UK Government

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ENERGY EFFICIENCY ACCELERATOR

Energy efficiency guidance for the food & beverage sector

Introducing energy savings opportunities in cooking processes

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Cooking

Cooking consumes a significant proportion of the total energy used in food and drink processing and, in sub-sectors such as baking, it is the main energy consumer. If a site employs cooking processes then there may well be simple opportunities to make considerable savings.

Energy savings opportunities in cooking

Baking

The vast majority of cooking processes use ovens for baking. There are two main types of oven: batch and continuous. In continuous ovens, conveyor belts are used to carry products continually through the oven while batch ovens tend to be loaded with trays of product.

At each product changeover, the oven needs cooling and heating up to the required temperature. Energy efficiency can be improved by good production planning so as to reduce the number of product changes.

Baking also offers good opportunities to improve process control (see below).

When buying a new oven consider energy efficient models and remember that using a more efficient oven could easily offset a higher purchase price. This is critical since:

- Most ovens last more than 10 years, and over the life of an oven you will likely spend more on the energy required to run it than you will spend on initial purchase and installation.
- It is anticipated that energy costs will continue to increase substantially during the life span of your oven.
- Selecting the most energy efficient equipment can reduce the amount of heat loss into the bakery area, thereby reducing the air-conditioning load and improving the general working environment.

When talking to your supplier, bear in mind that the following general factors can influence an oven's energy efficiency:

- Whether the oven door windows are double glazed
- Whether each deck has an individual control
- The thickness of the oven's insulation
- Flue gas heat recovery

Combustion control

Advanced controls linked to variable speed flue gas fan drives can adjust the fan speed in line with feedback from heat and humidity sensors in the oven to optimise the baking cycle.

> *Advanced combustion control on baking ovens can reduce energy consumption by 4-5%.*

Baking tins

Typically, the ratio of steel to bread passing through a bread baking oven is 2:1.

Usually made of steel baking tins have to be heated to the oven operating temperature during baking and cooled again before a new dough piece is added; they are a significant source of energy losses.

More efficient tins with less thermal mass should be considered, e.g. Aluminium or silicone.

Humidification

An important part of the baking process humidification has traditionally been carried out using steam.

Significant savings can be achieved by replacing existing steam systems with cold water ultrasonic humidification.

> *Ultrasonic humification can save 60% on energy costs compared to steam based humidification systems. Typical project paybacks 1-2 years.*

Infrared baking and cooking

When replacing ovens consider utilising infrared baking ovens. Significant savings arise due to the direct heating of the product and resultant reduced cooking times.

Infrared baking provides 50-80% energy savings over conventional convective baking methods.

Check process schedules

Ovens are at their most efficient when they are full. Check process schedules and make sure that they make full use of oven capacity and that whole ovens are not being heated and then only half-filled with product.

A bakery that uses its oven for eight full loads will use less energy than one that bakes the same quantity over 11 loads.

Improve process control

Bringing cooking equipment up to temperature uses considerable heat energy. You may find that your ovens are currently switched on earlier than necessary.

Establish the minimum heat-up time required for your equipment to avoid wasting energy.

Reducing the heat-up time for your oven will result in worthwhile cost and energy savings.

Frying

Energy savings can be achieved through heat recovery. Steam generated during the frying process can be condensed and used as pre-heated water for other processes. Typical projects payback in <3 years.

Steaming/blanching

Steam is used in a variety of cooking applications and is particularly important within the food canning process. Here a great deal of heat is used to steam cook or sterilise product which then requires cooling.

This process cycle presents opportunities to recover heat for reuse.

Modern equipment helps to maximise this potential by providing:

- fully insulated cabinets reducing heat loss
- improved seals reducing evaporative losses
- Integrated heat recovery systems

Together with reduced water consumption modern systems offer energy saving >30%.

Thermal oil

Thermal oil boilers can provide high temperatures at atmospheric conditions and negate the need for expensive and complicated steam-based systems, direct gas fired or electric fryers.

Their compactness means they can be process specific and offer consistently accurate temperature control.

With an 80% thermal efficiency, no flash steam, blowdown or condensate losses thermal oil boilers offer up to a 31% energy saving over steam systems.

Checklist and tips for efficient operation of cooking systems

This checklist summarises the key criteria and characteristics of energy efficient cooking systems. If you are unable to indicate "YES" to all questions, it is likely that the efficiency of your system could be improved, saving you money and reducing your carbon emissions.

Checklist and tips

Ref	Best practice criteria	Response	Feedback
1	**Have you investigated the opportunity to improve your blanching/steaming process?**	[yes]/[no]	Fully insulated cabinets, reduced evaporation and heat recovery. Savings >30%. Reduced water use <10% and shorter blanching/steaming cycle times. Any additional costs over standard machinery will payback < 1 year.
2	**Are all heat recovery options being exploited?**	[yes]/[no]	Many of the processes involved in the manufacture of food and beverages generate useful levels of waste heat. Every effort should be made to recover this heat. With 84% of energy used in the sector producing a potentially useful waste heat source there is a significant saving opportunity. Heat recovery projects typically payback in 3-5 years.
3	**Do your ovens have advanced combustion control?**	[yes]/[no]	Savings of 4.7% for bread ovens are possible by linking variable speed flue gas fan drives with advanced combustion control. For larger ovens updating controls would payback in <1.5 years.
4	**Have you considered the use of IR heating for cooking and baking?**	[yes]/[no]	Utilising infrared for heating and cooking purposes can provide significant savings with reduced cooking times. Improved efficiencies over conventional convective cooking offer 50-80% savings.
5	**Do you use ultrasonic humidification rather than steam?**	[yes]/[no]	Ultrasonic humidification can save 60% on energy costs compared to steam based humification systems. Typical project paybacks of 1-2 years.

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- advises businesses, governments and the public sector on opportunities in a sustainable, low-carbon world;
- measures and certifies the environmental footprint of organisations, products and services;
- helps develop and deploy low-carbon technologies and solutions, from energy efficiency to renewable power.

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