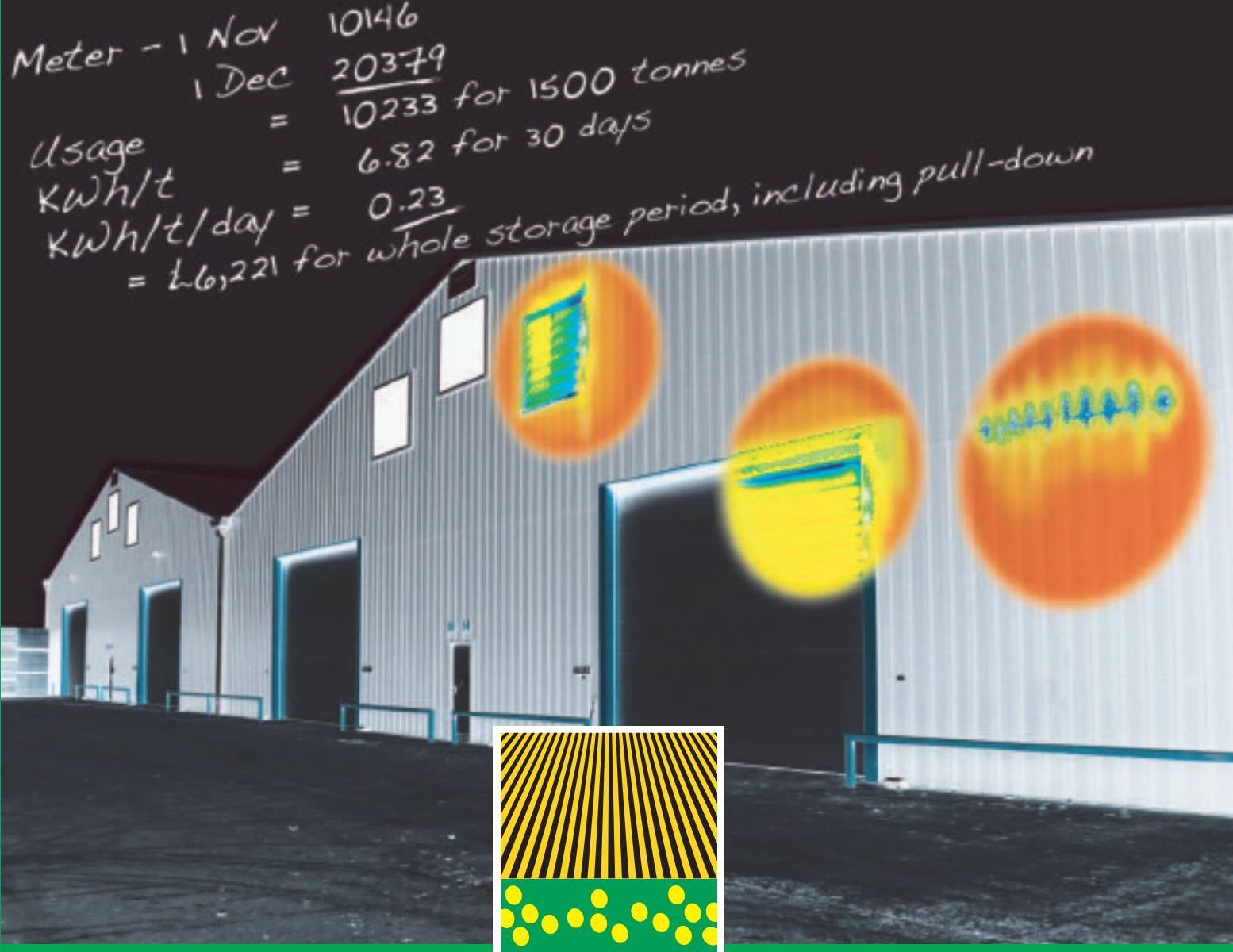


POTATO COUNCIL

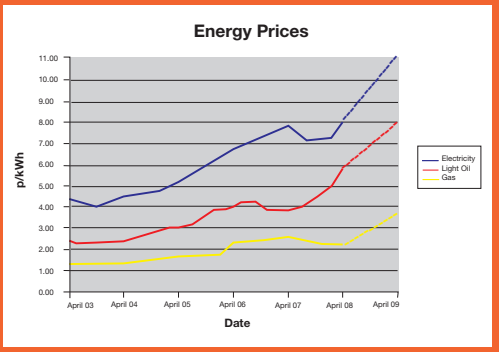
Improving energy efficiency

fec services

The problem

Energy costs are rising

- Between 2004 and 2008 electricity prices doubled
- By 2009 prices are predicted to rise by a further 40%*
- This will represent a cost rise of between £1 and £11 per tonne for British potatoes, depending on energy usage
- The British potato market demands a high quality product, free from chemicals, increasing the requirement for refrigeration, washing, etc



Prices of fuels purchased by manufacturing industry in Great Britain (source: BERR) showing predicted rise

Areas of high energy usage are hard to identify

- Electricity is usually supplied through one meter to an entire business, so usage for individual stores cannot be determined
- Electricity is usually billed quarterly, which is not frequent enough to track energy use with sufficient accuracy
- Energy bills are sometimes based on estimated readings, which further undermines their value in monitoring energy usage
- Unlike a water leak, there is no dripping tap to identify points of energy loss
- Energy need is related to weather conditions, and variations in use may have more to do with windy or warm days than crop requirement
- Movement of potatoes in or out of a store will have a considerable impact on short-term energy usage

The farm electricity bill is not a good gauge of energy usage

In the longer term, energy prices are likely to rise further

- The UK now sources most of its energy from non-indigenous sources, making supplies, and therefore prices, vulnerable to political conflicts
- Energy taxation (in the form of the Climate Change Levy) has recently been introduced
- Energy suppliers will be obliged to use more renewable fuels for energy generation in the future and this is more expensive

There is increased pressure on potato producers to monitor and reduce energy usage

- Other regulatory moves to address climate change issues may also impact on potato production, such as carbon credit schemes
- With many commercial interests in the food chain now keen to measure the carbon footprint of potatoes, the pressure is on to assess the contribution made by production
- Many retailers and brands are currently considering or are actively using low energy credentials as a marketing tool, a move that favours producers who accurately monitor energy usage

* Source: Submission by energy companies to House of Commons Business and Enterprise Committee, June 2008
Other figures, assumptions and references drawn from *Energy status report: GB potato storage* (Kneeshaw, 2006)

Concern over climate change will increase pressure on energy users

Action

Growers and store managers should

- Install energy-monitoring equipment in stores (see over for more)
- Monitor usage on a monthly or weekly basis during the storage period
- Make sure relevant staff are aware of the intention to monitor energy use and understand why
- Agree who in the business will take a lead role in monitoring and reporting

Benefits

- The actual cost of storing a crop can be identified more accurately
- High-load equipment can be identified and its energy cost estimated
- Points of high energy usage, such as pull-down or outloading, can be identified and energy peaks quantified
- Once energy use has been monitored and costs quantified and attributed to activities in the store, rational business decisions can be made to save costs

How it's done

During the 2007/08 storage season, FEC Services installed SMART metering in eight potato stores as part of a Potato Council-funded monitoring project.

The equipment monitored

- The electricity usage of the store
- The store temperature differential (outside minus inside temperature)

Each month the businesses involved received a report giving

- The store's energy consumption related to temperature
- Monthly and cumulative usage for the season
- How the store compared to others

For 2008/09, the project will be extended to cover a further 25 commercial stores.

Tips for success

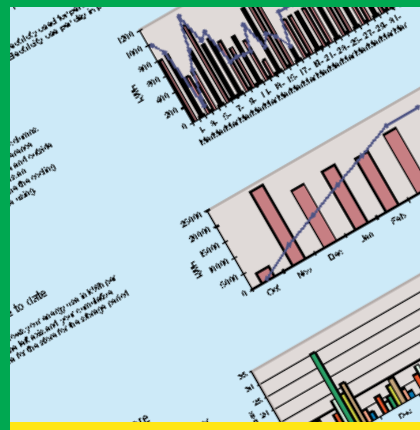
1. Monitor usage regularly
   - Take readings monthly or even weekly and record usage in a spreadsheet or chart
   - Take readings when there is a change – for example when part of the store is outloaded
2. Record significant events and relate these to energy usage records
   - Make a note of particularly windy, cold or warm days
   - Note when doors are left open or large volumes of stock are shifted, such as loading or outloading
   - Note any problems such as disease, hot spots or condensation
3. Try to identify the big energy users and how much they use
   - Refrigeration equipment is likely to be one of the biggest users – estimate cost by monitoring during periods when other equipment is not running
   - Consider using sub-meters to get a more accurate idea
4. Find out how your costs compare with others – visit the Potato Council Energy Hub (see panel, right, for details)

£11m

The estimated amount the UK potato industry could save if every British grower identified where they could save energy costs in store and acted on that information

Install monitoring equipment

Record and analyse usage



Potato Council Energy Hub
www.potato.org.uk/energy

- Latest advice – regular commentary and updates on energy issues
- Topical issues – weather, temperature and other effects discussed
- Information library – resources and reports to download
- Benchmark progress – regular updates on progress of Potato Council store-monitoring project
- Ask the expert – email a query specific to your store
- Share experiences – email a tip or suggestion to help others

Case study No 1. Two stores that performed differently

Store facts
Location: Near Spalding, Lincs
Purpose: Part of self-storage requirements for farm
Market: Pre-pack, all in boxes
Storage period: Harvest to end of April, depending on contract requirements
Holding temperature: About 2.5-3°C
Stores monitored in project:
Store X – Purpose-built potato store 5-10 years old. Tongue-and-groove panel-board insulation 75mm thick all round with purpose-built fridge units. Capacity 1,100 tonnes

Store Y – Converted grain store more than 10 years old. Glued panel-board insulation on walls and roof about 50mm thick with portable fridge units. Capacity 800 tonnes

Store X

Store Y

Results

November 1 to December 1	**Store X**	**Store Y**
Average kWh per tonne per day	0.34	0.76
Total kWh/tonne	10.4	22.7

Over the season Store X used 53.2 kWh/tonne since meter installation. If Store Y had been used for the same period, it would have used 116.3 kWh/tonne, or an extra 63.1 kWh/tonne.

This would have cost the business £4,985 extra for the period.

On the strength of the first month's report, Store Y was closed down in mid-December.

Conclusions
Store Y is not sufficiently insulated or sealed and is potentially wasting a considerable amount of energy
- The glued wall panels have probably parted enough to allow cold air to leak out of the building on warm or windy days
- The roof insulation is insufficient and allowing heat into the building on warm, sunny days
- Doors and louvres should be checked to ensure no energy is lost here

Next steps
- Store Y has been modified
  - Spray-foam insulation has been applied to walls, ceilings and doors
  - The store has been subdivided with a central wall to add flexibility and save further energy
- Monitoring will continue to see how effective any modifications have been
- Meters have been installed in all other stores across the business
- Business is considering the use of renewable sources to power stores

Comment
"We knew Store Y was not performing as well as others, but it was not until we saw the first month's results that it drove home quite how much the difference was – we should make back the expenditure on modifications in less than three years. With energy prices where they are, you cannot afford not to know where your costs are going. This has been a thoroughly worthwhile exercise, which is why we have now installed meters in all our stores."

Case study No 2. Two different stores that performed equally over a season

Store facts

Location: Sutton Bridge, Lincs
Purpose: Co-operative store with a number of buildings storing crop for members
Market: Pre-pack, all in boxes
Storage period: Depends on member requirements and must be flexible. Aim to store from harvest to end of May
Holding temperature: Just above 3°C
Stores monitored in project:
Store A – Brick with a fibre-cement roof, over 30 years old, converted from an ambient store and divided by a central hardboard partition; the whole store is spray-foam insulated. Capacity 1,500 tonnes

Store B – Portal-framed building with foam panel insulation; a new refrigeration unit has been recently fitted. Capacity 1,100 tonnes

Store A

Store B

Results

January 1 to March 11	Store A	Store B
Target set point temperature (°C)	2.5	2.9
Average temperatures measured (°C)	2.9	2.3
Average kWh per tonne per day	0.21	0.24
Total kWh/tonne over period	15.83	16.33
Average temperature differential (outside temp less inside temp) (°C)	3.40	3.93
Sum of daily average temp differential over period (°C)	220.0	258.2

This graph shows kWh/tonne/week taken simply by dividing electricity consumption over a week through the meter by tonnes in store.

Temperature probes showed one store maintained a temperature differential just 0.5°C higher than the other over the period. Although the difference was slight, it meant one store required 10% more energy than the other, or 5,730kWh (about £573).

Conclusions

- Energy requirement of stores appeared roughly the same
- When energy usage was adjusted to take account of differences in temperature differential, it showed one store slightly outperformed the other
- Overall the differences are small – it shows an old building that is well insulated can perform at least as well as a newly-built store
- It is important also to take temperature required into account, as well as energy consumption
- Half of the stock in Store A was outloaded early and one refrigeration unit was shut down, explaining the drop in energy requirement towards the end of this period – this highlights the importance of noting any stock movements

Next steps

- Monitoring equipment will be installed in more stores to gauge their performance
- Work will focus particularly on whether louvres, that enable ambient-air ventilation, may be a significant source of energy loss
- The data will be used to evaluate how much capital it is worth spending on equipment such as variable frequency drives and other energy-saving devices

Comment

"Our top priority is ensuring the quality of the crop. But to maximise returns for the members of the co-operative, we have to ensure we keep energy loss to a minimum, and you can't do that if you've no idea where it's going. Putting meters in tells you a lot about where you are spending money and whether you get good value."

Equipment you need to monitor store energy use

Entry-level			
Kit	A simple meter that captures just the electricity consumed by the store in kWh	+	Low cost
		+	Little specialist knowledge needed
Costs	c£150 (meter) + £150-350 (installation)		
Specialist assistance	Qualified electrician to install meter. Readings taken by store manager	–	Basic information may lack detail on temperatures and other data that can be analysed
Time input needed	Around half an hour per month to record readings and simple analysis	–	Readings must be manually taken and recorded, otherwise information is useless
Tips for success	Calculate a kWh/tonne figure and compare this with other stores		
	Read meter on a regular basis		
Medium			
Kit	A kWh meter and inside/outside temperature probes being measured and logged on a half-hourly basis	+	Automatic logging allows analysis/monitoring to be carried out at store manager's convenience
Costs	£1,000-1,500 (kit) + £200-800 (installation)	+	Temperature information shows how much energy is required to cool the store in relation to outside temperature
Specialist assistance	Best to start with specialist energy experts, such as FEC Services, to ensure best set-up and to get kit operational	+	Accurate daily energy consumption profiles can be drawn up with relative ease
Time input needed	Around half-an-hour per month to check equipment and monitor/analyse data	–	Specialist input needed to ensure equipment is used to best effect
Tips for success	Use data-logging equipment that feeds into a software package	–	Can generate a lot of data that needs to be managed
	Web-based monitoring services allow off-site analysis	–	Logging software may need web access
	Use temperature information to calculate cooling degree day values (outside minus inside temperature)	–	Some commitment to learning needed to interpret the output
Comprehensive			
Kit	Equipment that monitors and controls temperature in store by adjusting fans, vents, etc.	+	A significant degree of control over the store temperature and energy use
Costs	£3,000-10,000 (equipment + installation)	+	Ability to maximise energy use without time input needed
Specialist assistance	Essential. Most major storage equipment suppliers provide some level of service	+	Shows high degree of energy efficiency, which could have marketing value
Time input needed	Some initial training required but minimum input thereafter	+	System installers can monitor and diagnose problems without visiting site
Tips for success	Invest in specialist advice during installation to match equipment to needs	–	Expensive – only really cost-effective for the largest UK stores
	Track electricity consumption of individual items over the season	–	High reliance on automated and web-based technology

Looking for more advice and case studies on how to meet the challenge of climate change? Farming Futures provides inspiration and information via fact sheets which can be downloaded from www.farmingfutures.org.uk. Farming Futures is a communications collaboration project between Forum for the Future, the NFU, CLA, AIC, AHRF (on behalf of Agriculture and Horticulture Development Board) and Defra.

FARMING FUTURES

References:
Kneeshaw, A (2006). *Energy status report: GB potato storage*. Report for the British Potato Council, Oxford.
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