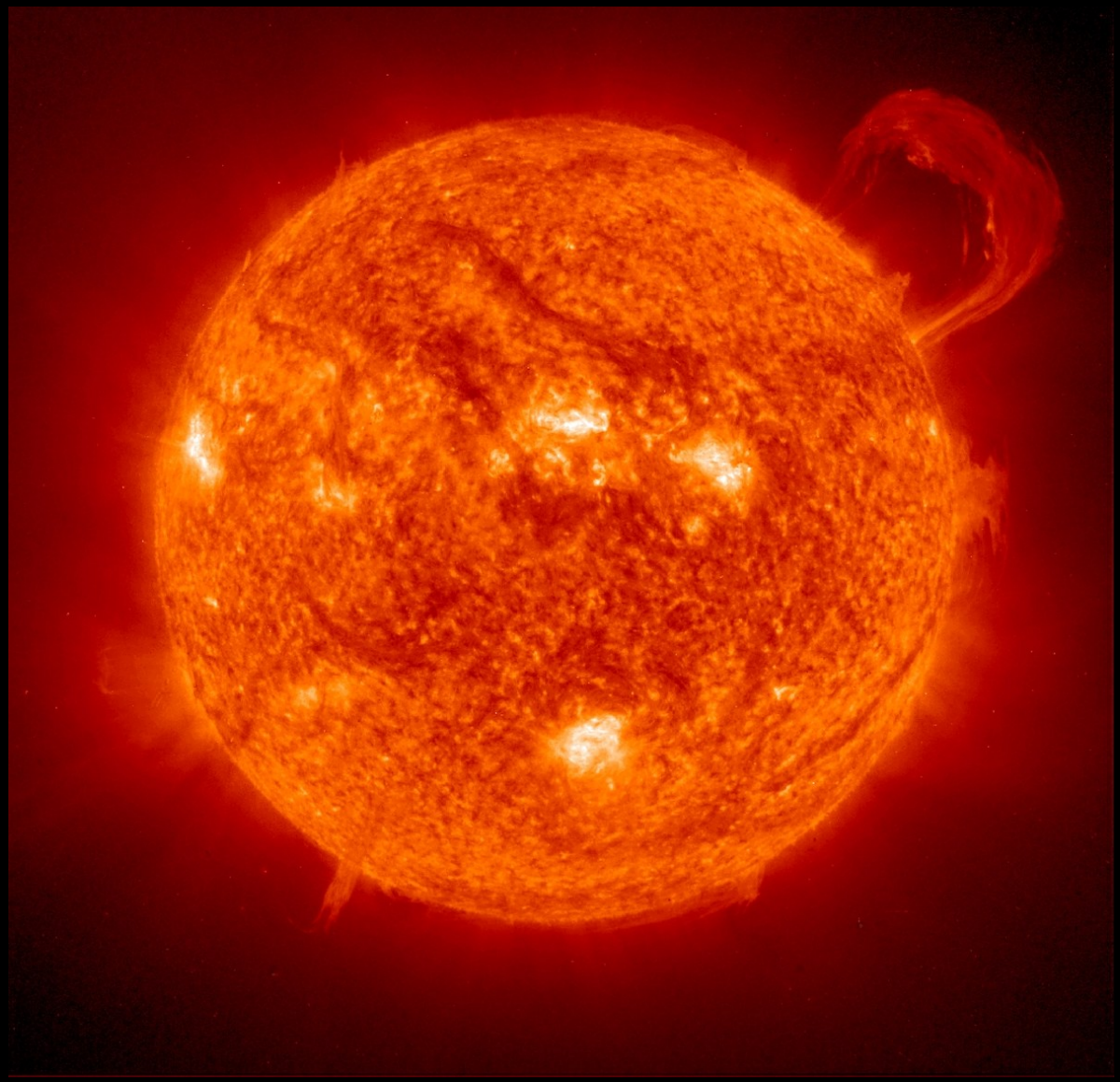
Shedding some light on solar power

Sunshine is loaded with energy



Sunshine is loaded with energy

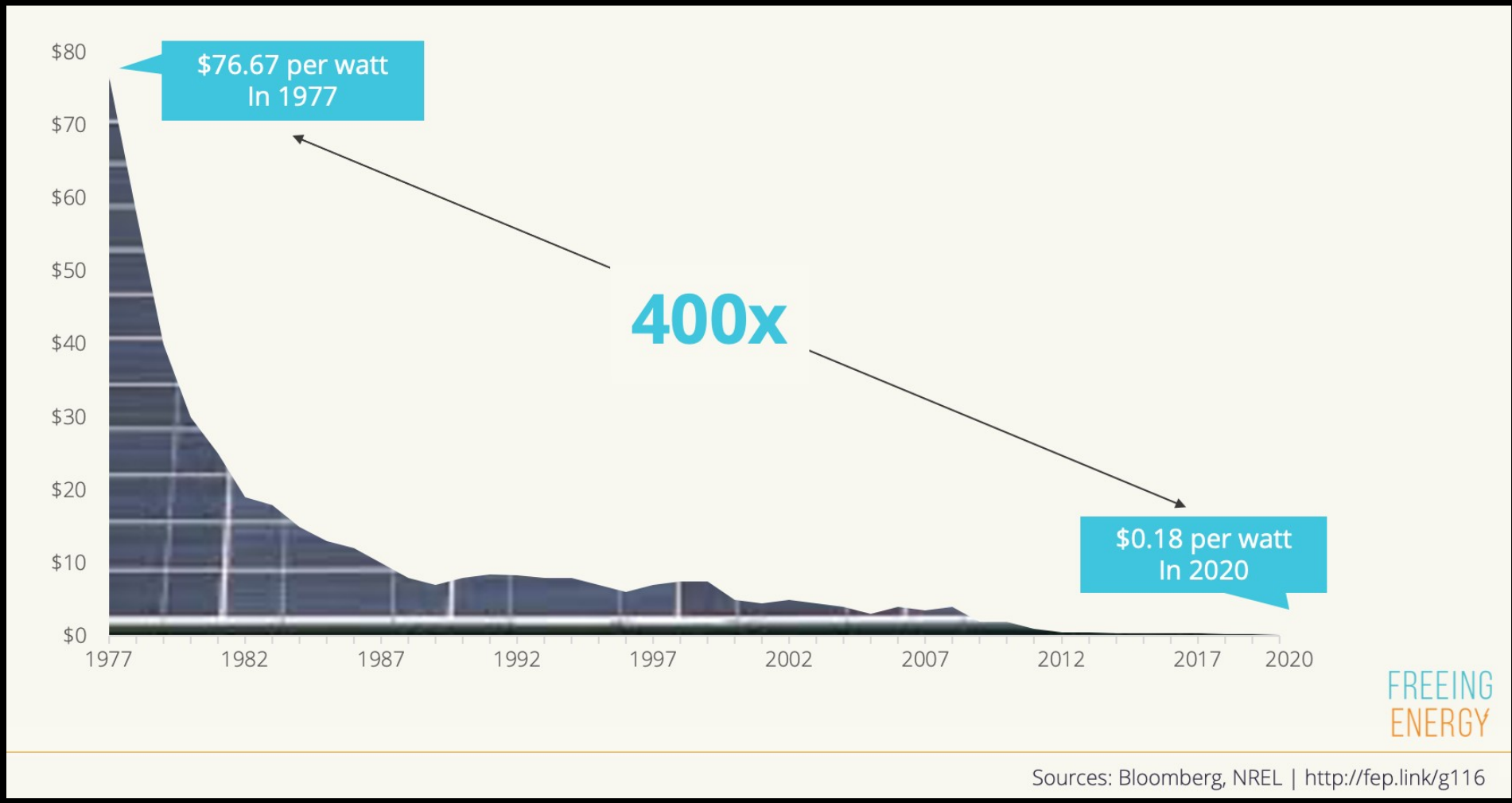
About 1360 watts per square metre at the top of the atmosphere.

At least half of this reaches the earth's surface on average.

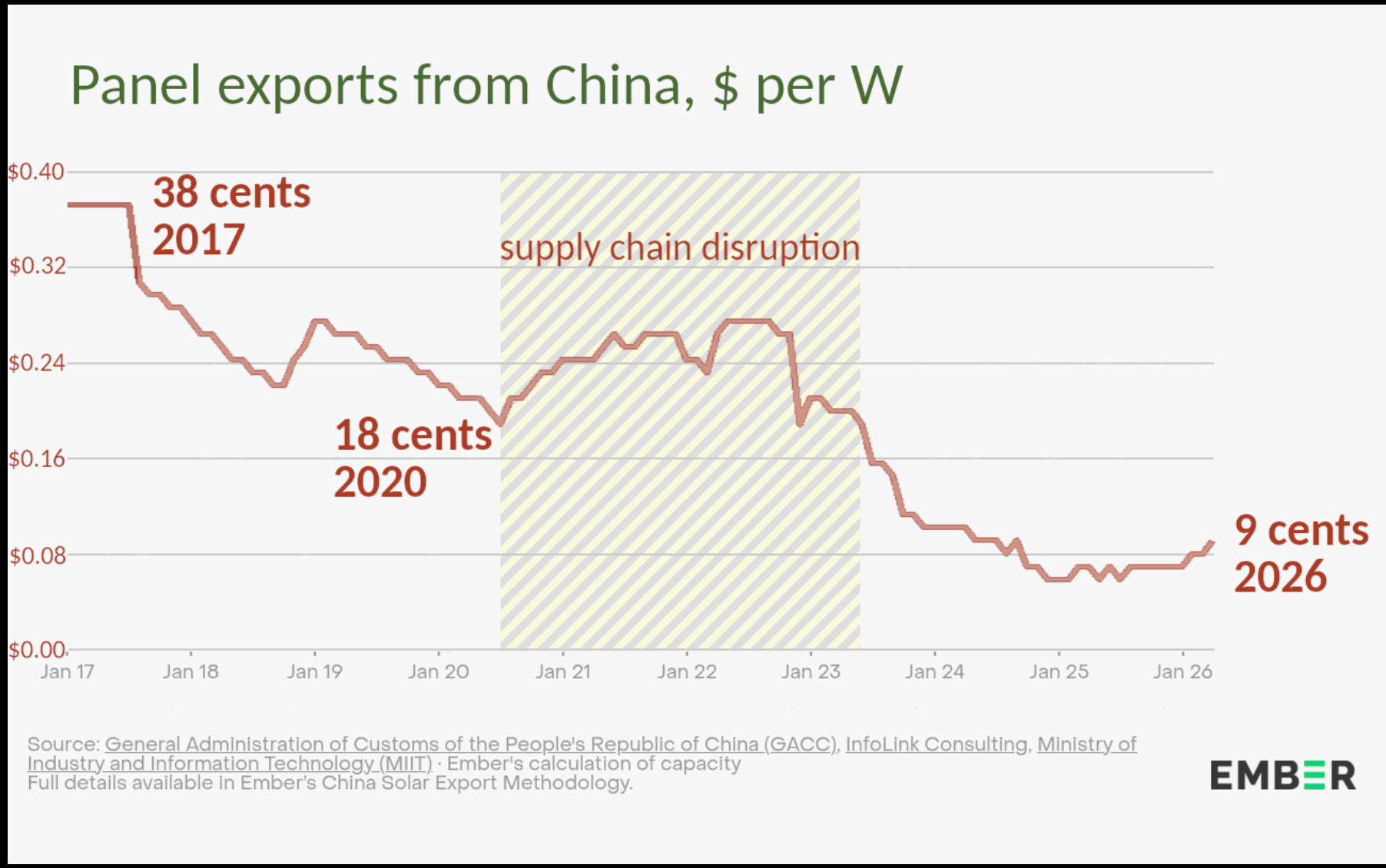
On a sunny day around noon, this would power a jug using only 3 square metres.

Technology advance

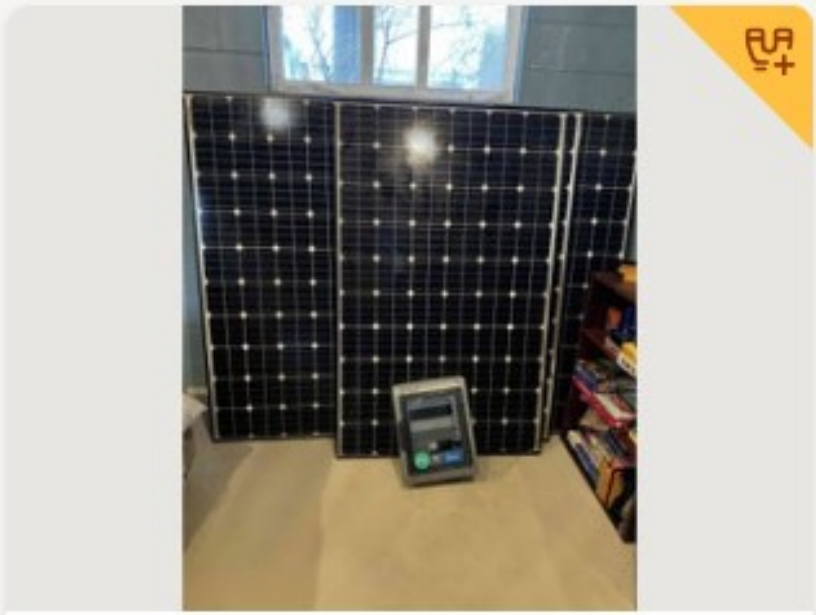
Technology has driven down prices



The curve is bottoming out...



Bargains galore



Marlborough — Closes: Mon, 8 Jun

Complete Used Solar Panel System

Reserve not met
$1,500

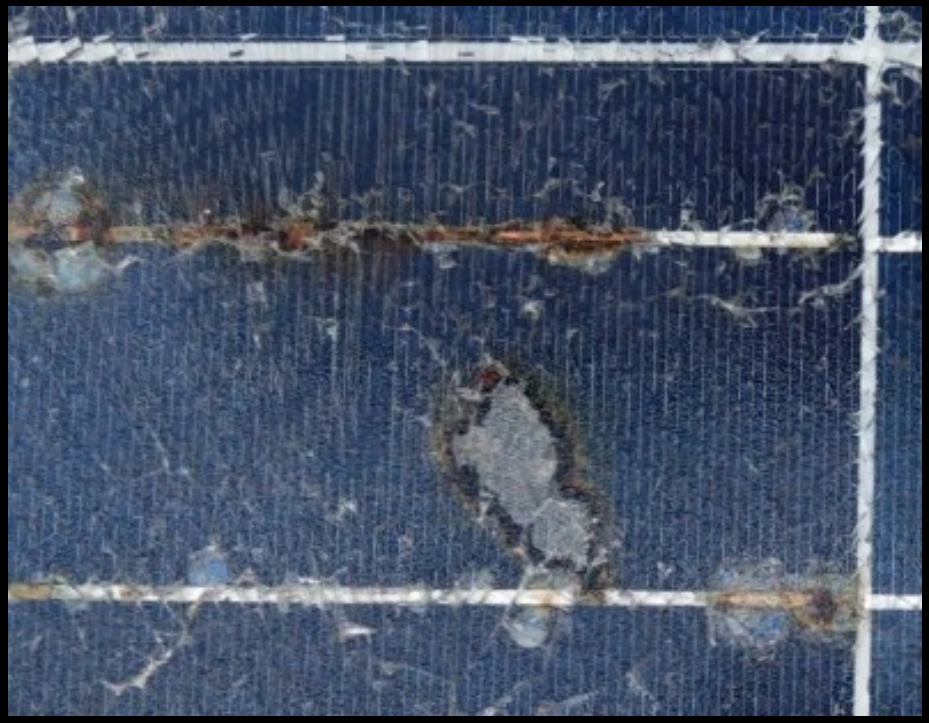
Buy Now
$2,000

Bay of Plenty — Closes: Sun, 7 Jun

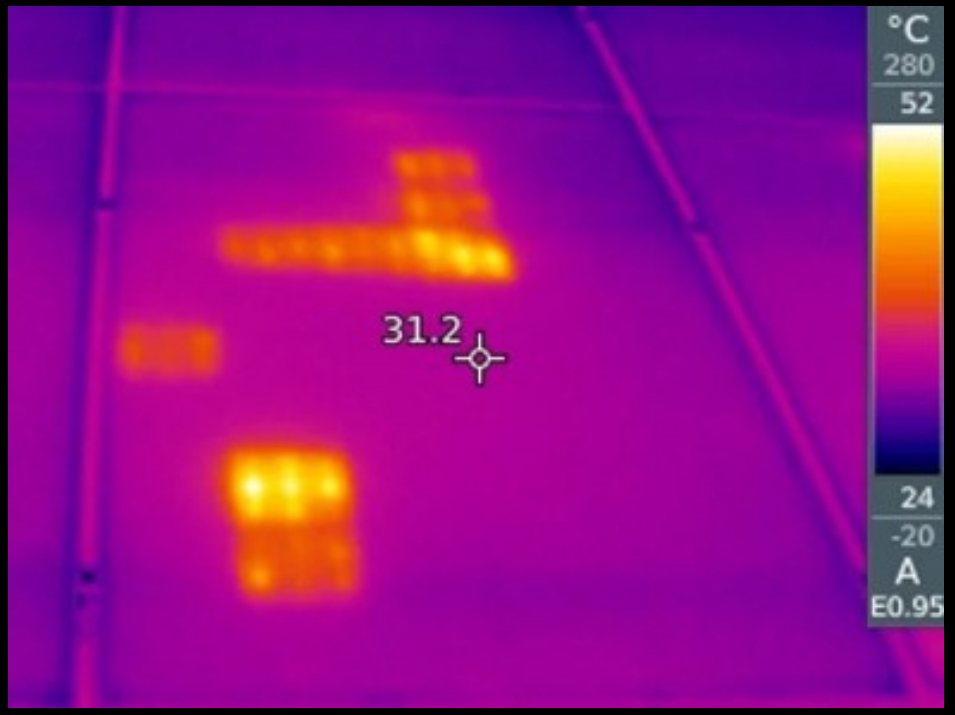
Solar panels

Reserve not met
$181.00

What failure looks like

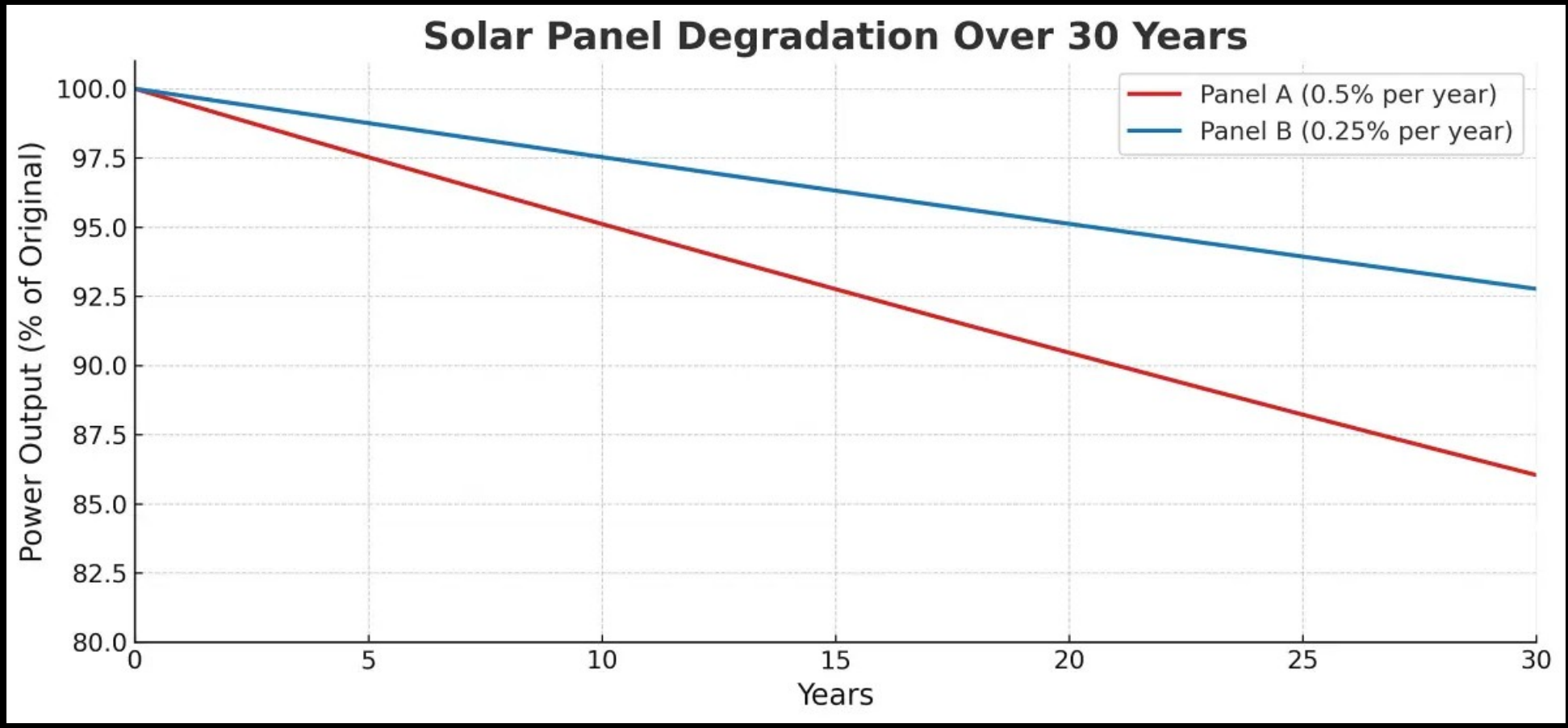


Corrosion of metal traces caused by water getting under the glass

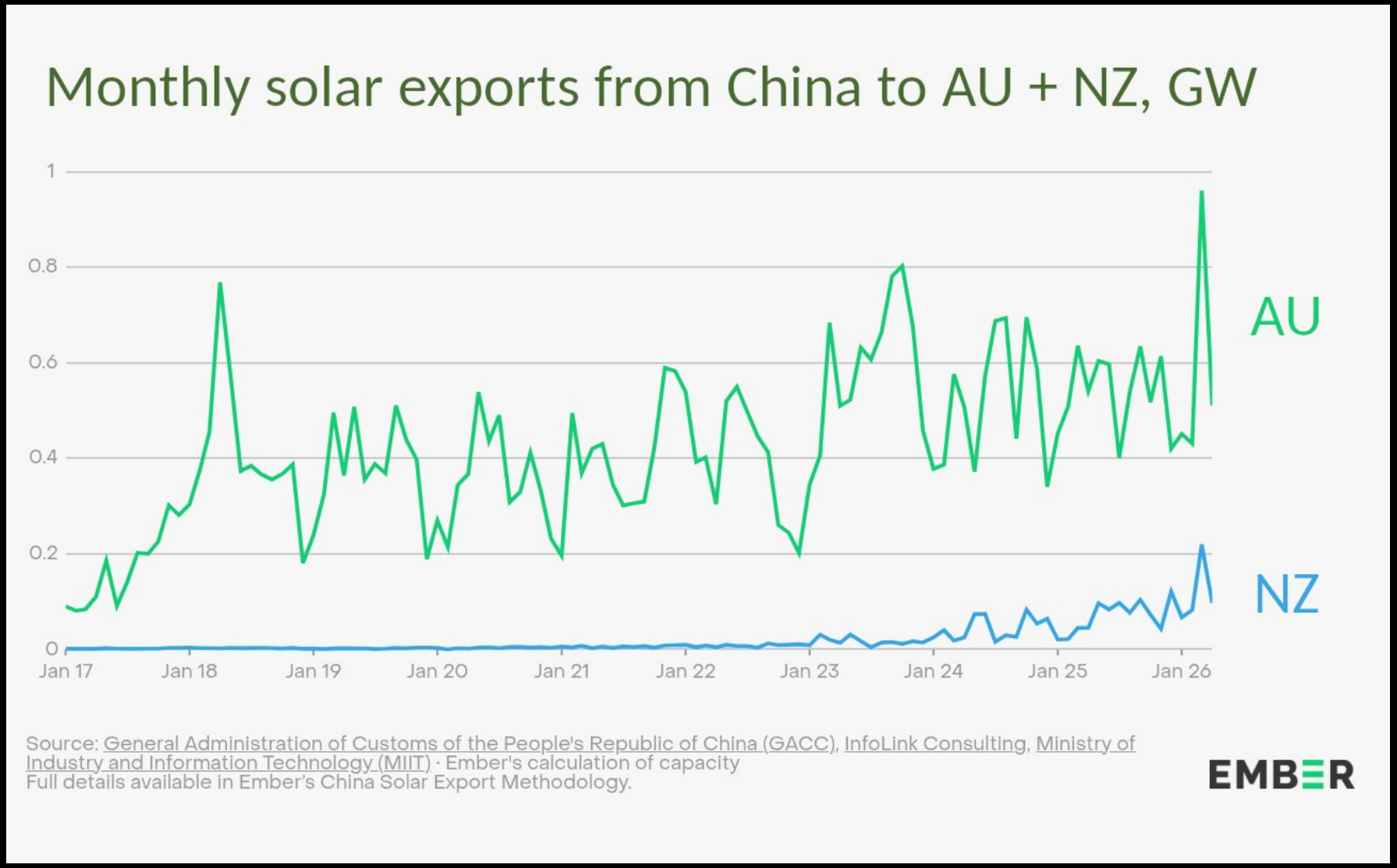


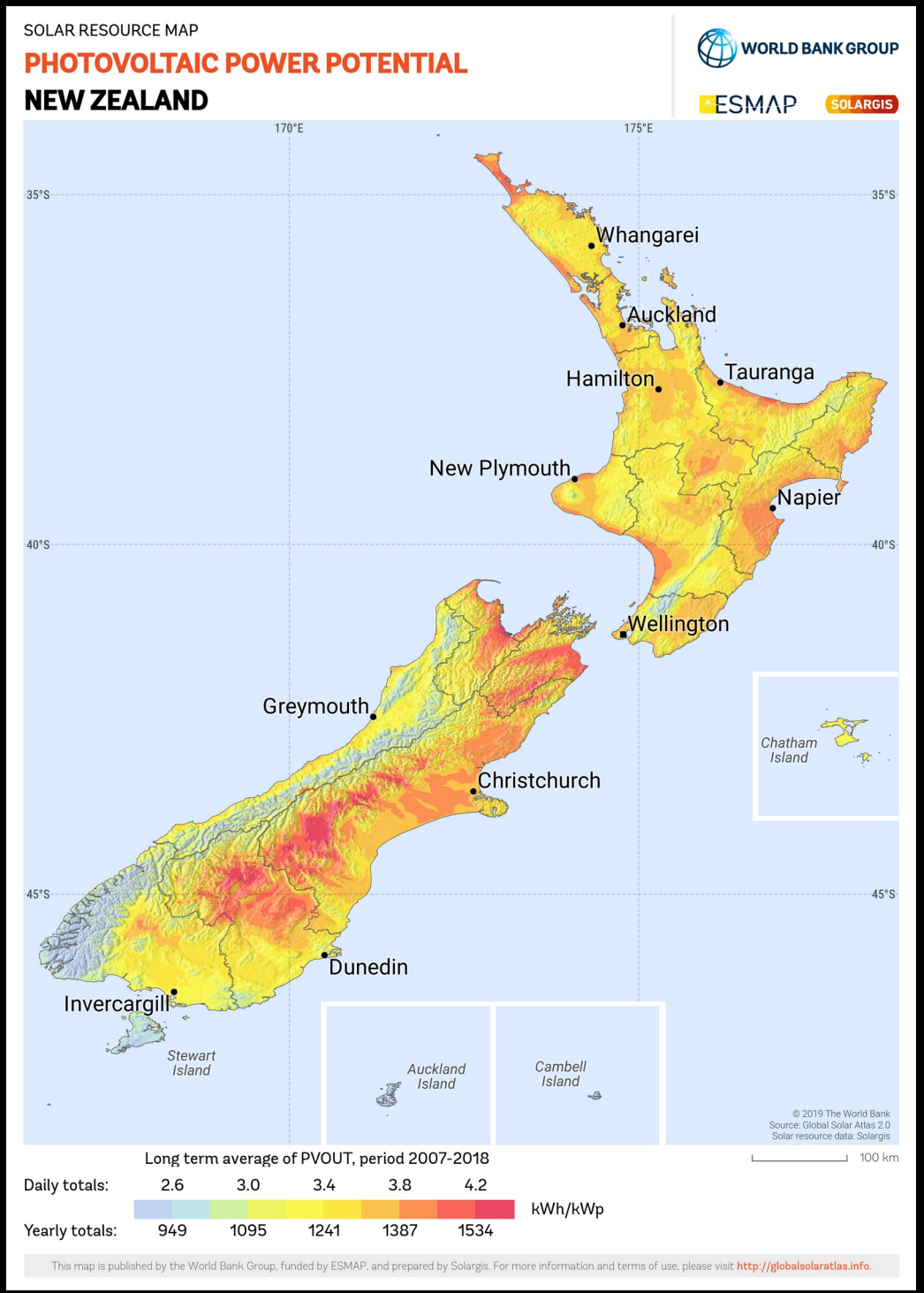
Hot spots resulting from micro cracks damaging the cell structure

Long haul performance



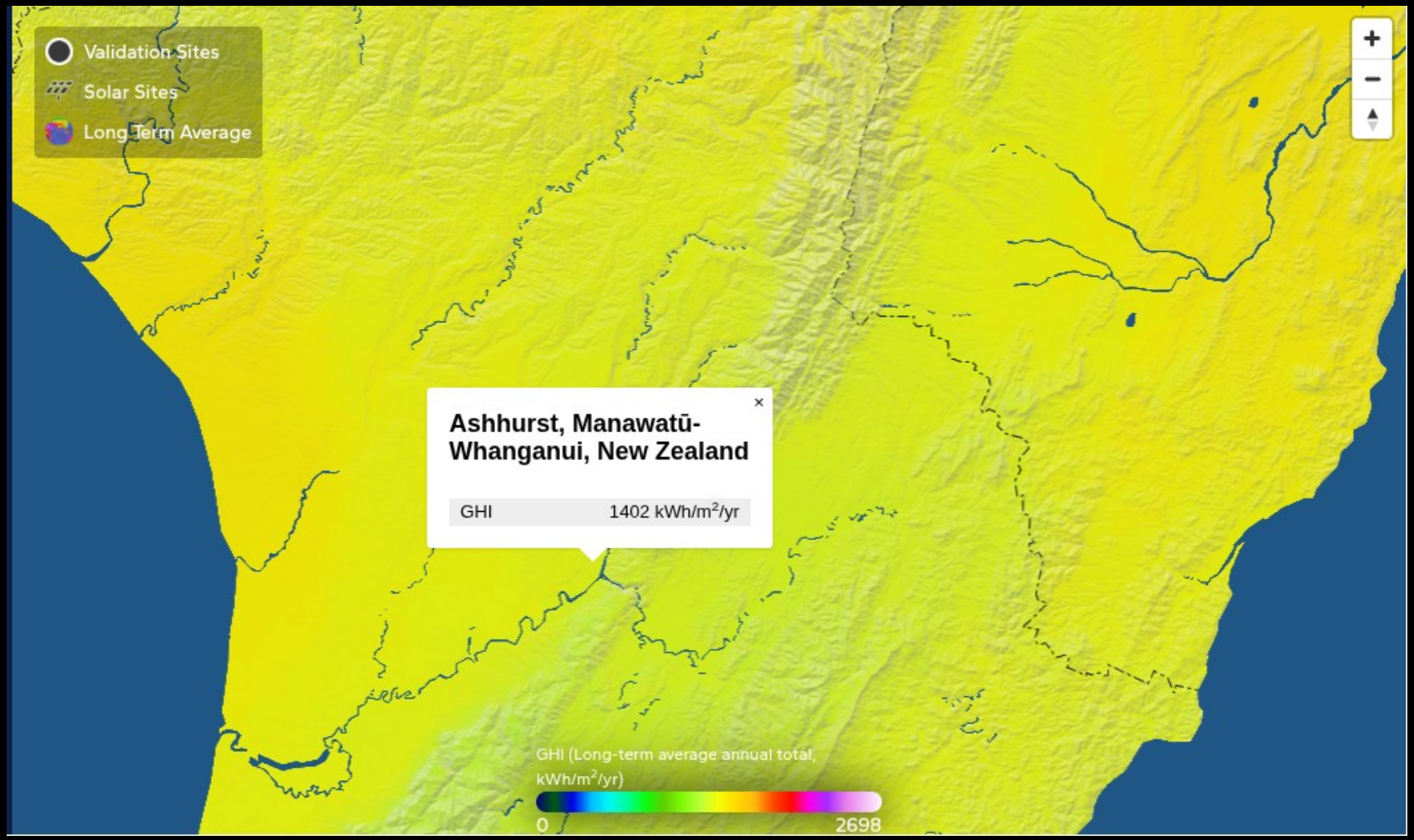
Comparing uptake with Oz





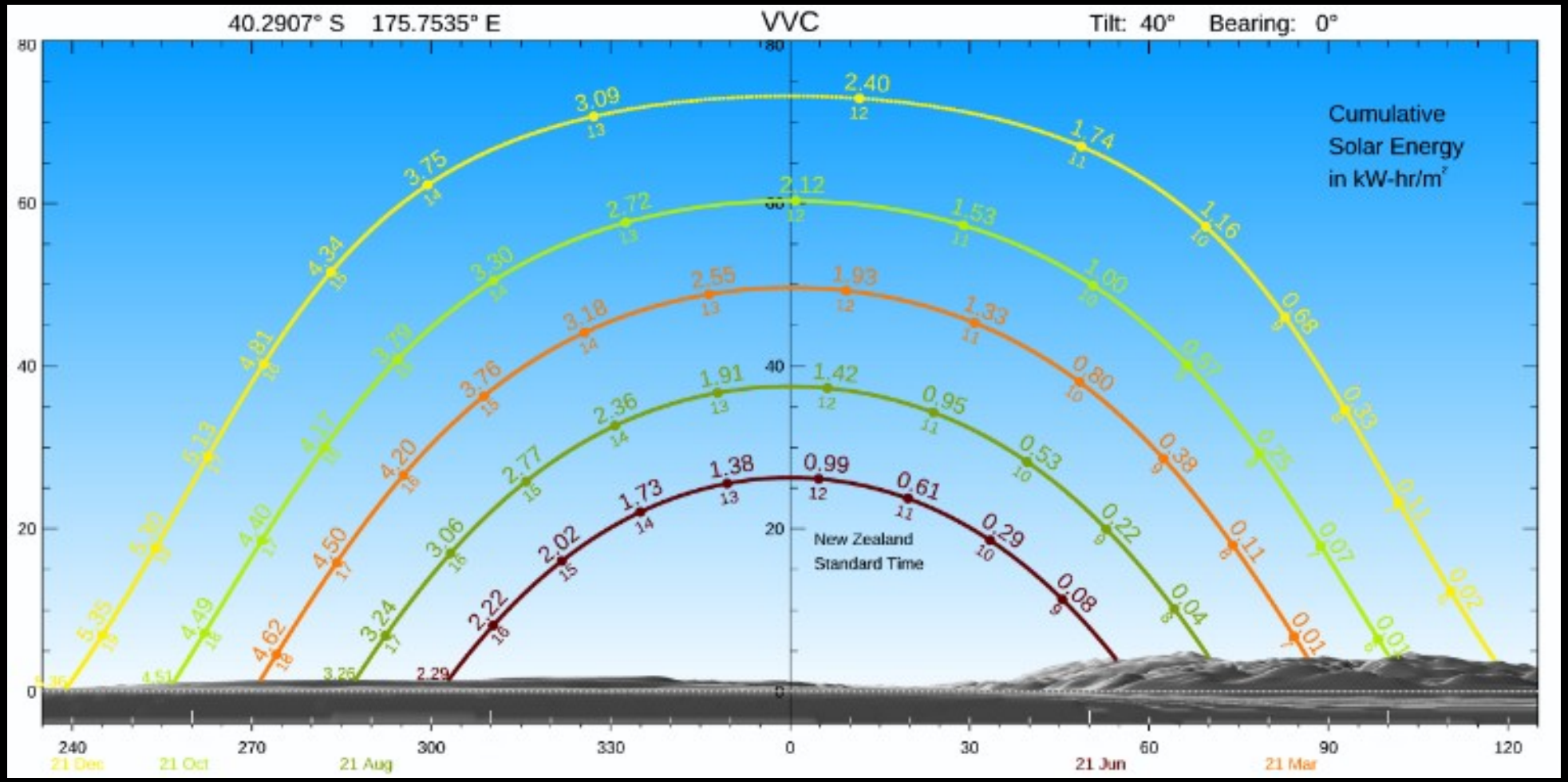
How well does it work here?

Ashhurst is near the middle



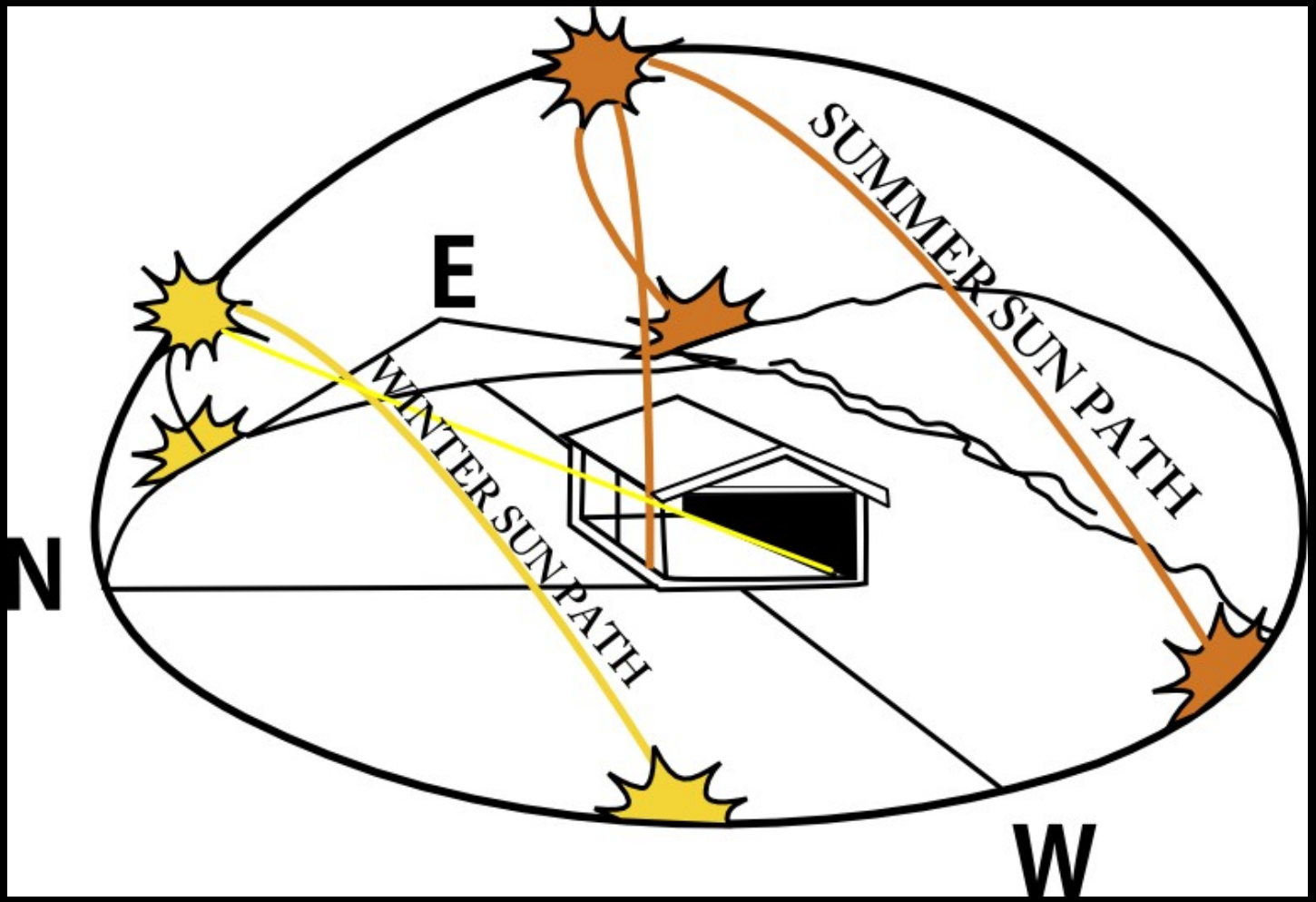
https://solcast.com/

NIWA Solarview



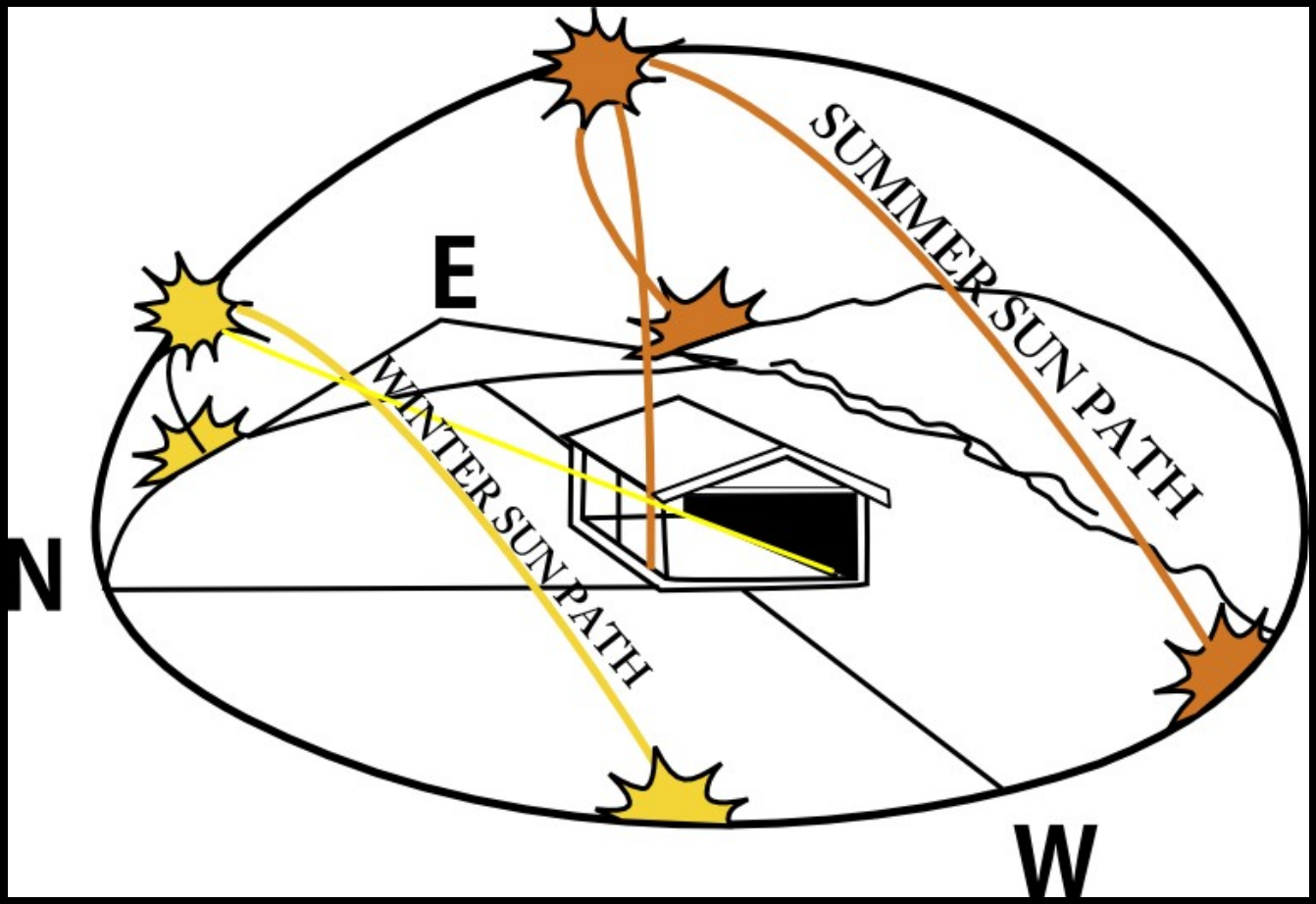
https://data.niwa.co.nz/solarview

Which way should panels face?



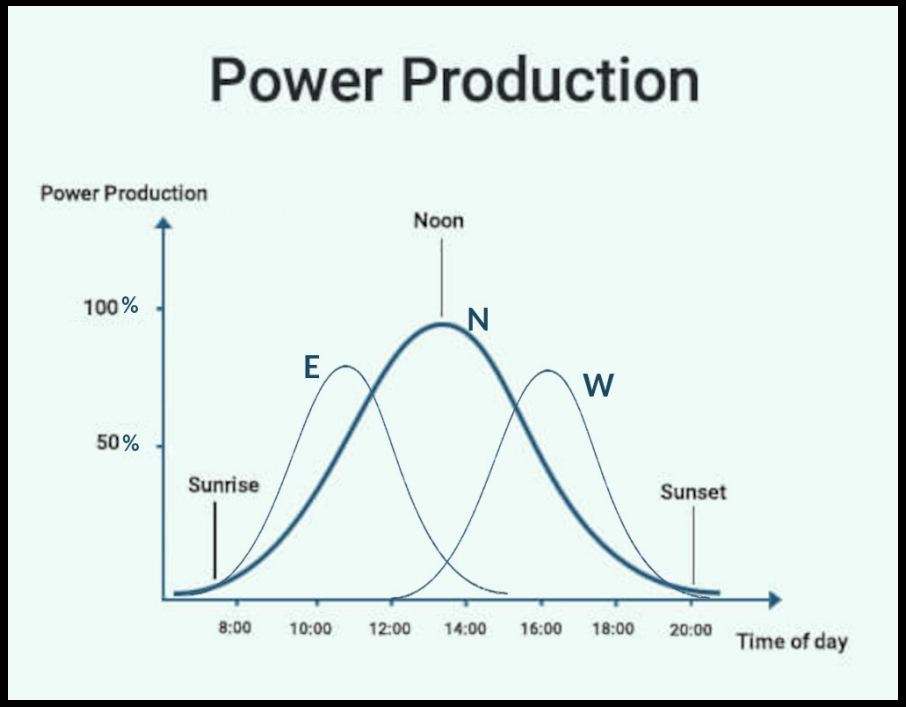
- North is good. So is NE + NW
- E and W give morning and afternoon boost

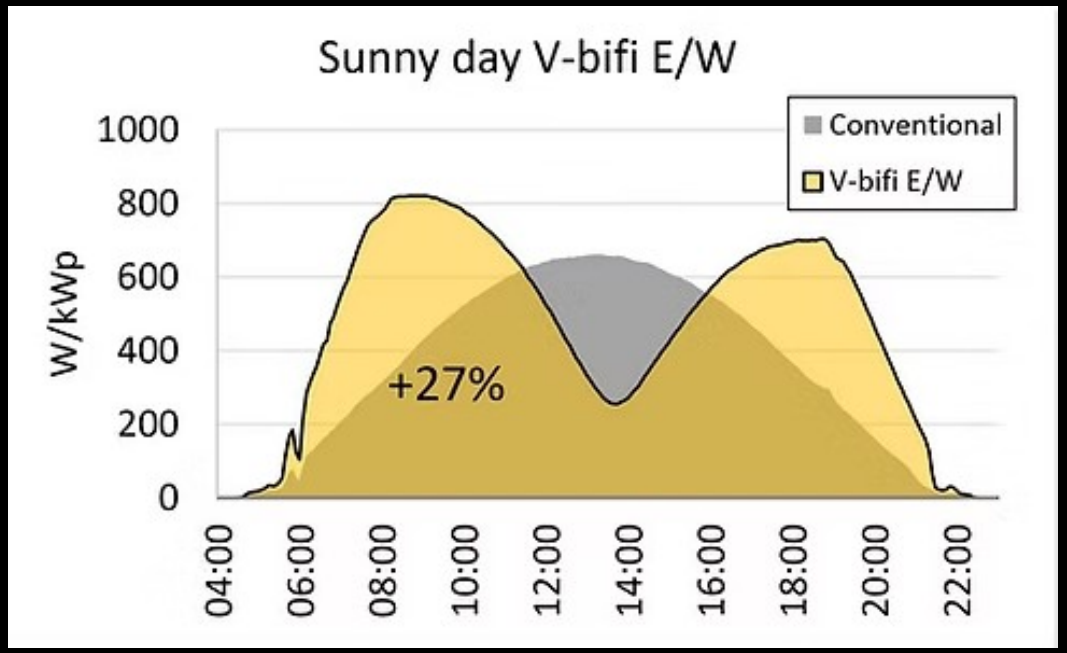
What about tilt?



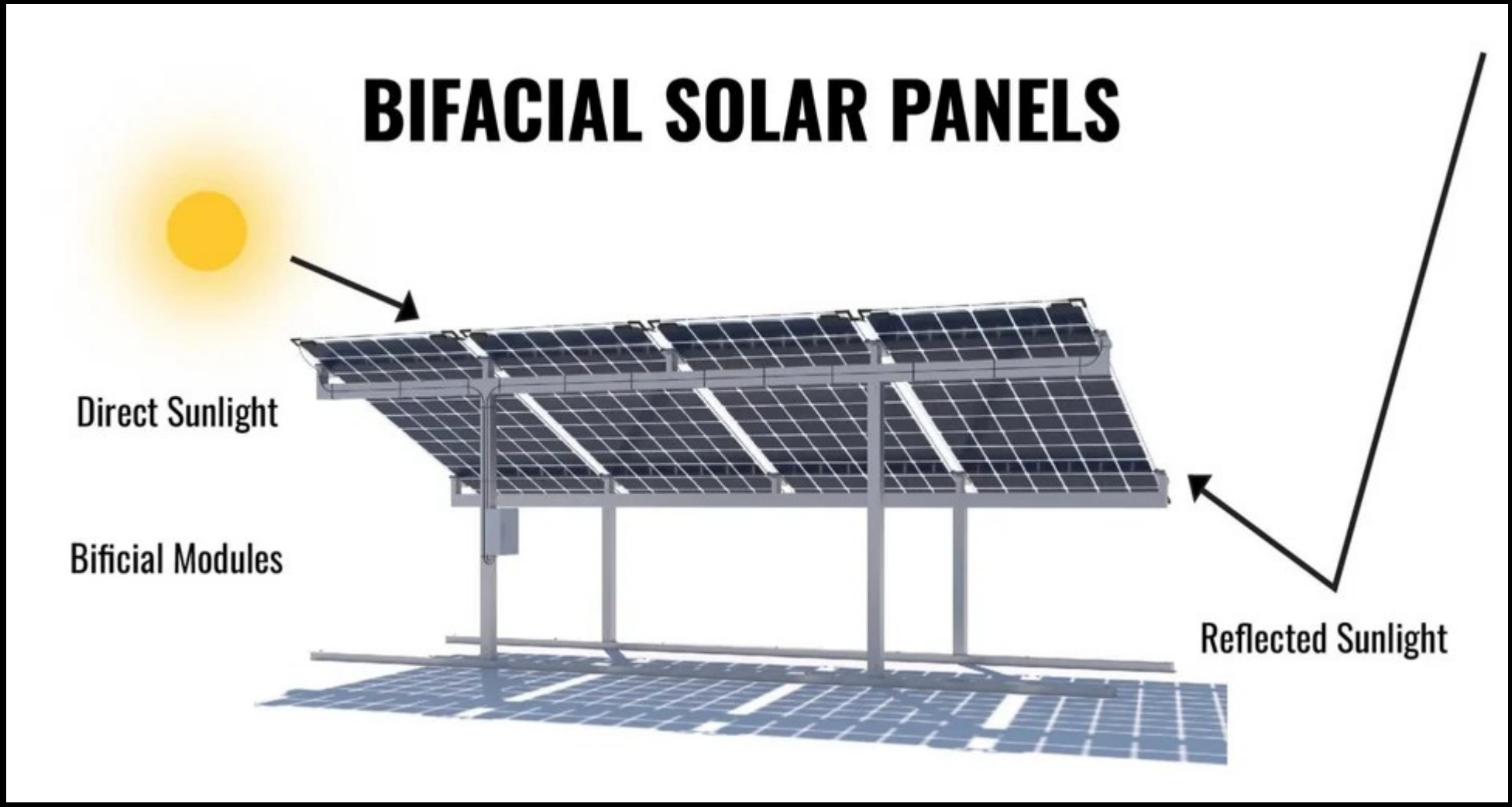
- 40 degrees is optimal for our location
- More or less is also OK
- 15 degrees is minimum for self cleaning

Spreading the peak

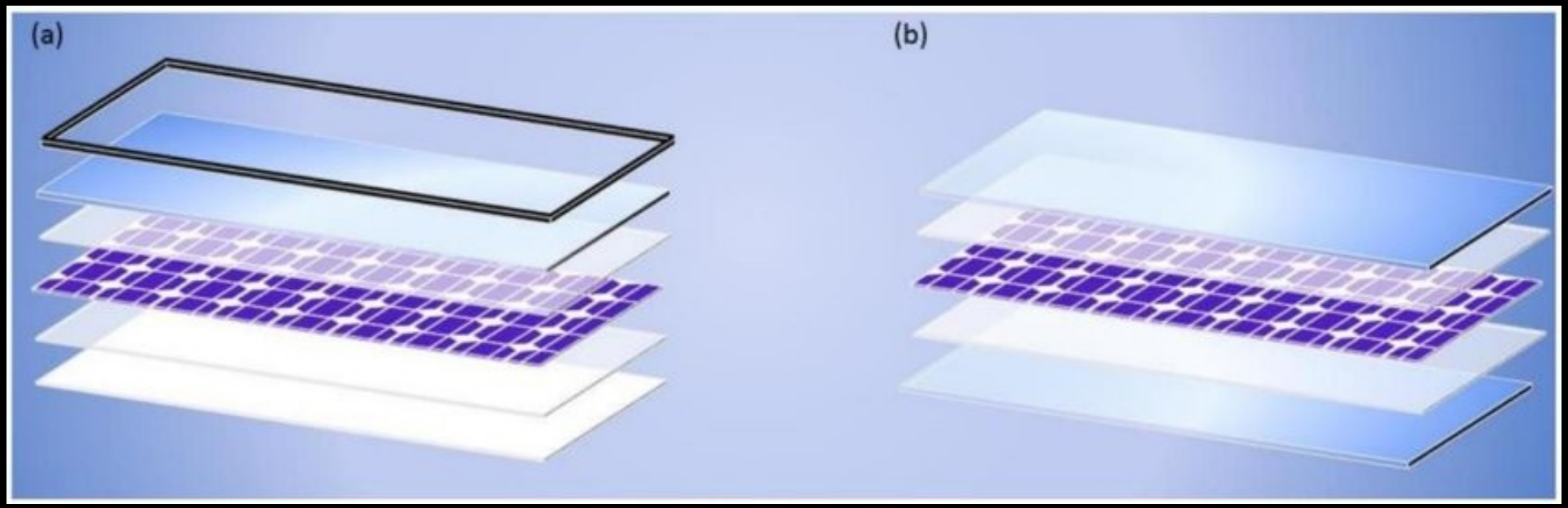




Both sides now



Solar sandwiches



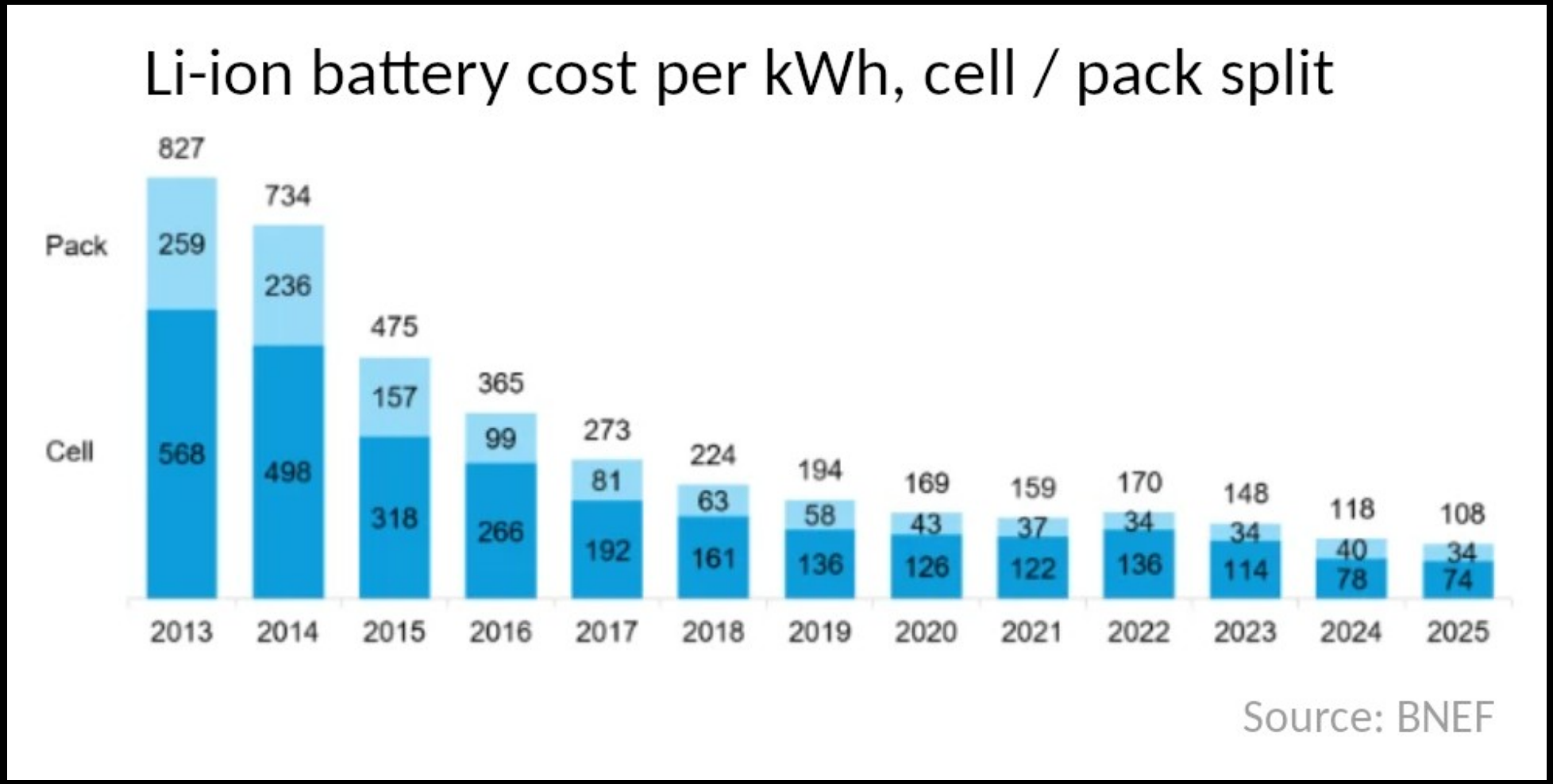
Monofacial panels use an opaque backsheet to sit behind the cells.

Bifacials use a transparent material. The best ones use glass just like the top.

Hooking up to the grid

- Grid is there...may as well use it
- Batteries not a requirement
- If there’s a power cut, you won’t be generating!
- Battery adds cost but also security and flexibility
- Feed-in tariffs low, so we’re better off using than selling
- Hot water cylinder is like a battery
- Load shifting with time of use tariffs

Battery costs are tracking the same direction as panels



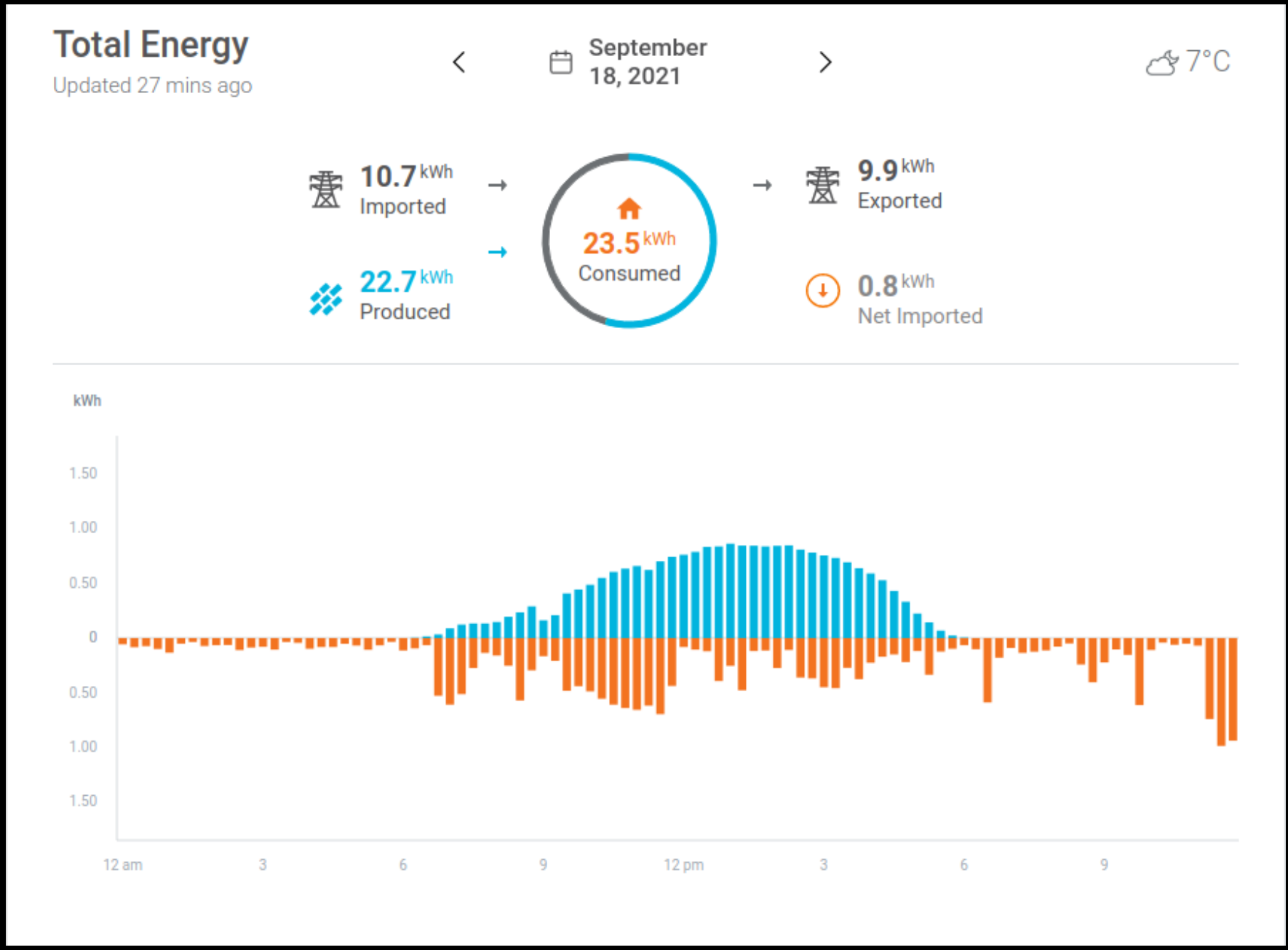
String or micro inverters?

- String systems are less costly
- Strings need to be carefully matched
- Expansion may require bigger inverter
- Shading one panel can cut out entire string
- All-in-one devices work with batteries
- Micro has greater up-front cost
- Wiring is easier and cheaper
- Expansion of system is easier
- Shading, dirt, or a fault on a panel doesn’t shut down the system

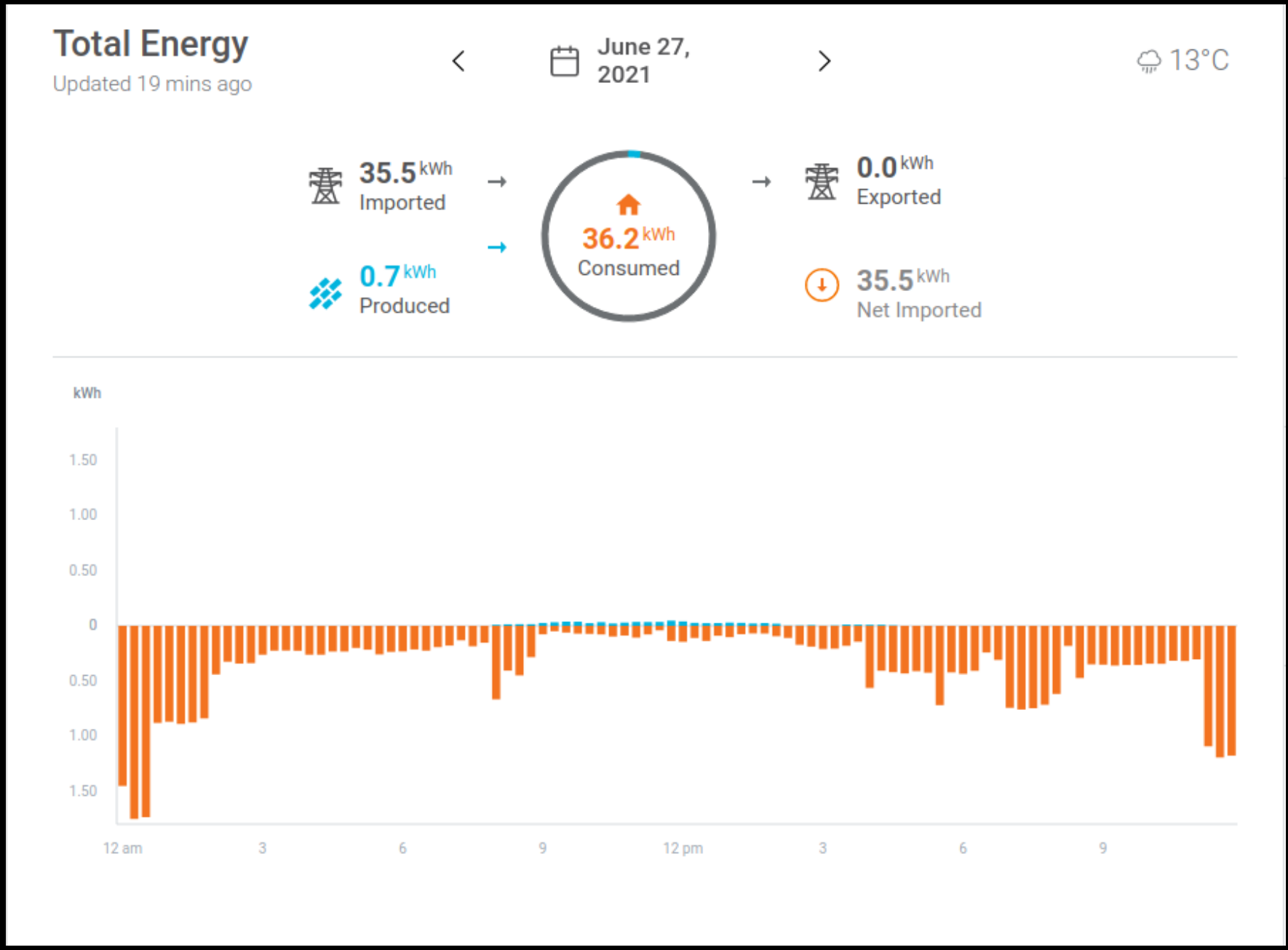
Sizing your system

- kW vs kWh
- kWp
- Peak loads and times
- Network constraints
- Off-grid requirements
- Maintenance and lifespan of components

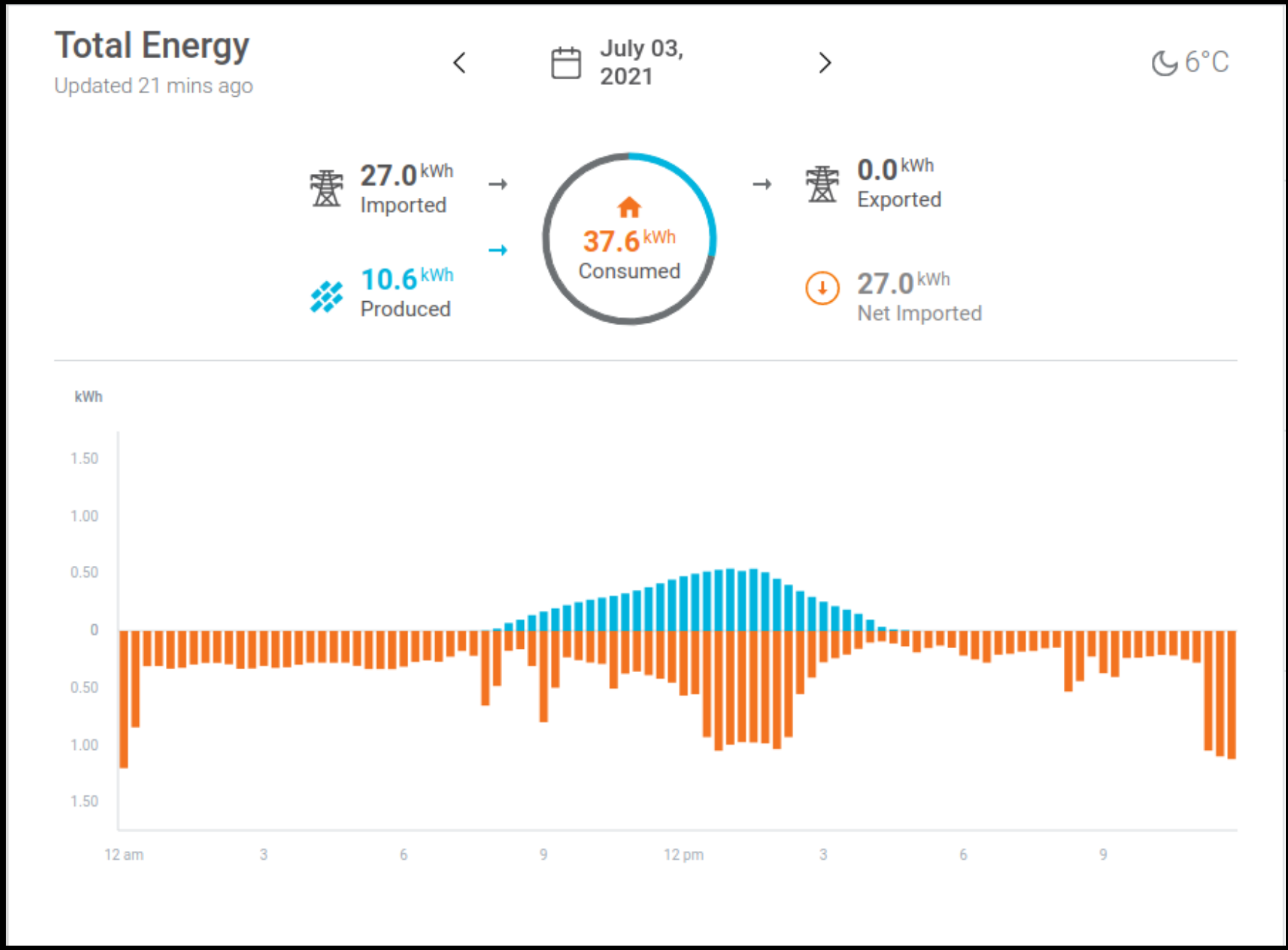
18 September



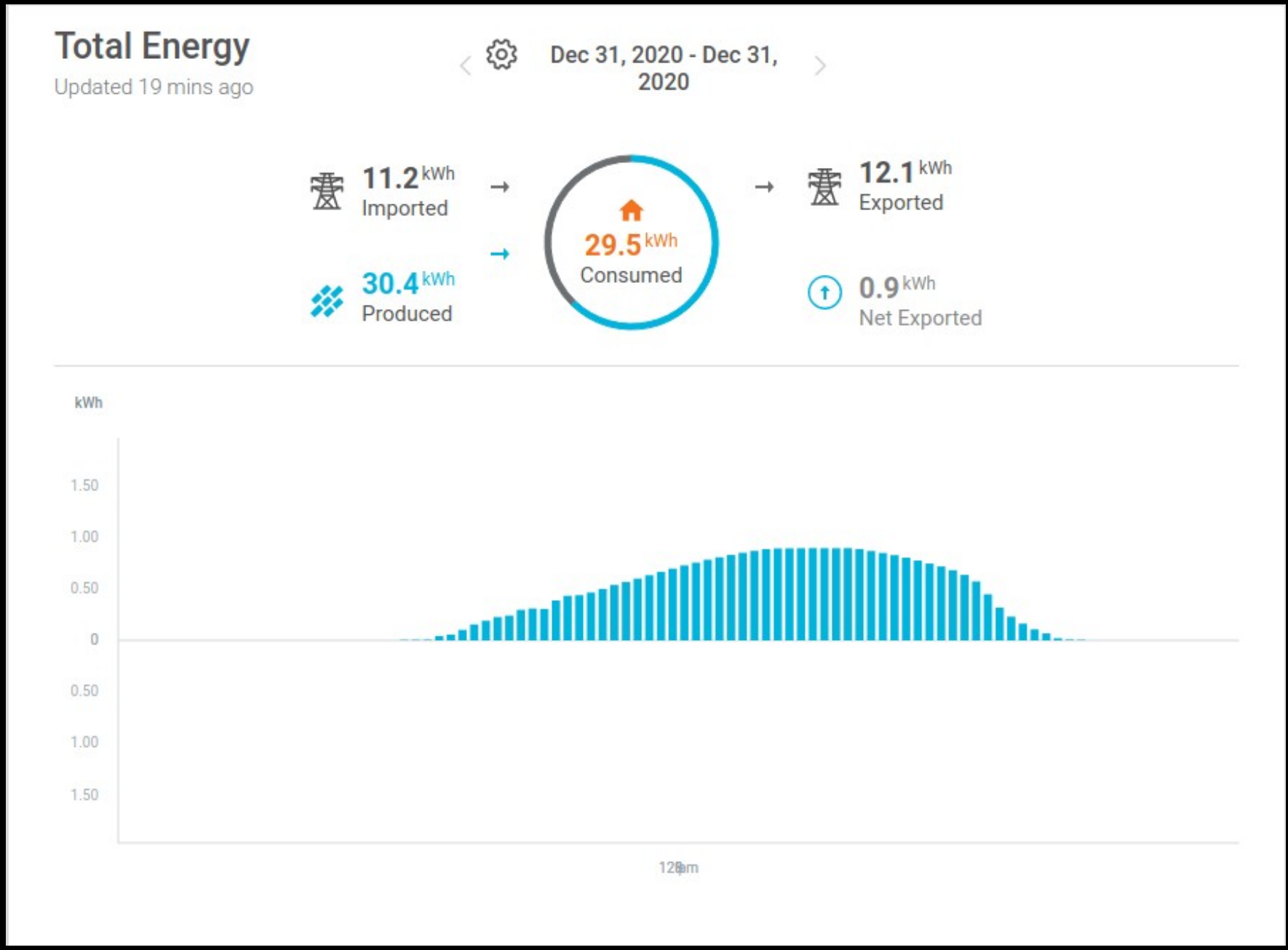
27 June


Total Energy
Updated 19 mins ago
June 27, 2021
13°C
35.5 kWh
Imported
0.7 kWh
Produced
36.2 kWh
Consumed
0.0 kWh
Exported
35.5 kWh
Net Imported
kWh
1.50
1.00
0.50
0
0.50
1.00
1.50
12 am
3
6
9
12 pm
3
6
9

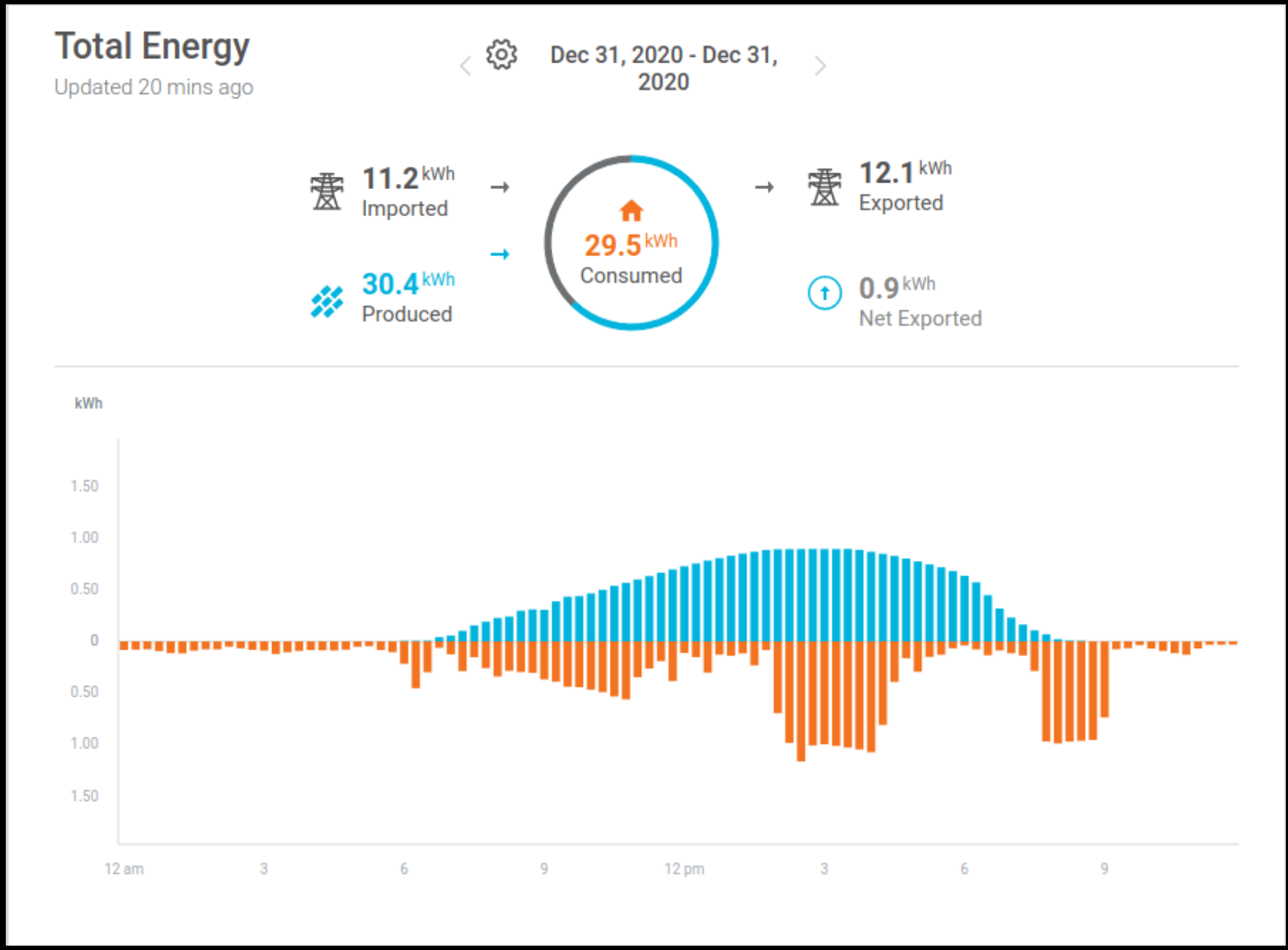
3 July


Total Energy
Updated 21 mins ago
July 03, 2021
6°C
27.0 kWh
Imported
10.6 kWh
Produced
37.6 kWh
Consumed
0.0 kWh
Exported
27.0 kWh
Net Imported
kWh
1.50
1.00
0.50
0
0.50
1.00
1.50
12 am
3
6
9
12 pm
3
6
9

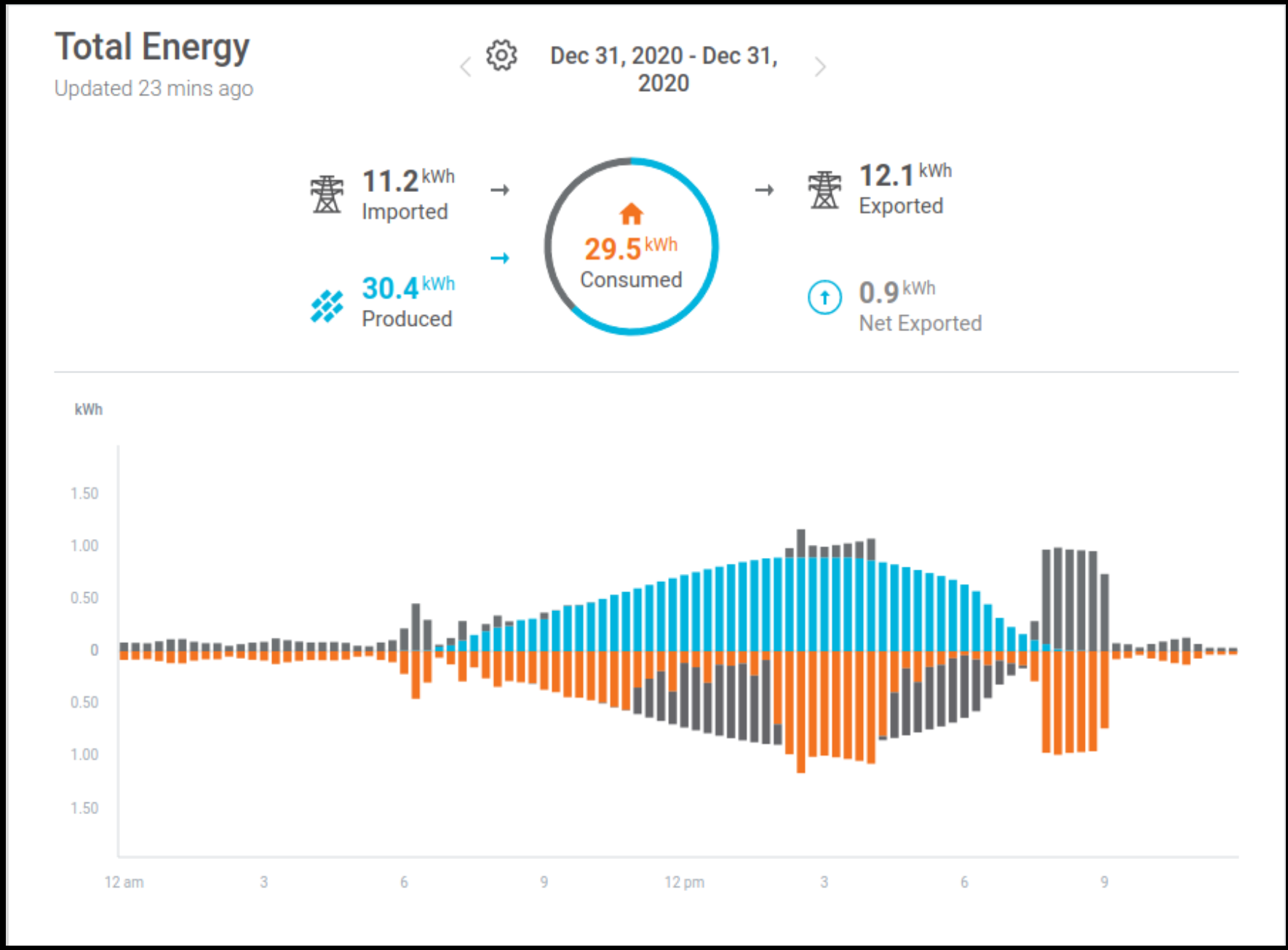
31 December


Total Energy
Updated 19 mins ago
Dec 31, 2020 - Dec 31, 2020
11.2 kWh
Imported
30.4 kWh
Produced
29.5 kWh
Consumed
12.1 kWh
Exported
0.9 kWh
Net Exported
kWh
1.50
1.00
0.50
0
0.50
1.00
1.50
12pm

31 December


Total Energy
Updated 20 mins ago
Dec 31, 2020 - Dec 31, 2020
11.2 kWh
Imported
30.4 kWh
Produced
29.5 kWh
Consumed
12.1 kWh
Exported
0.9 kWh
Net Exported
kWh
1.50
1.00
0.50
0
0.50
1.00
1.50
12 am
3
6
9
12 pm
3
6
9

31 December


Total Energy
Updated 23 mins ago
Dec 31, 2020 - Dec 31, 2020
11.2 kWh
Imported
30.4 kWh
Produced
29.5 kWh
Consumed
12.1 kWh
Exported
0.9 kWh
Net Exported
kWh
1.50
1.00
0.50
0
0.50
1.00
1.50
12 am
3
6
9
12 pm
3
6
9

Finance and related factors

- Energy efficiency pays for itself
- Good time to ditch gas
- Add an EV to the mix
- Bank lending via mortgage topups
- Grants available for insulation and heating
- “Green finance” credit cards...beware
- Personal loans
- Alternative options

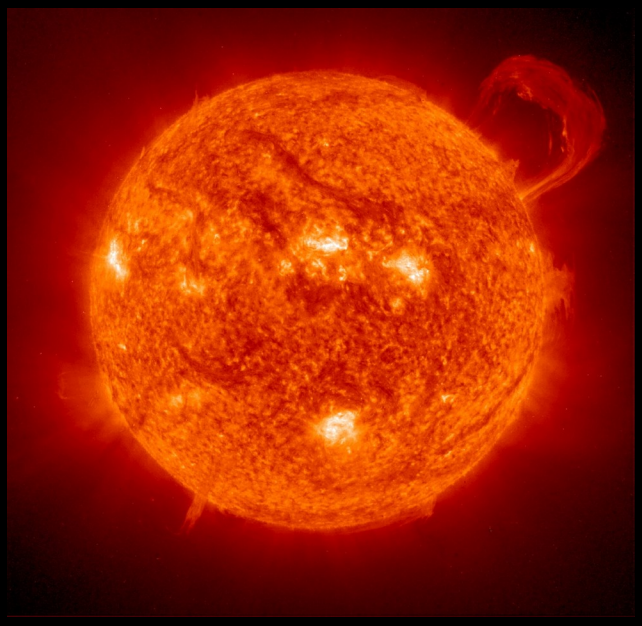
Q and A

Thanks for coming...we hope you got a charge out of it

RECAP

Shedding some light on solar power

Sunshine is loaded with energy



The sun is releasing millions of times more energy every second than humankind has ever used

Sunshine is loaded with energy

About 1360 watts per square metre at the top of the atmosphere.

At least half of this reaches the earth's surface on average.

On a sunny day around noon, this would power a jug using only 3 square metres.

...mind you, that's if we could turn 100% into electricity...

Technology advance

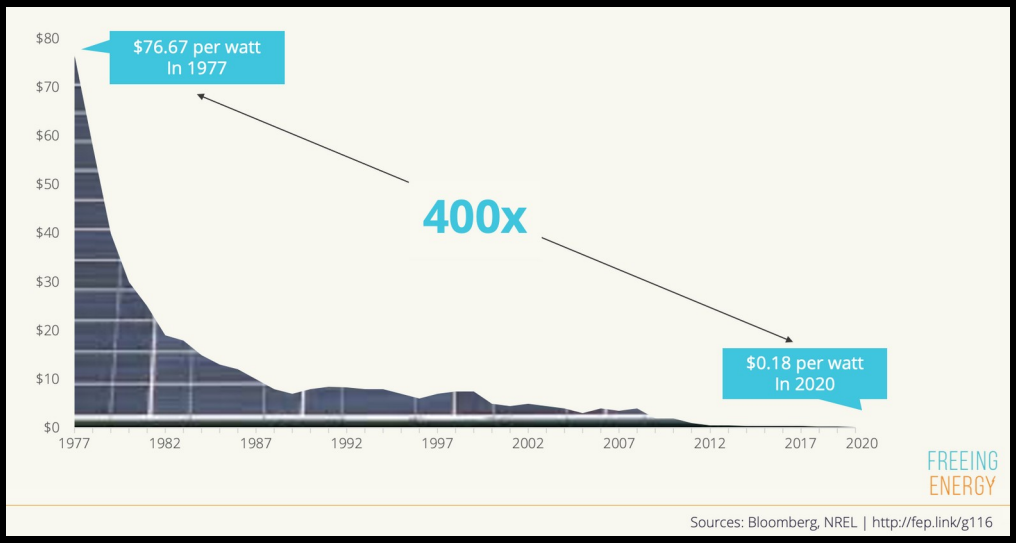
The first working solar cell was built in 1883. 1%

In 1955 the first commercial cells were produced at 2% efficiency and cost close to $2,000 per watt.

Right now it’s below ten cents.

Average panel efficiency is approaching 25% and the rate that cells degrade over time is decreasing. Warranties of 30 years are commonplace.

Technology has driven down prices

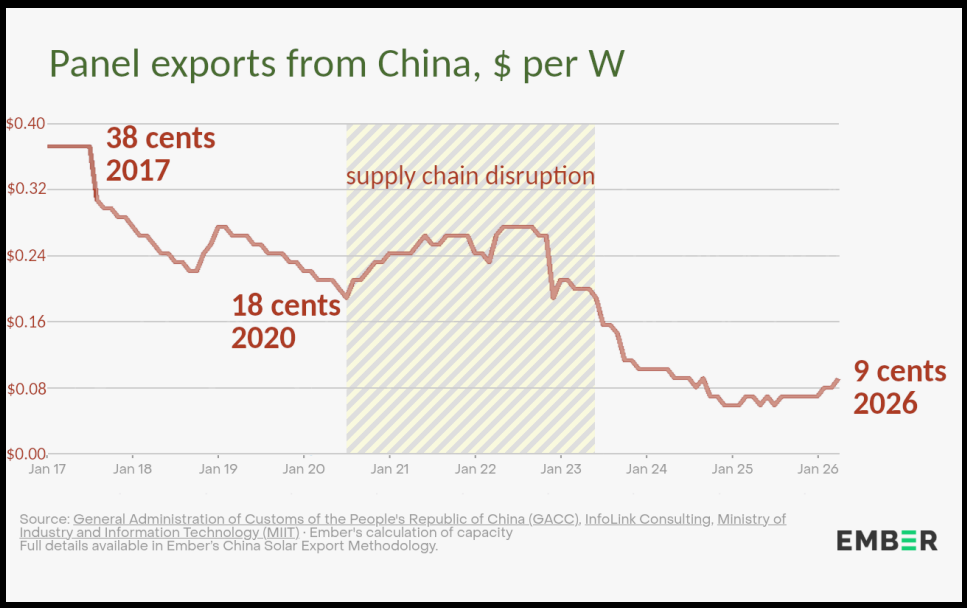


The cost of solar panels is driving a revolution in generation.

This graph shows a 400x reduction from the 1970s up to 2020.

But it gets even better....

The curve is bottoming out...

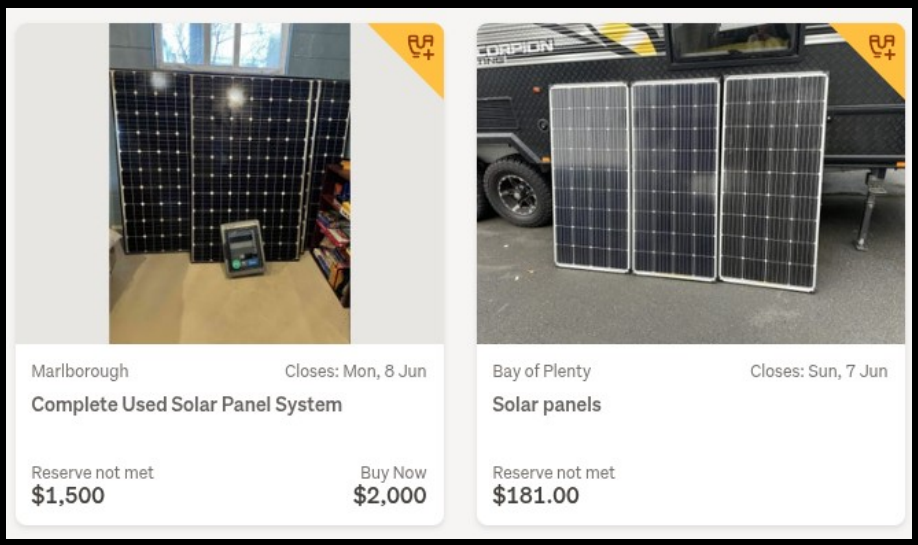


From 2020 to the present costs have dropped by half.

They probably won't get much cheaper, but performance improvements will keep happening.

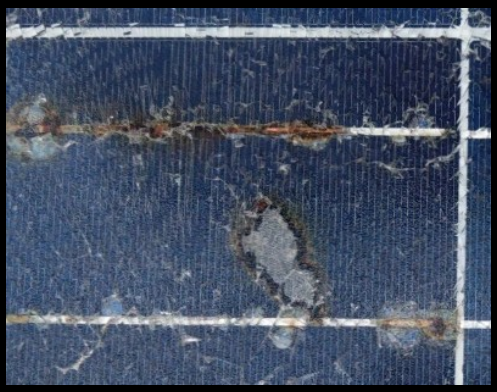
That's 800 times the value you could get 50 years ago...and the panels are far more efficient and last longer.

Bargains galore

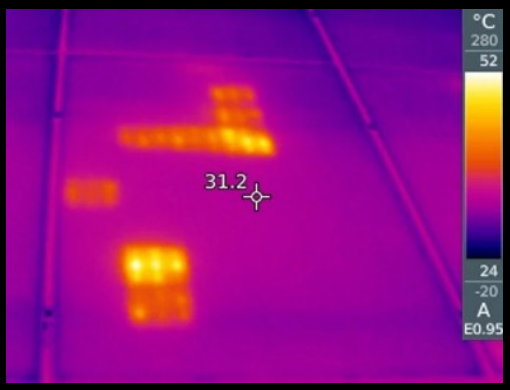


Another effect of this continued improvement is that a secondhand market is beginning to develop as people switch out older panels for newer ones that generate more in the same amount of space. A good quality 10-year-old panel might still have 95% or more of its rated output and will keep going for many more years with minimal losses.

What failure looks like



Corrosion of metal traces caused by water getting under the glass

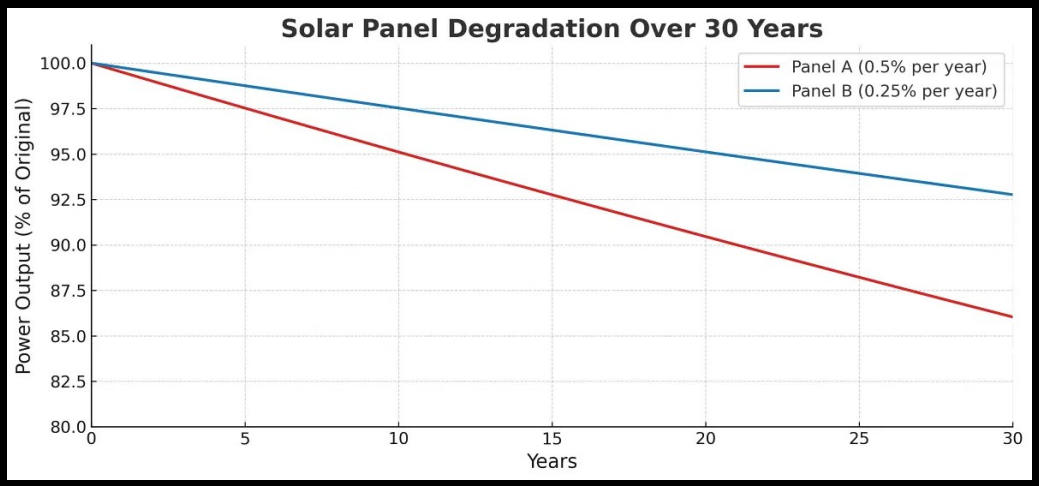


Hot spots resulting from micro cracks damaging the cell structure

The key here is good quality. As panels age, the things that cause them to fail are mostly mechanical and chemical in nature. Moisture ingress and corrosion are more likely to put a panel out of service than the cells wearing out.

But if you get a great deal on used panels and they last long enough for you to save up for new ones, that’s still a win.

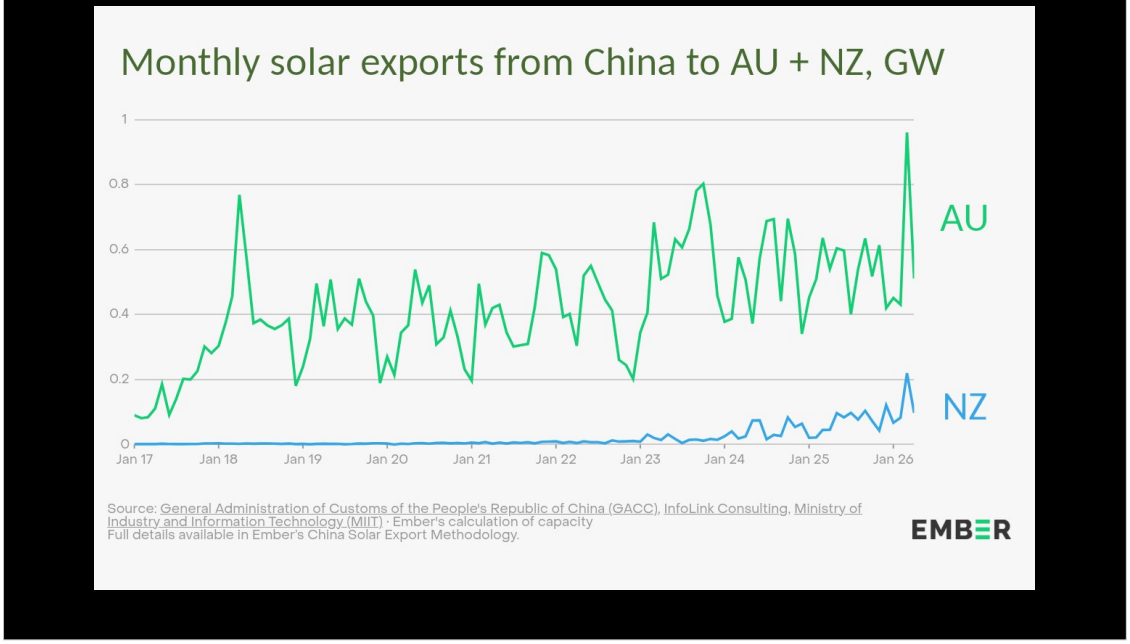
Long haul performance



Most newer name-brand panels are now showing early degradation rates of a quarter percent per year, which translates to better than 90% output at 30 years as long as they’re not physically damaged.

Fun fact: A typical top grade panel loses more in the first half hour than over the next 5-10 years.

Comparing uptake with Oz

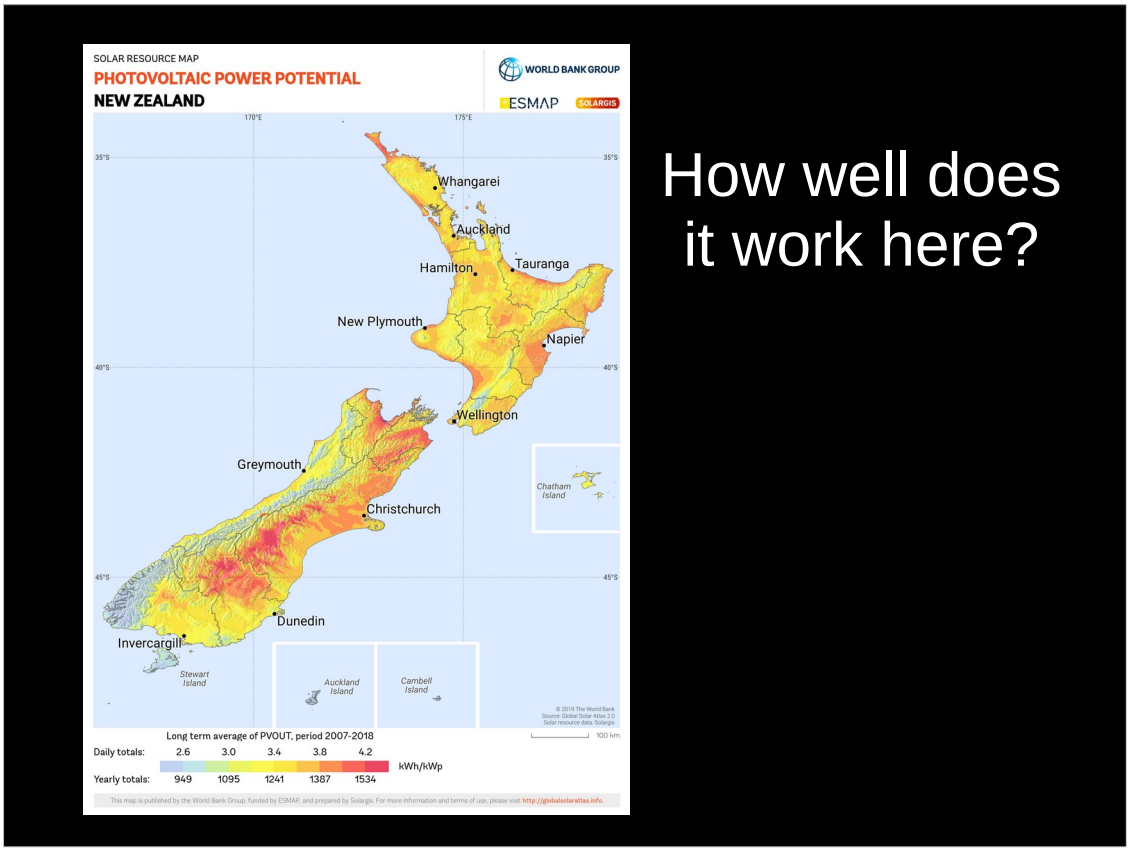


When the value proposition is this good, demand rushes in.

If we look across the ditch we see a steady rise in panel imports.

Aotearoa was late to the party but starting in 2023 we have been tracking at about 1/5 of Aussie volumes.

The head start has meant grid oversupply in the middle of the day, so the response has been to offer free power. Nice problem to have.



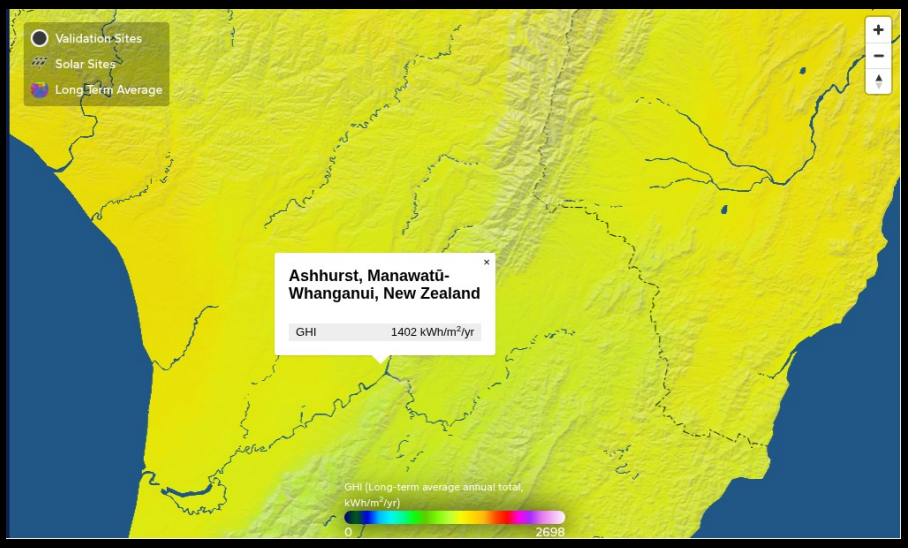
Pretty much everywhere except Fiordland.

Manawatū is one of the sunniest regions

Even on a cloudy day we still get some energy from the sun, and with overcast conditions the right type of panels will give decent generation.

Best panels for our conditions are monocrystalline. Bifacial panels are an interesting option – will go into a bit more detail later.

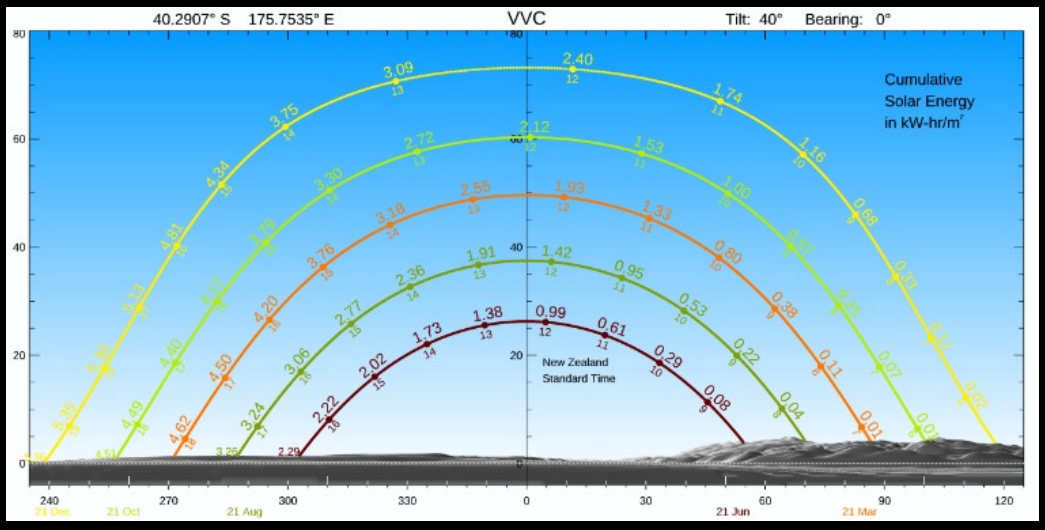
Ashhurst is near the middle



https://solcast.com/

Ashhurst is pretty close to the countrywide average for solar potential. Both coasts are sunnier than the interior.

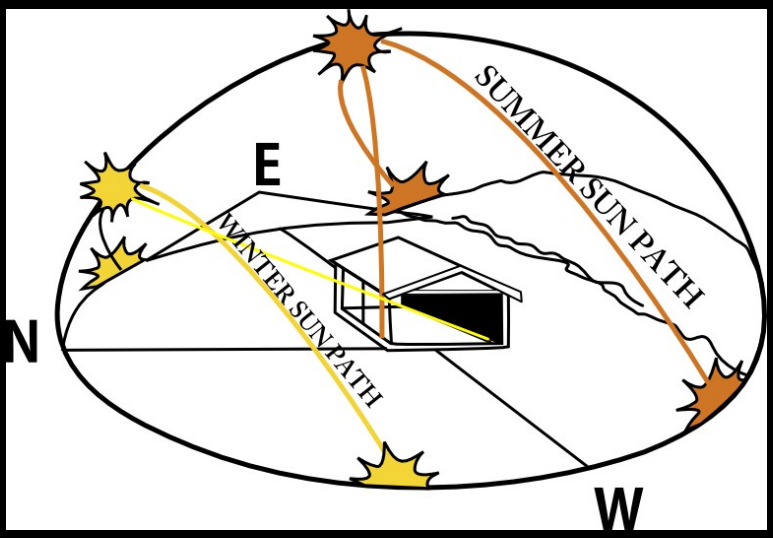
NIWA Solarview



https://data.niwa.co.nz/solarview

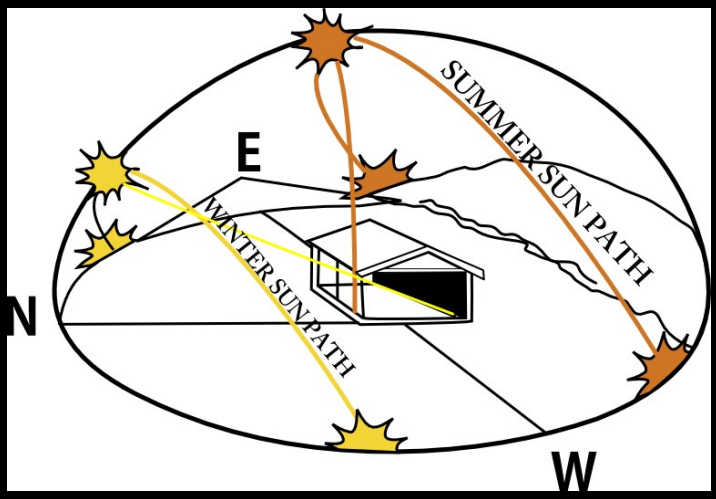
Wrap around effect

Which way should panels face?



Follow the path of the sun during the day and note its change across the seasons. The highest power is generated between 10 am and 2 pm.

What about tilt?



The sun angle is higher in summer and lower in winter, so if we split the difference we get good all round performance.

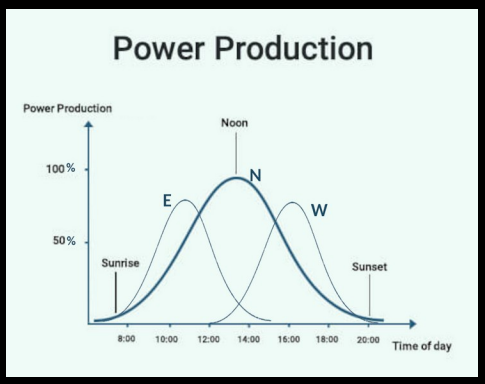
Anything close to 40 degrees is fine. Flat works, but pollen and dirt buildup will be a problem, so we usually advise 15 degrees at minimum.

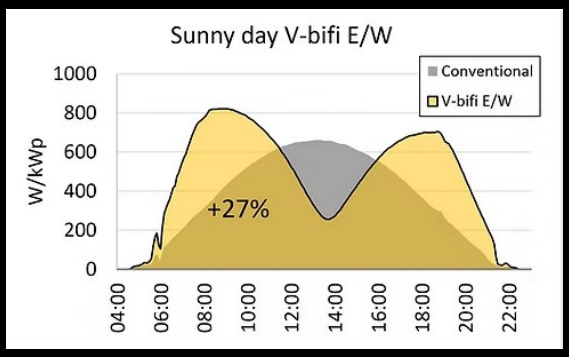
Fixing panel mounting systems directly to the roof is simple and strong.

Ground mounting a good option for those with land.

Mechanical trackers are just one more thing to break.

Spreading the peak

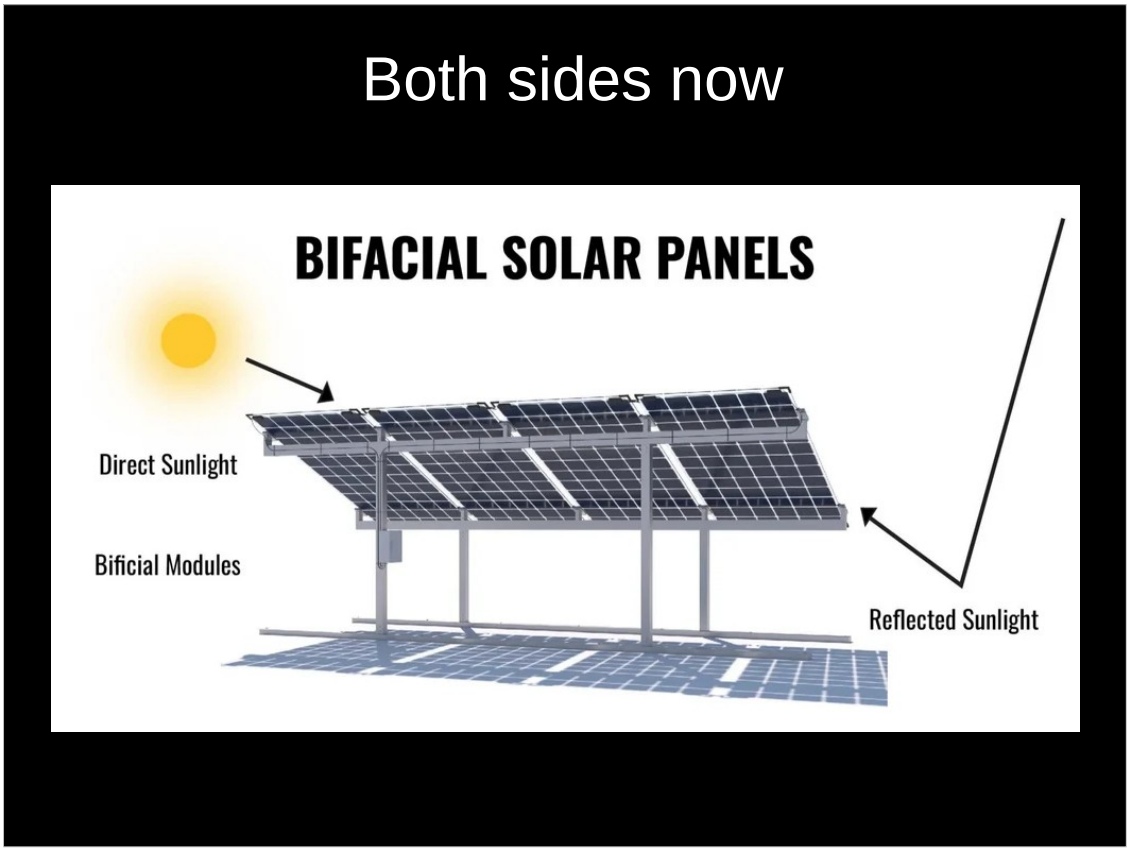




Left: Example of panels on N, E, and W faces

Right: Bifacials mounted vertically facing E-W

Both sides now

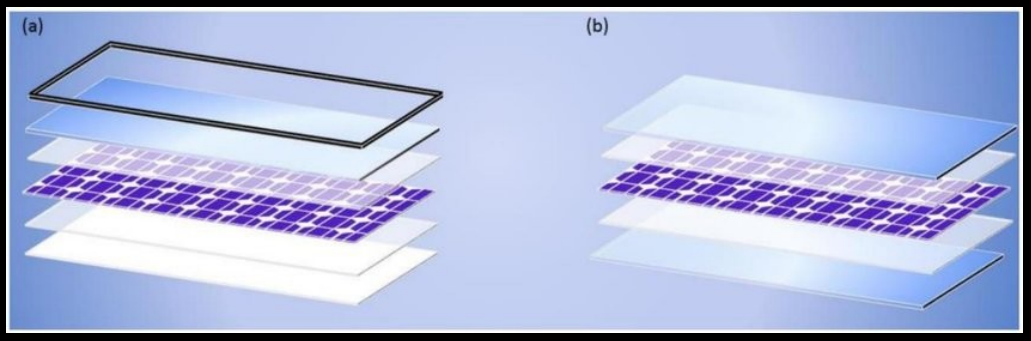


A recent development that has come onto the market is bifacial modules. These can generate power from light hitting both sides of the panel.

The obvious application is to mount them above a light coloured surface. Under the right conditions bifacial panels put out at least 15% more than the rated front side wattage.

They also have a durability advantage arising from the way they’re constructed. Single sided panels use a layer of aluminium or plastic on the back to protect the crystal cells, and this can flex and crack. It also expands and contracts differently compared to the top glass layer.

Solar sandwiches



Monofacial panels use an opaque backsheet to sit behind the cells.

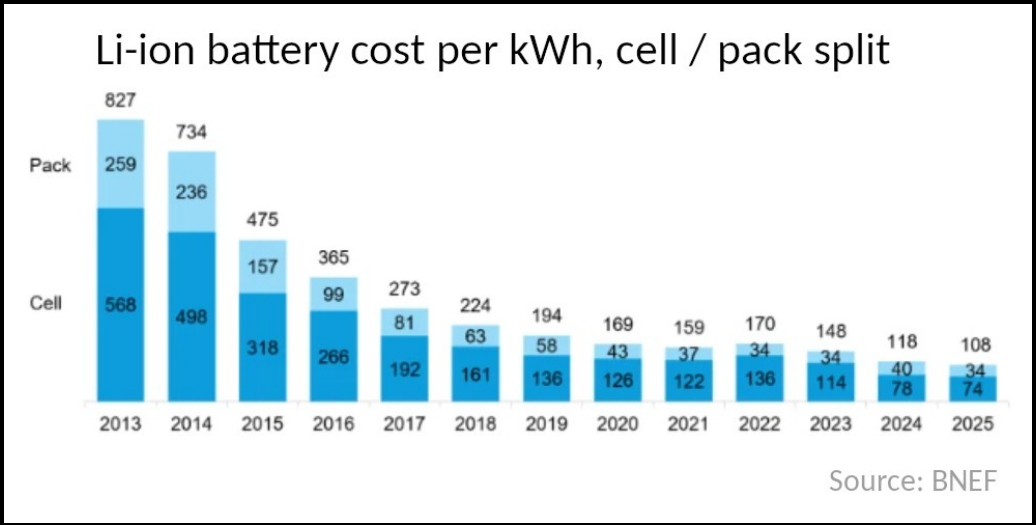
Bifacials use a transparent material. The best ones use glass just like the top.

Bifacial panels use two glass sheets with the cells as the filling in the sandwich. This makes for a more stable structure to protect the cells.

Downside is greater susceptibility to hail damage, but that’s not nearly as big of an issue here as across the ditch. Cost is now roughly the same as monofacials and in another 4-5 years we can expect them to be the norm.

Hooking up to the grid

Battery costs are tracking the same direction as panels



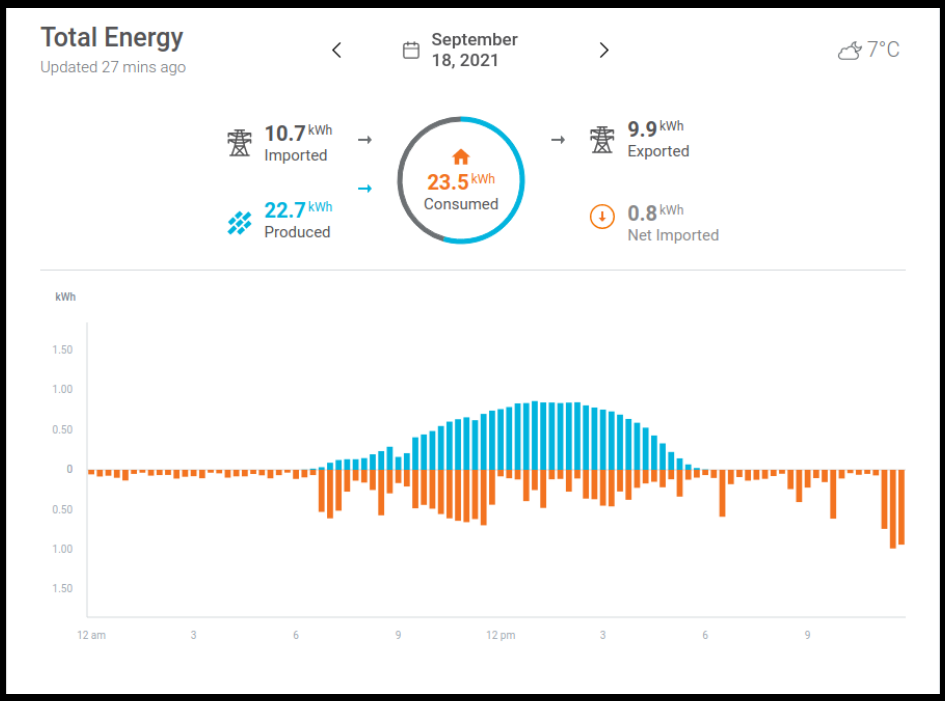
Lithium has pretty much ended the era of lead.

Next big story in battery chemistry will be sodium.

String or micro inverters?

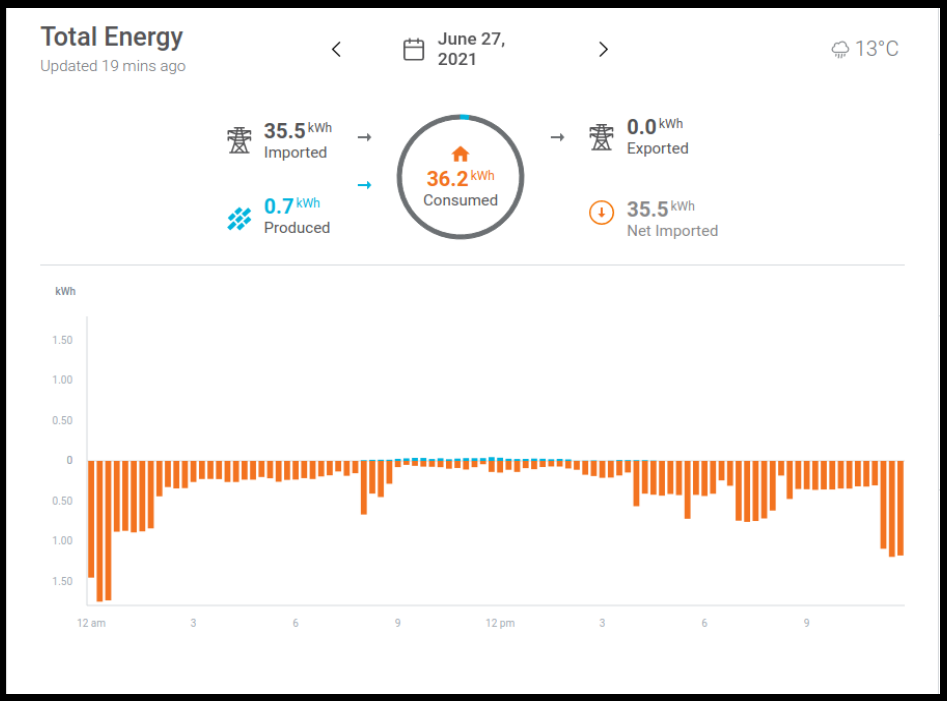
Sizing your system

18 September



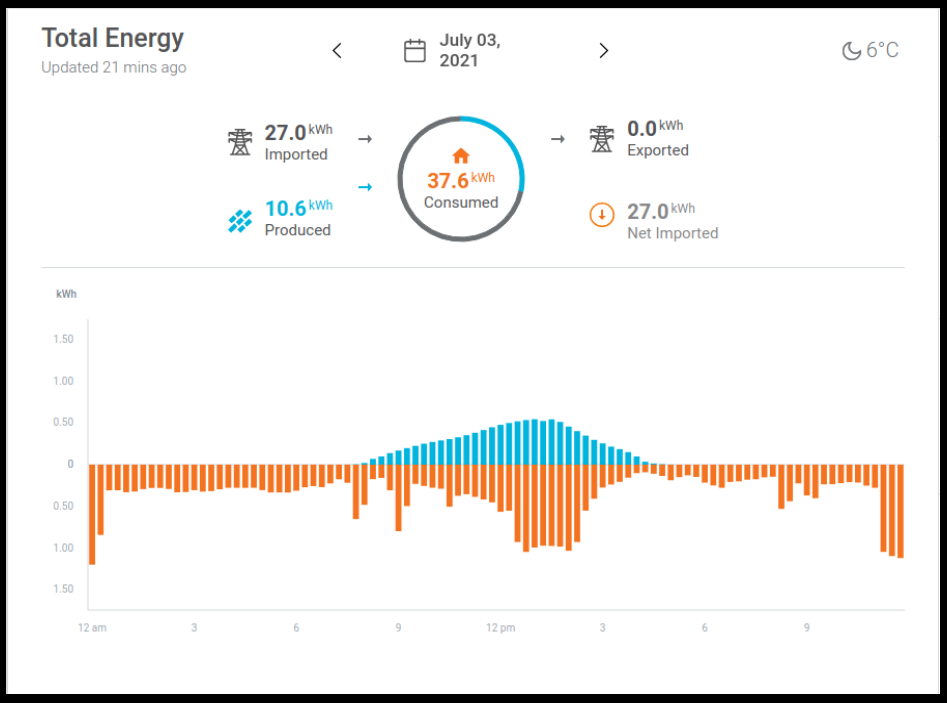
A sunny day in spring

27 June



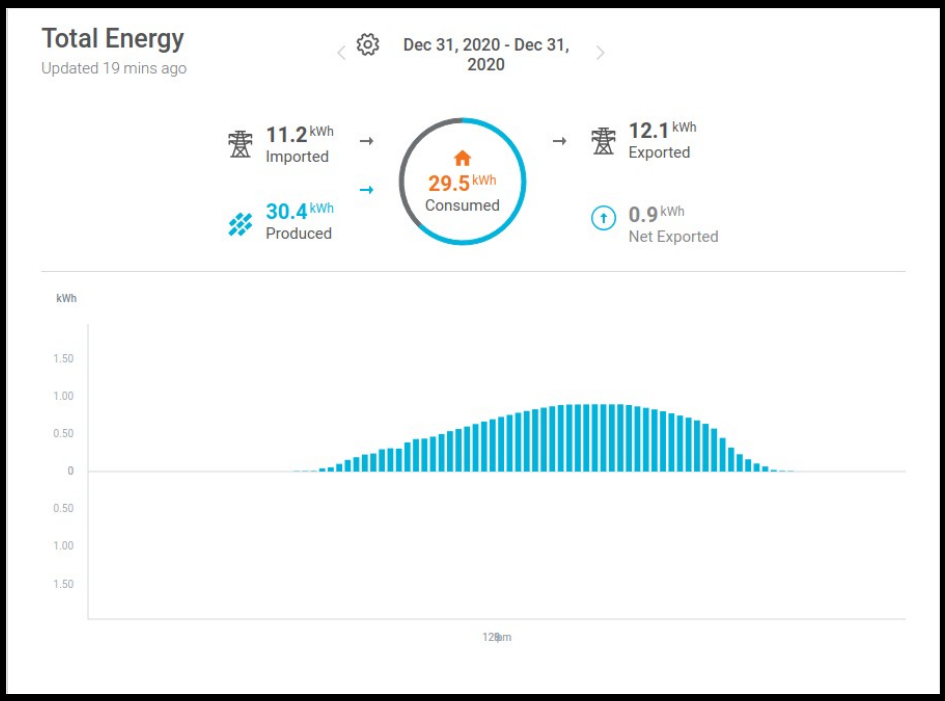
Stormy midwinter

3 July



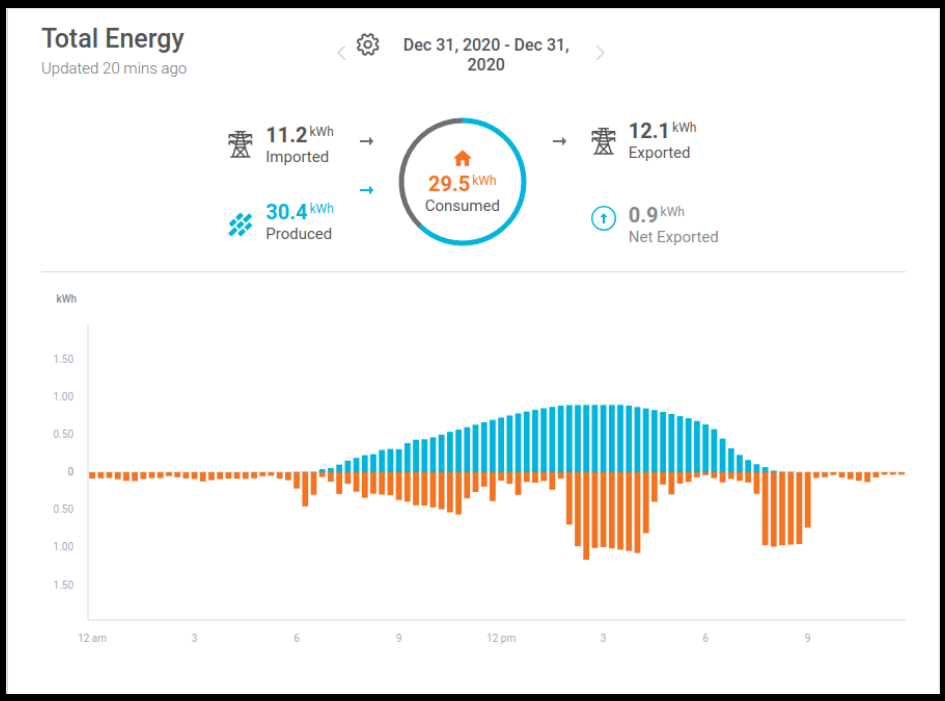
Sunny mid winter

31 December



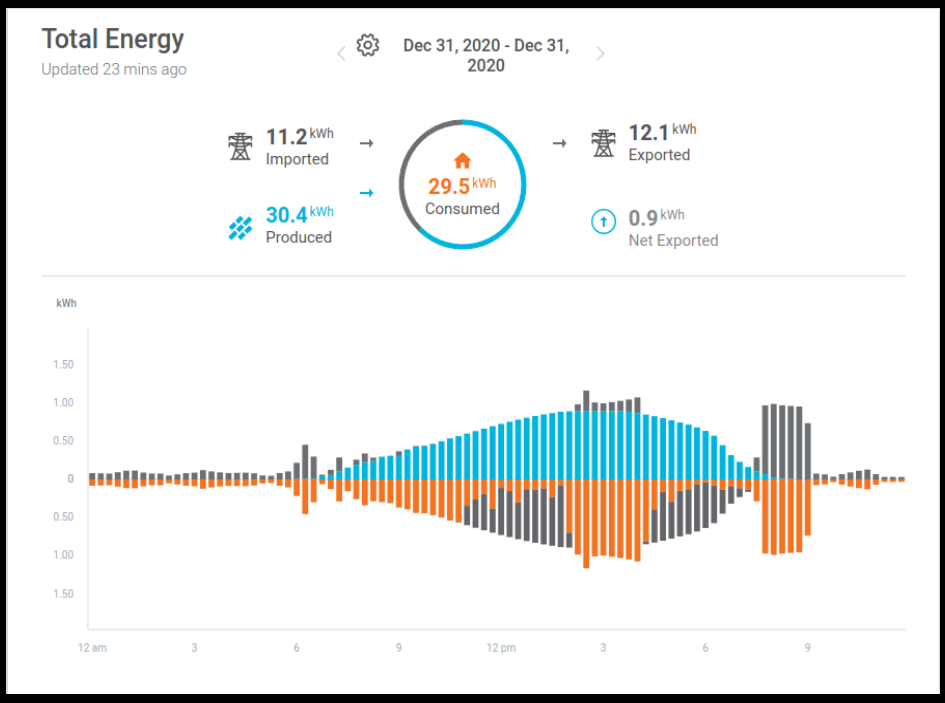
Generation on a sunny midsummer day

31 December



Add in consumption

31 December



Grey bars show how much we are drawing from or sending to the grid


Finance and related factors

Q and A

Thanks for coming...we hope you got a charge out of it

RECAP

SLOW FARM