

SIGNIFICANT ENERGY USAGE AND ENERGY SUPPLY ISSUES IN BAKERIES

Introduction. Enterprises in the food industry are significant consumers of fuel and energy resources (FER), and the issue of saving thermal and electrical energy in this sector is particularly relevant. Among food industries, those producing sugar, oil, alcohol, bread, and similar products are the most energy-intensive. In particular, in the baking industry, a large amount of fuel is consumed in the process of bakery ovens. For baking 1 ton of bread, between 50 to 65 kilograms of fuel is required. However, the useful efficiency of using this fuel is only from 30% to 32%, and from 30% to 60% of the heat is emitted as waste into the atmosphere.

The type of heating element selected for use in an oven or dryer affects the thermal efficiency of the system. Gas burners are 85 to 95% efficient while steam heat systems are 70 to 80% efficient, according to the report. Due to losses at the power plant and transmission lines, delivered electricity is only about 30% efficient. Advanced baking technologies such as radio frequency assisted ovens provide an energy-efficient way for goods to be baked that requires low final water content. Careful maintenance, control, and operation of an oven can improve the overall energy efficiency of a bakery. While large, direct energy efficiency savings can be found in improving the efficiencies of technologies such as motors and equipment insulation, indirect benefits can be realized by improving oven and dryer design, production throughput, decreasing downtime, and optimizing production processes.

The following figure(Fig.1) shows the annual energy saving potential on MWh for different groups of consumers based on the results of energy audits at 13 enterprises of the bakery industry.

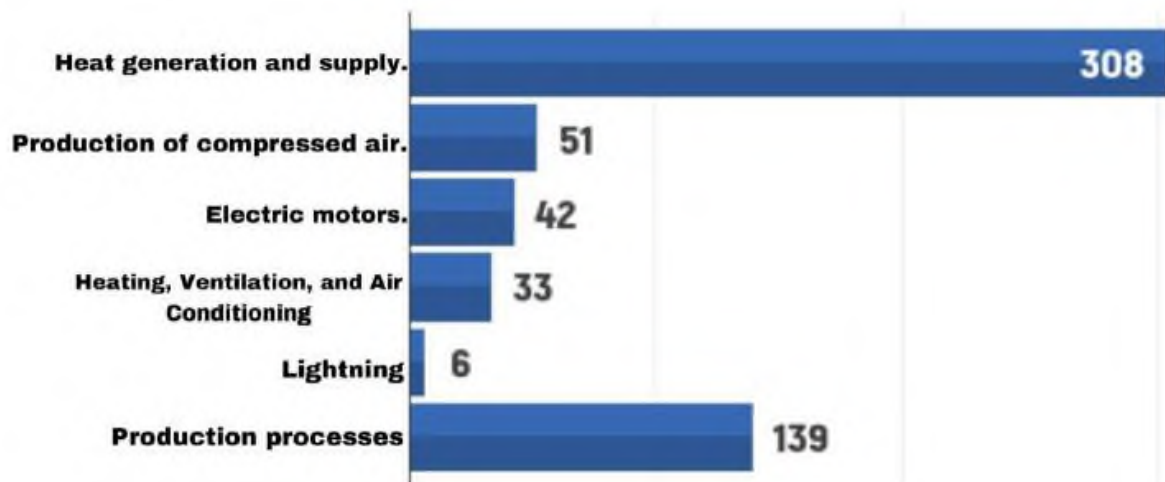


Figure 1 - Annual energy saving potential by different groups of consumers

The most promising groups of consumers from the point of view of energy saving potential, include the group of heat production and distribution with the potential of saving (308 MW*h/year), followed by production processes (139), compressed air production (51), electric motors (42), heating, ventilation and air conditioning (33). the last place is taken by lighting (6)

Electric Power Supply. In bakeries, electricity is usually supplied through two independent power transmission lines with a voltage of 6(10) kV, which enter through their own transformer substation (TS). Electric motors, electric ovens, dryers, various electric heating devices, charging units, and lighting devices are the main consumers of electrical energy at these enterprises.

Refrigeration Supply. Consumers of cold-on bakery industries can be chambers and devices for storing perishable raw materials and finished products. If the industry has a low cold consumption, a refrigerated cabinet is provided, which is placed in the raw material storage room

Water Supply and Sewerage. To ensure uninterrupted water supply in bakery industries, the presence

of two separate inputs to the ring water supply network is required. Additionally, an artesian well located on the industry's territory can be used as a water supply source

Bakeries can save energy through energy-efficient solutions: Utilizing more natural light in the production area; Adopting best practices to minimize compressed air losses and reduce energy consumption; Harnessing heat from the ovens;

With energy efficiency as the need of the hour, manufacturers are adopting practices that could take them closer to their goals of environmental sustainability. Some of these practices include improving the insulation of production plants, bringing down the amount of ambient air entering dispatch areas, ensuring variable speed drives on bakery ventilation systems, and reducing the leakage of compressed air. They are also adopting measures such as the periodic shutdown of major plants that include ovens, coolers, and conveyors periodically.

Conclusion. In the long run, optimization of baking processes will remain the top agenda of bakeries focused on energy efficiency. It is expected that the industry is likely to focus on new facilities, to bring about automation, streamline existing processes, deploy robotics, and focus on reducing equipment downtime toward achieving this objective.

References:

1. How to improve energy efficiency in the baking industry [Electronic resource]–
<https://www.plantengineering.com/articles/how-to-improveenergy-efficiency-in-the-baking-industry/>
2. ENERGY STAR Focus on Energy Efficiency in Bakeries [Electronic resource]–
https://www.energystar.gov/industrial_plants/improve/
3. Analysis of energy saving potentials in intelligent manufacturing: A case study of bakery plants [Electronic resource]–
<https://www.sciencedirect.com/science/article/abs/pii/S0360544219300465>
4. Figure 1 - Annual energy saving potential by different groups of consumers, GIZ Ukraine 2020, “Bakery analytical report”
5. Energy efficient intellectual control system of the electro-technological complex of a bread-baking plant . PAWEL OBSTAWSKI , VOLODYMYR KOZYRSKYI , VIKTORIA MOMOTYUK , NATALIJA ZAIETS/ Warsaw University of Life Sciences – SGGW