# Case Study Farm 3 - Beef and Sheep

**Summary Table**

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| Location | [redacted] |
| Load size and variability | Farmhouse, lighting and automatic muck scraper for cows through the winter, workshop. A second house may be built on site. |
| Suitable roof areas | There are 4 modern sheds with south facing roofs. All have a slope of 15°, Orientation within 2° of due south. Counting from the south sheds 1, 2 and 4 are considered below. Note it is assumed rooflights can be covered over on the south side if necessary. Shed 3 is shaded by shed 2 and hence unsuitable. Access for scaffolding may also be an issue.<br><br>Shed 1 |

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| | • Area around 41.6m by 7.4m<br>• Space for up to 50kWp<br>Shed 2<br><br>• Area around 24m by 6m<br>• Space for 18 to 22kWp<br>Shed 4<br><br>• Area around 24m by 4.2m<br>• Space for 13.5 to 16.5 kWp |
| Maximum feasible array size on roofs | There could be space for around 85 kWp if all 3 roofs were used. |
| Array sizes considered | 5 kWp minimum used for calculations<br><br>10 kWp used as a reasonable match to annual electricity use<br><br>20kWp used as fits within export limit with existing transformer |
| Current electricity supply | Fed from an underground LV network. The site is approx. 330m from the 315kVA transformer and is fed via a 0.075 copper wire. |
| Network limitations on generation capacity | Due to the impedance/length of the existing supply line it will not accommodate much more then 20kW 3-phase PV system.<br><br>It may be possible to increase the generation capacity but this would require a new connection. The costs involved would depend on the generator size installed. |
| Potential annual energy output | • 5 kWp system - Annual total 3695 kWh<br><br>(30% of annual electricity use)<br><br>• 10 kWp system - Annual total 7391 kWh<br><br>(59% of annual electricity use)<br><br>• 20 kWp system - Annual total 14782 kWh<br><br>(119% of annual electricity use) |

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| Preliminary cost estimates | 5kWp PV system without a battery approx. £6930<br>5 kWp PV system with a battery approx. £9000<br>10 kWp PV system without a battery approx. £12500<br>10 kWp PV system with a battery approx. £ 15000<br>20 kWp PV system without a battery approx. £24000<br>20 kWp PV system with a battery approx. £ 29000 |
| 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<br>• 5 kWp system - Annual total £1130 - £1760<br>• 10 kWp system - Annual total £1718 - £2605<br>• 20 kWp system - Annual total £2566 - £3750<br>With a battery<br>• 5 kWp system - Annual total £1239 - £1940<br>• 10 kWp system - Annual total £2044 - £3150<br>• 20 kWp system - Annual total £2783 - £4114 |

**Network Upgrading Possibilities**

Although there is a 3-phase supply to the farm fed from an underground LV network the site is likely to only able to accept around 20kW of generation. This is due to distance (approx. 330m from the 315kVA transformer) and the size of the existing supply wire (a 0.075 copper wire). The supply will therefore have a significant level of impedance. It may be possible to increase the generation capacity but this would require a new or upgraded connection. The costs involved would depend on the generator size requested.

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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**Potential Solar Generation**

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

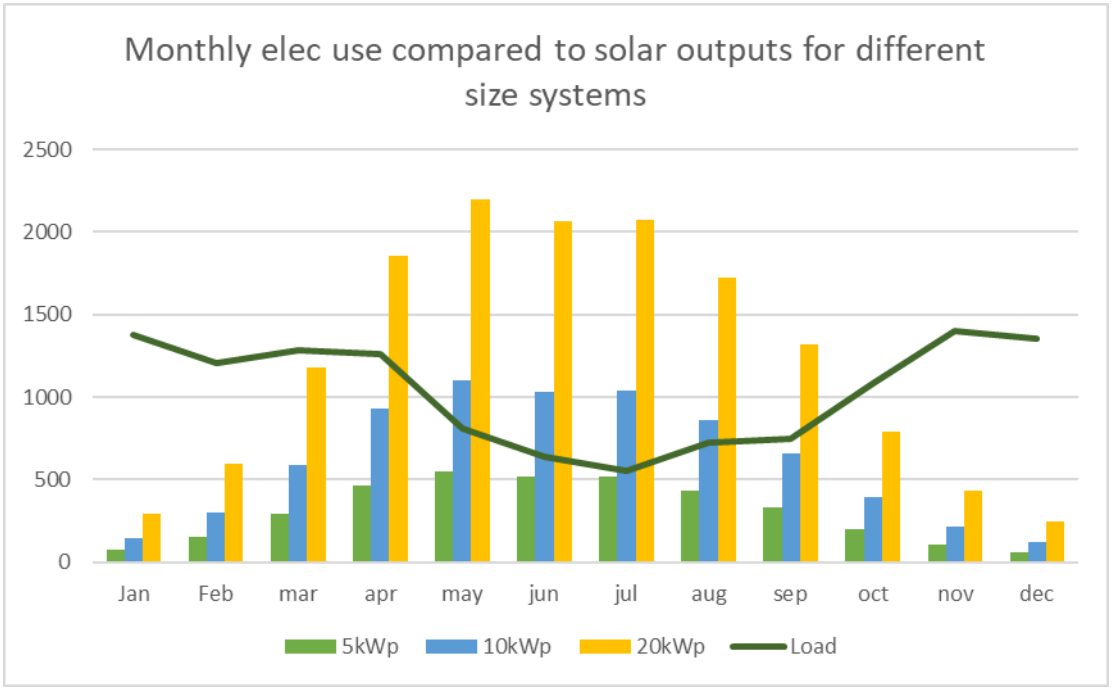
- 5kWp system 520 kWh per month in summer dropping to around 60kWh in December. Annual total kWh 3695 kWh. (30% of the annual electricity use)
- 10kWp system 1050 kWh per month in summer dropping to around 125kWh in December. Annual total 7391 kWh (59% of your annual electricity use)
- 20kWp system 2050 kWh per month in summer dropping to around 250 kWh in December. Annual total 14782 kWh (20% over the annual electricity use)

**Comparison of loads and Generation**

The graph of monthly electricity use since 2019 provided showed that the average daily energy use on the farm supply varies between 18 and 45 kWh/day, so the monthly energy use is varying from 550 to 1400 kWh, and the annual consumption is around 12430 kWh.

The major loads identified included the farmhouse, workshop, lighting and automatic muck scrapper in winter for indoor cattle. If a solar system was installed it might be beneficial to run the muck scrappers mainly in the day when solar power was most likely to be available.

The graph below compares monthly energy use with potential PV energy generation for 3 different size PV systems for each month of the year.




**Options and Benefits**

The smallest system (5kWp) is the green bars. Generation is consistently below electricity consumption so for most of the year nearly all of the solar energy could probably be used on the farm in the daytime displacing electricity. However, in the summer that does depend on how well the load times 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 mid-size system (10kWp) is the blue bars. Generation is around the level of consumption in April and September, somewhat above consumption the summer and below in the winter months. If the time of day of loads matches the solar generation times well then over the year the majority of the solar energy generated should be used on the farm, although surplus energy will be exported in the summer months. Installing a battery may 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 £300 to £550 per year, which would need to be balanced out against the additional cost of the battery system. However, the financial return would probably be better if a slightly smaller solar system was installed than 10kWp.

The large-size system (20 kWp) is the yellow bars. Generation is well over the level of daytime consumption from April to September, and the system will be oversized unless the loads increase. Significant amounts of electricity are likely to be exported in the summer. This means the financial return will be very dependent on the rate that can be achieved for exported electricity. Currently the rates on offer are fairly low, typically 5.6p per kWh, although better rates are available in some circumstances.

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