Case Study Farm 5 - Sheep and Cattle Hill Farm

Summary Table

Location	[redacted]
Load size and variability	Consumption is fairly low, averaging 4460 kWh/year over the last 3 years. Between June and Sept consumption averaged 10kWh/day or 320 kWh / month. Estimated winter consumption 14 kWh/day.
Suitable roof areas	The yard shed, tractor shed, and lambing shed have south facing slopes. Slopes: 15°, Orientation 10° off south . South facing slope of roof: • Yard shed approx. 22m by 2.4m below skylights • Tractor shed approx. 9m by 2.4m below skylights

Donna Munro, Solar Consultancy Donna.k.munro@gmail.com

	• Lambing shed approx. 22m by 2.4m below skylights (however western end and centre part shaded) There are other shed roofs with east/west slopes.
Maximum feasible array size on roofs	There is readily available space for: • Yard roof – 20 modules, 1 row in portrait orientation below rooflights • Tractor shed roof – 8 -12 modules, 1 row in portrait orientation below rooflights and possibly some between rooflights • Lambing shed roof – 8 modules, 1 row in portrait orientation below rooflights at eastern end of roof. Total 36 -40 modules, for 375Wp modules totals 13.5 to 15 kWp. This could be doubled or tripled if east/west roofs were also used.
Array sizes considered	3.5kWp minimum used for calculations as a good match to annual electricity use. 15 kWp maximum used for calculations as fits within export limit with existing transformer.
Current electricity supply	Single phase supply from a 25kVA pole mounted transformer (PMT).
Network limitations on generation capacity	– Export limit: 15 kW generation into the existing 25kVA transformer The electrical supply could be up-rated to a 50 or 100 kVA transformer for £10 000 - £15 000 (reduced due to cost share with mast supply). A 100kVA transformer could provide 75 kW generation capacity.
Potential annual energy output	• 3.5kWp system - Annual generation total 2759 kWh (61% of annual electricity use)

	• 15kWp system - Annual generation total 11823 kWh (2.6 times annual electricity use)
Preliminary cost estimates	3.5kWp PV system without a battery approx. £5500 3.5 kWp PV system with a battery appro. £7000 15kW PV system without a battery approx. £18750. 15kWp system with a battery appro. £22500.
Cost savings and export income. Lower end of range is with an electricity cost of 35p/kWh. Higher end is at 55p/kWh.	Without a battery • 3.5 kWp system - Annual total £722 - £1108 • 15 kWp system - Annual total £1705 - £2414 With a battery • 3.5 kWp system - Annual total £884 - £1381 • 15 kWp system - Annual total £1879 - £2706
Electric vehicles	Future possible need for EV charge points for 2 cars and 1 quad bike identified. According to ENW it may be possible to provide a 7kW EV charger from the current supply however the installer would need to check the existing supplies maximum demand and calculate if there is spare capacity.

Network Upgrading Possibilities

The existing 25kVA transformer could take about 15 kW generation into it. It would be possible to increase this, however, the cost is likely to be significant. The electrical supply could be up-rated to a 50 or 100 kVA transformer for £10 000 - £15 000 (reduced due to cost share with mast supply). A 100kVA transformer could provide 75 kW generation capacity.

The above information is based on a preliminary discussion with ENW. The Customer Engagement team at ENW connections department offer surgery sessions in which they can look at the network to a site in a bit more detail and provide a steer of what is in the art of the possible. Once you are in a position to submit an application, they can guide you through the process and submit an offer to you in line with your needs.

Contact person: Simon Taylor Simon.Taylor@enwl.co.uk

Current Transmitter

Potential barn roofs to install Solar PV modules.

Potential Solar Generation

The results from the PVGIS tool are attached. This gives the monthly energy output from a:

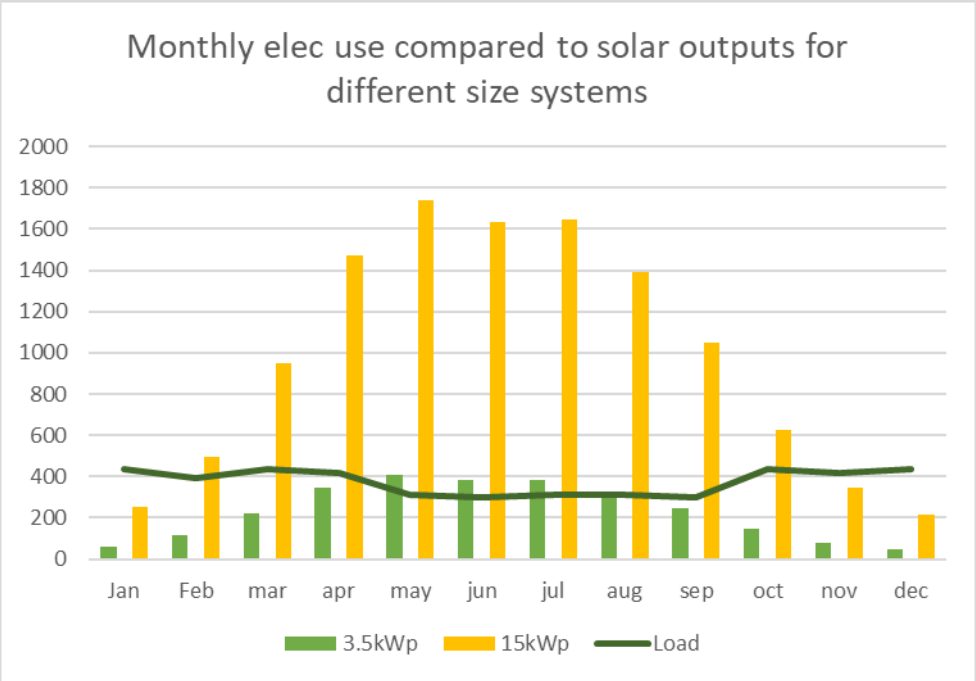
- 3.5kWp system 380 kWh per month in summer dropping to around 50kWh in December. Annual total 2759 kWh (61% of your annual electricity use).
- 15kWp system 1600 kWh per month in summer dropping to around 200kWh in December. Annual total kWh 11824kWh (over 2 and a half times your annual electricity use).

Comparison of Loads and Generation

The reported annual electricity consumption was 4460 kWh over the last 3 years. Between June and September 2022, this averaged around 10kWh per day. This suggests the energy use in the colder months will be around 14 kWh/day. Giving a monthly energy use of 300 to 430 kWh per month.

The loads we identified included domestic loads in the farmhouse (heating and hot water is provided by oil and wood burner). The oil boiler is used in the summer for hot water, this could be switched to electricity in the summer if a solar system was installed. For the farm the loads include a rolling mill for crushing barley and mixer for mixing food. Some all-night lighting and ventilation fans through the winter. Heat lamps during lambing. Battery charging for sheep clippers/trimmers. The suggests the loads will be fairly uneven, rather than steady throughout the day.

The graph below compares estimated monthly energy use (green line) with potential PV energy generation for 2 different size PV systems for each month of the year.



Options and Benefits

The small system (3.5kWp) is the green bars. Generation is generally below load/consumption so the majority of the solar energy could be used on the farm. However, the level of self-consumption will depend on how even the load is and how well the time of day of loads matches the solar generation times. It may be useful to read the meters every couple of hours (in the daytime only) for a few days to check how much electricity consumption occurs over the middle of the day and how much late or early in the day or overnight. If a significant proportion of electricity consumption is early or late in the day adding a battery to the solar system may be worthwhile but does add significantly to the cost.

The larger system (15kWp) is the yellow bars. In this case generation is around the level of daytime consumption in February and Oct/Nov, significantly above consumption the summer and below in Dec/Jan. The solar system should be able to supply nearly all of the electricity load for 10 months of the year, although a battery would be needed to supply night time loads. However, significant amount of electricity would spill out onto the grid for 7 months of the year. The value of this is dependent on the smart export guarantee (SEG) rate achieved (see report section on the Smart Export Guarantee). The rate is quite variable but a rate of 5.6p/kWh should be achievable. If we estimate that 30% of the electricity generated displaces electricity and 70% spills out the grid at 5.6p/kWh that should save between £1705 and £2414 per year depending on the cost of electricity. I've used a range of 35p/kWh to 55p/kWh which reflects the range of costs being paid for electricity by the farms we have spoken to recently.

If the larger system was installed adding a battery could increase the savings by £150 to £300 per year, which would need to be balanced out against the additional cost of the battery system.

This analysis suggests that a small system would meet current needs and offer the best rate of return. A larger system would offer scope for increased loads, for example due to electric vehicles. The financial return from a large system could be improved if a better SEG could be achieved than the relatively conservative figure used.

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Donna Munro, Solar Consultancy Donna.k.munro@gmail.com