Energy Improvements for High-Use Farms

Farm Advisory Service
National Advice Hub
T: 0300 323 0161
E: advice@fas.scot
W: www.fas.scot

This guide is intended to supplement the information in our 'On Farm Efficiency Practical Guide'. You can find it here.

The energy crisis, rising inflation and soaring utility bills are all putting pressure on farm finances and food production. Reducing energy use and improving efficiencies on farm can save you money, decrease your environmental impact, increase sustainability, and make the farm business more energy secure.

Energy use will vary from farm to farm, but highest energy-consuming farms are typically:

- Dairy farming
- High-intensity farming
- Glasshouse horticulture
- Grain dryers
- Farms with large cold stores such as for potatoes.

These farm types typically require significant energy inputs for processes like heating, ventilation, cooling, and milking operations. The use of energy across these businesses will vary depending on individual farm practices and the specific technologies employed. However, investing in new technology and applying small changes to current management practices can bring about substantial savings and a reduction in emissions.

Contents

SAC CONSULTING
Part of Scotland's Rural College (SRUC)

Scottish Government
Riaghaltas na h-Alba
gov.scot

Dairy farming

Dairy farm energy usage can be high because of the equipment required for milking and cooling.

Over 80% of total energy use on a dairy farm is accounted for milk cooling, water heating and vacuum pumping – AHDB (Agriculture and Horticulture Development Board).

Further steps that can be taken to deliver energy savings include:

Heating, Cooling and Ventilation

- Within the milking parlours and tank room, insulate water tanks and pipes.
- Heat drawn from milk using a plate cooler can then be used to pre-heat wash water, instead of it being lost to the atmosphere.
- Ensure plate coolers are sized to meet capacity and are operating effectively. Cooling fresh milk is an energy intensive process and plate coolers can speed the process, thereby reducing refrigeration energy by up to 40%, whilst ensuring optimal milk quality.
- Heat exchangers could be used to save energy costs by around 60%. Heat recovery units using refrigerants can be used to help heat water in an appropriately sized tank for various uses e.g., plant washing.

Equipment, Vehicles and Machinery

- Using variable speed drives on vacuum pumps could reduce energy use by up to 50%, extend the pump life and reduce noise.
- Variable speed milk pumps can help by reducing the milk flow speed and allowing the plate to cool and work more efficiently.
- A variable speed vacuum pump can reduce energy use during milking. It reduces the vacuum pump speed and energy use when the clusters aren't attached, speeding up only to meet the vacuum pump requirements.

For more information on options for dairy farms visit:
https://www.farmingforabetterclimate.org/resource/electricity-use-in-the-dairy/

High Intensity Farming

Pig and poultry housing can require a lot of heat. The type of production system and the stage of animal development will influence the temperature required for animal health and growth. Careful consideration of heating systems, costs and more sustainable options should be undertaken to meet your farm needs.

In the case of poultry, broilers, pullets and layers will all have different needs at different stages of life, generally birds like to be kept ~21°C, but it could be over 30 °C for chicks with temperatures gradually reduced as they grow.

Further steps that can be taken to deliver energy savings include:

Lighting

- Have energy efficient lighting and make use of natural light to maximise savings. This will ensure no energy is wasted while maximising animal health and welfare.

Heating, Cooling and Ventilation

- Pig and poultry buildings should be well insulated
- A lot of sheds are heated with LPG or Kerosene. Biomass boilers can also help to create more dry heat, benefiting animal health in addition to offsetting fossil fuels.
- Solar PV panels often correlate well with ventilation needs, as peak solar output is during summer days when ventilation and cooling requirements are likely to be higher.

Equipment, Vehicles And Machinery

- Animal housing can be ventilated automatically with computer controlled systems that monitor temperature and humidity to maintain optimal conditions in all weather conditions. A base rate of ventilation is maintained with additional fans activated when required.
- Solar panels should be cleaned regularly to avoid dust build-up and ensure they are operating to their potential.

Grain Driers

Grain drying can use significant quantities of fuel. Infield use, crop drying, and storage are all large energy demands on arable farms. ADAS estimates that conventional, high temperature dryers require 55 litres of oil per hectare of crop dried.

Further steps that can be taken to deliver energy savings include:

Heating, Cooling and Ventilation

- Grain drying costs can be considerable, particularly if the weather during the harvesting period has been wet. The ability to attribute fuel use to specific crop batches can inform decisions on harvest operations, storage, and marketing.
- Can you cool crops instead of drying?
- Can you change your drying system or fuel source? For example, heat pumps might be able to meet a portion of heat requirement and offset some fuel use, and at the same time could be used to aid cooling if you have cold stores. Anaerobic Digestion is another option if you have sustainable feedstocks and are able to make full use of the generated heat and power all year round.

Equipment, Vehicles and Machinery

- Modern driers might already have the capacity to allow you to download the drying records automatically. If not, keeping detailed records for each crop (e.g. total crop yields, crop moistures at harvest and fuel required to dry down to stable moisture content) can be useful when making decisions on crop choices in the following year.
- Knowing the energy use per tonne of moisture removed allows for management decisions such as whether to sell grain on a wet or dry weight basis, or to consider upgrading the drying facilities on farm to a more efficient and economical system.
- Ensure grain dryers are set up and operating correctly. Humidity is key to crop storage and drying, having the right level could save up to 40% of your energy use due to drying.

Farms with large cold stores such as for potatoes

Potato cold stores require a significant amount of energy to maintain the necessary temperature and humidity levels to protect the crop. These energy costs can account for up to 50% of the total operating costs of a cold storage facility.

Heating, Cooling and Ventilation

- Consider building “cold” or ice when lower priced electricity is available, therefore avoiding the need to purchase more expensive energy when demand on the grid is high.

Equipment, Vehicles and Machinery

- Ensure the cold stores are well insulated and operating correctly, with regular maintenance and component parts working properly.
- Good management is one of the easiest ways to improve efficiency, including closing doors and using plastic strip curtains as an effective low-cost way to keep the cool air inside when shifting produce to and from the store.

Glasshouse Horticulture

Glasshouse heating is highly energy intensive and energy is a significant total of the final input costs. Typically 60-80% is used in the management and production of the crop itself.

Further steps that can be taken to deliver energy savings include:

Heating, Cooling and Ventilation

- Heat efficiency in glasshouses can be achieved by:
    - Good insulation
    - Thermal screens – drawing screens over the crop at night has been shown to reduce energy use by 60% at night.
    - Appropriate glazing that makes best use of solar gain.

Equipment, Vehicles and Machinery

- Anaerobic Digestion can be used in the glasshouses to help grow plants, however there are some considerations for this.
    - Costs and investment can be high and they need ongoing management to be effective.
    - They need to operate on sustainable inputs, ideally waste products such as vegetable waste, FYM etc. to generate the biogas, but quite often waste streams on farm are not enough and additional sources are required.
    - This needs careful control to ensure quality and continuous, ample supply of feedstocks.
    - Animal manure and slurry are often the most sustainable option if already available on farm but biogas yield for this will be much less than specifically grown energy crops, which can conflict with land-use for food production.

For more information on Anaerobic Digestion and tomato growing:
https://www.fas.scot/publication/resilience-and-business-skills-an-interview-with-jim-shanks/

Useful further resources

- Agrecalc: https://www.agrecalc.com/
- AHDB - Improving energy efficiency on dairy farms: https://ahdb.org.uk/knowledge-library/improving-energy-efficiency-on-dairy-farms
- Business Energy Scotland - Offers loans, advice and support including cashback grants for energy efficiency and renewable heat measures: https://businessenergyscotland.org/smeloan/
- Carbon Trust – Energy efficiency in agriculture guide: https://www.carbontrust.com/our-work-and-impact/guides-reports-and-tools/energy-efficiency-in-agriculture-guide
- Cool Farm Tool: https://coolfarm.org/the-tool/
- Farm Advisory Service – Energy demand management: https://www.fas.scot/environment/climate-change/renewable-energy/energy-demand-management/
- Farming for a Better Climate – Improving farm profitability: https://www.farmingforabetterclimate.org/your-journey/improving-farm-profitability/
- Farm Carbon Toolkit- Energy efficiency: https://farmcarbontoolkit.org.uk/toolkit/farm-ghgs/energy/energy-efficiency/
- SAC Consulting – Food and Footprint: https://www.sruc.ac.uk/business-services/sac-consulting/sustainability/food-footprint/