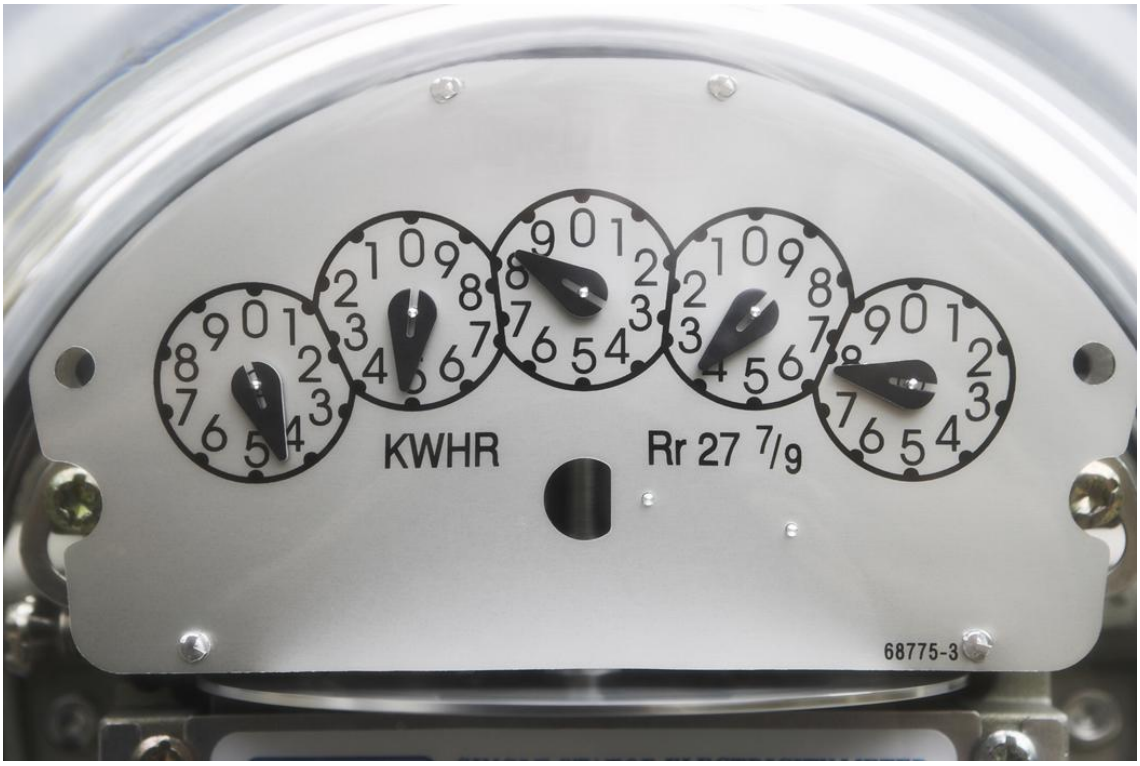
Energy management in Victorian industry:

the challenge of the future.



Interviews with Victoria's largest industrial energy users who reveal their attitudes, their needs and their actions.

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from green to gold

CONTENTS

EXECUTIVE SUMMARY

Australia is moving towards a low carbon future and the implications of this move are huge. This is especially important in Victoria, where energy is based on brown coal and the cost of electricity is forecast to more than double in price by 2013. The increasing price of power will open up many opportunities for companies to benefit from a market which is estimated to reach AU$5-15bn by 2015[4]. These figures do not include the value created by Energy Efficiency and Distributed Energy services, which is the market developed by Government regulations following an increased awareness of climate damage caused by carbon emissions. Federal and State government regulations are attempting to boost energy efficiency and reduce carbon emissions.

The primary objective of this research was to identify the most significant energy needs of medium and large organizations as they adapt to the emerging carbon economy. The research had a special focus on the energy management activities of the 200 largest energy consumers in Victoria.

It is important to note, that all the companies had at least 1 PTE assigned to environmental/sustainability tasks with 20% having more than 1FTE in the environmental department and all of them had environmental functions in their roles descriptions. While these companies' appear to have taken some action, mainly motivated by regulation and risk management, more than 70% of these companies had only implemented small projects with paybacks of 12 months or less; such as projects involving operational improvements or capital replacement or minor investments and not engaged in advanced technical projects.

In regard to energy efficiency, the biggest challenge that companies are facing is to identify, understand and quantify the opportunities. So far, companies have taken a static approach, which simply means identifying obvious energy waste through an external audit and then conduct isolated improvement projects based on the investment required and estimated payback.

A small group of companies has taken a continuous improvement approach to energy management where they: monitor and analyze their consumption patterns, implement efficiency control measures and embed energy management into everything they do. These companies have created an energy management policy, appointed a single responsible for energy management, set up monitoring and reporting systems and made users accountable for their consumption. These companies are enjoying far greater benefits than the others.

The research found energy managers wanted precise energy sub-metering and monitoring. This suggests that companies are aware that a change in approach is needed and that a long term solution involves making energy visible and everyone accountable for their usage and wastage.

As companies get more serious about managing energy, they look towards a continuous improvement process embedded into the corporate culture and see many rewarding energy efficiency opportunities. As company resources are used wisely and waste diminishes, the impacts on society will be immense and future generations of Australians will benefit.

INTRODUCTION AND BACKGROUND

Australia has proposed a carbon reduction scheme and new Government regulations are challenging organizations to adapt to the new carbon economy.
Some of these low carbon regulations are: Energy Efficiency Opportunities (EEO), Victorian Environmental and Resource Efficiency plans (EREP), National Greenhouse Emissions Reporting Act (NGER), and the coming Carbon Pollution Reduction Scheme (CPRS)

The first two regulations: EEO and EREP are already implemented and aim to support the largest energy using businesses to improve efficiency and performance[1]. EEO is mandatory for large energy using corporations across Australia, consuming more than 0.5PJ of energy per year. EREP is directed to commercial and industrial sites located in Victoria, using more than 100TJ (0.1PJ) of energy per year or 120 ML per year of water. The NGER came into effect in September 2007; its objective is to introduce a single Australian framework for the reporting of greenhouse emissions[2]. The CPRS's goal is to create one of the globe's most advanced emissions trading regimes by 2011[3] and reduce carbon emission by at least 5% in 2020. Additionally, organizations are looking to improve their image by achieving "green" certifications like: Carbon Neutral, Zero Emission, Zero waste, Zero Potable Water Usage, and subscribing voluntarily to the Carbon Disclosure Project (CDP) [3].

This new scenario has opened the opportunity to develop and implement carbon and energy management strategies in order to participate in a market estimated to reach AU$5-15bn by 2015[4], not considering the value created by Energy Efficiency and Distributed Energy services.

This research identifies the most significant and immediate needs of organizations to adapt to the emerging carbon economy, with special focus on the energy efficiency identification and implementation among the largest Victorian energy consumers all participating in the EREP program. The research goal is to understand what EREP registered companies have done in terms of resource efficiency, what their main challenge is, what kind of service would be their highest and immediate interest, and who are the decision makers developing resource efficiency projects.

MATERIALS & METHODS

In July 2009, there were 185 companies with 200 EREP registered sites. The research focused on these sites.

The research is based on the responses randomly obtained from a sample of 30% of the EREP registered companies; 85% of the companies that replied to the interview were from the manufacturing industry, 8% from the commercial industry, 5% from the oil and mining industry and 2% from the transport and storage industry.

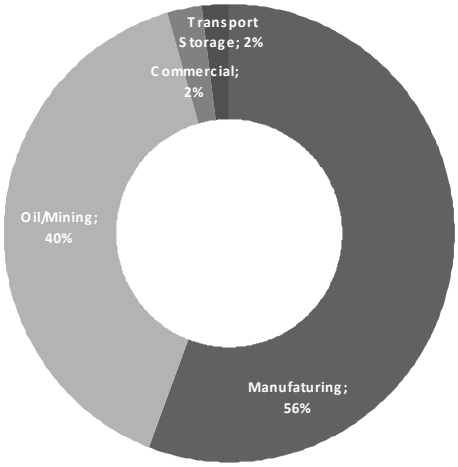
Information was obtained through telephone interviews with Environmental Managers (EM) or the manager responsible for energy efficiency and/or environmental compliance. Answers were received by phone and/or email.
Further information was obtained through the EEO reports submitted by some companies registered at EREP.

THE RESEARCH

Information from the major energy consumers in Victoria

The sampled companies can be classified accordingly with their activity as: manufacturing (61%), commercial (17%), oil/mining (10%), transport and storage (5%), generators (5%), and others (2%). (Figure 1)

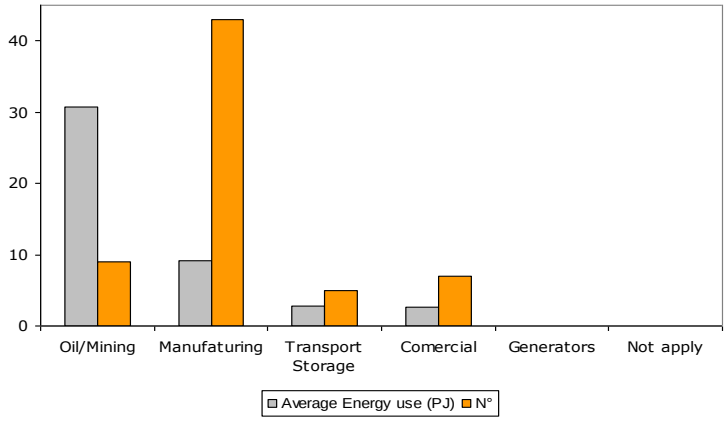
Figure 1. Victorian major consumer's classification



35% of the 185 companies are registered at EEO and have submitted a public report including an energy consumption assessment. As part of the program, the participants had to baseline their energy use, gather data on at least 80% of the corporation's energy use, undertake Energy Efficiency Opportunities assessments over a five year period, and report to the Government on a minimum of three Energy Efficiency Opportunities.

The total energy usage of the companies registered in both EREP and EEO was 541PJ (not including Qantas), in this EREP/EEO group, manufacturing companies accounted for 56% of the energy use, oil and mining accounted for 40% and commercial and transport accounted for 2% each. It is important to note that oil and mining represented 14% of the EREP/EEO registered companies. In terms of average energy use, they are the highest consumers with an average of 30.67PJ. (Figure 2)

Figure 2. Energy use per industry type



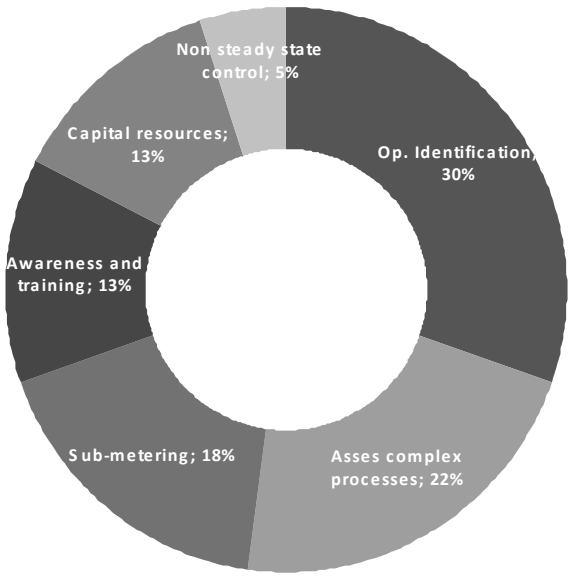
The challenge to achieve energy efficiencies

For almost one third (30%) of EM's, their biggest challenge was to "identify energy efficiency opportunities". Another 22% of EM's declared that to "understand complex processes" was one of the toughest challenges in resource optimization. An additional 18% stated "metering & monitoring" was a major challenge when it came to understanding how processes could be improved.
Employee's awareness and capital were other challenges that concerned 13% of EM's, while 5% of EM's struggled with non-steady state control (a huge problem in facilities with extremely high energy consumption). (Figure 3)
The first three categories lacked the measurement information to develop resource optimization. These categories comprised 70% of the responses and showed why companies are not investing in technical projects, which may have a longer payback but can provide the next big step to improve energy usage and resource performance.

Identifying energy efficiency opportunities was the approach taken to deal with the problem. Companies are starting at the wrong end; they first try to identify opportunities, then attempt to understand the processes and finally, to look for detailed information. This drill down methodology better suits a reactive rather than a proactive approach and doesn't suit cost-effective energy management.

It is advisable to start from a different angle, firstly, understand how the processes work as part of a whole system, secondly, monitor the important areas to establish trends and behaviors, and thirdly, work on these areas to continuously improve the process efficiency.

Figure 3. Energy management challenges



Energy and resource efficiency actions

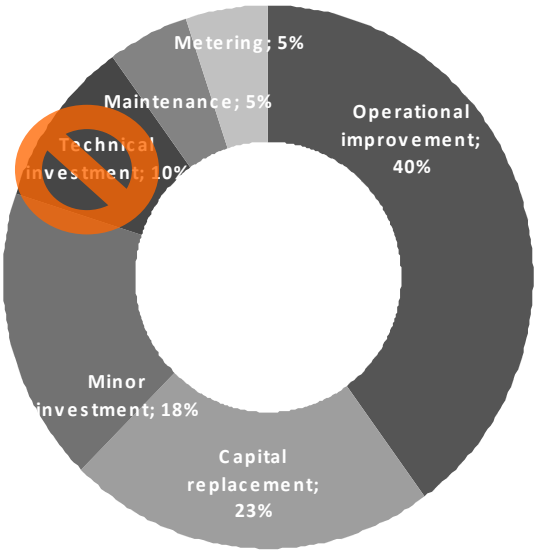
The resource efficiency projects undertaken by the interviewed companies were classified as follow:

- **Operational Improvements**: Process optimizations, change power factor, adjust temperature setups, fine tune, shutdown equipment, awareness program
- **Capital Replacement**: Switch from diesel to LNG, VSD, change V-belts, install EE engines/rotors/fans
- **Minor Investment**: Lighting, steam generator improvement, insulation.
- **Technical Investment**: Heat recovery systems, co-generation systems, biogas recovery, electricity generation from biogas, processes automation.
- **Maintenance**: Compressor, compressed air leaks, steam traps detection and maintenance
- **Metering**: Any initiative that involve the installation of metering and monitoring system.

Of the interviewed EM's, 40% declared operational improvements as the main type of resource efficiency project, 23% stated capital replacement as their main resource efficiency project, 18% declared minor investment projects, and only 10% acknowledge technical investment. The balance was maintenance and metering projects with 5% each. (Figure 4)

This result shows that companies were in the process of identifying energy waste and inefficiencies and developing projects which mainly involved operational improvements. Some capital replacement and minor investments were isolated one-off projects that secured the easy wins on the shop floor. This approach is static and explains why maintenance was not considered as a major component and why few companies recognize the value of metering projects to assess energy usage. It is remarkable that only 10% of the projects involve technical investment, however, it is not surprising because these projects require evaluation of complex processes, accurate quantification and detail engineering design.

Figure 4. Energy efficiency projects undertaken



Taking control of energy consumption

At the moment, one third of companies manage energy by using sub-metering, however, 75% of these are large corporations consuming more than 0.5 pj and already subscribed to the EEO program. Trend benchmarking is used by 30% of companies where energy usage is related to production intensity. Another 18% use the information from the main meter provided by the electricity retailer, 13% control energy consumption through financial budgeting, and 8% practice benchmarking across multiple facilities. (Figure 5)

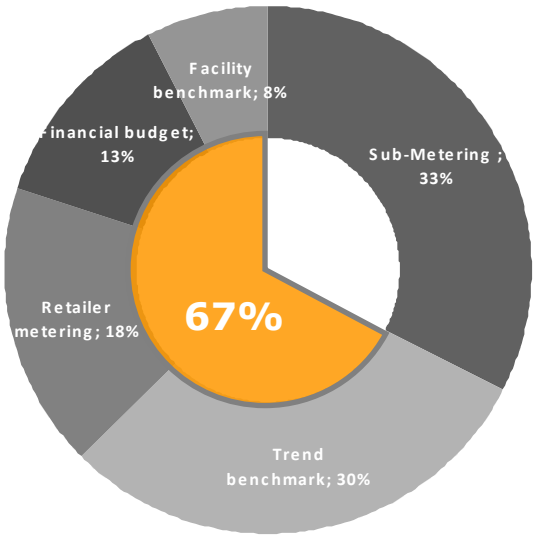
For the third of companies that already sub-meter energy consumption, there is a need to improve monitoring and the online access of required data. For the balance of companies, there is a strong need for both sub-metering and monitoring to better understand where and how the efficiencies should be allocated.

Companies registered in both EREP and EEO have stated that 15% of the developed projects are related to technical investments, due to a better level of results from sub-metering.

Monitoring, analysing and reporting energy consumption are three essential elements of an effective energy management strategy and must be used in conjunction with a well-designed information system.

To establish proper control over energy use, it is necessary to have information on energy flows and inputs across the entire organisation. When treated in this manner, energy use can be effectively managed in a similar way to other operating resources. Tight budgetary controls of energy consumption can reduce waste and establish a higher level of energy efficiency. However, cost controls alone don't provide the information needed to show whether energy is being used efficiently, or how it can be used more efficiently[7].

Figure 5. How are companies controlling energy?



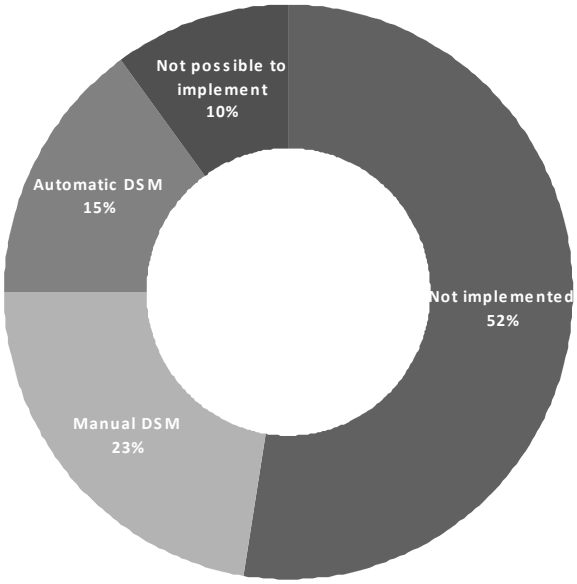
Demand Side Management (DSM)

DSM refers to the ability of electricity demand to respond to variations in electricity prices in the spot market and how customer participation in demand reduction programs supports the deferral or avoidance of network augmentation. It can be achieved through facility load reductions or the use of on-site generation. Its objective is to affect the load shape in order to achieve cost reductions. Large customers that can reduce their demand with prior notification are encouraged to do so, in return for both availability and dispatch payments.

Businesses have not been using their energy accordingly to the supply shortages and immediate price peaks. More than half of the companies do not practice DSM or are unfamiliar with the concept, 23% practice basic manual DSM for internal purposes to reduce their demand charges, only 15% apply automatic DSM responding to prices or some type of incentive program, and 10% state that DSM is not possible to implement due to the nature of the processes were the most significant loads are used.

The low participation on DSM can be explained by four main reasons; energy pricing is fully reflective of the costs, the disaggregated nature of DSM, the lack of company's data regarding their processes, and the scarce availability and promotion of DSM programs. (Figure 6)

Figure 6. DSM presence on Industry

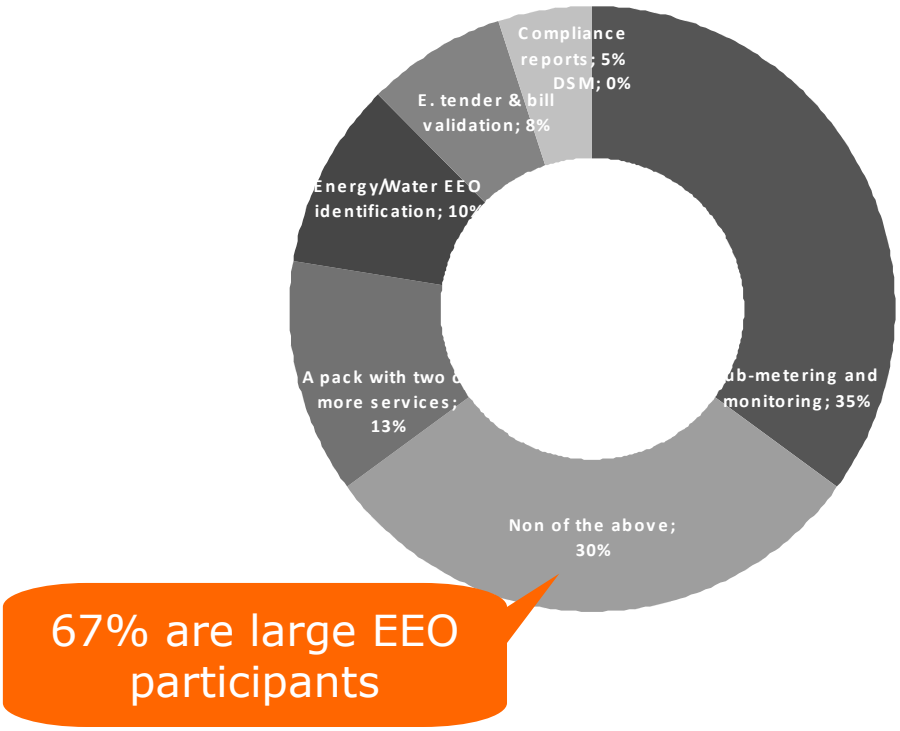


The energy manager wish list

According to the results presented here, one third of the interviewed EM's are interested in metering & monitoring services that help them identify, quantify, and implement resource efficiencies. Another third would not require any outsource service to achieve energy efficiencies, however 67% of the latter group are large energy consumers with a registered EEO program that are likely to have built the capabilities in house after years of program participation. The last third is composed by 13% with "a package of two or more services including sub-metering and monitoring", 10% that require "energy and water efficiencies identification", 8% who use "energy tender services", and only 5% with "compliance reports".

These results show how companies faced with the challenges of energy management are finding it difficult to assemble the full skill set and resources in-house. The low interest in reporting services and high interest in sub-metering and monitoring as well as identification of efficiency opportunities shows that companies understand the potential benefits of energy management and need accurate information to make the right decisions. They understand that short term, temporary measures are not going to achieve the results required to maintain their competitiveness in the market.(Figure 7)

Figure 7. Energy management interests



Decision making process and responsibility

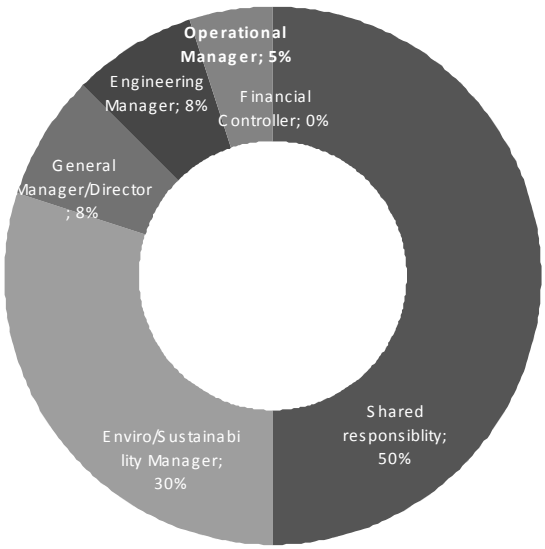
Energy and water usage is an executive responsibility for all the companies surveyed and an integral part of their sustainability strategy. The problem is that consumption and control in many organizations is a duty that involves different managers inside the organization such as General Manager, CFO, Financial Controller, Operations Manager, Engineering Department and environmental managers.

At a corporate level, 100% of the interviewed companies stated risk management was the main reason for engaging in sustainability in the first place, (risk is identified as non-compliance, cost increases and scarcity of raw materials), 30% indicated they had one PTE working on sustainability, 50% had one FTE and the other 20% had more than one FTE. In any case, the majority of their time was used in dealing with compliance and disclosure as well as corporate wide initiatives.

Almost one third (30%) of EM's were empowered to analyze, quantify, evaluate and take full action over energy and water projects. They also took full responsibility on energy and water consumption and compliance with regulations. All of the companies interviewed indicated that operations were engaged and had environmental functions such as energy management in their role descriptions but very few had created a special role in operations to do the job. In 70% of the cases the responsibility had been assigned to a senior engineer.

With no formal budget in 70% of the cases, money was allocated from other department budgets to cover auditing, monitoring and some specialist consulting services, so when the time came to implement projects it came down to payback evaluation with no priority against other projects. By not having a single manager responsible for energy management, decision making became complex and progress became challenging and slow. (Figure 8)

Figure 8. The decision makers



CONCLUSIONS

In the past, resources like energy and water were treated as basic, affordable and available commodities. With the current drought Victoria, pressure over fossil fuel energy and increasing climate change awareness, energy and water use has to be treated seriously. Federal and State government programs, such as EEO, EREP, and Water Maps are promoting the efficient use of resources by imposing energy consumption reporting obligations on the largest consumers. Regulations like RET, NGER and CPRS are aiming to reduce carbon emission by at least 5% by 2020[6] This will be achieved by increasing renewable energy targets in the grid, introducing more compliance obligations and creating a cost for carbon emissions; all this adds several layers of complexity and will drive energy prices up, especially in Victoria. Organizations will need to reduce energy consumption by implementing energy efficiency projects, as well as use metering and monitoring to reduce emissions in order to comply with regulations, lower risks, save costs and enhance their competitiveness.

The research conducted showed that the biggest energy management challenge is to identify efficiency opportunities, assess complex processes and measure resource inputs to the processes. The logic behind this problem seems to be a one-off project approach, where the opportunity is identified followed by analysis to quantify the opportunity. These three challenges are all parts of the same problem, the complexity of the processes and the lack of data make it difficult to determinate the potential of any opportunity making the identification of efficiency difficult, if not impossible, once the simple problems are solved. In terms of energy management, half of the companies didn't have a single person responsible for energy and water usage. This absence dilutes accountability, slows down the decision making process and fails to signal the importance of the initiative.

Less than 30% of the companies take a different approach, where energy efficiency is not a one-off project but a continuous improvement approach to energy efficiency. These companies control energy usage through sub-metering and monitoring; have a single manager responsible for energy and water consumption; aim to develop and implement energy efficiency projects; work to control their demand as a way to minimize their electricity bills; and integrate maintenance as part of their comprehensive energy management program. Interestingly, what all these companies have in common, is that they have identified not only the easy targets, but large opportunities which are already providing substantial benefits. The difficulties in identifying new opportunities is due to the need to continuously meter and monitor energy usage and appoint a single person with the authority to create a continuous improvement approach.

Our research clearly showed that the most required service by environmental managers is sub-meter and monitoring energy. Large energy consumers need to improve measurement and energy data analysis as a major step towards dramatically improved energy efficiency.

Most organizations are realising that a different approach is needed; that the continuous improvement philosophy needs to be applied company-wide; and that energy regulations will continue to grow, and should be seen in a positive light as a way to improve competitiveness and reduce the risks forced on every organization by climate change .

MOVING FORWARD

Over the next few years, Victoria will experience an enormous change in the way energy is generated and consumed, and every Victorian will feel the impact. Change brings with it challenges and opportunities, and its up to everyone to face them and succeed. The key to take advantage of these opportunities is preparation, and we can see from these research results, that while many of the largest energy consumers are already doing something, it is just the beginning of a journey of continuous improvement, where the status quo is challenged and the intangible is measured and quantified accurately.

To be prepared for the new energy world, industry needs to take it seriously and incorporate energy and resources into their strategic planning.

So what does a continuous improvement energy management strategy look like? At the very least, companies should ensure they are doing the following:

- **Organize management resources**
  Get commitment from senior management, establish accountability for and assign reasonable resources as well as reporting procedures
- **Appoint an energy manager**
  Appoint a senior staff member to be responsible for the overall coordination of the strategy and have them report directly to senior management
- **Prepare an energy management policy and set up targets**
  Include general objectives and specific targets, timeframes, budget limits, and resources
- **Establish an energy monitoring and reporting system**
  Make energy visible to the company. Implement a system to measure, aggregate, analyse and report on energy costs and consumption
- **Start an awareness and training program**
  Empower everyone to help reduce consumption. Communication is crucial to success, communicate the strategy's plans and report results to all staff and stakeholders
- **Identify energy savings opportunities**
  By understanding the energy use of each process, energy flows can be measured, and potential energy and cost savings identified
- **Prepare an abatement curve and plan of action**
  Develop a plan of action, set targets for energy savings that relate to specific areas of your organisation and include a project implementation timeline and state any funding and budgetary requirements
- **Implement efficiency projects**
  Implement the projects in order of priority as set out in the action plan and closely monitor the progress and outcome
- **Report and review results regularly**
  Review energy consumption regularly. Report results/progress to management and staff
- **Feedback into the strategy and set new targets**
  Review results at least annually and develop the new action plan and set targets for the following period.

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[1] EPA Victoria
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[3] PWC Carbon Ready…or not report
[4] Point Carbon CPRS Advisory Report; November 2008
[5] ESAA DSP in the National Electricity Market Draft Report; June 2009.
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CONTACTS

Enresco – energy management services

Enresco has been established to assist customers meet management and community expectations for them to reduce energy and water consumption.
Enresco brings together a holistic approach, strong engineering background and a value creation focus to deliver turnkey solutions through energy management programs tailored to maximise the opportunities available in your manufacturing business.

Acknowledgments
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