

Improving the Welsh Dairy Supply Chain

Hot water but cool bills



Cronfa Amaethyddol Ewrop ar gyfer Datblygu Gwledig; Ewrop yn Buddsoddi mewn Ardaloedd Gwledig
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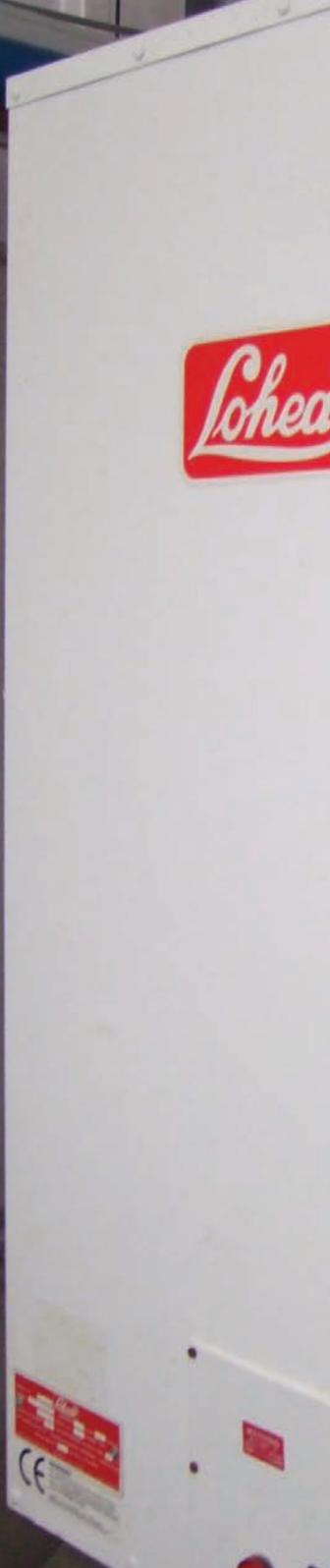
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Introduction

The cost of hot water for cleaning on dairy farms is an increasing overhead burden for many farm businesses.

There is however a number of simple and cost effective ways of reducing water heating bills. Farmers are also starting to recognise the role that renewable energy and recovering heat from other processes might have to play in cutting costs.

After milk cooling, water heating is the second largest consumer of energy on a dairy farm - accounting for 25% to 35% of the total energy bill. Most hot water is used for plant cleaning with water temperatures of up to 95°C. Tank washing and general hand washing account for between 10% and 20% of hot water use.

Equipment

Most systems use an electric immersion heater fitted into a tank. It's a simple system, very reliable and very efficient in terms of energy transfer. However, electricity is an expensive primary fuel (notably the case with on-peak electricity) - so it's important to conserve the heat and use the cheapest electric tariff rate available.

Insulation

The water heater should be well insulated and heat losses especially from lids and pipes minimised. All too often lids are un-insulated, leading to a high heat loss from this area.



Water heating systems can take advantage of cheap night rate electricity tariffs by having the heating element switch on during these periods. Heating water in this way uses electricity at a cost of between 30% and 50% of on-peak electricity.

To take advantage of off peak energy you must have:

- An 'economy 7' type tariff and meter.
- Adequate hot water storage so you don't have to heat extra water on day rate.
- A time-switch accurately synchronised with the off peak electricity rate time.



It's worth checking that both the electricity company's meter time-switch and your own water heater time-switch are synchronised properly as a 1 hour difference on a 3kW heater can increase your bills by £45 per year. Also, don't forget that when the clocks change to and from Greenwich Mean Time (GMT) to British Summer Time (BST), the electricity company's time-switch generally does not. So leaving your water heating time-switch set to GMT is probably the simplest way to keep things synchronised.

Heat recovery and water heating

During the process of cooling milk, heat is lost through the condenser coils of the refrigeration system. It is possible to recover this by passing the hot refrigeration gas through a heat exchanger which is immersed in water. Water temperatures of up to 60°C and energy savings of between 30% and 70% can be achieved by using this technique. Careful configuration of the water heating system needs to be carried out so that the heat recovery system can deliver the maximum benefit without compromising the operation of the milk cooling system, or the ability of the conventional part of the water heating system to take maximum advantage of cheap rate electricity.

Heat recovery systems come in two basic types. The first type uses a heat recovery coil immersed in - or wrapped around the water heating tank. The tanks slowly heat up as the refrigeration gas is re-circulated through the coil. Care must be taken if this tank is also to be used for heating to a final temperature using an immersion heater. Passing the refrigeration gas through the system when the water is at washing temperature will reduce refrigeration efficiency, and reverse the heat recovery process.

The second type of heat recovery uses a plate heat exchanger, similar to those used for pre-cooling of milk. With this type of system the hot refrigeration gas and cold water pass through the exchanger on opposite sides of the plates and the water is heated.

This system requires a controlled flow of cold water linked to the operation of the refrigeration equipment. It works best with a separate water storage tank to collect the pre-heated water during milk cooling. Pre-heated water can then be transferred to the main water heating tank when this needs filling.

Savings from heat recovery can be in the region of £100 per year for every 225 litres per day heated.



Renewable heating systems and water heating

Although a biomass boiler can be used for water heating it's seldom worth installing a biomass boiler for the water heating alone.

If however a biomass boiler can be shared with some other application, like domestic heating, then it may be worthwhile considering integrating the two requirements.

Solar water heating panels, like heat recovery, can provide some of the heat for the water, although it is unlikely to produce the temperature required for plant washing. To be effective a south facing roof capable of carrying the panels is ideal.



Evacuated solar heat tubes give the best thermal performance. As well as working well in bright summer conditions, they have the potential to provide some heat even in colder overcast and winter conditions.

The economics of using solar water heating has been recently improved by the introduction of the Renewable Heat Incentive (RHI). The RHI pays a 'tariff' for every kWh of heat generated by solar panels - (the current proposed tariff is 8.5p/kWh).

A 6m² solar array yielding an average of 3600kWh per day would roughly halve the cost of heating 225 litres of hot water equating to £216 per year. It would also yield an extra £306 in RHI payments.

The capital cost of such a system is likely to be in the region of £5,000.

With so many options available for water heating it's useful to prioritise. We suggest you work through the following list:

1. Make sure pipes, tanks and lids are well insulated.
2. Use a cheap night-rate electricity tariff when heating water. Ensure time-switches are correctly set and that there is enough water storage to enable all the water to be heated during the cheap period.
3. Consider recovering heat from your refrigeration system.
4. Consider solar water heating to reduce your water heating energy use.
5. Take into account biomass boilers, where you have a cheap source of renewable fuel available and perhaps a secondary application requiring hot water.

