

Energy

As the price of electricity, gas and oil has increased significantly over the last 20 years, minimising energy consumption to improve the farm business's bottom line is essential. Minimising the consumption of fossil fuels in particular is considered essential in order to combine business benefits and reduction of greenhouse gas emissions. There are many ways in which consumption can be reduced and each site may need to consider addressing different aspects such as in-field operations, crop storage or building design. Solutions may range from free- or low-cost options to those which require more significant investments.

"A 20% cut in energy costs can represent the same bottom line benefit as a 5% increase in sales" (Farming Futures – factsheet 23. Available on the Farming Futures website: <http://www.farmingfutures.org.uk>)

Understanding electricity or gas bills

A good understanding of all of the energy consumption on a unit is a fundamental requirement in the assessment of the environmental performance of the business. Energy bills provide a good starting point. The content and design of energy bills will vary depending on the size of the operation and the energy supply company but they will generally include the following information:

The kWh figure is the key number the farm should monitor, as this is how much energy has been used. The other figures (kVA) are important when looking at negotiating your supply contract and can make a significant difference to the final bill.

- For smaller operations: the bill will detail the kilowatt-hour (kWh) consumption and the period over which that energy was used. It will also state whether the reading is an estimate, has been customer read or read by the power company. Gas bills will have conversion factors which ensure you are charged the same amount per kWh, as the calorific value of gas can vary over time. Some companies have standing rates which are charged on a per day basis and do not vary with demand.
- For larger electrical users: the bills will contain the same information as for smaller users but will also include a peak demand kVA (kilovolt-ampere). Electricity companies charge for the maximum demand kVA within the billing period. Some energy companies also charge for supply kVA, which is the amount they have agreed will be available to the farm; this should be slightly higher than peak demand kVA over a 12 month period, as persistently exceeding supply kVA may result in penalties.

Machinery Maintenance

It goes without saying that good maintenance of equipment is important. A lot of farm machinery is used intermittently and therefore may need to be stored for significant periods of time. Sometimes access to storage may be constrained and machinery

will need to be left out in the open. The servicing requirements of equipment will vary with manufacturers however some basic tips may be considered:

- Oil / Grease equipment after use. This helps prevent damage to equipment while in storage
- Ensure correct tyre pressure. Incorrect tyre pressure reduces efficiency of vehicles, increases wear on tyres and may result in damage to the equipment
- Keep air filters clear. Blockages in air filters reduce the air getting into engines and decrease their efficiency
- Check manufacturers' instructions. All equipment comes with maintenance schedules. Following these schedules will increase the life of the product.

Lighting types and controls

Lighting is important to ensure safe working practice; it is essential to have the right type of lighting in the right place. Lighting technology has improved significantly in the last 30 years, meaning many businesses now have the potential to make large energy savings through improvements in this area.

An old-style conventional incandescent bulb (a filament bulb) only converts around 2.5% of electricity into useful light, while LED lighting can convert almost 99%. Control of lighting is equally important as it will ensure that lighting is only on when it is required.

Basic considerations

- Check that the building is maximising the available daylight.
- Consider the layout of sheds. With open-sided units, more light is available towards the edges. Often bales are used to create walls, which further limits daylight in the centre of the building.
- Reflectors can be useful for directing light to where it is required. These are generally low-cost additions and often come with the light fittings. Maintaining these is essential as over time they do get dirty and their reflectivity declines.

Extensive information on lighting types and their applications can be found in the **Carbon Trust lighting guide CTV 021** available on the Carbon Trust website (<https://www.carbontrust.co.uk/>).

Lighting Controls

Lighting controls will ensure that a light is on only when required.

There are three main types of lighting controls:

	Principle	Advantages	Disadvantages
Timers	Allow lighting to come on and off at set times	Easy to set Useful for animal housing and other sheds where livestock is being reared intensively and operators wish to enforce a natural cycle	Should not be used for external lights as they do not take into account external factors such as day length and weather.
Passive Infra Red (PIR)	Triggered by movement and provide light for a set period after they are triggered	Ideal for sheds used for storage or for lighting pathways that are used less frequently	Less suitable for open sheds where wind can move objects, or for use in animal sheds.
Daylight Sensing	Triggered by light levels either externally or internally	Commonly used for lighting paths to ensure that they are always lit or for sheds where specific light levels are required all the time	

Often a combination of the above measures is used. Keep in mind that there is also the option to use manual switches to override some automatic sensors.

Refrigeration

Many farm units have small amounts of refrigeration to keep samples in or vet medicines safe and out of kitchen units. These are generally domestic fridges or freezers and some simple checks like ensuring that seals are working and that the refrigerant levels are correct will help maintain their efficiency.

Basic Considerations

Good insulation of the area that is to be chilled is essential. The other main losses are through doors so ensuring they have good seals and are well insulated is important.

Maintenance

For existing large-scale refrigeration units, maintenance should be a very high priority. You may be able to do this operation yourself, however recent regulations mean that to carry out any work on the unit itself, an individual must be fully qualified (**Ozone Depleting Substances Regulations**).

Day to day on site maintenance should include the following checking:

- Ice is not building on the evaporator
- There is no excessive noise from the compressor (this would suggest a fault)
- Bleed/drip valves are not iced/blocked
- Internal fridge lighting does not remain on

Monitoring and Measuring

In addition, the site should record data on the energy use of the refrigeration unit. Spikes in energy use may indicate poor door closing (or a similar activity) or a fault with the system.

Replacing refrigeration units

Older refrigeration units are likely to contain CFCs or HCFCs that are very harmful to the environment if released. Changes to legislation mean that the production of these is now illegal and any refilling of existing systems is being done through recycled stock. This means that the price of the replacement gas is now rising and replacing older units may be more advantageous. The legal compliance section at the end of this chapter includes further information on the rules for handling and replacing refrigerants.

Fuel

Vehicles and sensible driving

With fuel prices rising, it is important to get the most from any fuel used on the farm.

- Select the right vehicle for the job, in particular match tractors and machinery
- Consider combining operations to optimise the number of passes
- Remove unnecessary ballast
- Maintain vehicles correctly, in particular check tyre pressure
- Switch into high gears quickly, anticipate braking and less aggressive acceleration

Where larger-scale refrigeration units are required (e.g. for dairy farms or where temperature controlled crop storage is on site) the type and maintenance of refrigeration units is a high priority, as they are highly energy intensive. For a dairy unit with a 20m³ fridge, the chiller unit is likely to be around 3-4kW, while large air-conditioning units for a 650m² potato shed would require 20kW.

Replacement refrigeration units are large investments, however the savings from replacement are quite significant and offer payback of between 3 and 5 years in most cases.

For potato growers, optimising cooling technique, including investigating combined ambient and refrigeration cooling, may reduce energy consumption of potato refrigeration by 20% (The Potato Council, 2006. Energy Status Report: GB potato storage. Available on the Potato Council website: <http://www.potato.org.uk>).

Different driving styles can make a significant difference to fuel consumption. Figures from the Energy Saving Trust suggest a 20% difference between the most and least efficient drivers.

Fuel Storage

Bulk storage of fuel on farms reduces transportation needs; however it is an area that has the potential to cause significant damage to the environment. It is therefore essential that legislation is complied with and that sites have in place plans for incidents.

Should a site have an oil spill, it is very important that it is contained and cleared up correctly. To help with this a site should consider putting in place:

- A spill kit (absorbent pads or granules, disposal bags and safety gloves)
- A protocol detailing how to use the kit and to dispose of contaminated kit material

Motor Types

Motors are used around the farm for a variety of uses, from operating belt drives to compressors.

- Match the motor type to the required use. Variable Speed Drives (VSD) allow the motor to produce different output speeds, which is useful for many activities. However they are not as efficient as single speed drives. A single speed drive which is damped to allow it to generate different speeds is a lot less efficient.
- Rewinding of motors allows an old motor to be reconditioned and prolong its life however it reduces the efficiency of the motor by about 3-5% (The Carbon Trust – CTV016 guide). As the cost of motors continues to decrease, a rewind motor should only be considered if it is to be used infrequently.
- Basic maintenance of the equipment driven by the motor: ensure that belts are free running and parts are well greased to reduce resistance.

Dryers and crop storage ventilation

- Check the sensors are working and are correctly calibrated; over-drying will waste energy, reduce the saleable weight of your grain and may inhibit seed germination. The Carbon Trust estimates that 5% of over-drying can add 10% to drying costs.
- For heated-air dryers, ensure the burner is checked by a qualified gas engineer every couple of years, even if it is not being used. It is arguably the most important part of the equipment and incorrect combustion not only reduces the efficiency of the system, but can also be dangerous.
- Ensure that it is well oiled and clean and that belts are tight.
- When replacing a dryer unit, look into whole-life costing (cost of purchase and cost of running). The burn efficiency differs considerably between different driers and it is likely that spending a small amount more on a drier may pay for itself in the first 3 or 4 years of its operation.

Heating systems

Basic considerations

- Check that temperature is appropriate and controls are accurate.
- Have boilers serviced and pipes checked regularly
- Insulate boilers and pipes

Legal Requirements

Tanks are required for storage and these must comply with the Water Environment (Oil Storage) (Scotland) Regulations 2006. These regulations require that all oil stored in volumes greater than 200 litres must be banded. Banding is a secondary containment for the storage vessel so that if liquid escapes from the primary containment it is still held and is not allowed to enter the environment. Banding should be sized appropriately and should be either 110% of the largest container or 25% of the total volume held within the bund (whichever is greater).

Lubricant, vegetable oil and oil used in feeds must also comply with these regulations, without threshold limit.

Detailed guidance is available in SEPA's PPG02 leaflet. This explains how banding can be built and also provides guidance on appropriate siting.

Changes to motor technology have not been as radical as in other areas such as lighting and engines but newer Higher Efficiency Motors offer around 3-5% savings (The Carbon Trust – CTV016 guide. Available on the Carbon Trust website: www.carbontrust.co.uk).

Grain drying and storage ventilation add a significant cost to the harvest operation. Small issues can have a large impact on operations.

Different types of heating may be envisaged, along with adequate insulation:

Types of heating systems	Advantages	Disadvantages
Electrical	Cheap to purchase Easy to fit within a building Suitable when heating is required infrequently	Expensive to run
Oil/gas	Half the running cost of the electrical system	Costs 5 times as much to fit than the electrical system
Renewable energy (heat pump, biomass)	Displace the use of fossil fuels and reduce greenhouse gas emissions Reduced operating costs compared with non renewable energy	Capital cost associated with change in heating system
Infra-red	Heat the objects they are directed at, no loss of energy to the surrounding areas due to lack of insulation or drafts Suitable for open spaces like open shed	

Building ventilation and insulation

Proper ventilation and insulation on a building will improve animal welfare and allow better conservation of crops and forages.

For any refurbishments or new builds, insulation should be a priority as it is fairly inexpensive material. Additional insulation will reduce the heating or cooling requirement for a building. In theory, the more insulation, the better; however, when amounts are increased significantly, ventilation should be considered, as damp and condensation may become an issue.

The Carbon Trust recommends ensuring building insulation is optimised before envisaging upgrading heating systems as draught proofing can reduce energy consumption by over 15% (**The Carbon Trust – CTV009 guide**. Available on the Carbon Trust website: www.carbontrust.co.uk).

More information on legal requirements and British Standard 5502 covering agricultural buildings can be found on the website of the Rural and Industrial Design and Building Association: www.ridba.org.uk/aboutridba.htm

Ventilation and insulation are most effectively considered when new buildings are being constructed and major renovations are being planned. Whilst retrofitting ventilation and insulation to buildings will bring some benefits, generally, in economic terms, they will not result in large paybacks.

Further Information

The Carbon Trust

www.carbontrust.co.uk

- Information, publication and guides regarding energy efficiency and energy reduction measures, including information by sector and technologies.
- The CTV009 guide (Agriculture and horticulture – Introducing energy saving opportunities for farmers and growers) provides useful tips and figures on energy and cost saving on farming businesses.

Energy Saving Trust

www.energysavingtrust.org.uk/scotland/Scotland-Welcome-page/Business-and-Public-Sector-in-Scotland

- Advice to reduce energy consumption and carbon emissions

Farming Futures

www.farmingfutures.org.uk

- Factsheets, case studies and other information on farming and climate change including information by sector

HGCA

www.hgca.com/content.output/2868/2868/Environment/Environment/Climate%20Change.msp

- Information and advice on arable farming and climate change

NetRegs

www.netregs.gov.uk

- Advice for businesses on environmental regulations

Potato Council

www.potato.org.uk/department/knowledge_transfer/energy/index.html?menu_pos=seed

- The Energy Hub – Information on energy savings for potato growers

Scottish Agricultural College

<http://www.sac.ac.uk/climatechange/farmingforabetterclimate>

- Advice on actions to take on farms to mitigate and adapt to climate change

Scottish Environment Protection Agency (SEPA)

www.sepa.org.uk

- SEPA's publication PPG02 – Information about oil bunding requirements

Energy saving and legal requirements

It is important to ensure that the relevant legal

- requirements are adhered to on the farm. In particular:
- **Water Environment (Oil Storage) (Scotland) Regulations 2006** requires oil (including vegetable and plant oil) to be situated within secondary containment systems (bunds).
 - **Ozone Depleting Substances Regulations (Various)** require the phasing out of certain CFCs and HCFCs and also controls who can work on refrigeration systems. R22 will be banned as of 2015 and currently only recycled R22 is available.
 - **Special Waste Regulations** require that any waste that is deemed hazardous through the European Waste Coding (EWC) be disposed of through authorised routes. This means that waste oil, fluorescent tubes etc will have to be collected separately to farm general waste. For more information, please refer to guidance available at www.netregs.gov.uk.