

Machine load, solar hours and phase balance: a 24-day review

Case study · 20 kWp on-grid solar plant (hybrid inverter, no battery), Ban Doo Chiangrai · Solar ESS Co. Ltd. · 24 October 2026

A large machine that runs twice a week draws 58–65 kW, more than four times the 14 kW peak that the 20 kWp solar system produces. Those seven days used 69% of the site's electricity and caused 82% of its grid purchases, and 40% of that purchase happened outside solar hours. On ordinary days, single-phase loads sit almost entirely on one phase, and since 22 October the plant has been exporting its surplus to the grid without payment.

903 kWh

Solar production

2,118 kWh

Consumption

1,431 kWh

Bought from the grid

167 kWh

Exported (unpaid)

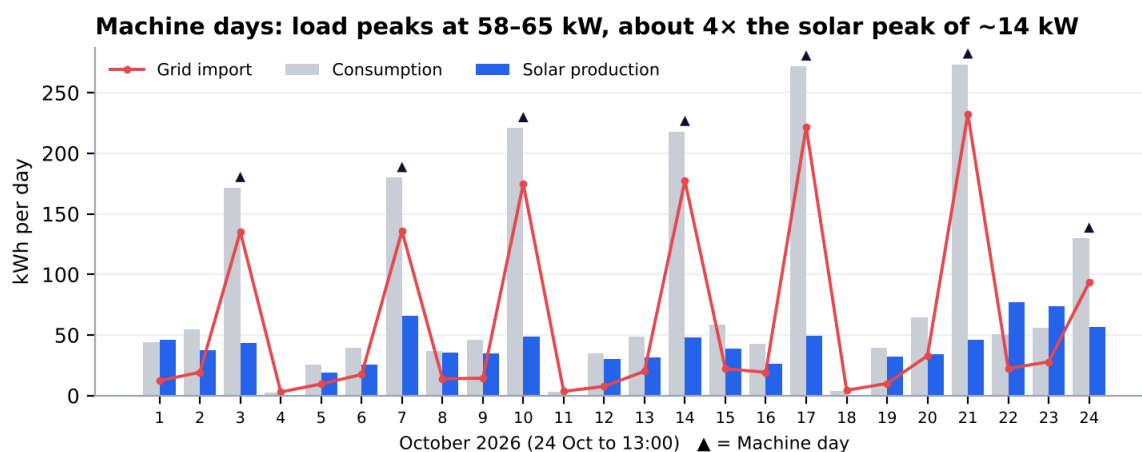
34%

Share of load covered by solar

Data: the plant's 5-minute monitoring records (solar, load, grid) and the grid meter's per-phase power, 1–24 October 2026; 24 October is included up to 13:00. Customer name and exact address are omitted.

1. The machine load overrides solar production

The machine ran on **3, 7, 10, 14, 17, 21 and 24 October**, every Wednesday and Saturday. It draws 58–65 kW, while the solar peak is about 14 kW, so even at noon solar can cover only a fifth of the machine. On ordinary days the site uses about 45 kWh and solar covers two-thirds of it: the system is sized correctly for everyday use, and the machine is what breaks the balance.

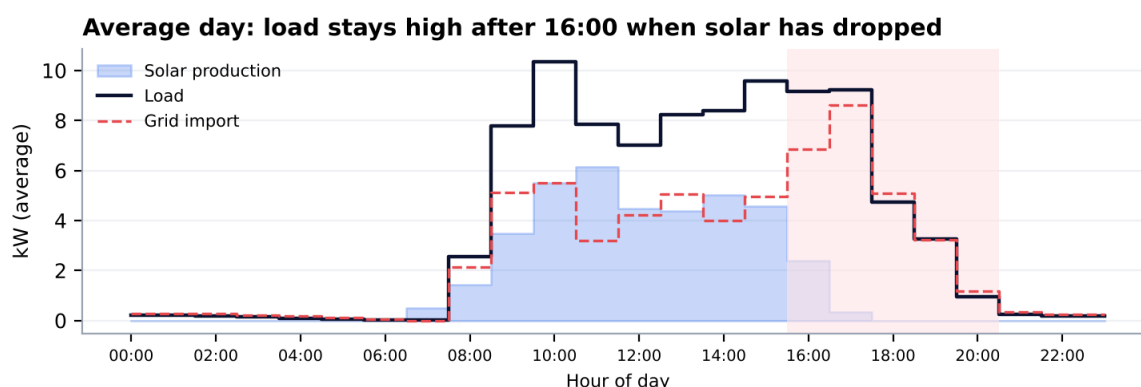


Day	Machine window (load > 30 kW)	Peak kW	Use kWh	Bought kWh	Bought outside 09–16	Solar share
3 Oct (Sat)	12:00–17:55	62	172	135	42	24%
7 Oct (Wed)	13:00–18:35	62	180	136	66	26%
10 Oct (Sat)	08:20–18:10	59	221	175	79	21%
14 Oct (Wed)	10:10–19:35	60	218	177	60	22%
17 Oct (Sat)	09:00–20:15	65	272	222	85	17%
21 Oct (Wed)	09:40–19:55	62	274	232	116	17%
24 Oct (Sat)	08:35–12:55*	62	130	93	21	31%

* data to 13:00. Machine days in total: 1,465 kWh used (69% of all), 1,171 kWh bought (82% of all), solar covered 21%.

2. Machine work outside solar hours

Machine windows start between 08:20 and 13:00 and often run to **18:00–20:15**. On machine days **468 kWh (40%) of the grid purchase came before 09:00 or after 16:00**, when the panels produce little or nothing. The average day shows the same pattern: load stays around 9 kW from 16:00 to 18:00 while solar falls to almost zero (shaded area).



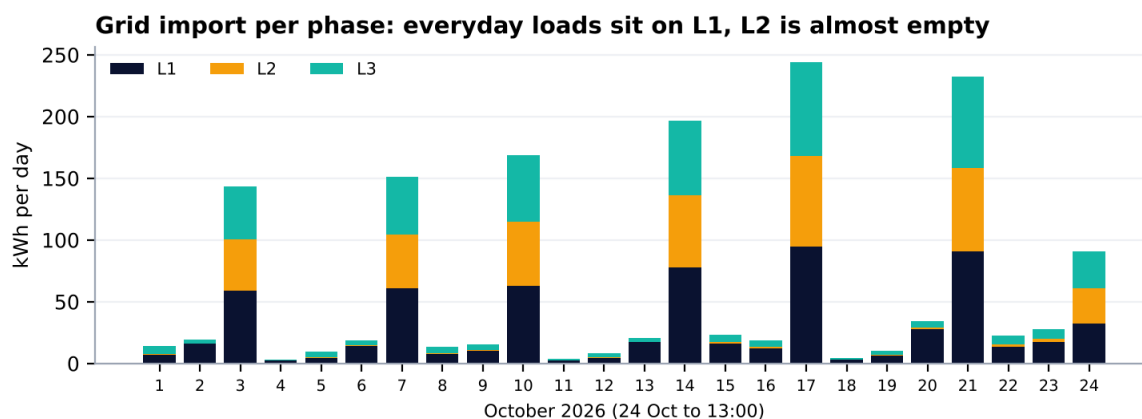
What to do

- **Run the machine 08:30–16:00** and avoid starting after midday, so the evening tail (16:00–20:00) disappears.
- **Check the PEA tariff.** On a TOU tariff, Saturday is off-peak all day, so Saturday runs are cheap; the Wednesday 09:00–20:00 runs fall in peak hours and cost the most. Moving the Wednesday run to the weekend gives the largest saving.
- **Use Sundays.** On 4, 11 and 18 October the site used almost nothing and, with export limited, the panels produced only 0.1–0.5 kWh. Flexible work around midday on Sunday would use about 70 kWh of free solar each sunny week.

3. Unbalanced loads

The machine itself is fairly balanced, about **16 / 15 / 15 kW on L1 / L2 / L3**. The everyday single-phase loads are not: on ordinary days **L1 takes 68% of the grid purchase, L3 27% and L2 only 4%**. Over the period the peak per phase was 24.1 kW on L1, 19.0 kW on L2 and 20.7 kW on L3. Because the inverter feeds the three phases

equally, one phase can export while another imports: **22 kWh left the site on L2/L3 while 47 kWh came in on L1 at the same moments.**



What to do

- Have a licensed electrician **move about half of L1's single-phase circuits (lights, sockets, office air-conditioners) to L2**, then re-check the per-phase readings.
- Ask the inverter manufacturer whether this model can run in **unbalanced-output mode**, which would let it follow the load phase by phase.

4. Export since 22 October

Until 21 October the zero-export limit held export to about 1 kWh a day, which also capped solar production at 30–48 kWh on sunny days. From 22 October export rose to **47, 44 and 16 kWh a day** and production doubled to **74–77 kWh**: the export limit appears to be off. Without a PEA sell-back contract this surplus is given to the grid without payment.

What to do

- Short term: **re-enable zero export** unless a sell-back licence is obtained, accepting that production will again be limited on light days.
- Better: this is a **hybrid inverter**, so a **30–40 kWh battery** can store the midday surplus and supply the 16:00–20:00 load, keeping the extra solar on site.

Summary of recommendations

1. Schedule machine work 08:30–16:00; move the Wednesday run to the weekend if the tariff is TOU.
2. Move flexible work to sunny midday hours, including Sundays.
3. Rebalance single-phase circuits from L1 to L2; check unbalanced-output mode.
4. Re-enable zero export, or add a 30–40 kWh battery to keep the surplus.

Scope: Solar ESS supplies energy from the solar system only and is not responsible for the electrical installation inside the customer's buildings. Figures are from the monitoring platform and meter and may differ slightly from the utility bill.