Introduction

The American dairy farmer manages a highly efficient food production system. Yet he/she continues to seek ways to become more efficient, because that is the only way to remain competitive. This guidebook provides a comprehensive study of energy utilization on a modern California dairy farm, including discussions of techniques to effectively manage energy costs.

The goal of this guideline is to increase the understanding of how electric energy is used, provide a measure for comparison, and explore available opportunities for conservation on a modern dairy farm. Electricity is not purchased as a direct end use commodity, but rather for the results that can be produced thru conversion to useful light, heat or power. By increasing the awareness for how electric energy is transformed to an end use and investigation of options for conservation, better energy related management decisions can be achieved to increase profitability.

Opportunities for significant energy savings exist that allow dairymen options to better control their energy costs. For example, adding a variable speed drive (VSD) to a vacuum pump will reduce energy use by 50% or more, with no loss of milking system performance. Although not all options for energy savings available are this dramatic, their cumulative impact can help improve dairy farm profitability.

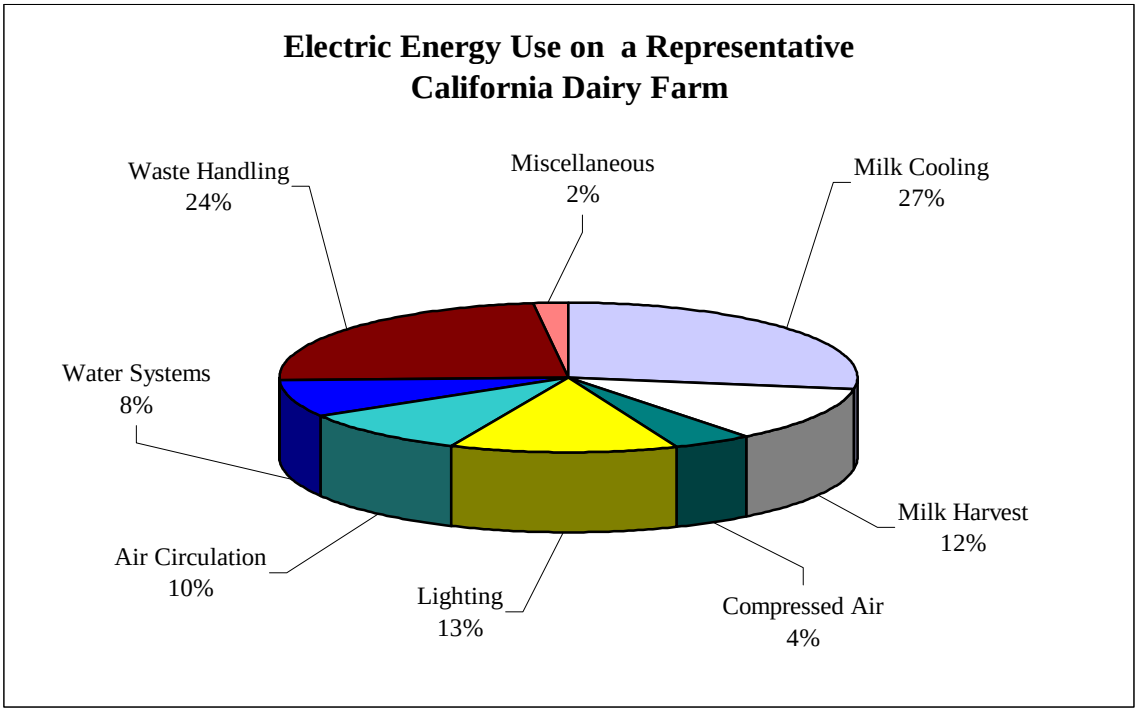
The first, least cost way to approach saving energy is to carefully maintain existing equipment at peak operating efficiency. Worn, poorly maintained equipment uses more energy while not meeting original performance specifications. When equipment needs to be replaced, select the highest efficiency equipment available. The pressures of increasing energy costs drive the advancement of energy saving technologies. Newer, more efficient equipment is always being developed. Take time to analyze the specifications and make the most cost effective choices.

The guide focuses on 7 major electric energy use categories found on California dairies, they include:

1. Milk Harvest
2. Milk Cooling
3. Lighting
4. Circulation & Ventilation
5. Washing & Water Heating
6. Water Systems
7. Compressed Air Systems

The pie chart on the following page shows the distribution of electric energy use on a representative diary farm in California. Washing and water heating is not shown because fossil fuel is primarily used to heat water.

The overall impact of each area of energy use is also represented in the chart.



The individual sections of the guide offer a comprehensive examination of

- Purpose and function of energy use for that category.
- Description and discussion of typical equipment employed.
- Development of an Energy Utilization Index (EUI) to provide a benchmark for comparison of energy use.
- Describe and explain Energy Conservation Measures (ECM) that can be implemented to use energy more effectively.
- Provide a series of basic field testing procedures and measures that can be used to maintain equipment at peak operating efficiency.

Energy Utilization Indices (EUIs) were developed to provide a measurement of how efficiently electrical energy is being utilized on the dairy farm. Values are commonly expressed in terms of kWh per cow-year, or kWh per hundredweight of milk cooled. EUIs provide a management and evaluation tool that can be used for comparison of energy use patterns on a specific dairy in relation to energy use on a representative group of dairies.

EUIs are useful for determining the overall efficiency of electrical energy use on a dairy farm as well as individual processes or equipment. They provide a benchmark to indicate whether energy use is in line with that on other farms. They can also offer insight on how electrical energy is used, identify areas of excessive energy use, provide an indication of effectiveness from implementing energy conservation measures and to distinguish the impact from adopting new technologies.

The following summary of EUIs for typical California dairies will provide you with typical energy use ranges for each of the major operations on the farm. They can serve as a guide to help you begin to make the most cost effective energy choices.

Overall Farm EUI – Typical Farm EUIs vary greatly depending on farm size, method of housing and milk harvest, utilization of energy conserving technology and extent to which environmental factors (lighting, ventilation/air circulation, waste and material handling) are modified through the use of electric technologies.

EUIs have been found to range from as low a 300-400 kWh per cow-year, to over 1500 kWh per cow-year. The lower values are found on large freestall, milking parlor dairies that use:

- High-efficiency milk cooling systems
- variable speed drive vacuum and perhaps milk pumps
- heat recovery, as this effects milk cooling
- high-efficiency lighting
- limited application of air circulation equipment
- less complicated waste handling systems
- efficient water heating (for electric water heating)
- efficient farmstead layouts
- effective cost control methods.

Farms with high EUIs generally indicate:

- smaller production units
- lower production efficiencies
- older, less efficient equipment

Larger Farm EUI values can also be attributed to:

- implementation of complex, integrated waste handling systems to comply with current or future environmental regulations
- extensive use of air circulation to reduce heat stress and maintain milk production levels
- adoption of “Long Day Lighting” photoperiod manipulation to reduce seasonal variations to milk production.
- limited management focus on energy related issues.

On a dairy farm, however, careful thought needs to be given to each opportunity to save energy. Some energy conservation measures can save energy, but at a cost higher than the value of the energy saved. In the area of ventilation and air circulation, energy savings measures could result in lower ventilation performance and greater animal discomfort. In such cases the dollars saved on energy could be insignificant when compared to the cost of lost milk production.

The first, least cost way to save energy is to carefully maintain equipment at peak operating efficiency. Worn, poorly maintained equipment uses more energy while not meeting original performance specifications. When equipment is replaced, try to get the highest efficiency equipment available. However, sometimes the extra cost of higher efficiency exceeds the payback realized from lower energy use. Take time to analyze the specifications and make the most cost effective choices.

Some of the basic processes found on dairy farms are discussed in more detail in a General Information section. These include energy efficient electric motors, gas-fired absorption heat pumps, heat exchangers, temperature monitoring, understanding pump curves, and variable frequency drives.

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