ALTERNATIVE ENERGY SOURCES – E4

Eco-efficiency resources for the food processing industry

Reduce reliance on fossil fuels

To reduce reliance on fossil fuels it is worth considering taking energy from a mix of sources. There are many renewable energy sources that the food industry could harness to provide low cost, green energy. Some systems do have high capital costs but can provide savings on energy bills for up to 30 years.

It is now possible for excess electricity to be put back into the electricity grid. Currently in Queensland, electricity fed back into the grid is bought at the standard tariff rate of between 14 and 20c per kWh. However, small solar power generators (consuming less than 100MWh per year, approximately 10 times the size of residential use) may now be eligible for the Solar Bonus Scheme which pays 44c per kWh for surplus electricity exported to the grid.

For more information visit: Department of Employment, Economic Development and Innovation www.dme.qld.gov.au/Energy

This scheme could potentially be extended to other forms of renewable energy generation and other sized systems in the future. Similarly, the Carbon Pollution Reduction Scheme (CPRS) could increase the viability of renewable energy generation as emissions free electricity. Refer to the *Greenhouse gas terminology (E3)* fact sheet for more information on emissions trading.

Renewable energy can assist companies in reducing their reliance on fossil fuel based energy.

Solar energy

Solar energy is particularly suitable for Queensland's climate and can be used for heating.

Solar hot water is suitable for a number of activities on site such as pre-heating of boiler feedwater and hand and boot washing, whilst the large roof spaces that are often part of a food factory are suitable for the installation of photovoltaic cells. Whilst solar systems have high initial costs, if they are properly designed, installed and maintained they have low operating costs.

Solar heating

There are several different types of systems depending on the requirements of the factory in terms of water use and space availability.

As part of the Climate Smart 2050 strategy, the Queensland Government announced that residential electric hot water systems will be phased out by 2010, with all new houses and replacement systems to have alternative heating systems installed such as solar, heat pump or gas.

Whilst this initiative currently does not apply to industry, access to electric hot water systems will reduce in Queensland as they are taken off the domestic market.

Solar heating – flat plate collectors

Heat energy is absorbed by water (or other fluid) passing through the flat plate collectors and can provide water with temperatures up to 70 °C.

Usually copper tubes attached to a dark-coloured metal absorbing plate are enclosed in a clear glass or plastic weathertight housing to maximise heat absorption.

A two square metre panel produces on average approximately 5 kW of heating energy per day and costs around $1,000 per panel. Twenty panels are required to heat 15 kL of boiler feed water from 20 °C to 70 °C. The payback period for 20 panels is approximately six months.

Solar heating – evacuated tube collectors

Although more expensive than flat plate collectors, evacuated tube collectors can achieve water (or other carrier fluid) temperatures of up to 170 °C.[1]

The tube collectors consist of a glass outer tube and an inner metal tube connected to a fin which is covered in a high-absorbing low radiant heat loss coating. A vacuum is formed by removing air from between the glass tubes decreasing heating losses. The high efficiencies and high temperatures that can be achieved make them appropriate for industrial applications.[2]

For more information visit: Department of Environment and Resource Management, Solar Hot water, www.epa.qld.gov.au/publications/p00399aa.pdf

Solar power – Photovoltaics

Photovoltaic (PV) systems are becoming more widely used in both residential and commercial sectors as renewable energy systems become more economical.

PV systems consisting of semiconductors such as silicon, absorb energy from sunlight and transform it into electricity which is passed to an inverter that converts it into AC electricity for use. Although energy is required to manufacture PV cells, after the first few years it has generated more than was used to manufacture, providing emission free energy for the next 15-20 years.

It is envisaged that PV systems will be affordable for residential applications within 10 years, and the Australian Department of Environment, Water, Heritage and the Arts has been providing rebates to assist with this.

PV cells could be a viable option for companies with large roof space.

For commercial applications PV systems are still not a financially viable option and there are currently no rebates available. This may change as energy prices rise and the CPRS increases the viability of emissions-free energy generation. Refer to the Greenhouse gas emissions (E3) fact sheet for more information on emissions trading.

PV systems not only avoid the need to purchase electricity from the grid but they can also include the option to sell power to the grid as 'green energy'. Under the current national scheme there is also the opportunity to purchase 'renewable energy certificates'. The use of PV cells, especially the ability to sell back into the grid, may become more profitable when the CPRS is introduced if electricity prices increase.

Future PV options might see third party rental of factory roof space to install PV cells for electricity generation, potentially sold back to the food company at a reduced rate, with surplus electricity fed back into the grid.

In addition, the feed-in tariffs for the net export of energy back into the grid for domestic supplies is now 44c/kWh. If this tariff were extended to industry, it would make the system more affordable.

Promising new technology may make it possible for the solar modules to be applied as a thin film to coat building materials. They could then be integrated with building materials such as roofing and windows to reduce costs. Other emerging technology uses less silicon which may reduce the cost of the technology making it a more suitable option for industry.[3]

[1] and [2] United States Department of Energy, 2006, Energy Efficiency and Renewable Energy, Solar Energy Technology Program, www1.eere.energy.gov/solar/sh_basics_collectors.html#evacuatedtube
[3] Origin Energy, SILVER Technology, www.originenergy.com.au/1234/About-us and www.sliver.com.au

TOWNSVILLE SOLAR CITY [4]

Townsville is taking part in the Solar Cities Program with funding from the Australian Government, Ergon Energy, the Queensland Department of Mines and Energy and a consortium including Townsville City Council. Townsville faced having to upgrade the energy generation and distribution network due to population growth but is now aiming to save 47 GWh of electricity and reduce greenhouse gas emissions by 50,000 tonnes through energy efficiency, demand management, solar power and education.

The project is lead by Ergon Energy with support and involvement from local companies and residents. The main activities of the project include:

- installation of solar panels on 500 residences and businesses
- installation of 1,700 smart meters
- 2,500 participants assisted in energy efficiency and demand management
- energy tariffs and incentives to reduce peak demand
- informing residents and companies about energy management and efficiency.

Solar thermal power

An emerging technology being trialled in Cloncurry in north west Queensland is a 10 MW solar thermal system, where mirrors focus solar energy onto graphite blocks. Water is passed through the blocks, where it is converted to steam and used to generate electricity through a turbine. This may prove to be an effective solution to meet industry energy needs as the energy can be stored within the graphite block and accessed 24 hours a day due to the high storage temperatures in the block.[5] Whilst this large scale trial is to supply energy to the whole of Cloncurry, future development may result in smaller scale applications.

For more information visit: Clean Energy Council www.cleanenergycouncil.org.au

University of New South Wales (UNSW), Future Students – What are Photovoltaic Devices? www.pv.unsw.edu.au/future-students/pv-devices/how-they-work.asp

Wind power

Wind power is becoming a feasible option for large energy users.

Wind generator, or turbine, capacities range from less than 100 kW to over 6 MW. A 2 MW system can generate over 6,000 MWh of electricity every year, providing sufficient energy for over 850 homes.[6] The average house requires between 5 and 10 kW to meet its needs,[7] but larger systems are more efficient in converting energy.

Wind systems convert the power in wind to energy which is either stored in batteries for later use or connected to the grid and sold back as surplus power. Wind systems have the benefit of no water requirement during operation and allow power to be stored for use when there is limited wind.

However, they need to be located away from obstacles, on towers at least 40m off the ground. They can generate noise so may not be suitable for factories located near sensitive areas and are dependent on wind so are not suitable for all areas. [8]

Technology is improving to reduce the capital cost of the turbines per MW of energy generated and operational costs are low as there is no need for fuel.[9] There are some maintenance costs due to the moving parts in the turbine, however these costs may become more affordable as electricity prices continue to increase and as demand for renewable energy increases and emissions trading occurs.

[4] Australian Government Solar Cities, 2008, Townsville: Queensland Solar City, www.townsvillesolarcity.com.au/; Australian Department of Climate Change, 2008, Townsville Solar City, www.environment.gov.au/settlements/solarcities/townsville/index.html
[5] Frew, W., 5 November 2007, Cloncurry so hot it doesn't need coal, Sydney Morning Herald
[6] Auswind, 2006, Why wind energy works, www.auswind.org/downloads/factsheets/WhyWindEnergyWorks.pdf
[7] Texas State Energy Conservation Office, 2008, Small wind systems, www.seco.cpa.state.tx.us/re_wind_smallwind.htm
[8] Clean Energy Ideas, 2007, Advantages and disadvantages of wind energy, www.clean-energy-ideas.com/articles/advantages_and_disadvantages_of_wind_energy.html
[9] The Australian Institute of Energy, 2004, Fact Sheet 7: Wind Energy, www.aie.org.au/facts_index.htm

WINE POWERED BY WIND – ELGO ESTATES WINERY, VICTORIA

A winery in Victoria purchased a 150 kW wind turbine and now generates 1,000 kW, twice its daily energy requirements, feeding enough excess energy back into the grid to power 34 houses. Legislation is currently waiting to be passed that will pay Elgo Estates for that power reducing the payback period. With the current arrangements, the payback period for the turbine is 10 years. [10]

For more information visit: Department of Environment and Resource Management, Wind Factsheet www.epa.qld.gov.au/publications/p00401aa.pdf/Wind.pdf

Auswind part of Clean Energy Council, www.auswind.org/main.php

Geothermal power

Geothermal energy is a means of converting the heat from within the earth into a useful energy source. This thermal energy can be tapped in two ways.

Hot dry rock technology pumps water into an underground granite seam which reaches temperatures of up to 3,000°C.[11] The water becomes superheated and returns to the surface to be used as steam in standard steam turbines to generate electricity. Initial studies indicate Australia has sufficient underground granite at a suitable temperature to satisfy its entire electricity demand.[12]

A second means of tapping this energy is by using **sub-artesian bores** to obtain water at a higher temperature. Birdsville currently generates the majority of the town's electricity by this method.[13] The benefit of this system is that both energy and water are obtained. The energy can be extracted from the water through a turbine or alternatively, the water can be used directly for activities within the process that require high temperatures, such as cleaning.

For more information visit: Department of Environment and Resource Management, Geothermal Energy, www.epa.qld.gov.au/register/p00395aa.pdf

Clean Energy Council, 2007 All about Geothermal Energy, www.cleanenergycouncil.org.au

WATER AND ENERGY SAVINGS FROM GEOTHERMAL POWER

Midfield Meats in Warrnambool, Victoria is a large abattoir using up to a third of the towns water demand in summer. Syncline Energy investigated the possibility of taking water from the ground to provide both water and energy benefits to the company.

The bore water would be extracted at 45°C and treated using reverse osmosis before being used in the plant as either general washdown or pre-heated water for the steriliser circuit. The capacity will be approximately 1ML of water every day providing $300,000 in savings every year in water and energy and reducing carbon dioxide equivalent production of 1,116 tonnes per year, the equivalent to 250 cars.[14]

This series of fact sheets provides examples and suggestions to the modern food processor on how to achieve both economic and environmental benefits from eco-efficiency. Visit the project website www.ecoefficiency.com.au for more ideas and case studies.

[10] Elgo Estate Wines, 2005, www.elgoestate.com.au/Sustainability.cfm Charles, E., October 2007, "Green and profitable" The Australian Business.
[11] Clean Energy Council, 2007, All about Geothermal Energy, www.cleanenergycouncil.org.au
[12] Clean Energy Council, 2007, All about Geothermal Energy.
[13] Department of Environment and Resource Management, September, 2007, QSEIF Birdsville Geothermal Power station, www.epa.qld.gov.au/publications/p00834aa.pdf/Birdsville_geothermal_power_station.pdf
[14] Syncline Energy Pty Ltd, 2006, Utilising geothermal energy, www.aie.org.au/melb/material/geothermal/galloway.ppt

ISBN: 978-0-9775169-7-1

The eco-efficiency for the Queensland food processing industry project is an initiative of the Department of Employment, Economic Development and Innovation and the Department of Environment and Resource Management with technical information provided by UniQuest through the UNEP Working Group for Cleaner Production.

This series of eco-efficiency fact sheets will demonstrate the importance of water in a modern food factory and suggest areas where savings can be made. The project website www.eco-efficiency.com.au has more ideas and case studies on water savings across the food industry.

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SD5934 02/10