Domestic solar panels – case study

Overview of our system

- 16 photovoltaic (PV) panels
- Single inverter (to convert power to a usable form)
- Nominal max. output: 3.92 kWp
- Cost: ~£10,000
- Originally installed in 2012 on an east-facing bungalow roof at inclination of 30°
- Moved in 2021 to south-facing second floor roof at inclination of 55°
- No battery installed; all generated power used immediately or exported to grid
- Smart meter measures export
- Feed in tariff (FiT) payable for 25 years from installation (payment received for total generated and portion exported to grid)
- Initial cost recouped by 2023.

Additional features

A recent rebuild allowed us to use our solar generated power more effectively. As well as improving the positioning of the panels, and removing shading from trees during the day, we have now installed:

- **Apollo generated energy manager (GEM)** – monitors output from the panels every second and adjusts the power to an immersion heater, using pulse width modulation (PWM). Essentially, if the sun comes out, the water will be heated more quickly than if there is less solar energy available (a second immersion heater switch available if the sun doesn't shine!) https://tinyurl.com/u5r3rx28

- **Zappi car charger with harvi energy harvesting sensor**– works in a similar way but on a slightly slower time scale, so that the immersion heater usually has priority. https://www.myenergi.com/zappi-ev-charger

Other comments

- Unfortunately, the company that originally installed our panels no longer fits domestic systems. I would have recommended them as they not only fitted the panels but had inhouse engineers who helped their supplier to improve the fittings and discussed the system with us as part of the sales process. Having had previous experience of a sales-only company fitting solar thermal panels to a different house, it was helpful to speak to someone with real knowledge about how the system worked and what was best for our situation before we made a final decision. Having said that, PV arrays are now much more common and hopefully better understood by those selling them.

- Although the payback time on our array was about ten years (taking into account the FiT as well as savings calculated for car charging and water heating) the economics of panels have changed significantly.

- A FiT is no longer available but the cost of panels has been significantly reduced (a 4kW domestic array would now cost in the region of £5000).

- Newer panels and inverters are all more efficient, and battery systems allow you to use more of what you generate. Some inverters now come with a built-in battery.

- A battery system would make sense if you use most power at night. We have an electric car at home most days, so use that for storage instead (using the harvi sensor to charge only when there is surplus energy).

- There are electricity tariffs that will pay you to export electricity (e.g. https://solarenergyuk.org/resource/smart-export-guarantee/ https://octopus.energy/export-tariffs/)

- Panels can be linked to a single inverter (like ours) or individually to micro-inverters. A single inverter is cheaper and more reliable, but if one panel is even partially shaded it will affect the output of all panels. Micro-inverters might be more effective on a complex roof design or if part of the roof is shaded from chimneys or trees for a significant part of the day/year.

- Our GEM water monitor cost ~£200 and the data it supplies indicates that we recouped the cost within 12 months. These are particularly cost effective if you are not using gas for water heating.

- Unfortunately, we cannot use our own solar power during a power cut! (We feed our surplus into the grid so there is an automatic cut-off for safety reasons.)

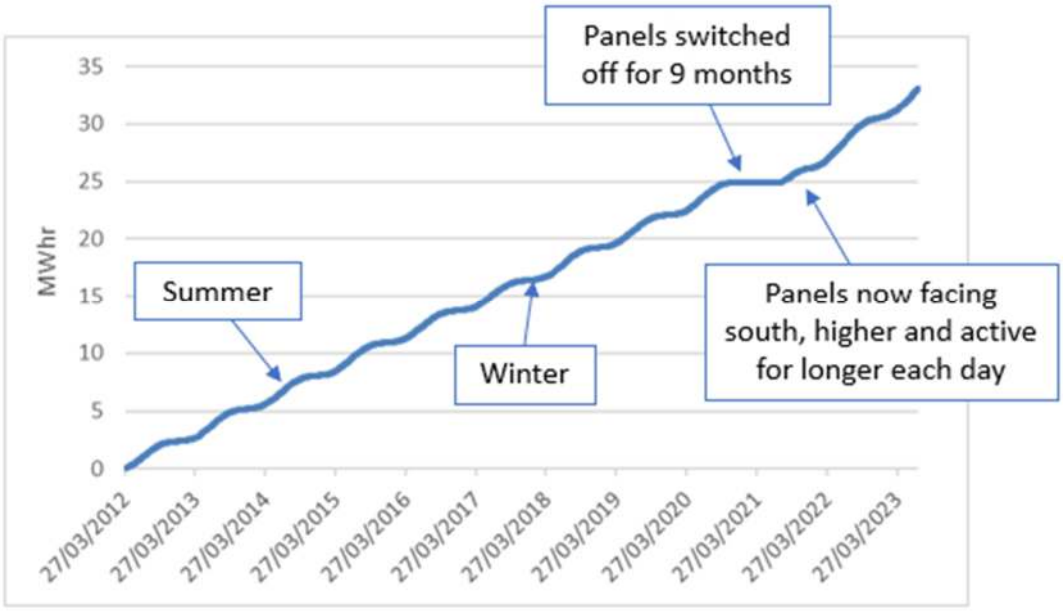
Output

Three factors will have the greatest impact on output:

- Geographical location – how much solar energy is available in your area?
- Orientation – south-facing is ideal; east-facing next best, but any direction is ok.
- Pitch – how steep is your roof? Ours changed from 30 to 55 degrees.

There are online calculators available to estimate annual energy production, e.g. https://energysavingtrust.org.uk/tool/solar-energy-calculator/

The following graph shows the total generated power of our system since installation:



There is a short break in readings (2020–2021) for house rebuild, which allowed us to reinstall the panels in a more advantageous position. They now have incident sunlight for longer each day – particularly in the winter when previously the sun was too low in the sky to reach them due to surrounding trees.

Output has not significantly reduced over the ten years the panels have been in operation, and the move to optimise output made a significant difference.

Some suppliers recommend regular cleaning of solar panels, but we have relied entirely on rainfall to do this – other than moving the panels, they have not required active maintenance.

More information

https://www.solar.sheffield.ac.uk/

https://energysavingtrust.org.uk