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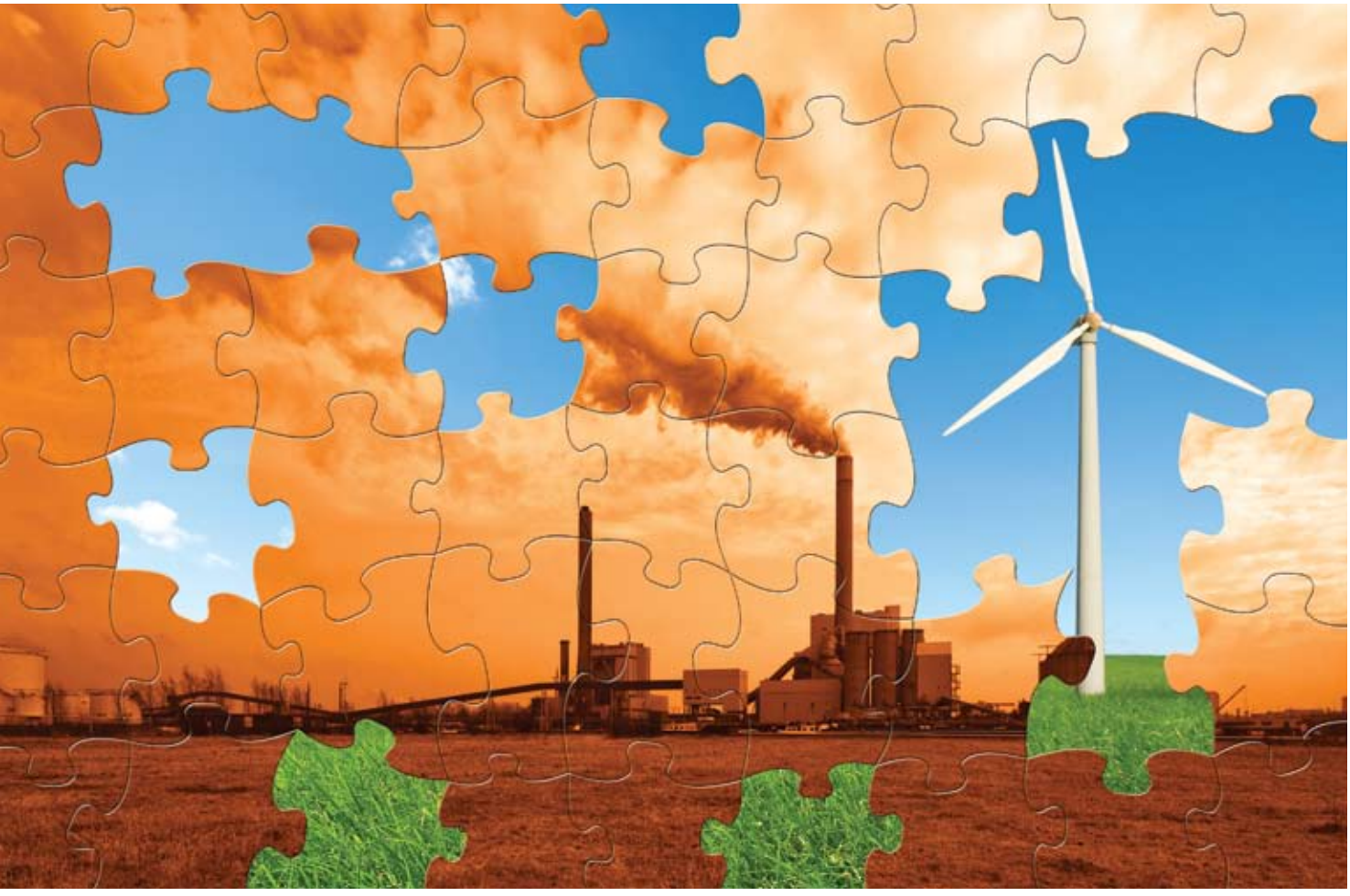
Sustainable manufacturing:
How you can make a difference

STEPHANIE CAMARENA REVEALS A FOUR-PHASE PLAN TO HELP MANUFACTURERS IMPROVE ENERGY EFFICIENCY.



Australia's manufacturing sector employs around one million Australians, generates 10 per cent of GDP, and exports over A$94 billion a year. Manufacturing is the largest domestic user of energy products (36 per cent).

In the sector, around half of energy use is the input of crude oil and other refinery feedstock to produce refined energy products (ABS, 2009). Primary energy supply is composed of coal (27 per cent), oil (32 per cent), natural gas (34 per cent) and biomass (7 per cent) (Garnaut, 2008).

As part of the Energy Efficiency Opportunities (EEO) program, it has been found that general manufacturing, which made up 34 per cent of EEO participants' energy use, reported 31 per cent of identified energy savings (see figure 1 and 2). These savings will potentially save ▶

Participants' energy use by industry sector 2007–08

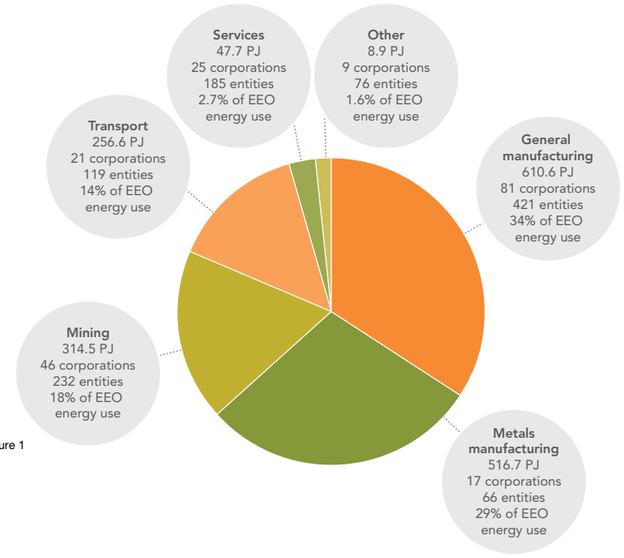


Figure 1

$135.9 million and 1.7 Mt CO2-e (metric tonnes carbon dioxide equivalent).

The "invisible" problem

Most manufacturing companies, or any company for that matter, do not take energy consumption into account when making planning or execution decisions. They lack the right data in the right context. Data acquisition, analysis, monitoring and reporting for energy consumption do not exist at the local level (by product, equipment, manufacturing area). Making the problem 'visible' is the first step towards addressing it, and companies can do this by following these steps:

- Develop a sustainable energy strategic plan (SESP). This should be developed as an integral part of the corporate-level strategic plans which include the business, asset strategic, risk management, and environmental management plans.
- Define the context within which the SESP will operate and what it will cover. For example, within manufacturing, savings can often be made in areas such as equipment, batch numbers, and product deliveries. It is also important to set measurable targets, as well as how the SESP will be used to derive particular outcomes.
- Link the SESP to existing business procedures, processes or systems. For example, there may be linkages to codes of conduct, quality assurance systems, procurement/purchasing procedures, internal audit requirements, risk management systems, annual reporting, et cetera. It should look at policies applicable throughout business units for reduction of energy demand.

Most importantly, the plan requires strong leadership from the organisation's executive team and a program to engage all staff in feedback and innovation opportunities.

Drivers for energy strategy

There are a number of reasons why manufacturing industries would look at implementing such a sustainable energy strategy:

Security of supply: Levels of investment in infrastructure in Australia are currently insufficient; infrastructure will require upgrades and investments in order to cover the growing needs and population growth.

Resource depletion and other environmental impacts: Close to half of the world's existing production capacity will need to be replaced by 2030 as a result of depletion *(World Energy Outlook, 2009).*

Non-renewable energy resources such as oil and gas are less accessible or have smaller deposits, and require much higher investments for exploration and extraction. It is riskier to extract, and the energy required per unit is increasingly higher.

Meanwhile, global demands for energy will continue to drive prices upwards. While non-renewable resources can support the global demands beyond 2030, the consequences of this scenario for the environment, energy security, and economic development are dire (World Energy Outlook, 2009).

The US Department of Energy's long-range projections forecast that prices for fuels and electricity will continue to escalate. Expected price increases predicted by 2030 are:

- 71 per cent for oil
- 20 per cent for natural gas
- 57 per cent for electricity.

Competitive advantage: Tax on emissions, whether via a carbon tax or an ETS or anything in between, already impacts manufacturers who export their products in countries where the price of carbon is accounted for.

The portion of direct product cost for energy consumed during the manufacturing conversion process varies by industry, but is substantial. It represents from 2.7 per cent up to 24 per cent of product costs (once energy is transformed into compressed air, heat, et cetera). Any increase in energy price will have an impact on the bottom line.

Competing on the price of products means reducing the percentage of energy use per widget.

A lower embodied energy in products and other product stewardship measures is increasingly in demand.

Social sustainability: Local requirements, but also international regulations, standards and protocols, all have an impact on energy strategy.

Reputation, community expectations, customer demands, industry trends, and cost savings are key to reviewing the role of energy at an organisation's every level – but risks and liabilities, while constituting the first trigger in many an efficiency initiative, can limit our ability to see real opportunities. Looking at the business as part of a complex system of relationships, and seeing what role energy plays in these relationships, will trigger some very innovative ways of thinking about energy management.

Sustainability and energy efficiency in an organisation have much better chances to

Identified energy savings by industry sector as a share of participants' total energy use, savings, and assessed energy use

Figure 2

Industry sector	Energy savings identified (PJ)	Share of total energy savings (%)	Savings as a % of total sector energy use	Savings as a % of assessed energy use
Mining	17.2	25.4	5.5	9.1
Metals manufacturing	17.0	25.1	3.3	5.4
General manufacturing	20.9	30.9	3.4	7.4
Transport	10.3	15.2	4.0	4.9
Services	2.1	3.0	4.3	12.3
Other	0.2	0.4	0.8	5.6
All industry sectors	**67.7**	**100.0**	**3.8**	**6.6**

be highly efficient if housed at the CEO's office level. This demonstrates the importance of executive leadership and of a cross-silo analysis and implementation approach (Executive Corporate Board – Case study: http://www.sustainability.executiveboard.com/case.html).

Making energy 'visible' and understandable to all in an organisation is critical to an energy-efficiency programme. It means that once the low-hanging fruits and quick wins of energy efficiency are delivered, the culture of conservation can continue to be developed and will encourage staff input into their field of expertise.

Creating a 'voice' for energy efficiency in an organisation will help break the barrier between core and non-core activities. The role, held by either a person or a group of persons, will facilitate the creation of programs and incentives for reduction across business, and the creation of focus groups across business units. It will aim at increasing participation of employees, suppliers and clients in innovative ideas on avoidance and reductions.

Sustainable energy technologies should be looked at not as a choice between renewable energy and conservation but as a complementary mix. This could help reduce reliance on imported fuel. The gap between Australia's production and consumption of petroleum continues to grow. In the six years to 2006–07, crude oil production fell 21 per cent; exports of crude oil and refined products fell 31 per cent; while imports grew by 35 per cent (ABS, 2009).

But being 'less bad' is still being 'bad'. End-of-pipe solutions are only the start of how energy use should be looked at. Eco-design, or environmentally sustainable design, needs to play a pivotal role in the design and management of:

- buildings and plants
- processes
- manufactured products
- services
- technological infrastructure
- information technology.

This can be encouraged via policy, incentives, innovation hubs and other mechanisms.

The four-phase plan for a more energy-efficient business

Phase 1: Measuring and understanding energy

In order to start reducing energy consumption within a business, it is essential to identify what type of energy is used (purchased fuels, electricity, site-generated energies) as well as analyse less obvious types. Examples of usage which may go unnoticed are: embodied energy in purchased raw materials, energy consumption during a product's use phase, transport fuels used for distribution, energy use during storage, and energy consumption required for disposal of product.

Next it is essential to ascertain which energy data is already available (high-level utility bills, existing metering, suppliers' documentation, product specifications) and which data will need to be researched and documented. Much data is available in different business software applications and might require a 'data mining' exercise to aggregate and report accurately (type, quantity, production area, equipment, products, et cetera).

Data is essential, and providing real-time visualisation of contextualised energy information enables manufacturing personnel to optimise planning and execution decisions. Explain the types of energy and energy usage that are considered 'in-scope' when measuring consumption.

Phase 2: Reducing consumption (short-, medium-, long-term measures)

Conduct energy audits and identify opportunities. Some past or existing energy initiatives might already be underway. Acknowledge them as part of the measures; examine and thoroughly analyse the energy-consumption profile; and give adequate consideration to opportunities – both short term and longer term – to achieve mandated reduction targets.

Consider staff behavioural changes, training and education programs, changes to maintenance practices, plant and equipment retrofit programs, and building upgrades – which are all relevant. Exploring more innovative and challenging opportunities can be rewarding: working closely with suppliers to identify possible innovations, or re-thinking the product design to incorporate eco-design principles.

The tricky part is to allow for the opportunities to develop without the immediate financial or other constraints impeding the thinking process. Opportunities to use alternative energy sources such as solar or wind power should be included, as they contribute to reducing consumption of 'purchased' energy.

Prioritise the proposed measures based on factors such as value for money (in terms of energy reduction), length of ▶

pay-back periods, feasibility, logistics, and service-delivery impacts.

Technological solutions: Energy-management software, metering and data gathering, building automation, process automation and control systems can also support the implementation of the sustainable energy plan.

Cogeneration, trigeneration and CHP systems: Investigate combined heat and power (CHP). CHP is proved to be 80 per cent more efficient at converting energy into useful energy and to halve the carbon emissions produced per kilowatt hour. Work is now progressing with cogeneration plants with a ratio of 95 to 97 per cent efficiency (Source: Omega Therm). A number of industries in northern Europe work with local communities to export heat to dwellings, store accumulated heat, or export excess electricity produced back to the grid.

Using its landfill methane to power the plant, BMW US produces up to 60 per cent of the plant's total energy demands. By replacing four turbines by two more efficient ones, they will increase the efficiency by 30 per cent and save an additional US$2 million a year on top of the US$5 million they already were saving yearly. This results in a reduction of 92,000 tonnes of CO2-e per year.

Phase 3: Resources required

Estimated levels of required funding investment should be identified together with funding sources, including re-investment of operating cost savings from reduced energy usage through to direct capital investment.

Compared with commercial or residential sectors, energy-efficiency investment in the industrial sectors typically requires longer project cycles and has limited opportunities for retrofitting. Efficiency savings in the industrial sector can be large and cost effective when implemented as part of a normal capital investment cycle.

The question of creating a dedicated energy-manager role or an energy-management team will be discussed. This is a critical role in a serious quest for managing energy in an organisation. It represents an opportunity for a centralised accountability so that energy efficiency is part of the business planning and KPIs. It is also about having a voice to raise energy efficiency, obtain energy-efficiency budgets, and implement energy-efficiency programs, reduce energy costs and environmental impacts.

The energy manager or energy-management group should oversee energy conservation, responsibilities and budget allocations, monitor energy management performance, and report on usage and energy-savings projects. Most importantly, the focus should be on creating a culture of energy efficiency. These roles and responsibilities will need to complement existing organisational and governance structures.

Amcor Botany Mill in Sydney undertook an energy-reduction project which resulted in a projected energy cost saving of approximately $1.65 million and greenhouse-gas emission reduction of more than 20,000 tonnes. Outcomes included technical improvements and, importantly, a change towards a conservation culture. In particular, they assigned an energy specialist to the site to "provide hands-on support, progress the implementation of specific opportunities, and ensure that the momentum gained through the innovation workshop was not lost".

The specialist coached and mentored Amcor staff to further develop their skills. Having a dedicated role enabled them to "break the barrier between core and non-core activities".

Phase 4: How will relevant information and data be recorded and reported?

A sustainable energy strategy should be considered an 'evolving' plan – one which will be progressively amended and improved each year or sooner, particularly as energy-reduction measures and efficiency increases are realised as reduced energy consumption. It is expected that the level of detail will gradually increase/improve over time as more detailed information is available, such as the findings from energy audits, investigations and studies.

Bakers Delight conducted an energy project which resulted in 32 per cent savings in annual energy costs and a reduction of 48 per cent in greenhouse-gas emissions per year compared to a standard Bakers Delight bakery.

Of particular interest, they focused on innovation in a test-site bakery. They looked at redesigned ovens, changes to design of the floor plans and fit-outs for efficiency, insulation, et cetera. Innovation was made possible by working closely with their suppliers, who had inputs on best practice, efficiency or re-design, modifying equipment and monitoring ongoing results.

Bakers Delight found that involving suppliers is imperative. It is part of the innovation process, which it supports. Suppliers were instrumental in staff training, giving feedback on maintenance and performance data, and highlighting opportunities for efficiency gains in the future.

Stephanie has extensive experience in the ICT [information and communications technology] industry, where she has spent the last 14 years managing software development and support teams, and implementing business technology solutions in a wide range of organisations.

International experience (Europe, Canada, the USA and Australia) has had an overwhelming influence on her understanding of differences and similarities between business cultures. It provides the underlying knowledge necessary to accurately advise organisations, both locally and overseas, in their transformation towards a sustainable model.

Over the past four years, Stephanie has actively researched and educated herself in the area of sustainability and environment. She is a qualified carbon auditor and lifecycle assessor, and is in the process of completing her postgraduate studies in sustainability.

Her business analysis, lateral thinking and strategic planning skills, combined with her experience and understanding of sustainability and environmental issues, constitute a very rare set of combined skills.