# Energy usage and efficiency review at Charlton Feedlot

***Briana Daly***
***Charlton Feedlot***

On the 1st of January 2008, the Victorian Government initiated a new regulatory program designed to assist and support businesses to improve the way that they use energy and water and how they manage waste generation processes. In Victoria all commercial and industrial sites that used more than 100 TJ of energy and/or 120 ML of water for the 2006/07 financial year were required to register with the Environmental Protection Authority (EPA) and prepare an Environment Resource Efficiency Program (EREP) plan by December 2008.

Charlton Feedlot is a 20,000 head licensed capacity beef cattle feedlot situated in central northern Victoria near the township of Charlton. The facility is owned and operated by Elders Pty Ltd.

The total energy and water usage and waste generation levels for the period July 2006 to June 2007 were compared against the EPA water and energy usage thresholds to determine whether an EREP was needed. The total water usage for the 12 month period, July 2006 to June 2007 exceeded the 120 ML threshold. Therefore, Charlton Feedlot was required to participate in the EREP program.

Whilst EREP type plans are not a requirement in other Australian states at this time, it is foreseeable that best practice resource management initiatives may become a requirement in the future.

An EREP include five key elements, these include;

1. **Resource use and waste generation baseline data**

Establishing a good understanding of resource use based on accurate energy, water, waste and production data provides the basis for identifying potential opportunities to achieve best practice resource management.

The baseline data requirements considered include:

- Energy used, by energy source/fuel type,
- Water used, by water source,
- Waste generated, by waste type, and
- Raw material used, by type.

Baseline information is ideally established for a 24 month period. However, where this is not available, the minimal requirement is for a 12 month period.

2. **Main resource using and waste generating activities**

An EREP needs to provide information showing the main energy and water usage and the waste generating activities at the site. This is used in developing an action plan that will deliver savings in resource consumption, waste generation and the associated costs.

The main information to be supplied about resource use and waste generating activities is:

- Description of main activities that use significant quantities of energy and water, or generate waste,

- Site map,
- Resource flow diagrams showing energy/ water used and waste generated, and
- Site assessment/ audit report (s) undertaken.

**3. Resource efficiency indicators**

To gain an understanding of the relative efficiency of a site, there is a need to track improvements and develop resource efficiency indicators for the particular site's operations. Resource efficiency indicators compare resource use data against a relevant business activity measure, providing a more useful measure than baseline data alone.

**4. Action plan**

An action plan guides the implementation of efforts to improve resource efficiency. It represents a commitment to saving resources and improving efficiencies across the business. It creates a management and operational system through which resource efficiency objectives and requirements can be developed, monitored and achieved.

The steps are:

- Identify resource efficiency actions,
- Estimate impact of resource efficiency actions,
- Estimate cost savings and implementation cost,
- Prioritise list of resource efficiency actions,
- Determine timeframes and responsibilities for each action, and
- Document supporting information.

**5. Monitoring**

The success of the assessment and action planning process will be determined by the ability to monitor and track progress of the adopted actions. Regular updating of the action plan is necessary to reflect any progress, delays or significant changes in the implementation process, including identification of actions that are most successful, any actions that need to be reviewed, or if there are any new actions that can be included.

A monitoring program must include:

- Monthly resource use of each area involved,
- Monthly resource use of the entire site,
- Monthly waste quantities and disposal costs,
- Records of any abnormal operating conditions or events (e.g. a water leak), and
- Records of any other relevant actions or events.

Charlton Feedlot has a variety of instrumentation to record onsite water and energy usage. These data coupled with various performance data allowed resource efficiency indicators to be determined and a baseline dataset to be established.

In 2007, Charlton feedlot commissioned a steam flaking feed processing system and their electricity supply contract was due for renewal in June 2009. These factors were the catalyst for Feedlot management to review opportunities for resource efficiency improvements in electrical energy prior to the renewal of the electrical supply contract.

The core element of this review was an electrical energy audit. An energy consultant, in cooperation with the feedlot's local electrical contractor, was engaged to conduct an electrical energy audit for the feedlot site. The objectives of the audit were to analyse electrical activity and energy use and to identify efficiency opportunities.

The scope of the electrical energy assessment included the following actions.

- Electrical and control diagrams were reviewed to understand the uses of electrical energy.
- Electrical loads were measured during operations to identify their contribution to site maximum demand and consumption.
- Analysis of electrical load profiles. Load profiles can be obtained from your electricity supplier i.e. Country Energy.
- Review existing maintenance and operating procedures including intervention levels or trigger points for maintenance.
- Review existing electrical supply contract to understand the implications of modifying the electrical load profile.
- Develop an improvement strategy to optimise the electricity demand and consumption without adversely impacting the operation of the feedlot.
- Recommend key performance indicators to benchmark energy consumption.

Electricity usage impacts financially and environmentally in the following ways:

In Victoria, the majority of electricity is generated using brown coal as the primary energy source. This form of generation produces significant carbon dioxide emissions. Although electricity may be sourced from renewable energy, the amount so generated forms a very minor proportion of the total.

The maximum demand determines the minimum electrical generation capacity and transmission infrastructure required to be provided by the supply authority.

The power factor (measured in terms of the phase shift between voltage and current) determines the magnitude of additional voltage drop in the supply authority infrastructure.

The electrical energy audit involved a site visit to review and document processes and equipment onsite and a review of the electrical load and demand data for the site which was obtained from the electrical supply retailer (Country Energy) for the period 1 October 2007 to 7 November 2008.

The audit identified that the feedlot had 3 supply points and documented the conditions of the tariffs associated with each supply point. The tariffs included Time-of-Use components and Maximum Demand component. Time-of-Use refers to different prices for electricity consumed during particular time periods. Maximum demand refers to the supply contract maximum demand allocated to the site. Having a contract maximum demand above the actual maximum demand of the site increases the unit cost of power.

The audit identified and documented the various processes within the feedlot that consume power. These include grain receival, tempering, grain milling, grain transfer, hay processing, pumping liquid supplements, office and to pump water from bores for drinking water, cattle washing and feed processing.

The findings from the audit included:

- The data as calculated for the site shows that the electricity supply has a very poor annual load factor of 15%; by definition, this will result in a higher unit cost of electricity. The primary reason for the poor load factor is that the main part of the plant operates over a relatively short time.

- The electrical equipment is of good quality, and has been installed in a manner that allows ease of inspection and maintenance

- The main plant is controlled through a series of programmable logic controllers (PLCs). The controllers allow monitoring of the electrical consumption, although this information is not used to manage demand.

- The feed mill operates only for the time required to transfer and process the feed, with a short lead in and clearing time. It is difficult to see opportunities to significantly reduce consumption of electricity.

- The Power Factor is poor, with the recorded minimum of 0.59. The average power factor is 0.76, and at maximum demand is 0.72. This is significantly less than the regulation requirement of 0.85

- The contract demand of 347 kW in the Powercor record is excessive compared to the highest recorded demand of 306 kW for the past 12 months. Again, this is significantly increasing the unit cost of electricity to this site.

- There is no ability to monitor the overall power consumption on the site. This makes it difficult to implement a demand management strategy.

The audit identified two key areas for further analysis, and estimates of cost savings. These were demand management and compliance.

The audit found that the plant is operating at reasonable efficiency levels. However, two key areas for further analysis, and estimates of cost savings were identified. These include:

**Electricity Demand Management**

Reducing the contract maximum demand by a significant amount is possible if equipment is installed to enable the entire site power usage to be monitored. The processes can then be managed to optimise demand.

A program is being implemented to manage the timing of various operations to achieve improvements in demand management.

Improvements to demand management could be gained by ensuring that the feed mill and tempering activities do not occur simultaneously (as is dictated by the process design) and the tub grinder not be used whilst either of these activities is underway.

However, manipulating activities is not straightforward, particularly at full capacity where there is less opportunity to only have one process in operation at one time. There are a number of practical considerations such as grinding hay outside of normal milling hours. For example, if mills operate for approximately 7 hours during the day, then tub grinding is required outside of normal hours to improve demand management. This presents additional issues for consideration such as labour and OHS requirements.

**Compliance**

Victoria, Tasmania, NSW and Western Australia have introduced some form of kVa or Power Factor electricity tariffs. The Power Factor is a measure of how effectively electrical power is being used by a system. A poor Power Factor indicates ineffective utilisation of electricity, while a good Power Factor indicates effective electricity and asset utilisation.

**Conclusion**

The outcomes of the electrical energy audit identified opportunities for electrical energy efficiency improvements. This allowed energy resource efficiency impacts, the implementation cost, and the annual cost savings that would be achieved from implementing each opportunity to be assessed.

It is likely that a review of energy usage will result in cost saving opportunities for many feedlots. Electrical energy, boiler and steam system assessments are the most relevant to lot feeders.

Further information on electrical energy audits can be found in Australian standard AS/NZS 3598:2000. This standard provides guidance on what level of assessment is appropriate for their needs and a guide when commissioning energy assessments.