# DOWNLOAD PDF ENERGY EFFICIENCY AND MANAGEMENT IN FOOD PROCESSING FACILITIES

## Chapter 1 : Gulfood Manufacturing in Dubai - Energy Efficiency in Food Processing Facilities

*Energy efficiency, environmental protection, and processing waste management continue to attract increased attention in the food processing industry. As with other industrial sectors, reducing costs while also reducing environmental impact and improving overall sustainability is becoming an important part of the business process.*

While there are specific energy conservation opportunities available for each type of facility, energy-saving upgrades to existing equipment or new equipment such as refrigeration, pump and fan systems, and combined heat and power could benefit most food processing facilities. Refrigeration Refrigeration systems consume a large amount of electricity in food processing facilities. Energy and cost savings can be obtained through a variety of modifications to the refrigeration system including improved insulation or tighter seals on doors. More complex changes to the system controls and variable frequency drives for the compressors or evaporator fans can also result in savings. Pumps are primarily used for cleaning operations and cooling, while fans are used for ventilation and cooling. When installed, pumps are often oversized to meet a maximum flow requirement; piping, valves, and the rest of the system may be undersized to contain costs. Fans are selected based on price and availability to provide a design air flow, not on energy and operating costs, and are also often oversized. Both pumps and fans can be evaluated for energy saving opportunities. Pumping systems should be evaluated during the design phase and installation, though there may be retrofit opportunities available for large process pumps that run long hours as well as large cooling towers and HVAC systems. Fan speed should be evaluated; often, oversized fans can be slowed, resulting in a large decrease in energy consumption. Slower fan speed can also reduce fuel consumption. For example, slowing the fan speed can reduce the amount of make-up air needed to be generated. Combined Heat and Power CHP CHP provides an opportunity to reduce the overall energy consumption in facilities by generating electricity on-site and recovering waste heat from the electrical generation for the production process. CHP processes convert waste heat or steam into electrical power. The food industry produces biomass waste, which could be used as an alternative fuel source. CHP, which requires a large capital investment, is an attractive opportunity for food processing facilities that have high energy intensity, a flat year-round load profile, and high thermal to electric ratios. Even facilities with an electrical demand less than 5 megawatts can benefit from CHP systems. Resources The following resources may help you start thinking about energy efficiency in your facility. Air Compressor Energy-Saving Tips  This fact sheet about air compressors will help you calculate their operating cost, understand your system and identify easy to implement energy efficiency strategies. Listening for Leaks pg6. MnTAP staff can help you find compressed air and steam trap leaks using an ultrasonic leak detector. This compressed air system assessment and analysis software package helps maximize the efficiency and performance of compressed air systems through improved operations and maintenance practices. BestPractices for Compressed Air. One facility installed a direct heat system that is  Inefficient and underused boilers were costing Schwan Food Company and Nordic Ware an excess amount in fuel. Inspect Steam Traps for Efficient System. Faulty or inoperative steam traps can cause losses of hundreds of thousands of dollars. This article explains how steam traps work and methods to monitor them. Motor Energy Saving Tips  This fact sheet will help you calculate your motor operating costs, develop a policy for motor repair and replacement and develop strategies to reduce energy used by motors at your facility. Variable frequency drives pg4. VFDs on motors can enhance process operations, especially for flow control, and can efficiently cut energy demand for pumps and fans. Assistance on how to print content from the webpage is provided on our Print Instructions page. Minnesota Technical Assistance Program Address:

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## Chapter 2 : Energy Efficiency and Management in Food Processing Facilities - PDF Free Download

*Energy Efficiency and Management in Food Processing Facilities - Kindle edition by Lijun Wang. Download it once and read it on your Kindle device, PC, phones or tablets. Use features like bookmarks, note taking and highlighting while reading Energy Efficiency and Management in Food Processing Facilities.*

Energy efficiency, environmental protection, and food processing waste management have attracted increasing attention in the food industry. Effective energy utilization and energy source management in food processing facilities are desirable for reducing processing costs, conserving nonrenewable energy resources, and reducing environmental impact. The food processing industry, on the one hand, consumes large amounts of energy and, on the other hand, generates large amounts of processing waste. Energy conservation and energy recovery from processing wastes have become two important issues to reduce production costs, maintain economic growth, and improve sustainability in the food processing industry. The food processing industry does not have sufficient resources to obtain knowledge and skills on advanced energy conservation and conversion technologies. The goal of Energy Efficiency and Management in Food Processing Facilities is to provide comprehensive knowledge and skills on advanced energy conservation and conversion technologies to students, researchers, engineers, and managers in food-related areas for improving energy efficiency and energy recovery from processing waste in food processing facilities. This book covers five key topics: Part I covers fundamentals of engineering principles, energy auditing, and project management. The development of energy conservation technologies starts from the comprehensive understanding of the principles of heat transfer, fluid mechanics, and thermodynamics underlying food processing systems. These principles are concisely reviewed in Chapter 1. Energy auditing is one of the first tasks to be performed in an energy conservation program. The energy audit is to examine how a facility uses energy, what the facility pays for that energy, and what changes can be made to effectively reduce energy costs. The fundamentals of energy auditing are covered in Chapter 2. An energy conservation and conversion project reduces energy consumption in a food processing facility but requires investment for implementation. In the implementation of an energy conservation and conversion project, it must be kept in mind that bottom-line decisions are based on economics as well as energy and environmental considerations. Management of energy conservation and conversion projects is addressed in Chapter 3. Part II focuses on various energy conservation technologies that can be applied to food processing facilities. Steam, compressed air, and electricity are the three main direct energy sources used in a food processing facility. Energy conservation technologies in generation and distribution of steam, compressed air, and power in food processing facilities are covered in Chapters 4, 5, and 6, respectively. Heating and cooling of foods are achieved in heat exchangers. Energy conservation technologies for heat exchangers are covered in Chapter 7. Food processing facilities usually generate large amounts of waste heat. Technologies for recovering waste heat and storing thermal energy in food processing facilities are addressed in Chapter 8. Various novel thermodynamic cycles such as low-grade heat powered refrigeration cycles, heat pumps, heat pipes, and heat and power cogeneration cycles have been developed to save energy in the food industry. These novel thermodynamic cycles are examined in Chapter 9. Parts III and IV examine energy efficiency and conservation in existing and emerging food processes, respectively. Chapter 10 in Part III gives an overview of the energy consumption in existing food processing facilities. Chapters 11 through 16 then examine the energy use and saving opportunities in six main food processing sectors in terms of food products, which include grains and oilseeds milling, sugar and confectionary processing, fruits and vegetables processing, dairy processing, meat processing, and bakery processing. Specific energy consumption in each food processing sector is examined. Energy-saving opportunities are identified and energy conservation measures are discussed for each sector. Various emerging food processes such as membrane processing, food irradiation, pulsed electrical field, highpressure processing, microwave heating, and supercritical fluid processing have been widely investigated. Chapters 17 through 21 in Part IV briefly address

the working principles, applications, energy efficiency, and energy conservation of these emerging food processes. Part V discusses energy conversion technologies for utilization of food processing waste. Current food processing facilities depend on large inputs of high-quality energy resources such as electricity and natural gas. Waste streams generated in food processing facilities are abundant renewable energy sources. Food waste can be converted to marketable liquid and gaseous fuels, and heat and power that can be used in food processing facilities. Chapter 23 gives an overview of food processing wastes and their utilization in various food processing sectors. Chapters 24 through 27 then discuss various energy conversion technologies used for energy recovery from food processing wastes. This book can be used as a senior level elective or graduate course in food science, food and bioprocess engineering, and industrial engineering programs. It is an essential resource for energy efficiency improvement and management for plant engineers and managers in food processing facilities. It can also be used as a valuable reference book by researchers, energy engineers, and energy management professionals. There are six basic forms of energy: Energy can neither be created nor destroyed. However, it can be changed from one form to another. Analyses of energy consumption and its efficiency in food processing facilities involve the application of scientific and engineering principles such as physics, chemistry, heat transfer, fluid mechanics, and thermodynamics. In a food processing facility, high energy demand, underutilization of facility capacity, and underutilization of individual unit operations may cause unnecessary energy consumption. Transient energy consumption profiles should be an important factor for optimizing the unit operations and minimizing energy consumption Simpson et al. Heat transfer calculations are also essential in selecting an insulation material and determining the thickness of the insulation layer. Pumps and fans are widely used to deliver liquid foods, such as milk and juices, and processing media, such as steam, water, and air, in food processing facilities. It is critical to understand how to choose the correct pump or fan, calculate the frictional energy loss, and design an efficient pumping system in food processing facilities. Power requirement and energy loss of a pumping system can be calculated by engineering principles of fluid mechanics Singh and Heldman,  Energy loss can be interpreted by the loss of energy content using the first law of thermodynamics and by the loss of energy quality using the second law of thermodynamics. The quality of energy is described by a parameter of exergy and is defined as its maximum potential to perform work Dincer,  This chapter gives an overview of heat transfer, fluid mechanics, and thermodynamics. Applications of these scientific and engineering principles for energy analyses are demonstrated through examples.

## Chapter 3 : MnTAP â€“ Energy Efficiency

*Providing practical guidance, Energy Efficiency and Management in Food Processing Facilities explores energy efficiency technologies, emerging energy efficient processes, and methods for converting food processing wastes into energy.*

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## Chapter 5 : CLEAResult | Strategic Energy Management

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## Chapter 6 : Energy Efficiency Opportunities in California Food Processing Facilities

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