Deploying energy management and improving energy efficiency throughout all operations

In a nutshell

<table>
<tr><th colspan="5">Summary</th></tr>
<tr><td colspan="5">Best practice is to manage energy use throughout all operations of the company by:
• putting in place a comprehensive energy management system (EnMS) such as ISO 50001[1], as part of an environmental management system such as EMAS,
• installing meters (or smart meters) at the individual process level, ensuring accurate energy monitoring,
• carrying out regular energy auditing and monitoring to identify the main drivers of energy use (at the process level),
• implementing appropriate energy efficiency solutions for all processes in a facility, in particular taking into account potential synergies in heat, cold and steam demand,
• investigating and, if possible, exploiting synergies for the production and use of electricity, heat, cold and steam with neighbouring facilities (i.e. industrial symbiosis).</td></tr>
<tr><th colspan="5">Target activities</th></tr>
<tr><td>All food and beverage manufacturing</td><td>Processing of coffee</td><td>Manufacturing of olive oil</td><td>Manufacture of soft drinks</td><td>Manufacture of beer</td></tr>
<tr><td>Production of meat products</td><td>Manufacture of fruit juice</td><td>Cheese making</td><td>Manufacture of bread, biscuits and cakes</td><td>Manufacture of wine</td></tr>
<tr><th colspan="5">Applicability</th></tr>
<tr><td colspan="5">This best practice is applicable to all food and beverage manufacturers.</td></tr>
<tr><th colspan="5">Environmental performance indicators</th></tr>
<tr><td colspan="5">• Overall energy use per product unit (kWh/weight, volume, value or number of products)
• Overall energy use per facility surface area (kWh/m2)
• Overall energy use (kWh) for specific processes
• Net energy use (i.e. overall energy use minus recovered and renewable energy) per product unit (kWh/weight, volume, value or number of products)
• Deployment of heat exchangers to recover hot/cold streams (y/n)
• Insulation of all steam pipes (y/n)</td></tr>
</table>

Benchmarks of excellence
• A comprehensive energy management system (EnMS) is in place (e.g. ISO 50001). • Regular energy auditing and monitoring are deployed to identify the main drivers of energy use. • Appropriate energy efficiency solutions are implemented for all processes in a facility. • Synergies in heat/cold/steam demand are exploited across processes, within the facility and neighbouring ones.

[1] More information on the standard ISO 50001 — Energy management is available at: http://www.iso.org/iso/home/standards/management-standards/iso50001.htm

Description

Like all process-based industries, energy represents for food and drink manufacturing businesses both a significant expenditure item and a large driver of environmental impacts. The initial steps in developing an effective energy management strategy involve assessing the drivers of an organisation's energy consumption, monitoring its energy usage, and identifying areas for improvement. Actions will then be deployed to reduce energy demand (through energy efficiency measures) and reduce the impact of energy supply (cf. best practice on "Integrating renewable energy in the manufacturing processes").

Food and drink processing in particular tends to be especially energy-intensive, with energy costs among the top cost items due mainly to the precise temperature-controlled processes specific to the industry (baking, boiling, freezing, sterilisation, etc.). However, a holistic investigation of the energy flows throughout a facility can help achieve significant savings in energy resulting in both cost and GHG emission improvements.

This best practice does not aim to develop specific process solutions relevant to individual sub-sectors (some of which are developed later in the document) but rather to outline the range of energy efficiency solutions which should be investigated to achieve best practice. Further documentation, both overarching and sector specific, can be found in the references. Please note that techniques related to refrigeration are addressed specifically in best practice on improving freezing and refrigeration.

It is also worth noting that non-process-specific energy efficiency solutions (e.g. for offices) can also be found in related reference documents, for instance the Sectoral Reference Document on Best Environmental Management Practice for Public Administration[1] (best practice on energy in sustainable offices).

Best practice in the area of energy management and efficiency can therefore centre on:

- putting in place a comprehensive energy management system (EnMS) such as ISO 50001[2], as part of an environmental management system such as EMAS,
- installing meters (or smart meters) at the individual process level, ensuring accurate energy monitoring,
- carrying out regular energy auditing and monitoring to identify the main drivers of energy use (at the process level),
- implementing appropriate energy efficiency solutions for all processes in a facility, in particular taking into account potential synergies in heat, cold and steam demand,
- investigating and, if possible, exploiting synergies for the production and use of electricity, heat, cold and steam with neighbouring facilities (i.e. industrial symbiosis).

The table below provides an example of common processes in use in the industry and some potential energy efficiency solutions which can be applied to these.

Table 1: Some food and drink processes and relevant applicable energy efficiency solutions

Energy efficiency solutions / Processes	Monitoring, measurement and control	Energy efficient installation (e.g. condensing boiler)	Co- / tri-generation	Compressed air optimisation	Insulation	Heat recovery (e.g. heat exchangers)	
Baking / drying	?	?	?		?	?	
Cooking / boiling / sterilisation	?	?	?		?	?	
[Refrigeration / freezing]*	?		?		?	?	
Cutting/ slicing/ mincing etc.	?			?			?
Canning/jarring / packaging	?			?			?
Maceration / kneading / fermentation	?		?	?	?	?	
Storage	?	?	?		?		?

*NB refrigeration/freezing are addressed in more detail in the corresponding best practice

[1] http://susproc.jrc.ec.europa.eu/activities/emas/public_admin.html

[2] More information on the standard ISO 50001 — Energy management is available at: http://www.iso.org/iso/home/standards/management-standards/iso50001.htm

Environmental benefits

Reducing energy consumption has a number of beneficial environmental impacts, especially in the most common case where energy demand is met with fossil sources. It helps reduce the upstream emissions of greenhouse gases and air

pollutants associated with fossil energy extraction and transport, but also reduces direct emissions on the premises, potentially improving local environmental and working conditions.

Side effects

The replacement of obsolete (inefficient/poorly insulated/ill-dimensioned etc.) equipment generates waste and the embodied emissions/energy of manufacturing and installing the replacement equipment also add to environmental impact of implementing some energy efficiency solutions. Therefore these should be considered in a more global strategy relating to the lifetime of production equipment.

Applicability

Energy efficiency solutions can be deployed in all facilities, from incremental to in-depth refurbishments. Regular walk-rounds are also recommended to identify new sources of energy waste even in facilities that have already been optimised.

Economics

Energy efficiency in all sectors is the area for environmental improvement with the most attractive business case, as energy savings result directly in lower energy bills as well as a hedge against future energy price increases.

Cost savings are in line with the energy saved with incremental measures delivering quick savings of over 5-10% while more transformational changes will deliver cost savings of 20-30% or up to 50% of the whole energy bill.

On individual cost items, the saving can be even higher (50-90%), e.g. recovery of waste heat to generate steam can altogether obliterate the need for a boiler.

Driving forces for implementation

As mentioned above, the drivers for energy efficiency are numerous, they include:

- cutting energy costs;
- cutting greenhouse gas emissions (which may also be associated with specific taxes/levies/permits);
- cutting pollutant emissions;
- improving process efficiency;
- improving working conditions and staff engagement;
- improving public image.

Literature

- Carbon Trust, 2012. Food and drink processing: Introducing energy saving opportunities for business. Carbon Trust guide ref.no. CTV004/CTV054.

- Energy Efficiency Exchange case studies on food and drink manufacturing http://eex.gov.au/industry-sectors/manufacturing/food-and-beverage/. Accessed November 2014.
- Energy efficiency in the food and drink industry – the road to Benchmarks of Excellence (Norway), Hans Even Helgerud - New Energy Performance AS (NEPAS), Marit Sandbakk – Enova, SF Eceee 2009 Summer Study
- Sectoral Reference Document on Best Environmental Management Practice in the Public Administration Sector, and supporting Best Practice report (forthcoming)