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Opinion

Some Dairy Challenges in the UK, Are They the Same as in Australia

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Opinion

I am presenting a selection of topics that I think are challenging the UK dairy industry. The following is an overview of energy prices in the UK. Unfortunately, it looks like higher energy prices are here to stay, and we will not return to levels we were paying in 2021. At home, we have reduced our annual energy consumption by 15%. I think that this is impressive and is what energy providers and the Government have encouraged us to do. However, it has not prevented my gas price increasing from 2.6 p to 9.5 p per unit and my electricity from 12.5 p per unit to 35 p. Small business have also suffered. My local fish and chip shop owner in Hull told me that his bills had increased from about £10,000 to over £35,000 a year. Milk processing is also energy intensive, so it is in all companies interest to establish how much energy is being used to process 1 litre (or tonne) of milk, as a starting point for improving efficiency. You will notice that energy from gas is about four times cheaper than energy from electricity in the UK, which is different to the situation in Australia. Similar conservation principles also apply to water utilisation in milk procesing.

Heat pumps for heating and cooling

There is a lot of discussion currently about heat pumps. Heat pumps are not new. In 1951 a heat pump was installed to provide both heating in winter and air conditioning in Summer for the Royal Festival Hall in London. In its heating mode, energy was removed from the River Thames. Heat pumps are based on the refrigeration cycle. Heat is removed from the surroundings, usually air or the ground. These surroundings will fall in temperature, which I will call the "refrigeration effect". Harnessing this refrigeration component is rarely considered in domestic situations, but it should be. This heat is rejected at a higher temperature, what I will call the "heating effect". This heat can be used for a variety of heating applications in your home or factory, for hot water or space heating. The mechanical part of the heat pump is the compressor, which is usually powered by electricity. Thus, the one system can produce "cold" and "heat". In the majority of applications its full potential is not realized. The energy cost for a heat pump is the compressional work. What is remarkable is that 1 unit of compressional energy can produce up to 5 units of heat and provide 4 units of refrigeration. The ratio of the heat produced compared to the compressional work is known as the Coefficient of Performance (COP). This will depend upon the refrigerant used. It is wasteful that we usually consider using the heating part of cycle and ignore the cooling part of the cycle. The reason that it works so efficiently is due to the thermodynamic properties of the refrigerant and its ability to remove heat from one location at low temperature and upgrade this energy to a second location at a higher temperature. The refrigerant acts like hot water in our domestic central heating systems, for transferring energy from one location to another. Conversely those who are using much refrigeration need to consider recovering the heat from these systems.

I think that heat pumps have not caught on for a number of reasons. Firstly, they are very expensive to purchase. I am not sure why this is the case especially when they are based on the refrigeration systems which are widely available. Secondly the compressor, which provides the energy to upgrade the heat is powered by electricity. Unfortunately, in the UK, electricity is about 4 to 5 times more expensive than gas for heating purposes. In countries where prices are similar the economics become more favourable They will become more much more effective if they can be combined with solar generated electricity. Thirdly, most of those advocating heat pumps have not considered that they would be even more effective if the cooling effect could be harnessed. There also appears to be a shortage of people who have the skillset to install heat pumps. My solution both for domestic situations and for dairy processing plants, is for solar panels to be installed to generate electricity; this electricity would power a heat pump which would provide both our refrigeration and heating requirements. Any excess electricity could be stored in a battery and used to power other mechanical household devices and our electric cars. Thus, all our energy needs would be provided free of charge, without any generation of CO2, which would be greener than green. This could all be done free of charge, with no effect on the environment.

Milk quality and price

As a consumer, I have noticed that milk prices have increased substantially in the supermarket, by over 40% in the last year in the UK. We are still fortunate to have some of the cheapest milk in the world. In fact, I have occasionally thought that milk is too cheap in the UK and that farmers are not paid enough for their milk. My one reservation is that no food prices should be considered good, as I am alarmed by the increase in numbers suffering food and energy poverty in the UK. So, it has been good to learn that prices paid to farmers have also increased although I have heard it argued that some are still not meeting their costs of production, as feed and other prices increases. I am also very aware of the need to eat plenty of protein and take regular exercise as a means of combating muscle wastage (sarcopenia). I did an investigation in 2018 which showed that milk was one of the cheapest sources of protein in the UK diet, and what poor value the plant protein beverages were in terms of supplying protein. I have recently revisited this and found that this situation has not changed. In fact, the price paid for protein in pence per gram (ppg) was found to be as follows; (semi-skim milk (2.1), soy (4.5), oat barista (20), almond (37) and coconut (95). Thus, milk still offers fantastic value for money. A similar exercise could be done in Australia. I was also pleased to notice that UK milk quality is being maintained. In fact, in November and December, 2022, average fat and protein values were at their highest levels for a long time and it will be interesting to monitor how these change into 2023. This is excellent news for cheesemakers for those months and about 30% of UK milk goes into cheese production. I am assembling some thoughts for an article along the lines ("in praise of the older literature") There is a mine of useful information available, much of which has just been forgotten. Two of my favourites are Dairy Information Cronshaw [1] and JG Davis Dictionary of Dairying [2]. One milk quality issue I recently encountered was ropy pasteurised milk. I struggled to find any information about ropiness in more modern articles but it is well described by Davis [2]. A second quality defect I encountered was feathering of milk and cream, when added to hot coffee and tea. This is the flocculation of fat and other material on the surface of the hot drink. This is also described briefly but succinctly by J G Davis. It is not fully appreciated that tea and coffee

are both hot and acidic, and the pH range of different teas and coffees may be between 4.8 and 5.8. Problems may arise with the most acidic of these, which has nothing to do with the milk, which was my conclusion in my investigation. I suspect that most tea and coffee houses do not routinely measure the pH of their drinks.

Considerable milk is now used by coffee shops for its foaming properties in cappuccino. Foaming is becoming more apparent to the general public. Recently I had two conversations within a short period of time related to recently purchased milk frothing gadgets. In the first case, the purchased milk would not produce a foam and it was concluded that the machine was faulty. However, with perseverance other purchased milk resulted in an acceptable foam from the same machine. In the second case the user had observed that every purchased milk foamed differently, both in terms of its volume and its stability. Both had correctly concluded that milk could vary considerably in its foaming ability. A further observation was that "filtered" milk was more consistent, although there is no simple explanation why this should be the case. This variability in foaming capacity was also observed by my last PhD student at Reading. He analysed 25 bulk milk samples from the University dairy herd over a period of one year and found that the time to produce a stable foam ranged from 24 s to over 200 s. Thus, supplying milk to be used in foaming applications is not straightforward. Another favourite book of mine is Dairy Chemistry and Physics, by Walstra & Jenness [3], which is always my starting point for topics I am less familiar with. I would be interested to hear if anybody has their own special favourites, as I am keen to add more of these to my collection. Finally, I never cease to be amazed about the wonder of the milk secretory cell in the cow and all other lactating mammals and how it can synthesise all those components in milk from components derived from the blood of the animal. I am so pleased to have spent 38 years teaching and researching at Reading University and in my early days, meeting and working with experts in milk, such as Reg Scott, James Rothwell, Harold Burton and J.G. Davis and many others at the National Institute for Research in Dairying (NIRD). I have them to thank for stimulating a lifelong encounter and adventure with milk and milk products.

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