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“ADAPTATION MEASURES FOR THE FOOD AND BEVERAGE INDUSTRY TO THE IMPACT OF CLIMATE CHANGE ON WATER AVAILABILITY”

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EU Food and Beverage Industry



- **EU Food and Beverage (F&B)** industry is the **largest manufacturing sector** in terms of **turnover, value added** and **employment**.
- The food and drink industry contributes 1.9% to EU gross value added.
- Throughout the economic recession, **it continued to increase**, while a sharp decrease was observed in other key manufacturing sectors such as the automobile and chemical industries.
- In 2011 **the turnover** for EU-27 reached **more than a million billions Euros** (increase of 6.8% compared to 2010) while the direct employment was stable compared to 2010 (4.25 million employees).
- In total, the EU food industry consists of approximately **287,000 companies** **99% of which are SMEs** and **only 1% of large companies**; however the latter contributes almost half of the value added of the food sector (48%).



Water consumption in F&B industry



- Water is an **essential input** for the F&B industry, as an **ingredient**, as a **key processing element** and as a **cleaning agent**.
- F&B industry is considered a large water consumer and in particular of drinking-quality water:
 - 3rd largest industrial user of water
 - responsible for about 1.8% of Europe's total water use
 - 75% is drinking-quality water

Water uses in F&B industry



- three basic water demand categories:
 - process water,
 - cooling water and
 - boiler feed-water

F&B process water



- water which can come into contact with the food product either directly or indirectly, or water used for technical purposes and which in some way or another can affect the quality of the food products
- It includes water used for:
 - direct preparation of products or other items which come into direct contact with the products,
 - cleaning and disinfection,
 - regeneration of water treatment equipment
 - various technical purposes (e.g. cooling water).
- Process water is mostly of drinking quality.

F&B Cooling water



- the water used for the removal of heat from process streams and products
- Applied cooling systems in the food industry:
 - once-through cooling systems , with no recirculation of cooling water,
 - closed circulation cooling systems (chilled water, brine)
 - open circulation cooling systems (cooling towers) and
 - cooling by direct contact with cooling water.
- In most cases no need to meet drinking water quality requirements

F&B Boiler feed-water



- the water used for steam generation through boilers
 - used for the sterilization of tanks and pipelines
 - for adjusting the water content of the raw material
 - water quality requirements vary depending on the working conditions of the boiler

Adaptation measures for the F&B industry

1. General



Application and maintenance of a 7-step methodology for preventing and minimising the consumption of water:

1. (a) Management commitment, (b) Organisation and (c) Planning
2. Analysis of production processes - identify areas of high water consumption and opportunities to minimise consumption, taking into account the water quality requirements for each application, hygiene and food safety.
 - water input and water output of the total installation
 - monitoring system for data collection, processing and reporting
 - Identification of water consumption benchmarks
3. Assessment of objectives, targets and system borders
The objectives include reduction targets, boundaries and time-scales. The objectives need to be measurable and scheduled into a programme plan so that they can be used to monitor if the programme is proceeding as planned. These objectives can be revised further in the process when implementing the actual prevention and minimisation programme

Adaptation measures for the F&B industry

1. General



Application and maintenance of a 7-step methodology for preventing and minimising the consumption of water:

4. Identification of options for minimising water consumption, using a systematic approach, such as water pinch technology (a tool for identifying water re-use, recycling and regeneration opportunities within an installation or process)
5. Evaluation and feasibility study.
Evaluate the proposed options and to select those most suitable for implementation. The options are all evaluated according to their technical, economic and environmental merits
6. A programme for minimising the consumption of water. Use of an action plan can ensure that the selected options are implemented.
7. Ongoing monitoring of water consumption levels and the effectiveness of control measures. This can involve both measurement visual inspection and review of their effects periodically. Corrective and preventive action can be carried out if a problem is identified.

Adaptation measures for the F&B industry

1. General



- Implementation of a system for monitoring and reviewing consumption and emission levels of the processes, to enable optimization of the actual performance levels. A good monitoring system includes:
 - records of operating conditions,
 - sampling and
 - analytical methods

- Transport solid materials dry.

Many raw materials, co-products, by-products and wastes can be transported without using water. This reduces water consumption and the entrainment of organic matter into water, which would consequently have to be treated in either an on-site or MWWTP, or sent for landspreading.

Adaptation measures for the F&B industry

1. General



- Segregation of water streams to optimise re-use and treatment
 - 4 water streams present in an F&B installation,
 - water directly associated with use in the process,
 - domestic/sanitary waste water,
 - uncontaminated water,
 - surface water
 - Water streams can be separately collected for optimised and easier re-use and treatment
 - A water segregation system can be designed to collect these water streams and separate them according to their characteristics, e.g. their contaminant load.
 - Example: uncontaminated water streams can be re-used for specific process applications, e.g. washing, cleaning, make-up for utilities for sequential re-use, and exceptionally, for the process itself.

Adaptation measures for the F&B industry

1. General



- Optimization of the application and use of process controls to prevent and minimize water consumption. This can be implemented
 - to control flow and/or level, by dedicated measurement
 - of pressure, using pressure sensors
 - of flow, using flowmeters
 - of level, using level sensors i.e. level-detecting sensors and level-measurement sensors
 - to use analytical measurement and control techniques to reduce waste of water (e.g. pH, conductivity and turbidity)
- Use of automated water start/stop controls to supply process water only when it is required
 - Sensors such as photocells can be fitted to detect the presence of materials and to supply water only when it is required.

Adaptation measures for the F&B industry

2. *Environmental management*



- Implementation and systematic monitoring of an Environmental Management System (EMS) that incorporates between others water consumption benchmarking
 - The scope (e.g. level of detail) and nature of the EMS (e.g. standardised or non-standardised) will generally be related to the nature, scale and complexity of the installation, and the range of environmental impacts it may have.
 - Implementation and adherence to an internationally accepted voluntary system such as EMAS and EN ISO 14001:1996 could give higher credibility to the EMS.

Adaptation measures for the F&B industry

3. *Equipment and installation cleaning*



- Cleaning of F&B equipment and installations is necessarily frequent and to a high standard because there are hygiene standards which have to be maintained, for food safety reasons.
 - Optimise the use of dry cleaning (including vacuum systems) of equipment and installations, prior to wet cleaning,
 - Management and minimisation of water, energy and detergents used without jeopardising hygiene
 - Supply pressure-controlled water via nozzles
 - Re-using warm cooling water for cleaning

Water consumption benchmarks in F&B sector



- Represent a theoretical optimum range of values of specific water consumption for a product.
- Enable comparison between facilities of the same F&B sector consumption against production
- Provide a good indication of:
 - The efficiency and wastage occurring within the process
 - The need for water savings

Target benchmarks in F&B industry



Benchmarks for some sectors published by the Environmental Agency. The achievement of these benchmarks is considered as Best Available Technique (BAT).

Product	Specific water consumption benchmark (Volume of water consumed per product unit or volume or mass of finished product)
Cattle	700 - 1000 (L/animal)
Pigs	160 - 230 (L/animal)
Sheeps	100 - 250 (L/animal)
Chicken	8 – 15 (L/Bird)
Turkey	40 - 60 (L/Bird)
Milk	0.6 – 1.8 (L/L)
Milk powder	0.6 – 1.7 (L/L)
Ice-cream	4 – 5(L/kg)
Beer	0.35 – 1 m ³ /hl (1hl=0.1m ³)

General Conclusions



- ✓ F&B industry is one of the largest manufacturing sectors
- ✓ Water is an important resource for the F&B industry,
- ✓ Reduced water availability due to climate change is expected to affect the sector if no adaptation measures are undertaken.
- ✓ Minimising water consumption can be addressed by applying appropriate adaptation measures in the framework of Best Available Techniques in F&B industries.

Thank you for your attention



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