Sector Focus

Potato Storage

	Sector	GWh/y
1	Retail display	9,233
2	Catering – kitchen refrigeration	4,380
3	Transport	4,822
4	Frozen storage – generic	900
5	Blast chilling – (hot) ready meals, pies	425
6	Blast freezing – (hot) potato products	316
7	Dairy processing – milk/cheese	250
8	Milk cooling – raw milk on farm	207
9	Potato storage – bulk raw potatoes	165
10	Primary chilling – meat carcasses	129

Mean estimated annual UK energy usage

Technology

Energy is a significant cost in the production and presentation to market of the UK potato crop. Between 10 and 20 kWh/tonne is used in short/medium term storage including initial chilling. 50 to 100 kWh/tonne is used in long-term storage.

Post harvest processing can account for between 12 and 135 kWh/tonne and cost between £1 and £12 per tonne. Energy used for cooling during storage eclipses all other uses.

Energy used in sector

Refrigerated for potato storage systems in the UK are estimated to use between 144 and 187 GWh of energy per year.

Systems in use

Chillers and chilled stores

In general potatoes are chilled and stored in the same systems.

Unlike many other foods potatoes generate CO_2 and heat due to respiration during storage. High air leakage into potato stores is one of the primary causes of high-energy costs in storage. Attention to key areas like joints in structures and doors is important.

Exceptionally good sealing in buildings can lead to the build up of CO_2 which can itself lead to problems with the crop and with safety. However, this is something that can be managed easily with controlled low-level ventilation.

Traditionally potatoes have been stored in boxes in unrefrigerated stores.

Unrefrigerated potatoes

However, high temperatures and/or poor temperature control can reduce high quality storage life and increase the number of potato defects.

Potato defects

Simple low cost energy savings

Reducing Main heat inputs

- Minimise heat that has to be extracted from potatoes.
  - Use ambient cooling to remove heat from potatoes products prior to cooling.
  - Minimise thermal load from packing and racking.
- Minimise heat generated.
  - Fit energy efficient fans with drive motors outside chillers.
  - Switch off fans when systems are empty.
  - Minimise air movement when chiller is in chilled storage mode.
- Minimise heat infiltration.
  - Position chill store to shield from heat sources, minimise south facing external walls and paint white.
  - Fit effective door protection systems on all personnel and food entry and exit points.
  - Minimise surface area of chiller that is exposed to ambient temperatures.
  - Use maximum thickness of insulation and design structure without thermal bridges.

System loading

- The energy efficiency of a blast freezer operating without any food in it is zero.
- Ensure air passages are not blocked during loading.
- When the system is only partially loaded:
  - Make sure the loading pattern does not allow air to short circuit and return to the evaporator without extracting heat from the food.
- Make sure that air cannot by-pass the evaporator by sealing ducts to force all air through the evaporator.

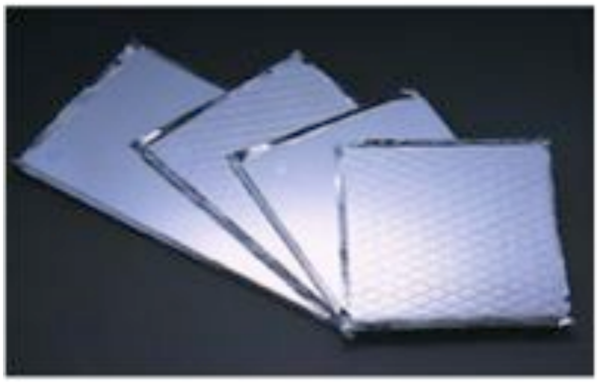
Maintenance

Energy monitoring is a key factor in successfully managing the energy use of potato stores. It is a relatively cheap thing to undertake but without it, it is virtually impossible to make rational decisions about how to save energy and when systems require maintenance

- Ensure that refrigeration systems are checked to ensure heat exchangers are free of dirt and that refrigerant is not leaking. Check operation of refrigeration components to ensure operating at installed capacity and efficiency.
- Replace and adjust worn or badly fitted door and food entry protection systems.
- Replace worn door seals.
- Check for any breakdown in insulation and replace.

Retrofit options

- Advanced insulation such as VIPs (Vacuum Insulated Panels) has the ability to reduce heat load across insulation. VIPs could replace current insulation and reduce energy consumption by 5-10%.



- A new generation of lighting equipment using gas discharge tubes with electronic ballast will produce good-quality lighting at a fraction of the cost of lighting with tungsten filament based equipment. The economics are such that it is rarely worth installing a replacement lighting system on energy cost grounds alone. However, where old lighting has failed or where new lighting has to be installed for a new facility then the marginal cost of the high efficiency option is invariably worth it

Other options to consider

- High efficiency components such as compressors, heat exchangers, fans and lighting can reduce energy by up to 20%.
- Improving performance of the refrigeration system through liquid pressure amplification, suction pressure optimisation, evaporative condensers and checking to ensure no leakage of refrigerant can produce energy savings of up to 30%.
- Consider reclaiming heat from refrigeration plant for heating water or space heating.

Energy saving potential of future technologies

A number of technologies are under development for use in the near future. Some of the most promising include:

- Greater use of renewable energy sources such as solar electricity (PV), solar thermal, wind energy, biomass, geothermal heating and cooling.
- Greater system integration by use of heat pumps, Combined Heat and Power (CHP) and Trigeneration.

Summary of energy saving technologies & potential (Potato Council)

Measure	Potential energy reduction (%)	Kwh /p per tonne saving	Value to industry	Cost category
Energy management	10% overall	10 kWh / 68p	17 GWh £1.44m	Low
Building improvements	Up to 20%	15 kWh /128p	34 GWh £2.9m	Medium to high
Advances control techniques	10%	7.5 kWh / 63p	17 GWh £1.44m	Medium

Variable speed drives	30%	6 kWh / 51p	11 GWh £0.92m	Medium to high
High efficiency motors	3%	0.3 kWh / 3p	1.1GWh £0.09m	Medium
High efficiency lighting	30%	0.5 kWh / 4p	1.8GWh £0.15m	Medium
High efficiency fans and ducts	30%	4 kWh / 34p	14GWh £1.2m	High
Cooling technique optimisation	20%	15 kWh / 128p	34GWh £2.9m	High

Fostering the Development of Technologies and Practices to Reduce the Energy Inputs into the Refrigeration of Food

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For further information on saving energy see: www.grimsby.ac.uk/What-We-Offer/DEFRA-Energy