

Enphase Solar. Maximum reliability.

It shines in all kinds of weather. Enphase Solar is IP67 rated, meaning it can endure just about anything Mother Nature sends its way.



Solar inverters heat up from the inside out

There is a common misconception that inverters heat up from the outside in rather than the inside out. Solar inverters typically run at around 97% efficiency, which means that 3% of the power is converted to heat.



Thermal transfer: microinverters vs string inverters

For a string inverter running at 5000W, this means that 150W of heat must be dissipated to avoid thermal runaway. In contrast, for a microinverter running at 300W, only 9W of heat needs to be dissipated.



The highest ambient temperature ever recorded

According to the World Meteorological Organization, the highest temperature ever recorded was 56.7°C on 10 July 1913 in Furnace Creek, California, United States. The second highest was 54.4°C, also recorded at Death Valley's Furnace Creek.



Enphase microinverters shine in extreme conditions

Due to low heat dissipation to surface area ratio, along with elegant mechanical design and distributed architecture, Enphase microinverters are resilient up to 65°C ambient temperature and 85°C internal operating temperature.



One million hours of reliability testing

Microinverter design incorporates more than one million hours of reliability testing, and 15-years of applied reliability lessons learned from more than 34 million shipments.



Fully potted with no moving parts

Enphase microinverters are protected by a double-insulated, corrosion resistant enclosure made of Noryl V0150B, a modified polymeric resin that meets the same performance standards as a genuine Multi Contact MC4 solar connector.



No heat-related failures

For solar inverters that use cooling fans for internal temperature control, extreme heat introduces service disruption and failure risks microinverters are different. As long as world heat records don't get broken, they will consistently deliver high performance.

Evidence from the field

Field data stored in our Enlighten servers enabled the identification of the maximum internal temperature of Enphase microinverters in each Australian capital city on the hottest days of 2020, as recorded by the Bureau of Meteorology.

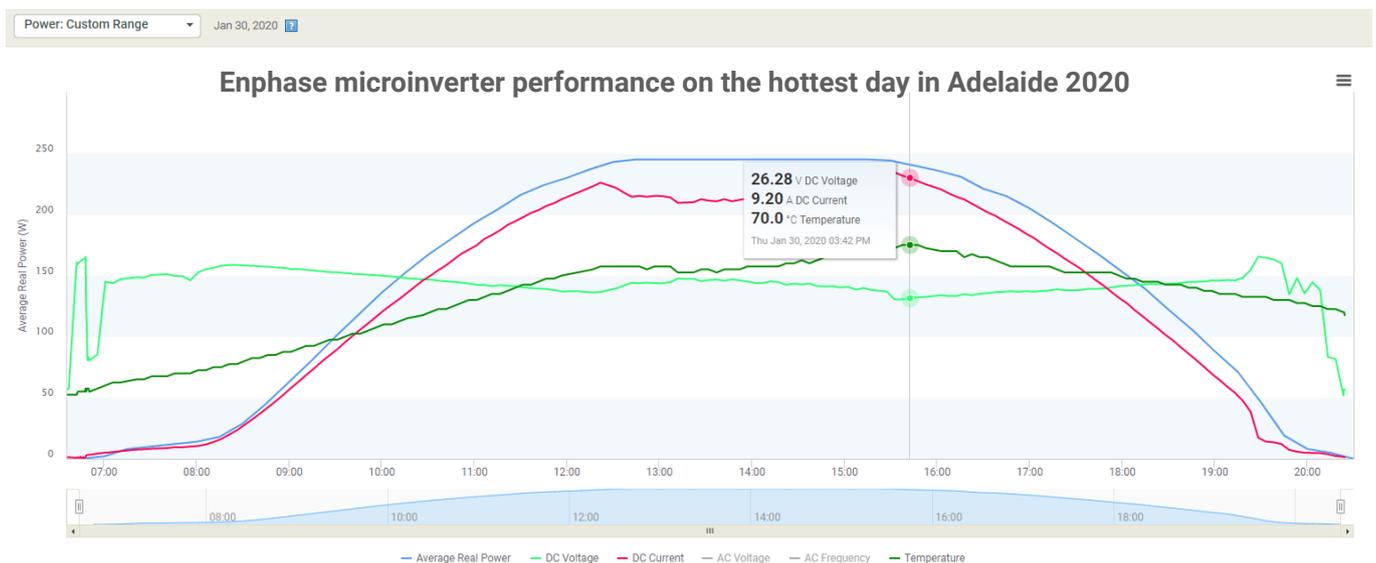
| Date | Location | Max ambient temp | Max microinverter temp |
|-------------|-----------|------------------|------------------------|
| 4 Jan 2020 | Penrith | 48.9°C | 63°C |
| 31 Jan 2020 | Melbourne | 42.9°C | 64°C |
| 30 Jan 2020 | Adelaide | 43.9°C | 70°C |
| 4 Feb 2020 | Perth | 42.7°C | 68°C |
| 6 Dec 2020 | Brisbane | 43.5°C | 52°C |

What the data shows

Hot ambient temperatures do not directly influence the internal operating temperature of microinverters but rather a combination of clear sunny skies and low wind speed. Hot days are often cloudy (less power) and windy (better cooling).

The above is best evidenced in Adelaide, where the hottest day in 2020 happened to have clear skies:

- You can see in the graph below that the internal temperature is more sensitive to the power being generated (internal heat) than the ambient temperature (external heat). This is particularly noticeable between 12:00 and 14:00, where the internal temperature actually decreases.
- The decrease in internal temperature is because the inverter is “clipping” and therefore operates at a lower DC current (higher DC voltage), which results in less heat being generated internally.



Exceeding environmental testing requirements



Power



Thermal cycling



Submersion time

NEMA | IP

0% power on

No thermal cycling

30 mins of submersion

Enphase

100% power on

**Cycling between
-30°C and +65°C**

21 days of submersion

Global research and development in New Zealand



Based in Christchurch, New Zealand, our global R&D Centre has a team of 80+ engineers and support staff all focused on maximising the performance and reliability of Enphase solar and storage technology.

Designing, building, and testing for quality



Approved vendor list control

We source materials directly from the best suppliers – creating the best output for our customers around the world.



Testing for a perfect score

All our products must score a 100% on in-circuit, functional, hipot, and burn-in tests to leave the factory.



Ongoing reliability testing

Tests include thermal cycling (between -45°C and $+90^{\circ}\text{C}$ for over 1000 hours) and damp heat testing (in $+85^{\circ}\text{C}$ and 85% relative humidity for 400 cycles).

We go above and beyond to ensure we deliver premium quality products from the ground up.



Enphase microinverter advantage

No fans. No moving parts. No high-voltage DC. Solid state solar.

Defect rate is just 0.05%, meaning only one microinverter will need to be replaced out of a batch of 2,000.

IP67 certified, microinverters can endure just about anything Mother Nature sends their way.

Meet even the strictest government safety requirements. Commonly chosen for daycares and schools, public spaces, and fire stations.

Get more with Enphase and Specialized Solar & Electrical

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