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STRATEGIES FOR REDUCTION IN ENERGY DEMANDS IN DAIRY INDUSTRY

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Abstract: Energy is a topic whose importance has rapidly increased in the last few years. Not only has the cost of energy generally increased, but the world has become increasingly aware of both the unsustainability of our present modes of energy use, and he effects of the Co_2 emissions from our fossil fuel usage. Operators of dairy processing facilities have also become increasingly aware of the significance of energy use. For many processor this is the one of the largest cost components and one of the processing cost components that is most amenable to reduction by improved technology and closer management control. The following paper addresses several aspects of minimizing the environmental effects of energy use.
Keywords: Energy, unsustainability, management, fossil, processing.

INTRODUCTION

Energy conservation is the need of the hour, each dairy farm is unique and each business has its own set of criteria that needs to be met. Any energy saving measures that are instigated must not compromise milk quality, nor lead to milk grades, create adverse environmental effects and to be widely adopted they must improve the profitability. Dairy factories producing mainly market milk use energy for heating and pasteurization, cooling and refrigeration, lighting, air-conditioning, pumping, and Operating processing and auxiliary equipment. Factories producing concentrated milk Products, cheese, whey or powders require additional energy for churning, pressing, separation, concentration, evaporation and drying (Bendicho 2002). The cost of electrical energy will increase dramatically in the years ahead and awareness of energy consumption in the dairy industry is becoming an issue as the cost of milk production increases and milk price decreases a research statistics showed that milk cooling is the largest consumer of electricity (32%) followed by water heating (27%), vacuum pumps (19%) and lighting (18%). Other items such as wash pumps, milk pumps, feed augers and air compressors make up the balance (5%).

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INTERNAL STRATEGY

Measuring and monitoring energy use will highlight opportunities for Savings and in turn reduce energy demands as well as greenhouse gas emissions. The formation of energy Management team, involving a wide cross-section of staff, is a proven way of identifying opportunities to reduce energy consumption, to identify energy issues, installing energy-efficient lighting, improving the operation of the refrigeration system compressors, more closely linking boiler operation to process plant requirements by improving communication between the boiler house and process operators, benchmarking plant start-up and shutdown times tagging and measuring energy consumption of all relevant equipment items, repairing steam and air leaks and maintaining pipes (Caric 1994).

ENERGY AUDITING

Reducing the demand for steam and hot water as in Evaporation may prove beneficial as in Evaporators are commonly used in dairy processing plants to concentrate heat-treated Milk from approximately 10% to around 50% total solids. Evaporators may be single- or Multiple-stage (effect) where energy savings are made by using the vapour from the First effect to heat product in the second, and so on. Energy consumption is reduced by increasing the number of effects; Thermal vapour recompressors (TVRs) further reduce energy usage by Using a steam ejector to compress the vapour, increasing its temperature and pressure before utilizing its evaporative energy. Mechanical vapour recompressors (MVRs), which use a motor or mechanically driven compressor, are even more energy-efficient than TVRs.The most energy-efficient evaporators use a combination of multi-stage design and Mechanical vapour recompression (Bendicho 2002).The efficiency of a boiler can be monitored by measuring the excess air and the composition of flue gas. Insufficient excess air will lead to incomplete fuel combustion, while too much causes a loss of heat in the boiler and a decrease in efficiency. Optimum percentages of oxygen (O_2), carbon dioxide (CO_2) and excess air in exhaust Gases are of utmost importance. The ratio of boiler air to fuel can be adjusted to obtain the optimum mix of flue gases for natural gas 5 % and for coal 20% of excess air is optimum to control CO level in flue gas below desirable level of 400ppm, using oxygen trim system. Such systems usually reduce energy consumption by 1.5–2%. Several other factors that are to be kept in mind are regularly recording of the flue gas temperature, operation the boiler at the design working pressure, regular monitoring and cleaning the boiler tubes to remove scaling, proper matching of steam supply with demand. Leaks allow live steam to be wasted, causing more steam production to be required to meet the plant's needs. As more replacement feed water is required, more fuel is used for heating and more chemicals are needed for treatment. Boiler condensate (as opposed to evaporator condensate) contains valuable heat energy.

Condensate should be returned to the boiler feed tank to save water and utilize this energy, unless It is excessively contaminated with product or corrosive elements. Rationalizing steam and condensate pipe work can lead to savings in boiler operating costs.Uninsulated steam and condensate return lines are a source of wasted heat energy. Insulation can help reduce heat loss by as much as 90%,Boiler efficiency can be improved by installing heat recovery equipment such as economizers or recuperators.Recuperators are air-to air heat exchangers that are used to recover heat from flue gases to pre-heat combustion air.

STRATEGIES FOR COMPRESSOR

The dairy's most of the electrical consumption is due to the refrigeration system and energy cost of a refrigeration system can approach 20% of the total energy costs In a liquid milk processing plant The selection of Compressor is important, when selecting a compressor to choose a type best suited to the refrigeration duty and one that will enable the system's COP to be as high as possible. The compressor's capacity needs to be matched with the load. The use of multiple compressors with a sequencing or capacity control system to match the load can help to improve efficiency. Ice banks can be an effective way of meeting peak demands without the need for large compressor capacity. They are best used in applications where there are short to Medium peak loads but a much lower average load during a production day. Ice can be formed during the night to take advantage of cheaper off-peak electricity. Hot gas from the outlet of the refrigeration compressor can be used to defrost freezers. The defrost water may then be used elsewhere in the plant. Once the evaporator is no longer covered in ice its cooling capacity will be increased.

LOAD BALANCING

Variable speed drives (VSDs) reduce energy consumption by adjusting the motor speed to continually match the load of equipment such as pumps, fans and compressors. VSDs are ideal for equipment that has to operate at variable loads or be oversized to cater for occasional high loads. Power consumption in refrigeration plants can be from heat ingress through doorways in coolrooms, here automatically closing doors or an alarm system could be considered; and plastic strip curtains or swinging doors are useful at frequently opened entrances.

ENERGY EFFICIENT AIR CONDITIONER

Selection of an air-conditioning system should be by Energy-efficient models may have higher initial costs; such a system will usually pay for It several times over in saved operating costs during its lifetime. Energy efficiency will depend not only on choosing a system that produces as much cooling per hour as possible for every watt of power it draws. Economy air cycles are a good way of reducing energy use in air-conditioning systems, particularly in cooler regions. Economy air cycles take advantage of outside air temperatures, reducing the use of energy for cooling. Other opportunities for reducing the operating cost of an air-conditioning system Include: selecting a system based on the accurate sizing of your plant's cooling requirements (Some contractors use specifically designed software to determine the best size, the number and size of ducts, and the dehumidification capacity of the system.), ensuring the system is accessible for cleaning and maintenance so that components Such as filters, coils, ducts, fins, refrigerant, compressor and thermostats can be easily maintained and leaks repaired (CAE 1996).

OPPORTUNITIES

There are many opportunities for recovering heat in dairy processing plants; In relation to the potential area of use, the capital cost of heat recovery equipment, and the potential energy savings. In addition to the commonly used regenerative Pasteurizers and sterilizers, examples of heat recovery opportunities in dairy processing plants include from heated whey during cheese processing to preheat incoming milk, from boiler flue gases, boiler blow down and condensate recovery systems and from the heated air from spray dryers. The potential for heat recovery from evaporator, condensate varies with the type and efficiency of the evaporator. For example, Evaporators using mechanical vapour recompression are more energy-efficient than those with thermal vapour compression strategic method for looking at the opportunities for heat recovery is through a procedure known as 'pinch technology'. This involves analyzing the heating or cooling requirements of various process streams and matching these requirements to determine the minimum amount of heat energy input into a system. Fouling and cleaning of heat exchangers is a serious industrial problem in the dairy Sector. It was reported that fouling caused an increase of up to 8% in the energy consumption in fluid milk plants and another 21% of the total energy consumption was used to clean milk pasteurization plants Correct thermostat temperature over heating water is wasteful Spherical milk vats Improved cooling due to insulation and vat design Ventilation of system. Refrigeration costs can be lowered if system is well ventilated. In CIP cleaning volume, rather than time based control on burst rinses and CIP flows in turn reduces water quantities (Sims *et al.,* 2004).

Cogeneration or combined heat and power (CHP) systems use a single source of fuel, to produce both electrical and thermal energy. The main advantage of a cogeneration system is the overall system efficiency, can be as high as 80%.Steam turbines require a source of high-pressure steam to produce electricity and is mostly used when electricity demand is greater than 1 MW. Gas turbines produce electricity while also providing a heat source suitable for applications requiring high-pressure steam. They can be used for smaller-capacity systems (from a fraction of a megawatt) and provide the flexibility of intermittent operation. Reciprocating engines can be operated as cogeneration systems by recovering the heat from the engine exhaust and jacket coolant. Approximately 70–80% of fuel energy input is converted to heat that can be recovered to produce hot water up to around 100°C, or low-pressure stream (CEC 1998).

CONCLUSION

The above written concludes that even slight change in practices leads to appreciable reduction in energy demand in dairy that is both in favour of dairy as well as environment. In future equipment can be developed which will reduce the energy demand and will be helpful to the dairy industry.

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