Energy efficiency in European industry

Food & Beverage

Introduction to the food & beverage sector

The food and beverage industry covers NACE sector codes C10 (*"Manufacture of food products"*) and C11 (*"Manufacture of beverages"*). F&B is the EU's biggest manufacturing sector in terms of jobs. As the sector is very diverse, there is a high variety of processes in the sector. In terms of overall energy consumption, the key categories in food processing are process heat (29% of energy use) and refrigeration (16%).

GP **Mechanical Vapour Recompression for concentration**

54%
energy savings

Concentration is a process used in food industry in order to reduce the amount of water contained in a product. In the analysed case, the ex-ante configuration is a multiple effect evaporator where the solution is concentrated in a series of stages, each of which uses the steam coming from the previous one, in order to reduce steam consumption.

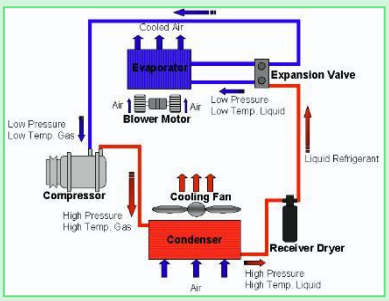
This process can become more efficient with the introduction of Mechanical Vapour Recompression (MVR), that uses water evaporated from the product and then recompressed to increase the amount of steam. This implies a reduction in steam (produced by burning a fossil fuel) consumption. MVR can be used for example for whey concentration, starch concentration, or milk serum concentration.

The EU-MERCI database contains 12 cases where MVR has been applied in Italy. The measure led on average to energy savings of 54%. Where available, the payback time varied from 0.9 to 9.3 years, indicating that the potential for MVR depends largely on the individual cases. *more info*

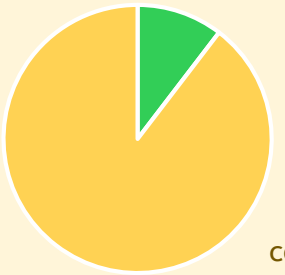
GP **Refrigeration systems**

The EU-MERCI database contains 93 records of applications related to refrigeration systems. Various of these applications have been identified as 'good practices', including a refrigerant under-cooling system, inverter installation, and heat recovery.

The average energy use improvement is 16%, and payback time is in most cases less than a year. Energy efficiency in refrigeration systems is easily replicable. *more info*



Statistics EU food & beverage



Food and beverage:
10.4%
of EU industry energy consumption

- **280,000 enterprises**
- **4.3 million people employed**
- **Gross added value > € 250 billion**
- **Final energy consumption: 28.4 Mtoe per year (10.4% of EU industry energy consumption)**

Based on analysing the food and beverage sectors in Austria, Italy, Poland, and the UK, most energy saving measures/interventions have been implemented in the dairy products subsector. However, this does not directly correspond to the final energy savings: the measured savings per intervention have been much higher in the fruit and vegetable subsector and especially the subsector of grain mill and starch products.

The most widely implemented intervention in the food and beverage sector has been on heat recovery and cooling, covering about 25% of all interventions and resulting in 38% of the energy savings. In this sector, standard measures (including heat recovery) have the highest potential. Process-related measures show less potential, as the processes are usually simpler than in other sectors.

Recommendations: standard measures

The food and beverage sector is a diverse sector with many different subsectors. However, in many cases the processes are relatively simple, and the sector shows high potential for standard measures such as heat recovery and refrigeration systems, that are easily replicable across subsectors.

Because of this, programmes supporting companies with training and knowledge as well as raising awareness on energy efficiency achieve generally good results in the food and beverage sector, also because the costs of interventions are usually low (per unit of energy saved). However, such programmes may only work for a short period, as saturation of the sector with such measures is reached quickly.

GP **Use of biomass boilers**

A biomass boiler is either a steam or hot water boiler that uses biomass (i.e. wood, animal waste, cooking oil etc.) as fuel. Although biomass boilers are not necessarily more energy efficient than traditional boilers, they are considered low carbon technologies, as the amount of emissions will not exceed the amount absorbed by the biomass over its lifetime.

This measure can be implemented across different applications in the Food & Beverage sector (as well as other sectors) to produce heat for direct use or conversion to electricity. It is also possible to pair the biomass boiler with heat recovery, to recover the flue gas of the boiler and re-use it in the production cycle. *more info*

GP **Optimisation of vinasse concentration process**

Vinasse is a by-product of the yeast production process that can be further processed, through concentration, in order to obtain commercial products for use in zootechnics. The optimisation of the vinasse concentration process was made in 3 actions:

1. before the existing concentrator, a mechanical vapour recompression pre-concentrator has been installed to recover and re-use process vapour after retraining it to a useful pressure;
2. in the pre-concentrator, a pre-heater has been installed in order to increase the vinasse temperature to a value more suitable for the system;
3. at the final stage of the concentration, the re-concentrators (2 single effect evaporators) have been replaced with a triple-effect evaporator that increases efficiency.

The EU-MERCI database contains three cases of this optimisation scenario for the vinasse concentration process. The energy consumption improvement amounted to 36% compared to the reference baseline, based on an investment of about €2,600 per *toe* of energy savings. The observed payback time was 6.7 years. *more info*

GP **Use of waste for process heat generation**

3.0 years payback time

Many of the by-products used in F&B can be used as fuel for heat generation. The use of waste as a fuel may require additional adjustment of the combustion process. Some wastes can be used with other fuels or can be a substrate for fuel production such as biogas. The waste can be used directly in the combustion process in recuperative boilers fuelled with animal fat and LPG. The new rendering system can be installed together with the intervention. The new rendering system can be installed to increase the thermal energy of the plant.

This practice does not lead to energy savings (only a change of fuels), but can lead to significant emission reductions. Investment in this practice has an average payback time of 3 years. *more info*

Recommendations: focus on SMEs

More than 95% of companies in the food and beverage sector are SME's (small and medium-sized enterprises). In most countries, large companies still make up the share of the production value. However, for example in Italy 70% of the production value is by SMEs. Policy-makers therefore have to take into account that complexity of policies and support schemes may act as a barrier for energy savings, as this often hinders small companies from participating. It is recommended that procedures for SMEs are simplified, or that additional support is provided for smaller companies with high energy efficiency.

An example of such a programme that is suitable for SMEs is the Carbon Trust Energy Efficiency Advice programme in the United Kingdom. The 'Better business guide to energy saving' shows how to identify measures where energy and cost savings can be easily made with little or no cost. For many SMEs, such low-threshold programmes may be much more useful and therefore more effective than complex EEO schemes or legislative and regulatory measures.

Policies

In many EU Member States, the food and beverage industry is covered by an energy efficiency obligation (EEO) scheme. EEO schemes could provide stable savings over a longer time, and usually also target more expensive process-related innovations with higher energy savings. However, for SMEs these often complex schemes should be complemented with information and financing schemes. Other policy types focused on the F&B sector include voluntary agreements (such as the sectoral agreement in Wallonia), financial support, fiscal incentives, or requiring energy audits.

The sector shows a strong potential for using renewable energy, including biofuels based on food waste. In order to achieve a reduction of fossil energy use and reduction of CO2 emissions, schemes could promote renewable energy in addition to energy efficiency measures.

The EU-MERCI project

EU-MERCI is an EU-funded project aimed at supporting the growth of energy efficiency in industry processes. The project shares good practices of energy efficiency measures, helps industry actors to overcome expected barriers and maximise benefits, and supports policy makers. → eumerci.eu.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 693845.