

Energy Efficiency On Farm

INTRODUCTION

When was the last time you looked at your farm's energy costs?

This fact sheet aims to provide a clear and informative introduction to using energy efficiently on the farm. More detailed technical information can then be sought as required. Details of sources of further information are listed at the end of the factsheet.

The cost of supplying power to a dairy farm is significant and, like any other farm input cost, this should be reviewed to see if savings can be made.

This is even more pressing due to the imminent rise in the cost of electricity and gas. Prices are increasing due to the diminishing supply of coal to power stations and the decline in the UK's gas supply, resulting in demand having to be met from imports. Climate change levy is also adding to energy prices.

The aim of this fact sheet is to help farmers gain a greater understanding of what their actual energy costs are and to identify potential savings and ways of using energy more efficiently in the future.

The first step is to be able to measure the energy that is actually being used on your farm. The biggest source of energy will almost always be electricity but gas and fuels such as oil and diesel should also be reviewed.

(A) MEASURING ENERGY CONSUMPTION

- Collate data from utility bills and fuel invoices to establish how much your business is spending on each type of fuel over a period – ideally 12 months with a monthly or quarterly breakdown. Beware of consumption data from invoices based on estimated meter readings.
- Take regular meter readings to give more detailed information and enable any variations in consumption to be quickly identified – once a month is a good target. Any significant variance in consumption should be investigated as it may be a result of a problem with electrical equipment, for example the malfunction of a timer switch on a water heater. A faulty time switch could cause the heater to heat water at the wrong time of day or to continually heat water. Early detection could prevent unnecessary costs and avoid plant breakdown.
- By reading your meter regularly you will also be able to compare current consumption with previous figures, so you can quickly assess the impact of new equipment or procedures, changes in production or even the weather.

- Once you are familiar with your energy consumption data you can then use this information to help you compare your business with other similar operations. Benchmarking tools such as MilkBench (www.milkbench.org.uk) allow you to compare your costs and business performance with other similar dairy farms. You can establish if the amount of energy you are using is 'normal' in comparison, and set targets for improvement.
- Farmer discussion or buying groups are also a useful forum to get together and share this information.
- To make a true comparison it is best to relate energy consumption to the level of production or unit of output on your farm e.g. kWh (kilowatt hours) per cow or per 1,000 litres of milk.
- Having measured your energy consumption and analysed the data for the different types of energy you can then consider how to make savings.

(B) MANAGING ENERGY CONSUMPTION

There are 2 key elements to this process:

1. The price you are paying for the energy you use
2. The amount of energy you are using

1. ENERGY PRICES

You need to consider:

- Your supplier – are you getting the best in terms of price and service?
- In the case of electricity, your tariff – are you on the most appropriate tariff for your type of business?

CHOOSING THE RIGHT SUPPLIER

The gas and electricity markets were deregulated in the 1990's enabling you to choose your preferred supplier. There are many companies to choose from and it is worth at least looking to see what is on offer. In particular, large businesses with high energy consumption can often negotiate an individual deal.

Both the industry regulator **Ofgem** and the independent industry watchdog **energywatch** publish lists of gas and electricity suppliers on their web sites (www.ofgem.gov.uk and www.energywatch.org.uk) so you can check to see which companies operate in your area. All these companies must publish the prices they charge and this price information is also available on the **energywatch** website or you can contact the suppliers direct.

If you are thinking of changing to another electricity supplier you will need to check if you are tied into a contract with your current supplier. Many companies offer contracts for periods of one to five years and breaking this contract can incur a penalty charge which needs to be taken account of in the overall cost/benefit analysis.

To get a quote all you normally need is:

- The 16 digit MPAN number (quoted on your bill).
- Your last electricity bill (or ideally bills for the last 12 months so annual consumption can be calculated).

Your prospective supplier will then give you a quote based on the same tariff that you are currently on. If you want to change tariff e.g. to an Economy 7 (E7) tariff at the same time, you will need to become a customer first and then you would be moved across to your new tariff (normally there is no charge for installing the new metering equipment for E7).

When considering the quoted price you need to take account of:

- The unit charge **and** the fixed or standing charge. Some companies offer no fixed charges but as a result the unit cost is higher.
- Payment method – you would normally pay monthly or quarterly and can do this by cash/cheque or by direct debit. In some cases direct debit does attract a discount and some companies insist upon this. Beware of deals which deduct a fixed amount from your account each month, with no reference to energy used. With these, if energy use changes, it is easy to get behind (or too far in front) with payments.
- Annual consumption – higher users may be offered additional discounts.
- Your location – the price of electricity does depend on where you are in the UK as your chosen supplier has to make a payment to your local regional electricity company and they charge different prices.
- Group discounts – if you belong to an organisation with several other farmer members check if they have negotiated a special deal with a supplier offering a group discount or some benefit to all group members.
- Additional benefits – some suppliers may not offer the cheapest price but offer additional benefits such as discounts on other services e.g. telephone. The value of this is subject to individual circumstances.
- Dual fuel deals – if you buy both gas and electricity from the same supplier they will probably give you an extra discount.
- Finally, look at the terms and conditions of your contract and penalty clauses should you wish to exit the contract early.

CHOOSING THE RIGHT TARIFF

Equally if not more important than your electricity supplier, is your choice of tariff. Electricity supply companies offer a range of tariffs and you need to ensure you are on the best one for your business.

The most suitable tariffs include those with cheap night rates and in some cases cheap evening and weekend rates. Generally the cheap night rate tariffs (E7) are the best for dairy farmers, and the cheap evening and weekends (EWE7) suit farmers with three times a day milking.

For example E7 can offer real savings to a dairy farm primarily by allowing water to be heated using cheap rate night electricity (normally between 12:00pm and 7:00am but times vary slightly according to supplier).

You need to look closely at the timetable of your daily routine as an E7 tariff does charge a higher unit price for electricity consumed outside the cheap night rate period.

You do not need to change supplier to change tariff. Most companies have small business advisors who will be happy to discuss tariffs with you. Look for your customer services contact number on your electricity bill.

ENERGY CONSULTANTS

There are many consultants who specialise in gas and electricity tariffs and they will obtain quotes on your behalf. They know what is happening in the gas and electricity markets and should be able to provide you with a competitive deal. (Be wary of the 'very best' deal as this is often short lived.)

Consultants obviously have to make a charge for their services and therefore you need to use a certain amount of energy to make this cost effective. It is better to agree upon a fixed fee rather than a percentage of any savings achieved.

Once you are happy that you are paying a fair and competitive price for the energy you use you can focus on how you utilise this energy.

2. EFFICIENT USE OF ENERGY

Studies have shown that electricity usage on a sample of dairy farms can vary between 200 kWh and 400 kWh (kilowatt hours) per cow, per annum, so there is significant potential for savings to be made.

Milk cooling and water heating account for around one third each of electricity consumption with the remaining third being used by lighting, heating and ventilation. As they are the biggest users of electricity, water heating and milk cooling offer the greatest potential for saving and should be reviewed first.

In most cases new equipment is more energy efficient than old equipment but the capital cost of replacement can be prohibitive and must be taken into account. When reviewing any piece of equipment you will need to:

- Understand the current cost
- Look at alternatives
- Calculate the investment needed for replacement
- Calculate the payback period to establish if the investment is viable
 - Now
 - In the short term
 - In the long term

WATER HEATING

On a typical dairy farm, water heating can account for 25-50% of total electricity consumption and therefore is the most critical process to review in terms of potential cost savings.

Tips to reduce water heating costs:

- If not already on an E7 tariff consider switching to this.
- If already on E7, heat as much water as possible during the cheap rate night period. Use a time switch to ensure that the heater only operates at the chosen times.
- The tank should be big enough to heat enough water for the day's needs i.e. washing down after both morning and afternoon milking.
- Ensure the hot water tank is well insulated.
- Consider using a refrigerant to heat the water recovery unit.

ECONOMY 7 & SIZE OF TANK

The main use of hot water is the cleaning of the milking equipment and bulk tank. Most pipe systems are cleaned twice a day, once after each milking. Often the water heater is only big enough to heat enough water for one wash therefore the water used for washing after afternoon milking is heated during the day.

As there is a significant difference between the cost of cheap rate night electricity and day time electricity it can be worth investing in either a bigger heater or an additional heater which can heat water during the night for the second wash. Provided the tank is well insulated this will only require a short boost during the day.

TANK INSULATION

The Farm Energy Centre have carried out a study which showed that an un-insulated tank will lose about 50% of its heat over a 17 hour period compared to a 5% heat loss for a tank that is well insulated.

A pre-insulated water heater is the best option but simply fitting a glass fibre lagging jacket to the tank will significantly reduce heat loss and is a cheap option until the current tank is due for replacement. In fact, it is well worth fitting two jackets to provide extra insulation!

The guidelines for insulation are 50mm polyurethane foam or 85mm of glass fibre.


All pipe work, including joints, should also be well insulated (minimum half inch) and the heater should be placed as near as possible to the point of use to minimise the length of pipe work required and the potential for heat loss.

HEAT RECOVERY UNITS (HRU)

The principle of a heat recovery unit is to utilise the waste heat from the milk cooling system by transferring it to the water before it is heated by the water heater.

The HRU is installed in the refrigerant line between the compressor and the condensing unit. At this point the refrigerant is at its highest temperature.

The refrigerant is placed in thermal contact with the water and thermal transfer occurs.



There are different types of HRU and the type of milk cooling system will determine the most appropriate one.

Key points to remember are:

- Installing and operating a HRU should not increase the amount of higher cost day time electricity if on E7.
- The water heater should always be full of water at the right temperature (85°C) at the right time which is at the end of morning milking.
- HRU's usually cost between £600 and £1500.

MILK COOLING

The two main types of milk cooling are 'Direct Expansion' or indirect via an 'Ice Bank'.

DIRECT EXPANSION

The evaporator plates of the refrigeration equipment are attached directly to the surface of the tank. The equipment runs when there is milk in the tank and therefore the ability to maximise the use of cheaper rate night electricity is limited.

ICE BANK

The milk is cooled by chilled water from ice banks or reserves which are built up using cheaper night rate electricity. Because this type of cooling is in operation for a longer time the size of compressor tends to be smaller.

Taking the operation of the tank on its own the ice bank would therefore appear to be more efficient due to its ability to operate at night. However, there are other factors which affect the cost of milk cooling including:

- Design of the tank
- Age of the tank
- Efficiency of compressor
- Location of dairy unit
- Ambient temperature
- Use of some form of pre-cooling mechanism
- Use of ice bank controllers

PRE-COOLING

Pre-cooling equipment can either be an integral part of the milking equipment or an addition to existing equipment. The aim is to achieve 'free' cooling from a mains or borehole water supply and also speed up the cooling process, reducing the burden on the refrigeration process and hence reducing costs.

A pre-cooler is basically a milk-to-water heat exchanger using cold water to cool the milk before it enters the bulk tank. The water takes the heat from the milk and becomes warm itself. This warm water is then available for use elsewhere. In terms of overall cost it is important that this water is utilised otherwise any cost savings from pre cooling are offset by the additional costs of the water (unless water is from a spring or bore hole).

The capital cost of a pre-cooler is on average around £600 plus installation.

HEATING, LIGHTING AND GENERAL ENERGY USAGE

Although these are not the main power users, they are still significant and savings can still be made.

HEATING

Milking parlours are very difficult to heat due to their open design. In general radiant heating systems are more efficient than space heating systems.

PARLOUR LIGHTING

Good lighting is vital in the parlour as the herdsman needs to be able to see clearly to perform the milking routine and also to inspect the herd.

Fluorescent lighting or sodium lamps are more efficient than standard tungsten bulbs.

To prevent degradation of the lighting equipment in damp parlour conditions polycarbonate fittings should be used. These also protect the tubes from mechanical damage and will prevent any glass particles falling down and being a potential contaminant if a lamp should shatter.

OUTSIDE LIGHTING

The level of lighting required will depend on the activities being carried out and for how long they are being carried out. Where lighting is required for most of the time, running costs must be taken into account. If a yard or area is only used infrequently the actual cost of installation is more important and a less sophisticated system may be more appropriate.

Regular maintenance of all equipment is an essential part of any energy management programme. Particular attention should be paid to refrigeration equipment.

(C) SUMMARY – TIPS FOR ENERGY SAVING

- Measure and monitor the amount of electricity being used on farm. Calculate your annual (and if possible monthly) consumption and compare this to your output and operation and previous consumption. Any large variations in consumption should be analysed immediately.
- Check that your bills relate to actual consumption and not estimated data. Successive estimated bills can lead to a significant over or under payment.

- Familiarise yourself with the electricity usage on your farm. Note the major pieces of electrical equipment and the time they are in operation.
- Compare what your current supplier is charging you with what other suppliers are offering in your area.
- Wherever possible use cheaper rate night electricity, especially for water heating.
- Insulate the water heater and all pipe work.
- Install a plate cooler.
- Switch off any equipment and lighting whenever possible and ensure everyone is aware of the focus to save energy.
- For a more detailed study of energy use on farm the Farm Energy Centre has developed a self assessment audit package for all areas of the farm.
- If you are due to replace equipment, energy efficiency and running costs are key criteria.

SOURCES OF FURTHER INFORMATION

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| ■ Farm Energy Centre
Tel: 024 7669 6512
www.farmenergy.com | ■ Ofgem
www.ofgem.gov.uk |
| ■ Carbon Trust
Tel: 0800 58 57 94
www.thecarbontrust.co.uk | ■ EnergyWatch
www.energywatch.org.uk |
| ■ Energy Saving Trust
Tel: 0800 512012 | ■ MilkBench
Tel 01554 748595
www.milkbench.org.uk |

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