

Factsheet – Milk Cooling And F Gases

This factsheet is a part of a series that examines factors influencing the sustainability of the dairy industry. It discusses the significant energy consumption and environmental impact of milk cooling on dairy farms, emphasizing the need for efficient cooling systems, proper maintenance, and the adoption of natural refrigerants.

Global Warming linked to milk cooling

Milk cooling can account for a third of the electricity used on a dairy farm. If this energy comes from the grid, it contributes around 0.225 kg CO₂e per kWh towards greenhouse gas emissions. There are also risks associated with the refrigerants used. Many bulk milk tank refrigeration systems are charged with fluorocarbon based refrigerant gases (F Gases), which can cool milk very efficiently, but have the potential to contribute to global warming through leakage or release during installation and maintenance.

Owners of most bulk milk tanks containing F Gases have an obligation to have equipment leak tested/checked every six months. This check must be carried out by a Registered F Gas Technician.

Refrigerants and Global Warming Potential (GWP)

F gases are potent greenhouse gases with global warming potentials (GWPs) that typically range from thousands to tens of thousands. GWP reflects the amount of heat a gas traps in the Earth's atmosphere in comparison to an equivalent mass of carbon dioxide.

This table shows comparative GWP of refrigerant gases:

Refrigerant	GWP	Ozone Depleting?	Banned
R12	10910	Yes	2015
R22	1810	Yes	2015
R401A	1182	Yes	2015
R404A	3920	No	2020
R410A	2088	No	2020
R422D	2729	No	2020
R507	3985	No	2020
R134a	1430	No	~2030
R407c	1770	No	~2030
R448A	1273	No	~2030
R449A	1282	No	~2030
R290 (Propane)	3	No	No
R744 (CO ₂)	1	No	No

A 1 kg leak of R404A has the same GWP as 3,920 kg of CO₂. A 12,000ltr bulk milk tank contains around 20kg of refrigerant, so if it all leaked into the atmosphere it would have the same impact on climate change as **74,400 kg of CO₂**.

The UK Government is phasing down F Gas usage, with a target of 79% reduction by 2030. Refrigerants with a GWP over 150 will be banned from 2030. In practice, natural refrigerants like Propane or CO₂, or a blend of both, are the only real options to meet the stringent refrigeration regulations and phase out existing products.

Natural refrigerants have their challenges too. Propane is highly flammable and CO₂ poses a suffocation risk, so increased ventilation or even an outdoor silo should be considered to reduce the risks in the event of a leak.

How to improve cooling efficiency

To reduce energy consumption and emissions, consideration must be given to more fundamental efficiencies when renewing or updating cooling systems.

Single Stage Pre-coolers: Energy use can be reduced by pre-cooling milk. As long as the water can be reused, the cooling done by a single stage pre-cooler is free! Mains water temperature varies from 10 to 20°C (Winter- Summer). Bore hole water (or spring) is also a viable option with temperatures varying between 5 and 15°C. With optimal set-up, it should cool milk to achieve a milk temperature around 5 °C higher than the incoming water. Ideally, the ratio of water to milk flow rate should be at least 2 to 1. Another option is to slow down milk flow with a variable flow milk pump (speak to your MEA Registered dealer for more information).

Dual Plate Coolers: Milk is first cooled using mains or bore hole water, then a second stage cools it further using ice or a glycol mix. Using this configuration the first stage can achieve a milk temperature of approximately 20°C, then the second stage can achieve a final milk temperature below 4°C. An ice builder or glycol cooler can also utilise electricity generated by solar panels during daylight hours. This energy is then stored in the form of ice or a glycol mix for use during milking, reducing mains electricity consumption.

Condenser units: The positioning of a condenser unit can have a large effect on cooling (and maintenance) efficiency and therefore costs. Condenser units should be:

- Outside to allow for the best air flow.
- Away from direct sunlight (i.e. facing north).
- Away from heat sources, e.g. vacuum pumps.
- Free from dust/oily fumes/other obstructions.

Incorrect positioning means that the equipment must work far harder to do the same amount of cooling, increasing running costs and reducing the life of the compressor as well as increasing the risk of refrigerant leaks due to higher pressures. Agitating milk for longer periods reduces its quality and increases your free fatty acids (milk should be cooled to <4°C within 30min of the end of milking).

Heat Recovery systems: A heat recovery system can be coupled with the cooling unit/s. This will recover some of the energy from the milk and transfer this heat into a water storage cylinder. Usually heat

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recovery systems can heat the water to around 40-50°C, without having a negative effect on the cooling process. Water from the heat recovery cylinder can then be used directly or transferred to a secondary tank for additional heating. A word of warning: heat recovery cylinders operate at ideal temperatures for Legionnaires disease, and therefore the water should be treated or the tanks boiled weekly to prevent issues.

Where can I find more information?

- Find a registered F Gas technician through REFCOM - <https://www.refcom.org.uk/refcom-register>
- NFU provide advice on renewable energy generation - <https://www.nfuenergy.co.uk/services/renewable-energy-solutions-generate-your-own>
- HSE information about Legionnaires Disease - <https://www.hse.gov.uk/legionnaires/what-is.htm>

England, Scotland and Wales

- F gas regulation in Great Britain - https://assets.publishing.service.gov.uk/media/63a2f8e9e90e075878e52448/F_gas_regulation_in_Great_Britain.pdf
- When to check F gas equipment for leaks - <https://www.gov.uk/guidance/checking-f-gas-equipment-for-leaks>
- Banned F gas for refilling equipment - <https://www.gov.uk/guidance/banned-f-gas-for-refilling-equipment>

Northern Ireland

- F Gas legislation - <https://www.daera-ni.gov.uk/articles/fluorinated-greenhouse-gases>

The Dairy Roadmap

The Dairy Roadmap aims to improve the environmental sustainability of the UK dairy sector whilst ensuring the continued prosperity of the industry, and the provision of safe, affordable, nutritious and sustainable produce for years to come.

This factsheet was produced in association with [The MEA](#)

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