Responding to electricity cost increases

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Electricity costs have been on the rise with increases this year of between 16% and 36% for Provisor clients, with up to 60% reported as companies come out of long-term contracts this year.

Domestic electricity bills are also rising, with increases of 16% in Queensland and 18-21% in NSW in July this year and 78% in West Australia over 2009 and 2010[1]. These increases are due to capital upgrades, increases in the cost of electricity generation and distribution, changes in electricity market pricing behaviour and drought.

Electricity also accounts for up to 90% of facility[2,3] greenhouse gas emissions produced by wineries.

Further electricity cost increases with the introduction of the Carbon Pollution Reduction Scheme

Estimates by treasury, based on the market value of carbon credits at $20/tonne, suggest that the Carbon Pollution Reduction Scheme (CPRS) will add 17 to 24% to the cost of electricity.[4]

Even if the CPRS is not implemented in its current form, or even at all, we should be anticipating some sort of carbon taxation. International pressure is mounting with the US developing standards and European concern that climate change is at the high end of predictions. It is prudent to expect an electricity cost increase from carbon regulation of at least 10%.

At the time of writing (July 2009) the CPRS has been delayed in the Australian Senate.

Impact of global financial crisis on coal prices

77% of Australia's electricity comes from coal fired power stations and with commodity prices falling it is possible to hope that this aspect of electricity pricing will fall. However, the price of thermal coal (used for electricity generation) is not falling due in part to forecast demand. There is no reason at this stage to expect any relief in electricity prices from falling coal prices. Currently, 200 Gigawatts of new coal fired power plants are being built internationally, supporting recent strength in thermal coal prices with thermal coal price indexes showing only a small impact from the global crisis.

Responding effectively to price rises

In a 2005 New Zealand Winegrowers energy audit (level 1) that surveyed 22 wineries (53% of the NZ crush) the average electricity use was 435 kWh per tonne crushed[5]. The variability between sites was substantial, with the highest at 2066 kWh per tonne crushed and the lowest at 133 kWh. This shows the clear opportunity for the less efficient electricity users to make significant savings.

Clients who have recently had their energy use audited by Provisor have seen easily implemented savings of over 15% of current electricity consumption. These savings come from tariff management, power use management and improving operational efficiency. Similarly, in 2003 the then Department

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[1] The market regulators for these markets have recently published their price increase data.

[2] A guide to energy efficiency innovation in Australian wineries (2003) Commonwealth of Australia reported 60 to 75%, however recent greenhouse gas accounting work by Provisor has found values as high as 80 to 90%.

[3] Based on scope 1 and 2 greenhouse gas emissions – those emissions over which wineries have direct control, but excludes greenhouse gases from inputs, packaging or transport.

[4] *Australia's Low Pollution Future: The Economics of Climate Change Mitigation* (2008) Commonwealth of Australia. www.treasury.gov.au/lowpollutionfuture

[5] Improving energy use in the wine industry: Stage 1 project report http://www.nzwine.com/assets/Improving_Energy_use_in_the_wine_industry_stage_1_report.pdf

of Industry Tourism and Resources found that savings of 15-30% and more were available in wineries.[6]

Companies have a range of strategies available to manage electricity costs, both from a demand management and cost management perspective. These include:

- Auditing and developing a cohesive energy strategy;
- Operational change –
  - Improvement in operational efficiency to reduce electricity use or improve electricity use patterns,
  - Investment in capital to improve equipment efficiency, and
  - Improving load factors on major equipment;
- Tariff management; and
- Alternative generation such as substitution, co-generation and tri-generation.

Auditing electricity use

Level 1, 2 and 3 Energy Audits

An external audit is a valuable tool to identify opportunities to reduce energy use through operational changes, capital improvements, load factor optimisation, tariff management, maximum demand reduction, and changing the electricity supply mix. It is an inexpensive tool used to establish a framework to make significant electricity cost savings.

AS/NZS 3598:2000 specifies three levels of energy audit, and is an effective starting point for developing an understanding of the opportunities to reduce electricity usage. Most consultants audit to this standard. The three levels are shown in Table 1.

Table 1. Levels of Energy Audit as defined by Australian/New Zealand Standard 3598:2000 (AS/NZS 3598:2000)

	Level 1 Energy Audit	**Level 2 Energy Audit**	**Level 3 Energy Audit**
Audit Location	Remote (desktop)	On Site	On Site
Detail	Overview	Process equipment detailed by type and equipment name plate. Metering of individual equipment may be included.	Detailed metering down to half hourly intervals on significant individual process equipment.
Performance Indicators	Site wide	Main processes	All processes
Report	Verbal presentation and short report	Formal report	Formal analysis and report

A Level 1 Energy Audit is an excellent place for any business to start understanding the opportunities to improve their energy performance. It starts the business down the path of consolidating the information needed to improve energy performance, builds staff buy-in, will identify some high level opportunities and establishes the framework for subsequent work.

[6] A guide to energy efficiency innovation in Australian wineries (2003) Commonwealth of Australia.

Level 2 and Level 3 Energy Audits increase the resolution and detail of understanding operational performance and are necessary on more complex sites, particularly where large plant is in use.

In Level 2 and 3 Energy Audits, the energy consumption of major items of equipment can be temporarily metered with inductive meters to directly measure electrical energy consumption.

For companies with electricity bills of around $30,000 to $35,000 per annum a Level 1 Audit is expected to generate a positive return.

Operational Experimentation

Conducting on-site experiments is an adjunct or alternative to site auditing. There are two major tools to conduct experiments in operations:

- Installing temporary metering on items of equipment and/or areas within wineries with power meters to break power use into smaller units than is available from site metering; and
- Conducting “smart meter” experiments at the metered area level.

We have been able to use temporary metering of areas, sub-areas and individual items of equipment to ask questions about current operational practices. Electricity use can readily be measured and current practices reviewed against alternative practices and efficiencies identified. There are often assumptions made about performance of areas and items of equipment that can be quickly reviewed and often easily modified. Temporary metering requires the installation of portable inductively based meters that are left in place for a period of time from hours to weeks, and are effective on small and large operations.

The second operational “experimental tool” is the smart meters that are on many winery sites. Smart meters record data every half hour, meaning that, with appropriate design and data analysis, large-scale experiments can be conducted and the electricity use and cost data quickly analysed. These experiments require care and good data management, but large scale practices such as refrigeration control can be tested live and “on the grid”.

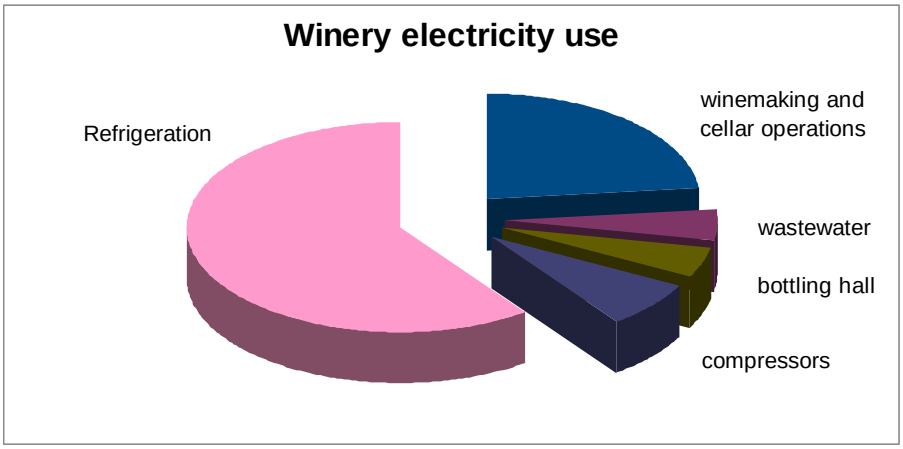
Reducing Electricity Use

Electricity use can be attacked through operational change and capital replacement programs. Operational changes alone will typically yield savings of over 15%.

Operational Management

Figure 1. shows relative proportions of electricity use in a winery, based on Provisor’s experience of site energy and greenhouse gas auditing. There are clear opportunities in refrigeration, compressors and wastewater treatment plant. Within winemaking and cellar operations there are particular opportunities in lighting and in the operation of major items of equipment.

Figure 1. Example of a winery electricity use breakdown



At every winery there are different opportunities depending on the unique mix of products, equipment and practices of the business. Examples of operational electricity consumption savings opportunities include the following.

- Switching to off-peak power, for example by rearranging cooling schedules in multiple stage cooling systems. This has the added benefit of cooling at night, when less cooling energy is required.
- Ensuring fixed speed pumps and motors are efficiently loaded against equipment performance curves.
- Changing warm-up and warm-down practices on major equipment items – individual item power measurement can facilitate significant performance savings. Major consumers of power include centrifuges, RDV's, filters crushers and compressors.
- Changing lighting to more energy efficient globes. Tank farms can consume significant lighting energy.
- Scheduling to minimise equipment start-ups and shut downs.

Making these changes can be readily facilitated by either using temporary metering and/or using smart meter based experiments.

Capital Improvement

Capital change can have very short pay-back periods, depending on the age and state of equipment. Not all capital changes are expensive or complex and many may have been identified for maintenance, safety or age reasons already.

Capital improvement opportunities include the following.

- Replacement of underperforming equipment. Payback periods on reduced maintenance costs and electricity consumption may be very short.
- Installation of variable speed drives and soft start motors.
- Changing coolants and optimising and modifying coolant reservoir operation to reduce warming of coolant and optimise cooling practices with off-peak electricity use.
- Various modifications of refrigeration systems which can include changing pumps, compressors, reservoir sizes, zoning of brine lines and coolants.
- Installation of power factor correction equipment.
- Installation of insulation on refrigerated tanks.
- Recovery of waste heat and waste cold. A good example is the recovery of cooling from cold stabilisation to cool wine moving into cold storage. There are significant opportunities for waste energy recovery in wineries.
- Supplementary solar and wind power generation.
- Installation of supplementary gas, solar or wind power to "peak-shave" maximum demand, reducing electricity tariff.

Power Factor Correction

Power Factor is important on pumps, motors, condensers, compressors and transformers with windings that draw an inductive load.

Power Factor is the ratio of active power to apparent power. Active power is the power used by equipment and apparent power is the power that has to be delivered to make it work. When apparent

power is greater than active power the power factor is low and suppliers have to deliver more power than is required to make the equipment work. Power factor correction synchronises active and apparent power to maximise power efficiency and minimise the useless power that is delivered to site.

An analogy is a stream that is used to drive a paddle wheel where the level in the stream has to be a certain height to drive the wheel. In an inefficient system the stream is much wider that the paddle and a high flow of water across the width of the stream maintains a suitable level for the paddle to operate. It would be more efficient for the stream to be the same width as the paddle wheel and less water would have to flow along the stream to make the paddle do the same amount of work.

Effectively, if Power Factor is low, electricity suppliers have to deliver more power to you than you need to make up for the inefficient utilisation of the power flow to your site.

Some electricity providers charge industrial customers on the basis of power factor via either kilovolt amps (kVA) metering – rather than kilowatt hours (kWh), or charge power factor based tariffs.

Tariff Management

There are significant opportunities to reduce electricity costs through active tariff management strategies in addition to the operational optimisation of switching from peak to off-peak power consumption.

Active retail contract negotiations

There are potentially considerable savings from actively negotiating electricity contracts and/or putting your electricity contract to tender. Even whilst in a long-term contract, alternative contracts can be reviewed, either for when a current contract expires, or it may be more economic to break and pay early exit charges.

To support a program of active contract management, separating metering contracts from electricity supply contracts is useful. This may not result in direct cost savings, but if you change electricity supplier, it will maintain the integrity of meter data, which would otherwise be lost when retailers are changed.

Some metering suppliers also partner with active contract management companies or provide active contract management proactively capturing and reporting meter data, reviewing optimum pricing strategies and providing active review of operational consumption peaks.

If the value of maximum demand (see below) used by an electricity supplier in calculating tariffs is clearly an anomaly, it is also possible to re-negotiate the maximum demand component of billing with suppliers and this should be considered.

Maximum demand

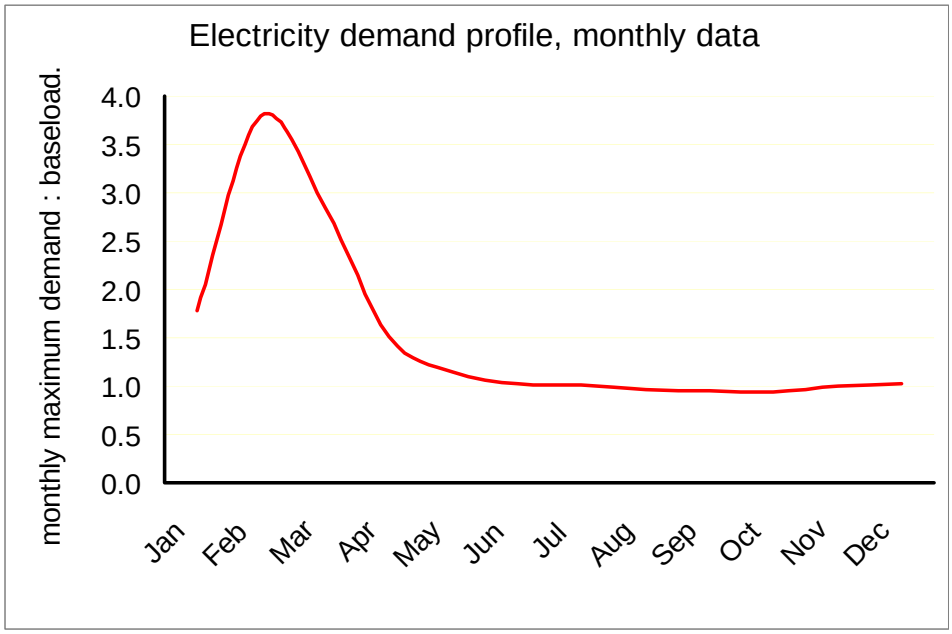
Electricity costs for companies with bills over $50,000 per annum are typically made up of:

1. Consumption charges with both peak and off-peak components
2. Network charges, consisting of:
    a. Network access charges, with both peak and off-peak components
    b. A maximum demand charge
3. Other charges that include access charges, metering charges and statutory charges

Maximum demand is the highest sustained 30 minutes of electricity consumption for the year and maximum demand components of billing are based on this amount. It accounts for around 20% to 40% (typically 30%). Figure 2 shows a ratio of monthly electricity demand to base demand for a typical winery. The ratio of monthly maximum demand to base load can be over four times higher during vintage at many wineries. The half hour maximum will be even higher than the maximum monthly peak.

Minimising maximum demand by substitution of alternative electricity sources to “peak-shave” demand during vintage and managing resources actively to minimise maximum demand can both be effective.

Figure 2. Ratio of monthly electricity demand to monthly baseline demand



Substitution, Co-generation and Tri-generation

Substitution, co-generation and tri-generation are all strategies to use advanced technology or to replace existing sources of electricity to reduce overall use.

Substitution

Substituting an alternative source for metered electricity can be done for several reasons:

1. To substitute a more environmentally friendly process such as solar or wind, with the benefits of:
   - Reducing carbon footprint; and/or
   - Matching the environmental aspirations of owners and brands.
2. Reducing maximum demand by the substitution of gas, solar or wind during vintage peaks.

During vintage electricity consumption peaks, installation of on-site generation capacity with gas, solar or wind can all reduce maximum demand for grid electricity by “peak shaving”. Solar energy also peaks around vintage, so solar can be a good option and in some regions wind energy also is high in summer and autumn. Simple substitution of gas to minimise peak demand can be an effective cost reduction strategy with short payback periods.

The payback period for solar and wind systems can often be lower than many companies calculate, when maximum demand is taken into account. Reductions in maximum demand costs should be included with transmission charges and in consumption charges when conducting cost benefit and payback period analysis.

Substituting “off the grid” sources of electricity specifically to reduce maximum demand is referred to (inaccurately) by some suppliers as co-generation.

Co-generation and tri-generation

In a winery installing a gas-fired plant to peak shave maximum demand, there would also be opportunities for co- and tri- generation.

Co-generation is the simultaneous production of heat and power and is the process where a power generation source is used for supply of heat in addition to electricity. An example is a power station that generates electricity and also uses waste heat as a source of water heating or steam generation. This process is reasonably common in Scandinavia, Eastern Europe and North America.

Waste heat can also be used in absorption chillers for cooling, and a plant that produces electricity, heat and cooling is referred to as a tri-generation plant.

Grant opportunities

There are several pathways to obtaining government support for energy efficiency initiatives. Companies may be interested to look at *Enterprise Connect*[7] which allows organisations to identify key business issues then co-funds improvement opportunities through provision of external support[8] such as energy auditing.

In NSW the *Sustainability Advantage Energy Saver*[9] program gives significant support to businesses interested in understanding energy efficiency, including 80% of the cost of a Level 1 Energy Audit, 70% of a Level 2 and 50% of a Level 3 Energy Audit. To be eligible you must be an active *Sustainability Advantage Partner.* Partners are part of a group or cluster of companies that have a regional, industry or supply chain interest.[10]

Re-Tooling for Climate Change

There are opportunities to obtain federal government support through the *Re-tooling for Climate Change* program, which is designed to "help small and medium sized Australian manufacturers reduce their environmental footprint, through projects that improve the energy and/or water efficiency of their production processes". Grants are between $10,000 and $500,000, with government funding up to half of the cost of a project.

Details of projects that have received grants are published on the AusIndustry website[11]. Wine companies that have received grants include D'Arenberg to upgrade insulation on wine storage tanks and Belgrave Park to install solar electricity. Other grants that are of interest have been for installation of power factor correction equipment, rainwater harvesting and storage, capture and treatment of stormwater, various water efficiency projects, process improvement and waste minimisation.

The next two rounds of *Re-tooling for Climate Change* close on August 24 and November 30, 2009.

Summary

Electricity price rises are inevitable, independent of the Global Financial Crisis and Carbon Trading schemes. Carbon trading will simply add to the increases that are already in the pipeline.

Wineries have significant opportunities to reduce the overall impact of price rises and potentially make significant reductions in electricity costs. Opportunities include:

- Getting to grips with the issues and opportunities through energy auditing;
- Conducting operational experiments to identify opportunities through inductive temporary metering or "smart meter experiments";
- Modifying operational practices to reduce the electricity demand of operations;
- Implementing capital programs to address electricity cost issues, with some of the options having very short payback periods;

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[7] www.enterpriseconnect.gov.au
[8] Note that Provisor is a registered service provider to Enterprise Connect
[9] http://www.environment.nsw.gov.au/sustainbus/energysaver.htm
[10] Note that Provisor is a registered service provider to Sustainability Advantage
[11] To view Re-tooling for Climate Change on the web go to www.ausindustry.gov.au then click on **Innovation and R&D** then click on **Re-tooling for Climate Change**.

- Implementing “active tariff management”;
- Implementing meter data interpretation and reporting;
- Identifying opportunities to reduce maximum demand through re-negotiation, “peak shaving”, operational change and capital improvement;
- Substituting alternative electricity sources; and
- Implementing co- or tri-generation where gas fired “peak shaving” or other on-site generation is used.