Evaluating solar PV with electric heating: Wondrwall – Summary

As part of the 'Evaluating solar PV with electric heating' project, two Wondrwall systems were installed. These involved replacing storage heaters with infrared panels for heating. The system also included a 5.81kW solar PV system, a 6kWh battery and a smart hot water cylinder. There were also smart light switches which could monitor temperature and humidity and could provide thermostatic control for the heating panels.

An assessment of the energy score for the Energy Performance Certificate (EPC) was made before and after the installations, with the energy score increasing from D58 to A94. However, replacing the storage heaters with infrared panels initially reduced the energy score to E48.

The average installation cost per Wondrwall property was £18,455 inc VAT.

A control property had existing infrared heating panels and a 5.81kW solar PV system and Mixergy smart hot water cylinder with solar diverter was installed.

The EPC energy score for the control property increased from E47 to A92

The installation cost for the control property was £9,472 inc VAT

Temperature

One of the Wondrwall households (W-01) had an older resident who could not control the heating with a tablet computer. The automated controls were removed and replaced with timer switches. The other household (W-02) had a resident who did not feel the cold and rarely used the heating which led to cold room temperatures. The control household (IC-01) had external wall insulation (EWI) completed at a similar time to the solar PV installation.

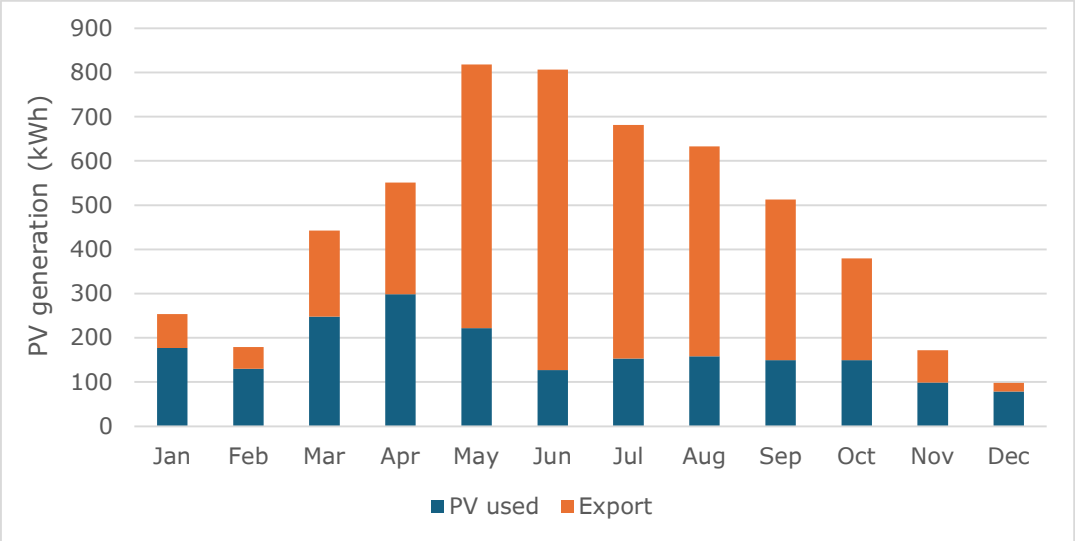
Household	Average temp before install 1 Nov 22 to 1 May 23	Average temp after install 1 Nov 23 to 1 May 24
W-01 – living room	18.1°C	18.2°C
W-02 – living room	12.3°C	12.1°C
IC-01 - bedroom	17.7°C	19.1°C

Solar generation and electricity consumption

	W-01	W-02	IC-01
Household consumption (kWh)	6,460	999	7,097
PV generation (kWh)	5,531	5,224	5,116
Grid import (kWh)	4,466	96	5,144
Grid export (kWh)	3,540	4,285	3,168
Battery charge (kWh)	2,480	674	0
Smart meter grid import (kWh)	4,686		5,136

The data such as the PV generation, grid import and export were monitored using the hybrid inverter for the solar PV system and this is shown for 2024 in the above table. The grid import recorded by the smart meter for W-02 was 346kWh between 10 Jan 24 and 31 Dec 24. This is higher than recorded by the hybrid inverter, but still remarkably low for an electrically heated home.

Case study – Wondrwall household W-01



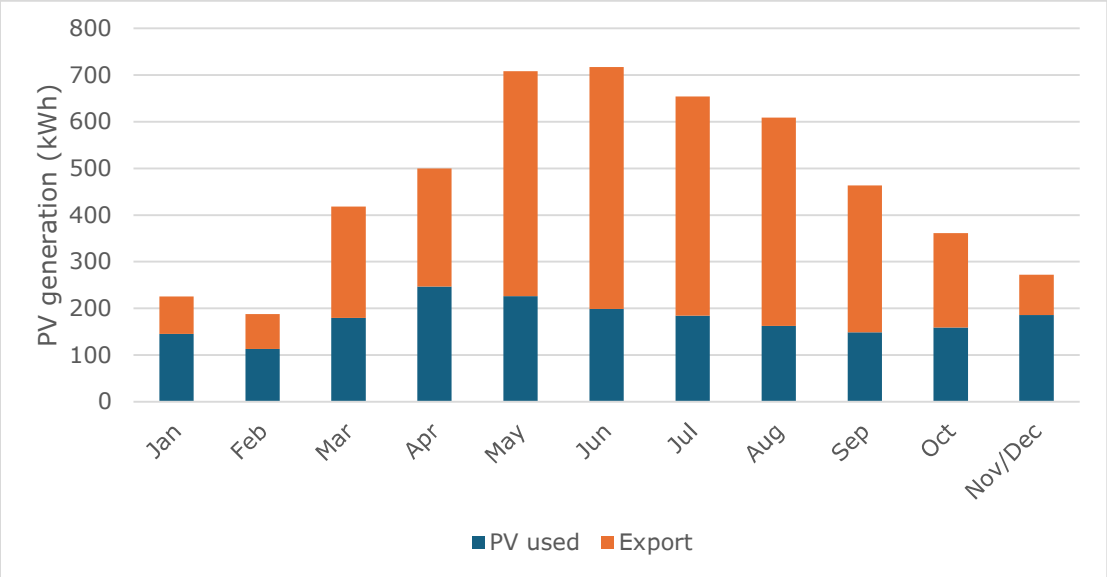
- The annual PV generation in 2024 for W-01 was 5,531kWh
- The monthly PV generation used in the home ranged from 78kWh in December 2024 to 299kWh in April 2024
- There was a low percentage of PV generation used in the home in the summer (15.7% in June) but during the heating season most of the solar generation was used in the home (69.7% in Jan and 79.8% in Dec)
- In 2024, after installation of Wondrwall, the electricity cost for W-01 was £836, assuming a peak rate of 30p/kWh, off-peak rate of 12.5p/kWh and not taking the standing charge into account
- Between 1 Oct 22 and 30 Sep 23 with the storage heaters, the modelled cost for W-01 on Economy 7 was £783 but this included a couple months while the resident away

Case study – Wondrwall household W-02

Start date	End date	No of days	Consumption (kWh)	Electricity cost (£)
15 Apr 21	21 Apr 22	371	1,437	£340
14 Oct 22	19 Oct 23	370	1,357	£328
10 Jan 24	31 Dec 24	356	346	£74

- The table above shows the electricity consumption and modelled cost (excluding standing charge) for household W-02 on Economy 7 for periods before and after the Wondrwall installation in October 2023
- The electricity consumption was remarkably low due to the resident using few appliances and rarely using the heating
- After the solar PV and battery was fitted, there was a reduction in grid consumption of about 1,000kWh and a saving of about £250 on the electricity cost on Economy 7

Case study – Control household IC-01



- During 2024, the PV generation for IC-01 was 5,116kWh compared to 5,531kWh for W-01
- The PV generation consumed by the control household was broadly similar to Wondrwall household W-01 despite the Wondrwall household having battery storage as well as a smart hot water cylinder
- The grid consumption in 2022 before the solar PV and external wall insulation was 7,620kWh and this fell to 5,136kWh in 2024
- The percentage off-peak consumption for IC-01 in 2024 was 26.6% which meant it was cheaper to be on a single rate tariff
- The electricity cost on a single rate tariff fell from £1,829 in 2022 to £1,233 in 2024
- The electricity cost for IC-01 was £397 higher than for W-01 despite the electricity consumption being only being 450kWh higher
- Household W-01 had a percentage off-peak consumption of 69.5% due to charging of the battery and some heating overnight
- The high off-peak consumption meant the electricity cost for W-01 on Economy 7 was significantly lower than for control property IC-01 on a single rate tariff

Recommendations

- While both Wondrwall households remained on Economy 7 during the project, household W-01 may have been able to reduce the electricity cost by switching to an advanced time-of-use tariff
- Tariffs such as Cosy Octopus and the EDF heat pump tariff have more than one off-peak period per day which could allow the battery to charge twice a day and increase the percentage off-peak consumption
- An issue has been that tariffs like Cosy Octopus and the EDF heat pump tariff are nominally restricted to households with heat pumps
- There is a need for flexibility from suppliers in allowing households with other technologies to benefit from specialist smart electricity tariffs