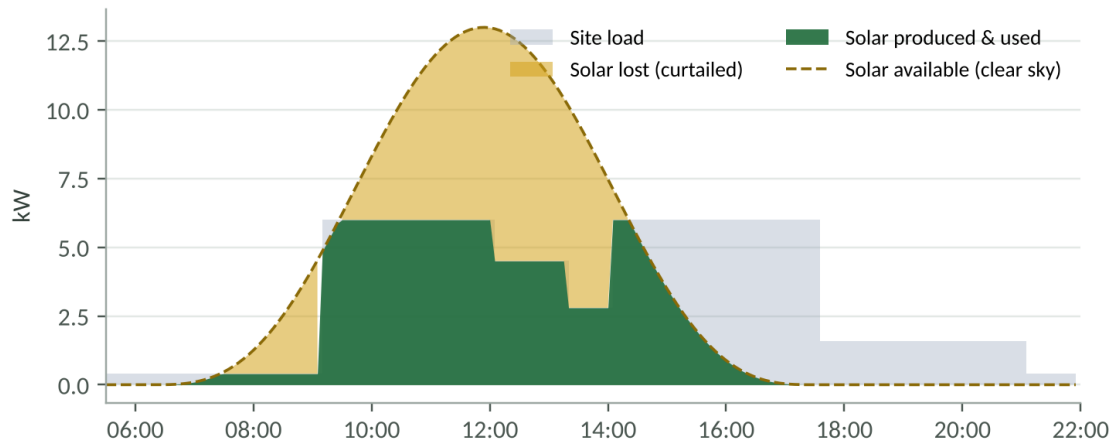


Figure 3 – Modelled normal day: ~62 kWh solar available, ~33 kWh produced, ~29 kWh curtailed. The inverter follows the ~6 kW shop load and drops to ~2.8 kW over lunch.

The gold area is solar the panels could make but the inverter is not allowed to produce, because nothing on site can use it and export is blocked. It is largest around midday – exactly when the load is lowest.

Machine day (modelled on Wednesday 21 Oct)

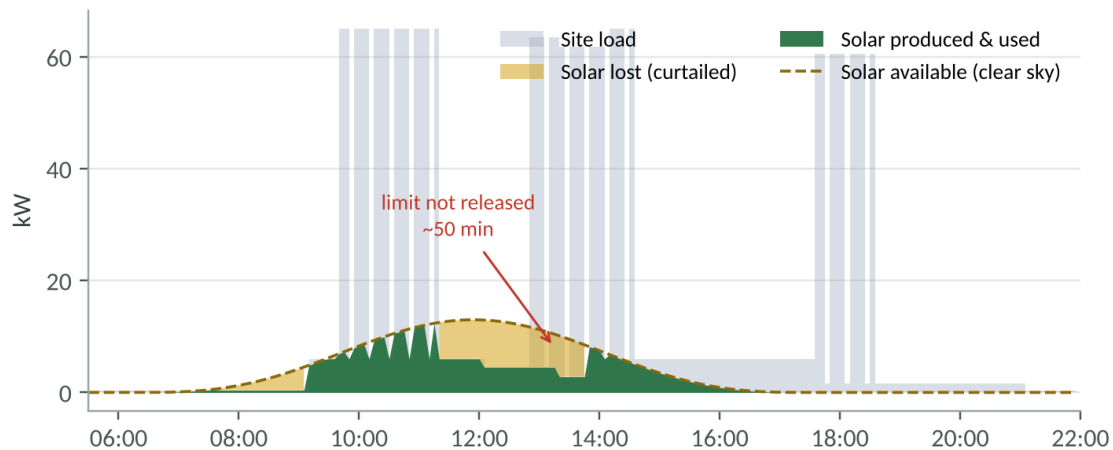


Figure 4 – Modelled machine day: ~250 kWh used, ~40 kWh produced (actual on 21 Oct: 281 kWh used, 47 kWh produced). Solar is lost in the gap between runs and while the limit is slow to release.

While the machine runs, the inverter is at full output and still only meets a fraction of the load. The losses are in the **gaps**: between the morning and afternoon runs, during the 45–55 minutes the export limit takes to release (seen on 10, 14 and 21 Oct), and the evening run after 17:30 gets no solar at all.



4. Phase balance by day type

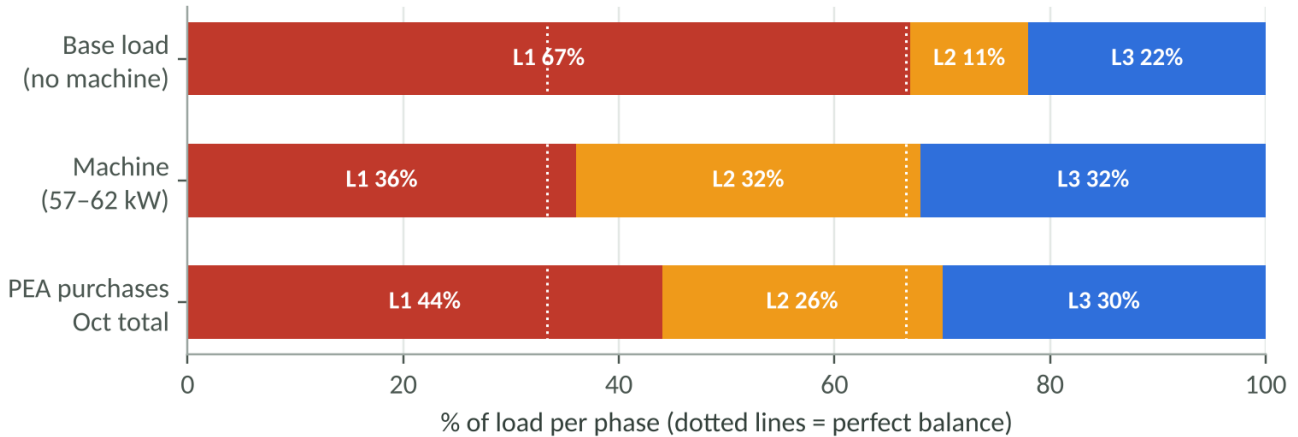


Figure 5 – Share of load per phase, October 2026 (grid and inverter per-phase data).

- **The machine is balanced** (36 / 32 / 32%). It is not the cause of the imbalance.
- **The base load is badly skewed** – about 67% on L1, 11% on L2, 22% on L3. On normal days L1 buys about 12 kWh, L3 4.4 kWh and L2 only 0.7 kWh. This is a **non-machine-day** problem.
- **It does not limit production.** The hybrid inverter supplies each phase separately (e.g. 15.6 / 4.3 / 5.3 A), so the imbalance is a wiring-stress issue, not an output issue.

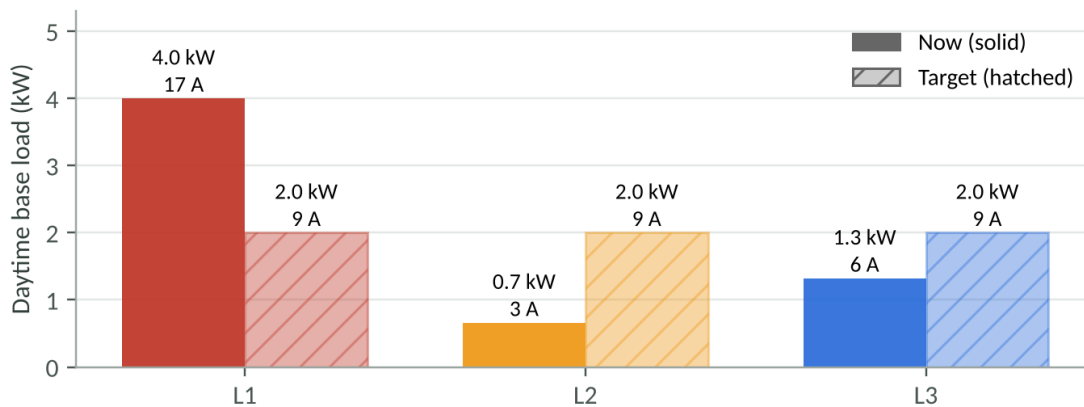


Figure 6 – Daytime base load per phase now and after rebalancing (230 V per phase).

Why it matters after the September arc fault: with ~4.0 / 0.7 / 1.3 kW on L1 / L2 / L3 the neutral carries roughly **13 A** and L1 carries most of the current. Moving single-phase circuits so each phase carries about 2 kW brings the neutral current close to zero. Moving only 2 kW from L1 to L2 (the earlier suggestion) still leaves about 5 A; splitting it ~1.5 kW to L2 and ~0.5 kW to L3 is better.



5. What to do, by day type

Action	Day type	Est. gain / month	Cost
1. Fix the 45–55 min export-limit lag: our supplier to check meter/CT communication and limit response time	Machine days	40–85 kWh (190–400 THB)	Settings / service visit
2. Keep machine runs between 09:00 and 15:00, close the midday gap, avoid runs after 17:30	Machine days	part of the ~85 kWh above	None
3. Add ~6 kW of timer loads 09:00–15:00 (water heating, cooling, charging, pre-heating)	Normal days	up to ~425 kWh (~2,000 THB)	Timers / contactors
4. Split machine work into shorter midday runs on more days	Normal days	~20 kWh per day converted	None – scheduling
5. Rebalance base load to ~2 kW per phase; thermal-scan and re-torque L1 and neutral terminations	Normal days	~0 kWh (protection)	Electrician, half day
6. Battery 15–20 kWh (only after 1–4)	Normal days + Sundays	~270–330 kWh (~1,300–1,550 THB)	Quote from our supplier

Gains are estimates and overlap: actions 3, 4 and 6 all target the same daytime surplus, so they do not add up.

Battery sizing

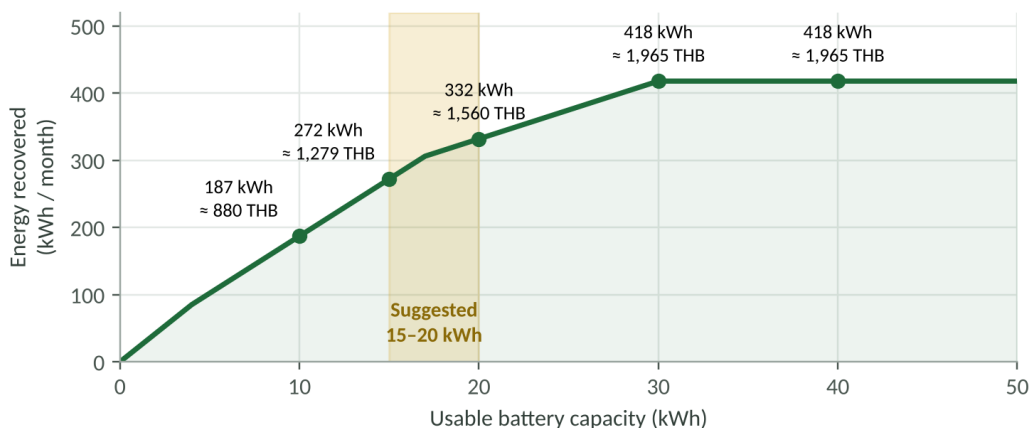


Figure 7 – Estimated solar recovered per month by usable battery size (no export, 4.7 THB/kWh).

On a normal day the battery can only discharge into the evening and night base load (~17 kWh). Before a machine day it starts nearly full and the machine absorbs all the PV, so it barely recharges. Beyond ~20 kWh the extra capacity is used only on machine days and returns flatten above ~30 kWh. For a 10-year payback the installed cost should be below about **150,000 THB for 15 kWh** or **190,000 THB for 20 kWh**. If the timer loads in action 3 work out, the battery case gets weaker.

Keep the export limit on. With the limit off (28–30 Sep) the panels made 52–69 kWh/day, but on this site the extra 20–35 kWh/day would flow to PEA unpaid, and export through a meter not approved for it can cause problems with PEA. The gain should come from raising daytime load, not from switching off the CT.