Case Study Farm 4 - Dairy farm with caravan site

Summary Table

Location	[redacted]
Load size and variability	Dairy farm- Primary load daily milking and ice building for milk cooling (currently done Off-Peak) Fairly steady load over year, slightly higher milk cooling load in summer. Caravan site load is more erratic, depending on who is resident at the time.
Suitable roof areas	The best option identified is the cowshed roof South-east facing slope of roof: • Slope: 15°, Orientation 45° off south • 30.5m by 9.4m This is sufficient for around 30.4kWp (81 modules in 3 rows of 27 modules, portrait orientation) below the roof lights.

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	There were no suitable roofs identified on the caravan site.
Maximum feasible array size on roofs	There could be space for up to 100 kWp if a number of roofs were used.
Current electricity supply	Single phase supply from a 100kVA 1-ph transformer (Ref (663323)). The closest 3 phase supply is 2 fields away.
Network limitations on generation capacity	15-20kW generation on the existing supply line 25kW generation with an upgraded 200A supply line 35-40 kW generation if directly connected to a cabinet at the base of the transformer pole. These 3 options were all considered for the estimates below.
Potential annual energy output	• 15kWp system - Annual total kWh 11510 kWh (25% of annual electricity use) • 25kWp system - Annual total 19183 kWh (40% of annual electricity use) • 35kWp system - Annual total 26857 kWh (55% of annual electricity use)
Preliminary cost estimates	New 200A 1-ph supply approx. £4k + VAT, upgrading to 3-ph would be price on application. 15kW PV system without a battery approx. £18750. 15kWp system with a battery approx. £22750. 25kW PV system without a battery approx. £30000. 25kWp system with a battery appro. £36000. 35kW PV system without a battery approx. £42000. 35kWp system with a battery appro. £50000.

	Adding a battery to the system would add to the costs but would also increase the proportion of PV energy used on site and reduce the quantity exported.
Cost savings and export income. Lower end of range is without a battery, higher end is with a battery.	• 15kWp system - Annual total £2620 - • 25kWp system - Annual total £3731 - • 35kWp system - Annual total £4532 - £5500

Network Upgrading Possibilities

It may be possible to install a new 200A 1-ph supply line from the existing transformer, for a cost of approx. £4k + VAT. This could deliver 40kVA of demand and 35-40 kW of export generation capacity if the generation was directly connected to a cabinet at the base of the transformer pole. This could reduce to around 25kW generation if it shared the farm supply line.

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.

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It would also be possible to install solar PV connected to the supply line to the caravan park. This has not been looked at in any detail but the practical limits would probably be similar to the situation on the farm supply line.

Potential Solar Generation

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

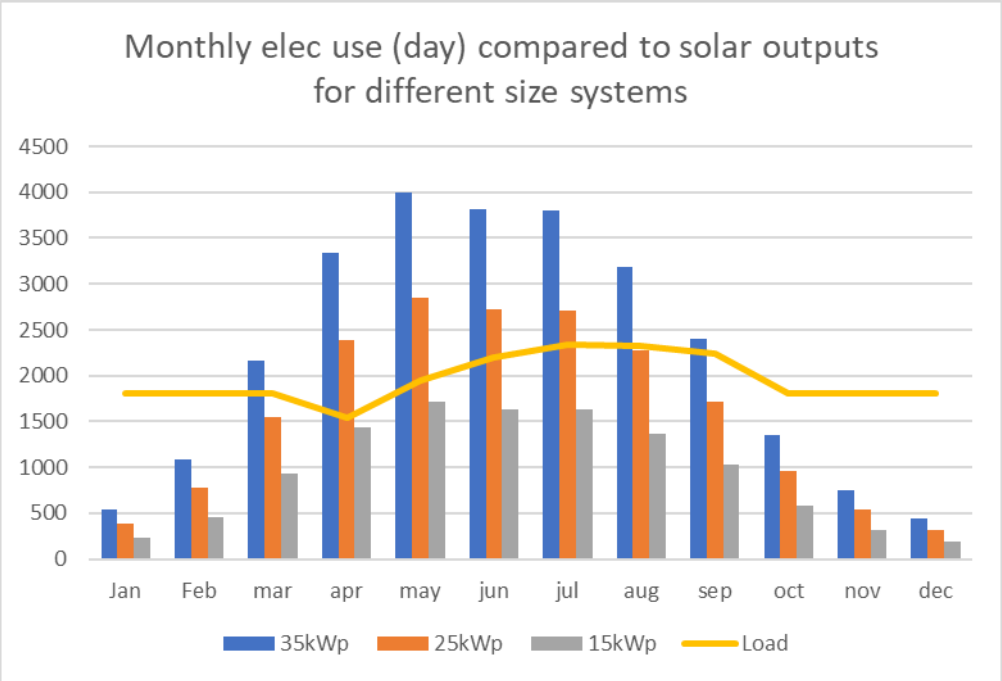
- 15kWp system 1600 kWh per month in summer dropping to around 200kWh in December. Annual total kWh 11510kWh. (25% of your annual electricity use)
- 25kWp system 2700 kWh per month in summer dropping to around 300kWh in December. Annual total 19183 kWh (40% of your annual electricity use)
- 35kWp system 3800 kWh per month in summer dropping to around 450kWh in December. Annual total 26857 kWh (55% of your annual electricity use)

Comparison of loads and Generation

A review of recent electricity bills showed that the average daily energy use on the farm supply is around 125kWh/day, so the monthly energy use is around 3750kWh, and the annual consumption was 46000 – 52000 kWh over the last 2 years.

Consumption is currently fairly evenly split between day and night use. The major loads identified included milking (done from 4.30-6.30am and 4.30-6.30pm) and hot water and ice cooling, (currently done at night but could potentially be shifted to the day).

The graph below compares monthly **daytime** energy use with potential PV energy generation for 3 different size PV systems for each month of the year. Note electricity bill data was only available for the summer months, hence the straight sections of the yellow line is an average for the colder months of the year.



Milk Washing and Cooling Systems

Options and Benefits

The smallest system (15kWp) is the grey bars. Generation is consistently well below daytime consumption so nearly all of the solar energy could probably be used on the farm in the daytime displacing day rate electricity. However, that does depend on how even the load is and how well the time of day of loads matches the solar generation times. In this case it would be useful to read the meters every couple of hours for a few days to check how much electricity consumption occurs over the middle of the day and how much at milking times. If a significant proportion of consumption is early or late in the day adding a battery to the solar system would help. At 22.78p/kWh (current rate for daytime electricity) and displacing 11510kWh that could save around £2620 per year.

The mid-size system (25kWp) is the orange bars. In this case generation is around the level of daytime consumption in March and August, slightly above consumption the summer and below in

the winter months. If some of the night load can be shifted to daytime in the summer this would probably use nearly all of the solar energy on the farm in the daytime displacing mostly day rate electricity. Again, that does depend on how even the load is and how well the time of day of loads matches the solar generation times. If we estimate that 75% displaces daytime electricity, 10% displaces night time electricity at 15.25p/kWh and 15% spills out the grid at 5.6p/kWh (see report section on the Smart Export Guarantee) that should save around £3731 per year.

The large-size system (35kWp) is the blue bars. Generation is over the level of daytime consumption from March to September, but below in the winter months. If some of the night load can be shifted to daytime in the summer the farm would probably still use the majority of the solar energy in the daytime displacing mostly day rate electricity. Again, that does depend on how even the load is and how well the time of day of loads matches the solar generation times. If we estimate that 60% displaces daytime electricity, 10% displaces night time electricity at 15.25p/kWh and 30% spills out the grid at 5.6p/kWh that should save around £4532 per year.

If the larger system was installed installing a battery would probably be worthwhile as it would allow solar energy to be stored for use at night or when the daytime load exceeds the generation at the time. This could increase the savings by around £1000 per year, which would need to be balanced out against the additional cost of the battery system.

EVs

The possibility of installing 5 or 6 EV charge points for caravaners in the near future was considered. There may be need for more charge points for own vehicles at a later date.

It would probably be possible to install a single 7kW EV charger on the existing farm supply. Upgrading the farm supply would increase the capacity for EV charging and for generation.

According to ENW it would probably be possible to install 5 EV chargers for the caravan site at a location within 75m of the transformer. In general, closer is better. The cost would be in the region of £5000 to install a supply for the EV chargers.

Potential space for EV Charge Points to service caravan park

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