

Power consumption and Efficiency during manufacturing of dairy products in a dairy plant

Brahmanand Bairwa¹, MdIrfan Ahmed², KKumar Singh¹,
Anuruddh kumar³ and Sujit Mehta¹

¹School of Agricultural Sciences, Career Point University,
Kota, Rajasthan, India

²Electrical Engineering, Career Point University,
Kota, Rajasthan, India

³Department of Animal Husbandry (Dairy Science), R B (PG) College,
Agra, Uttar Pradesh, India

Abstract

Nowadays, Power is the major concern for every industry as the conventional sources of energy are depleting and at the same time there is a significant growth in the industrial loads. Dairy industry uses electrical energy and thermal energy as main energy source. This paper attempts to find the scope available in dairy to use resources in a proper manner by energy audit. Investing to improve the energy efficiency of a dairy industry provides an immediate and relatively predictable cash flow resulting from lower energy bills.

Keywords: Dairy Plant, Dairy Products, Power Consumption, Electrical Energy, Thermal Energy

1. Introduction

Energy is the most critical element for economic development as its optimized use has become an issue of International importance. Dairy and other food processing industry use a high amount of energy in processing, manufacture and storage of various products due to obsolete technology. In dairy plants Power is directly states that are the utility's generation and consumption such as steam, refrigeration, electricity and water. Water and steam are used as heat transferring medium in dairy operations [2]. Water consumption is very high in most of the dairy operations. Dairy industry contains of several subdivisions like raw milk reception, processing section, products section, storage and

dispatch section. Dairy processing plants are traditionally divided into two separate categories for the purpose of production and energy statistical data presentation.

These two categories are described as follows:

Fluid Milk Processing: It involves the pasteurization and processing of liquid milk for direct consumption, as well as creams, chocolate and other flavored milks, and buttermilk.

Industrial Milk Processing: It involves the processing of milk into value-added products. These include butter, cheese, ice cream, and other frozen products, dried milk powder, curd and other cultured milk products. The milk used in the manufacture of industrial milk products is also pasteurized before processing [3].

Two types of energy-use in the operation of dairy plants, summarized as follows:

Electrical Energy: Electricity is used throughout the dairy processing industry to drive process motors, fans, pumps and compressed air systems, as well as building lighting and HVAC systems. By adding to machine drives, one of the main uses of electricity in the dairy processing industry is for process cooling, freezing, and cold storage.

Heat Energy: It is supplied as fuel primarily in the form of natural gas, fuel oil or propane, used for

direct process heating and steam generation via boiler systems.

2. Electricity Consumption

The plant receives electricity from EB (Electricity Board) at 33KV with contract demand of 2000 KVA by express feeder. Power supply to plant is done through four distribution transformers. Transformer 1 supplies power to refrigeration, liquid milk processing plant and capacitor bank. Transformer 2 supplies power to other two old transformers which are installed at the start of dairy. These two old transformers act as substation [1].

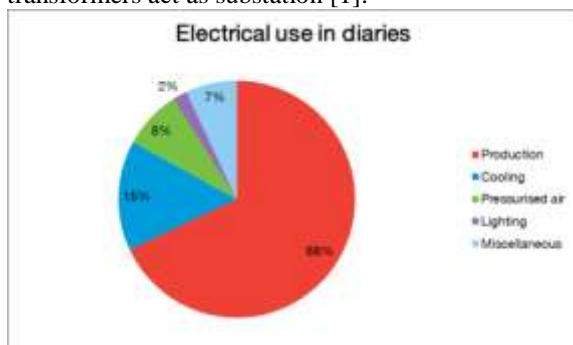


Fig. 1 Electricity uses in Dairy Plants

2.1 Benefits of Combined heat and power for Dairy Plant

- Energy costs savings - Overall efficiency (electrical and thermal) can reach 95 percent using a wide fuel range
- Resilient and robust power - You don't have to rely on the grid alone to ensure your facility has the power it needs 24/7
- Environment friendly - Less fuel burned per MW generated at lower CO₂ emissions. DLE technology can sustain lower emission levels while eliminating system water requirements
- Standardized design - Smaller footprint, sizable to your unique spatial requirements
- Flexible power - Thermal energy can be stored for use, electricity can be fed into the public grid or used for artificial lighting, and an optional full island lighting control system is available

3. Different methods of energy conservation in milk dairy plan

Dairy industry requires both electricity and process heat. There is a chance of co-generation [5]. The co-generation system shows relative fuel saving and heat rate of co-generation is less than the heat rate of

power plant. Hence cogeneration is seen to be feasible but it has following limitation: The Power generation is so small hence it is difficult to get the generator of such a small capacity. Even if we get the generator then scale of pay is very high hence it is not that affordable. The other methods are [4]

- By economizer to heat feed water for boilers, so use waste heat
- By proper integration of chilling system to the main process by load balancing
- To use waste heat of air compression outlet to heat boiler inlet water
- By proper loading of electrical motors and lightening system
- By using variable frequency drives in air compressors

4. Conclusions

The cost of milk and milk based products is going up due to the cost of raw materials and energy required for processing. The cost of milk depends upon utilities consumption, such as water, steam, refrigeration and electricity. Thus, analysis is done for improvement in the energy conservation operation. This paper shows that the energy consumption for various operations and equipment's and to suggest ways and means for the improvement. It is, therefore, essential that existing plant is instrumented well and at a significant level. Plant manufacturers should be encouraged to give more accurate service consumption figures for the desire.

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