

ENERGY NEWS

OFFICIAL JOURNAL
OF THE AUSTRALIAN
INSTITUTE OF ENERGY



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Smart Meters
Electric Vehicles
Energy Efficient Homes
BP Statistical Review of World Energy
PLUS
Special Feature
Earthquakes and Energy Infrastructure Damage

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Subscription Information

ENERGYNEWS is published by The Australian Institute of Energy and is provided to all members as part of the membership subscription. Non-members may obtain copies of this journal by contacting either the Secretariat or the Editor.

Contributions Welcome

Articles on energy matters, letters to the editor, personal notes and photographs of those involved in the energy sector are most welcome.

Published By

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Print Post Approved No. PP 32604/00001

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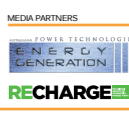


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A time of change



Tony Vassallo FAIE, President
Australian Institute of Energy

The Australian Government released its draft carbon pricing legislation and supporting initiatives in July. Of course there is still a long way to go before the legislation is passed by parliament, but the package, if and when it comes into force, will certainly start to drive change in the energy sector. While the scheme only covers about 60% of Australia's greenhouse gas emissions, it will have an immediate effect through the introduction of a price on carbon dioxide emissions of A\$23/tonne. The price applies to those corporations that emit more than 25,000 tonnes of 'scope 1' emissions (ie emissions produced at the plant or site of activity). According to estimates, this will impact about 500 businesses across electricity generation, mining, and industry. This is a wide-ranging change and, by design, should lead to a significant change in how we generate and use energy. While some have genuine

concerns about the way the scheme will be managed, there is considerable scope for the development of new industries that will arise from the need for businesses to reduce emissions. These industries will develop the new processes, technologies and materials that provide energy services with lower emissions.

Beyond the carbon price, other initiatives in the energy sector include a greater incentive for development of cleaner technologies and renewable energy sources. The legislation provides for the new Australian Renewable Energy Agency, which will manage support for research and development, demonstration, and commercialisation of renewable energy. These industries will need energy professionals with new skills in technology, legal, financial and business-related disciplines. This is an area in which the Institute is considering to play a role, through the development and delivery of training. The AIE Board is currently looking at expanding our activities to include in-house courses, workshops and certificate courses, in conjunction with tertiary institutions, depending on need and availability. We would be pleased to receive your thoughts on this possible new role for the Institute. Send comments to aie@aie.org.au with 'AIE Training Initiative' in the subject line.

Also in the news, it appears that residential electricity demand has actually declined in some regions over the past couple of years. According to AusGrid in NSW, average residential

demand has dropped by a few percentage points each year for four years. It appears that more efficient appliances, the home insulation rollout, higher retail prices and a drop in the use of electric off-peak hot water heaters has finally started to curb growing household demand. Whether this is the start of a new trend or a temporary hiatus in the historical growth in demand remains to be seen.

Finally, the AIE Board has resolved to undertake a survey of members later this year to ensure we are aware of and can strive to exceed the expectations of our Members. It has been five years since our last survey, and much has changed in our industry and the Institute. Since that time, we have engaged PAMS to manage our administration; founded the Young Energy Professionals; introduced the annual Energy Study Scholarship; redesigned our journal **ENERGYNEWS**; and hosted two national conferences, one international conference, and over 250 events throughout our Branches. We invite you to think how the Australian Institute of Energy can develop over the next five years, and to use the survey to provide feedback to the Board so that we can begin planning for another successful five years of growth and improved services for Members. We encourage all Members to respond when you receive the invitation so that all views are considered.

Tony Vassallo FAIE

Energy Standards

On 15 June 2011, the International Standards Organisation (ISO) published ISO 50001 on energy management systems. ISO 50001 provides public and private sector organisations with management strategies to increase energy efficiency, reduce costs and improve energy performance. See www.iso.org.au for more information.

On 16 June 2011, Standards Australia announced its Smart Grid Road Map. The Australian Government Department of Resources, Energy and Tourism has commissioned Standards Australia (SA) to initiate the delivery of a Smart Grid Standards Roadmap, and SA will soon form a working group and undertake a smart grid standards scoping study. See www.standards.org.au for more information.

Earthquakes and energy infrastructure damage

Earthquakes have featured a lot in the press recently, and the Fukushima power plant has been the most obvious energy casualty. The Pacific basin, an earthquake hotspot, has demonstrated energy infrastructure's increasing vulnerability to the phenomenon in Chile and New Zealand as well, writes Maria Kielmas.

Nearly three months after Japan's massive earthquake and tsunami struck the north-east of the country, Mark Pierepiekarz, President of Washington-based consulting engineers MRP Engineering, observed that it was hard to find significant damage downtown Sendai. With a population of one million, Sendai is the nearest major city to the earthquake epicentre. Structurally, high-rise buildings in Sendai performed very well. But most Sendai residents had no electricity for a week and no water for two weeks. A resident living on the 28th floor of a high-rise apartment building was effectively homeless, even though the building had withstood the earthquake.

Critical utilities, lifelines and electricity substations and ports located along Japan's north-east coast were destroyed by the earthquake and tsunami. Their replacements have to be shifted to higher elevations. The traditional focus of earthquake engineering has been to design structures that can withstand earthquake forces sufficiently to save human life. Now, this means ensuring that essential services and communications continue to work through the disaster and after it, including through aftershocks.

Lifelines, electricity and gas supply, clean water, wastewater treatment, communications and a transportation system are even more important for response and recovery operations in the aftermath of an earthquake. Of these electric power is probably the most crucial.

Unexpected consequences

In Chile, the lack of secure anchoring of equipment such as transformers to ground proved to be one of the most serious issues for power generation. The efficacy of ground anchoring has been an ongoing non-structural defect in power plant design for over four decades. Today's additional non-structural defect is the loss of basic communications. Mobile networks, emergency communications and telecom lines are mostly linked with power transmission lines. When power fails, so do modern communications. In Chile, these

were embedded in infrastructure such as road bridges that collapsed. When all modern communications failed, rescuers and repair teams had to rely on traditional telephone lines, if these were functioning.

Ground shaking during the Japanese earthquake caused the automatic shutdown of 11 nuclear reactors totalling 9.7 GW. The Fukushima nuclear power plant's automatic shutdown should have been compensated by ten back-up power generators. But these had been installed underground in accordance with a 40-year old turnkey contract the plant's operators had signed with their US supplier. The tsunami knocked out all but one of these power generators.

A further 19.5 GW of conventional thermal plant capacity shut down. With interest concentrated on nuclear plants, little attention has focussed on why thermal plants were so vulnerable, even allowing for the strength of the earthquake and subsequent tsunami. In 2007 after the 6.6 magnitude Chuetsu offshore earthquake, Tokyo Electric Power Company's (Tepco) Kashiwazaki-Kariwa nuclear plant was shut down following minor damage. But thermal plants were not affected by the earthquake. Earlier, in 2002, 17 nuclear plants were shut down following news that Tepco had falsified various safety reports and thermal plants took up the slack for power demand.

Most of Japan's 400 dams survived without major damage. The exception was the Fujinuma irrigation dam in Fukushima Prefecture. The dam was 18.5m high and held back a 15mn cubic metre volume reservoir. The dam was completed in 1949 and retrofitted between 1984 and 1992. It collapsed because initial construction had not grubbed out completely an organic rich residual soil beneath the embankment fill and foundations, which acted as a sliding surface.

In June 2011, Japan's Institute for International Policy Studies issued a report concluding that the country has not done very well in preparing for a serious situation. There was no single command and control function for disaster counter measures. Despite the fact that research and development

on robots for hazardous environments was underway in anticipation of a nuclear disaster, there was no actual demand for them from the power companies. These judged that the possession of such robots would cause unease regarding the safety of nuclear power.

Blackout and fire

The February 2010 earthquake in Chile (see Box 2) caused an immediate blackout of a 4.5 GW load on the country's principal electric grid, the Central Interconnected System, which provides electricity to over 93% of the population. The peak demand on the system was 6 GW compared with a national installed generating capacity of 11 GW. Power generation capacity totalling 693 MW was damaged and a further 930 MW of capacity under construction was put on hold.

Three-quarters of the pre-earthquake load was restored within two days but the blackout had one important consequence: it minimised fire ignition. There were some 10 major fires after the earthquake. In modern cities, fires following earthquakes are caused mostly by sparks from damaged electrical circuits.

Fires following the Japanese earthquake were unprecedented. Speaking at a Pacific Earthquake Engineering Research

Centre briefing on the event at Berkeley University, California, Charles Scawthorn, retired professor of engineering at Kyoto University, said that the number of fires was more than double the number of all documented fires following historically recorded earthquakes. Half of the fires started as a result of the earthquake and the other half following the tsunami.

The most devastating fires were at Cosmo Oil's 222,000 barrels-per-day (bpd) Chiba refinery and at JX Holdings' 145,000 bpd Sendai refinery. The earthquake caused the first fire and the tsunami the second one. In an April statement, JX Holdings said that its losses due to the earthquake and tsunami at its Sendai and Kashima refineries, as well as its Isohara metals plant, amounted to 126bn yen (US\$1.6bn). In late May, Tepco estimated an 800bn yen (US\$9.6bn) in losses for damage at its Fukushima nuclear plant.

Liquefaction

Both of Chile's oil refineries – one in Santiago and one in Concepcion – shut down after the earthquake because of the loss of power, and for staff to check for damage at critical elements. The 98,000 bpd Aconcagua refinery near Santiago resumed operations ten days after the earthquake. The Bio refinery at Concepcion shut down because the crude oil pipelines feeding to it failed due to soil liquefaction

and lateral spreading of beach sands. Engineers shut down the pipelines until the damage was repaired. The refinery resumed operations in mid-July 2010.

Soil liquefaction was the predominant characteristic of the New Zealand earthquake sequence. The September 2010 earthquake produced 11,000 tonnes of sand ejecta. The February 2011 event not only re-liquefied previously liquefied areas, but caused a more widespread liquefaction in the city centre and its suburbs. Over 200,000 tonnes of ejecta were produced. Christchurch residents posted numerous videos on the Internet of sand boils during the June aftershocks.

Liquefaction effects of the February shock were unprecedented by any modern standards, says Canterbury University earthquake engineer, Mirko Cubrivovski. This includes the effects of the 1995 Kobe earthquake in Japan where ports and waterfront facilities had been built on reclaimed land consisting of cohesionless fills. Liquefaction caused buildings in Christchurch suburbs and its CBD to sink by over one metre. Christchurch was built on an ancient river valley and drained swamp, locations deemed inappropriate for modern buildings. Local engineers argue that over half of the city centre and suburbs are not worth rebuilding.

The destruction of underground cables by liquefaction dominates energy supply issues. Buildings and the ground continue to move in Christchurch's 'red zone', a cordoned-off inner city area deemed dangerous. Electrical engineers attempting to repair underground cables describe the area as if 'hit by an underground tsunami'. New faults appear and fill up with water from underground. The Avon River,



Damaged power transmission towers across the Bio Bio River, Chile
Source: Mark Pierepiekarz, MRP Engineering

which runs alongside the city, behaves as though trying to redirect itself.

Restoration of power supply is like putting a band aid on an electric cable, engineers say. The cables blow with every rainfall or when local power demand increases. By mid-June sand ejecta requiring removal had reached 360,000 tonnes. Power distributor Orion Energy said that some underground cables were stretched over one metre. Repairs to the 11,000 volt underground cables were completed in May but the 66,000 V underground cable remains beyond repair. Orion plans overhead lines to compensate until soil investigations over the next few years determine where or if underground cables can be relocated.

Great East Japan earthquake, March 2011

The magnitude 9.0 earthquake that struck north-eastern Japan on 11 March 2011 is among the largest earthquakes recorded in modern times. It occurred at a depth of 32km with its epicentre located 72km east of the Tohoku peninsula. The shaking lasted approximately six minutes.

The earthquake generated a tsunami with waves up to 34 m high and travelling at speeds of up to 600 mph. It reached the Japanese coast nearest the epicentre after about 30 minutes. The earthquake and tsunami destroyed towns, infrastructure and lifelines along the north-east coast. An estimated 27,000 people were killed or remain missing. Some 95% of the human losses were concentrated in the prefectures of Iwate, Miyagi and Fukushima where tsunami heights were at their greatest. The highest economic losses were at regional centres such as Onagawa, Minmisanriku and Rikuzentakada. Blackouts were suffered by 8.9mn homes while 2.2mn homes were left without water. All harbours along Japan's northeast Pacific coast were out of operation. The Japanese government estimated total economic losses as up to US\$309bn, or 5.3% of Japan's GDP in 2010. Recovery and repair costs could reach \$615bn.

The earthquake occurred on a subduction plate boundary where the Pacific plate meets the North American plate (or the Okhotsk plate) on which Japan is located. As a result, Japan moved to the east as if being pulled towards the earthquake source. Broad scale subsidence occurred in all coastal areas, hampering recovery efforts. Various agencies estimate that the fault rupture zone was between 400 and 600 km in length and up to 200 km wide; slippage was between 15 and 20m on average.



Fire at the Chiba refinery, Japan
Source: Flickr

Maule, Chile earthquake, February 2010

The 8.8 magnitude earthquake that struck the Maule region of central southern Chile on 27 February 2010 was located approximately 130km offshore of Maule, 300km south of the capital Santiago, and at a depth of 30km. The longest duration of the shock was three minutes. Coastal areas in south central Chile were displaced vertically by between 1.5 and 2.5m. The earthquake was associated with the subduction of the oceanic Nazca plate eastwards below the South American continent.

The earthquake triggered a tsunami that reached heights of 20 m along parts of the Chilean coast and spread 12km inshore from the coastline. It arrived on the Chilean coasts in initial bursts between 12 and 40 minutes after the earthquake, and then between 2.5 and 4.5 hours after the main shock, causing damage in coastal regions and the Juan Fernandez islands. The earthquake caused 562 fatalities, affected 80% of the Chilean population, and caused economic losses of US\$30bn.



Damaged candlestick-style live tank circuit breakers at power plant, Chile
Source: ASCE Technical Council on Lifelines Earthquake Engineering (TLCEE)

Canterbury, New Zealand earthquakes

New Zealand's second largest city, Christchurch, was struck by a series of earthquakes starting on 4 September 2010 at magnitude 7.1. This was followed by a magnitude 5.2 shock four days later. The movement was caused by previously unrecognised strike slip faults located west of the city in the Canterbury Plains. The epicentre was located 50km WNW of Christchurch at a depth of 10 km.

The 22 February 2011 earthquake was located 10km southeast of Christchurch at a depth of 5km. Small aftershocks continued over the following months culminating on 13 June, 2011 in two larger aftershocks of magnitudes 5.5 and 6.3. The February earthquake was caused by movement along a fault that has not broken to the surface.

New Zealand lies on the boundary of the Pacific Plate to the west and the Australian Plate to the east. The Alpine fault is the inshore expression of this boundary and is

the country's largest active fault, extending for 500km under the Southern Alps. Previous estimates calculated that the Alpine Fault could produce magnitude 8 earthquakes every 300 to 350 years. But the scale of liquefaction caused by the 2010–2011 earthquakes had not been foreseen.

There were no fatalities from the first shock. The February shock caused 181 deaths because of its magnitude, shallow depth and proximity to urban and suburban population centres. The New Zealand Treasury estimated economic losses from both earthquakes at NZ\$8.8bn (US\$6.9bn). By June, there were unconfirmed reports that losses had risen to NZ\$15bn (\$11.8bn). The government has set aside NZ\$4.5bn (\$3.5bn) for reconstruction but Finance Minister Bill English has acknowledged that this may rise significantly. The liquefaction potential of the area means that there are serious possibilities that half of the city centre and the suburbs will not be rebuilt.

Ports

The Christchurch authorities hope to use 8.5mn tonnes of rubble and debris from the earthquake to reclaim 10 ha at Lyttleton Port, located 12 km from the city. The port was New Zealand's premier coal exporting facility. Repair to wharves and container depots from land subsidence and rock falls is expected to cost hundreds of millions of dollars and take up to five years.

After the Japanese earthquake, damage to ports and fuel-offloading facilities was a particular issue affecting fossil fuel power generation. Coal terminals closed at Onahama, Hitachinaka and Kashima. Tepco and Tohoku Electric Power had to declare *force majeure* on coal shipments. Floods in Australia during 2010–2011 already had affected coal exports to Japan.

Trading company Itochu is diversifying by acquiring a 20% stake in Drummond Corporation's Colombian coal mining venture. Itochu will export 7mn tonnes of Colombian coal annually to Japan and provide 6% of the country's coal needs. Japan faces severe power shortages over the summer but its

bifurcated electricity grid limits improvements to supplies. A 50Hz grid runs along the east coast while a separate 60Hz grid supplies the west coast. Only one conversion station links the two.

Lessons

The Circum-Pacific region's recent earthquakes have demonstrated the increasing vulnerability of modern cities to natural disasters, and how easily essential services and lifelines collapse. Engineers underestimated peak events, be they maximum tsunami height, ground acceleration or soil liquefaction potential. The future challenge is to design independent, back-up communications, power and fuel supplies to maintain essential services throughout rescue and aftershocks. Policy-making inertia notwithstanding, this could be a more enduring legacy than the ongoing debate about nuclear power.

First published in the July-August 2011 issue of Energy World by our sister association, the UK Energy Institute, www.energyinst.org



www.aie.org.au

It's a Wrap

Australian Government energy announcements

- **Clean Energy Future draft legislation** was released and comments are sought from the public. www.treasury.gov.au
- **Carbon Farming Initiative** legislation passed Parliament and will come into effect from December 2011.
- A new **reference guide** has been launched for **sustainable mining: A Guide to Leading Practice Sustainable Development in Mining**. www.ret.gov.au
- A further A\$35.2 million will fund shopping centres, hotels and office block owners to upgrade and reduce greenhouse gas emissions under the **Green Building Fund** and **Tax Breaks for Green Building Fund**. www.innovation.gov.au
- Consultation paper on the **National Carbon Offset Standard** was released. The review is considering eligible offsets and how to align itself better with the Carbon Farming Initiative and GreenPower. www.climatechange.gov.au
- Applications are open for the **Emerging Renewables Program**, which focus on energy technology projects such as geothermal, solar and ocean. www.ret.gov.au
- A new space research project is undertaking Greenhouse Gas Monitoring, which will boost **weather and climate change modelling**, using remote sensing instruments. www.innovation.gov.au
- Applications are being sought for the A\$25 million **National Solar Schools Program** which grants of up to A\$50,000 to support schools to install solar and other renewable power systems www.climatechange.gov.au
- New ways of generating **zero emissions electricity** using a printing machine to produce solar cells are being investigated. Funding through the Australian Solar Institute will investigate the development of efficient solar cells using organic materials as well as conventional printing methods. www.australiansolarinstitute.com.au
- The **Gas Appliance (Carbon Monoxide) Safety Strategy** was released for comment. www.mce.gov.au
- The **southern hemisphere's biggest solar array** at St Lucia Campus at the University of Queensland was open with ministerial representation.
- The Regulation Impact Statement for **mandatory disclosure** of residential building energy, greenhouse and water performance has been released. www.mce.gov.au
- Fact sheets released will help gas and electricity consumers understand the **rights and the services** available to them. Fact sheets cover a range of topics including energy savings, changing contracts and moving house. www.aer.gov.au
- A **new institute for energy and resources** has been opened in Newcastle; it will be a hub for leading-edge research into the development of clean energy sources. www.newcastle.edu.au
- Recipients of the **Green Car Innovation Fund** have been announced with A\$6.2 million to make lighter and greener cars by manufacturers CFusion, Toyota Gosei, Composite Materials Engineering and Hirotec. www.innovation.gov.au
- Work has progressed on research to make **fuel from sugarcane** for use in cars, trucks and aircraft. Funding of more than A\$5 million has been provided by the Australian Government for the Mackay Renewable Biocommodities Pilot Plant. www.innovation.gov.au
- A Coal Sector Jobs Package of A\$1.3 billion to support jobs in the coal industry during the move to a clean energy future was announced as part of the Clean Energy Future package. www.ret.gov.au
- An Energy Security Fund and Energy Security Council will be established under the Clean Energy Future package. These initiatives will maintain energy security, ensure market reliability and support the transformation of the energy sector. www.ret.gov.au

continued on page 66

Branch Events

Smart Meters Explained

Seminar presentation to AIE Melbourne Branch on 24 May 2011.

Three speakers – Mark Kealy, Project Manager Economic Infrastructure, Victorian Government Department of Business and Innovation; Dave Davy, Director Sales, Silver Springs Network (SSN); and John Nachev, Business Development Manager, Connected Energy Group, Cisco Systems – gathered to demystify one of Victoria's more controversial infrastructure rollouts – smart meters. With around 30,000 smart meters being installed every month across Victoria and a significant amount of attention from the media, this was a timely event.

AIE Study Scholarship Update

In January 2011, Mark Kealy, winner of the 2010 AIE Study Scholarship, travelled to Texas and California to attend the Smart Energy Summit and Distributech, and meet with utilities, technology companies and regulators. His aim was to investigate how consumers can realise the benefits of smart meters in the short term through home energy management. At the seminar, he provided an update on the emerging products and services that give electricity consumers access to their smart meter data and depict it in a meaningful way, noting that Tendril and Origin Energy had just announced a smart home energy partnership. Tendril is one of the leading energy management technology companies in the United States. Origin plans to trial Tendril's home energy management technology in customer homes in the second half of 2011. For information on the trial, see <http://www.originenergy.com.au/smarthome>.

Mr Kealy found four key trends:

1. Consumer engagement is the hot topic.
2. Home energy management is an emerging market.
3. Electricity market competition dictates the drivers and the passage to market.
4. There are products and services available now.

In non-competitive retail electricity markets, such as California, with only one incumbent electricity retailer, home energy management is not as big a priority. In these jurisdictions, the priority is more on demand response and reducing peak demand, which is being driven by regulated energy efficiency targets.

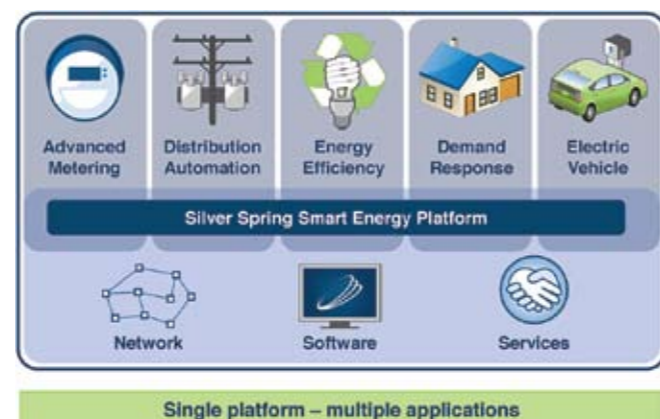
In competitive retail electricity markets, such as Victoria, Texas and the United Kingdom, retailers are looking for ways to engage with customers; to attract and retain market share. Home energy management technologies are seen by retailers as a new tool to assist in building better relationships with their customers, allowing them to be engaged and informed with their energy service.

Home energy management will be implemented in stages over many years, beginning right now with the provision of meaningful information on energy use, appliance monitoring, web portals, smart phone apps and bill inserts. In years to come we will begin to see smart appliances, electric vehicles, distributed generation and home energy storage solutions that will be capable of communicating with meters. These technologies will allow consumers to use electricity in a more intelligent and sustainable way.

As retail electricity prices increase and pricing structures change, meaningful and convenient products and services that help monitor and manage energy consumption will have increased appeal.

SSN's Smart Grid Strategy

SSN is a leading provider of smart grid solutions, with more than seven million homes networked across five continents. In 2009, SSN won the contract to supply the smart meter network infrastructure for four of the five Victorian distribution businesses, and provides the wireless communications system that allows the smart meters to communicate with the electricity distribution business. This remote communication system not only saves costs



SSN's smart energy platform

on meter reading but also gives the distribution business greater visibility of the grid that enables a range of 'smart grid' functions. Because each smart meter represents a separate point on the local grid, the status of the network at any given time becomes instantly observable back at the utility head office. This allows rapid detection of outages and a more targeted effort when restoring power, improving overall system efficiency and reliability.

In addition to its communications platform for the utility, SSN has developed a series of consumer-facing products designed to engage consumers and allow them to interact with their smart meter data. The utility needs to engage the customer based on the customer's own preferences. SSN's options for consumers include a website, smart phone and tablet computer applications, bill inserts, email notifications and compatibility with the range of in-home displays that may be offered in the future.

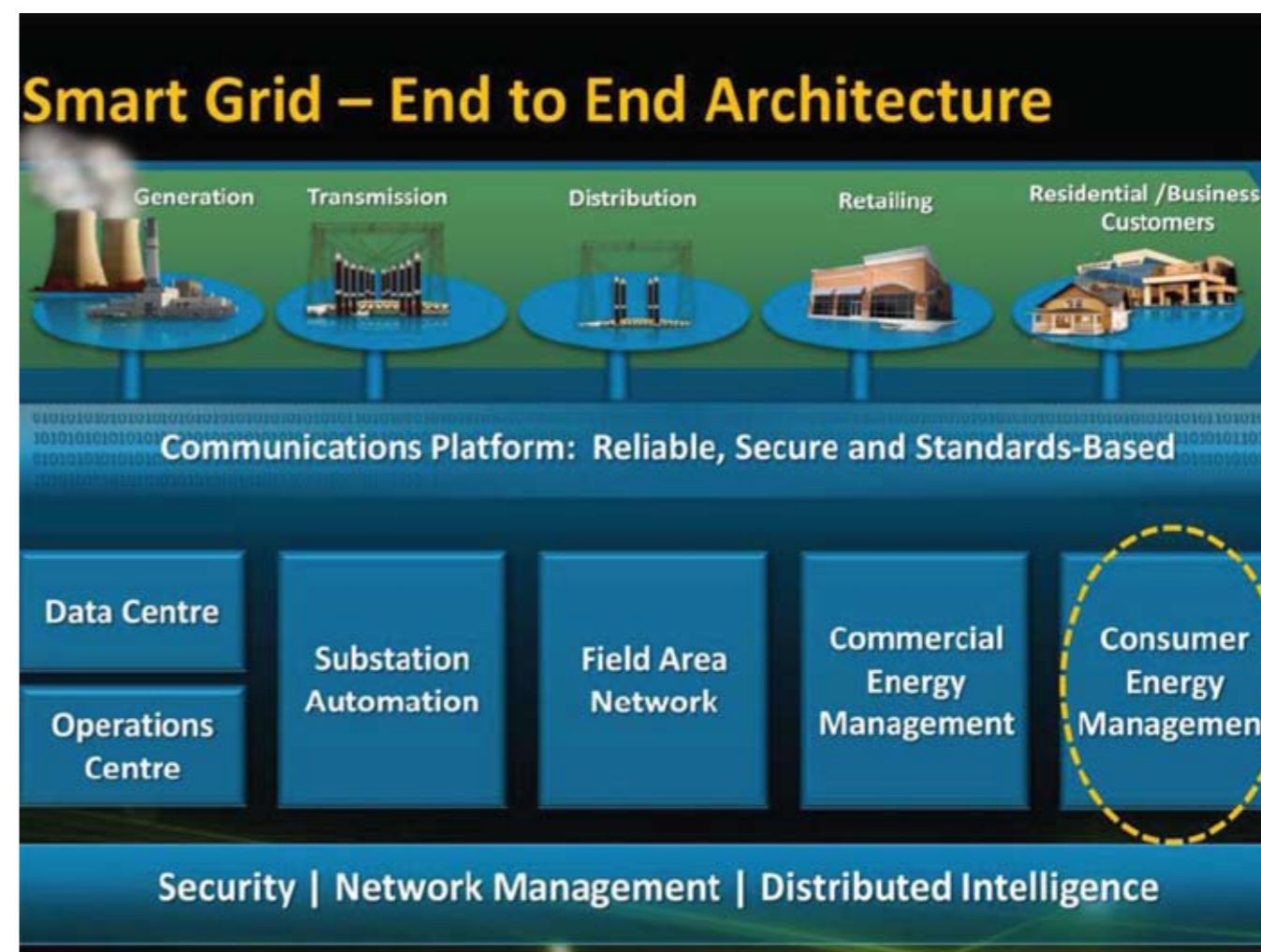
A platform that connects the devices that generate, distribute, consume, and monitor energy, and interact with customers is fundamental to the smart grid, with one platform supporting many applications.

Smart Metering and the Grid

Cisco Systems is the worldwide leader in networking for the Internet, delivering network communications to business, education, government and homes across the world. Cisco is applying its experience with the Internet to the electricity network to create a smarter grid. Cisco's vision for a smart grid involves the creation of an end-to-end (from generation to consumption) communications network that will bring electricity systems and processes together to increase the intelligence and efficiency of the national grid.

Typically, network owners build their networks in an ad hoc fashion over time by taking lowest cost and best-of-breed options when the need arises. However, a 'systems approach' looks at the total cost of ownership over the life of the asset and puts value in investing in a more holistic solution. This may be more expensive up-front but will not require costly upgrades during its life and lower total cost in the longer term. This approach also reduces network downtime during upgrade maintenance.

EN



Cisco's vision for the smart grid

Greenhouse Policy, Investment Certainty and Electricity Prices

Presentation by Rod Sims, Chair, NSW Independent Pricing and Regulatory Tribunal (IPART), to AIE Sydney Branch on 16 May 2011.

Meeting Australia's greenhouse targets requires a major change from 'business-as-usual'. Although the 5% greenhouse gas (GHG) emissions reduction target (relative to year 2000 emissions) is seen as too modest by many, it in fact represents a 25% reduction from business-as-usual levels by 2020 and this will be difficult to achieve. A 25% target would require a 40% reduction relative to business-as-usual (Figure 1).

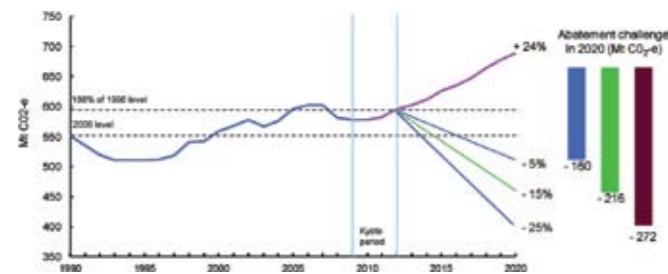


Figure 1. Australia's GHG emissions trends 1990 to 2020

Coherent policy formulation has proven difficult. Taking tariff reform as a benchmark, emission reduction via a carbon tax or an emissions trading scheme is proving to be a much greater challenge. This is partly because tariff reform was seen to be in Australia's interest, whereas legislating for a reduction in carbon emissions is aimed at preventing a problem, rather than creating a gain. In addition, to embrace a market-based solution to climate change, it is necessary to believe in the economics as well as the science.

To meet the 25% reduction in emissions (relative to business-as-usual), a variety of measures are available, including:

- using R&D incentives to accelerate technological gains;
- having the government specify how the emission reductions will be made; and
- using market-based mechanisms.

The first two approaches require the government to effectively 'pick winners'. With the market-based mechanism, there continues to be debate over a carbon tax versus an emissions trading scheme. Issues frequently raised when comparing a carbon tax to an emissions trading scheme are summarised in the following table.

Mechanism	Issues
Carbon tax: fix price, not abatement	<ul style="list-style-type: none"> • Investors cannot be sure how the tax rate will move in future • Harder to establish forward price to guide investment decisions • Harder to allow full purchase of overseas offsets – risk that Australian price get out of alignment with world prices

ETS: fix abatement, not price	<ul style="list-style-type: none"> • With full banking, borrowing (as with CPRS) will get forward curve • Easier to allow full purchase of overseas offsets (as with CPRS) • Investors can judge where international targets/prices will go
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Future electricity prices are much discussed in the media at present, and the following factors are understood to be primary drivers:

- increased network costs
- rising gas and coal prices – gas prices are likely to move closer to export parity; coal prices may increase as contracts are renewed
- continuing carbon price uncertainty
- non-market driven renewable energy schemes, such as the Small Scale Renewable Energy Scheme (SRES) and the Large Scale Renewable Energy Target (LRET).

The first two factors are largely unrelated to carbon prices; however, the last two factors both potentially lead to high-cost outcomes because future electricity generation will largely come from relatively expensive sources such as wind and peaking plant.

Of the 17.6% increase in electricity prices in New South Wales foreshadowed in a draft report by IPART from 1 July 2011 (Figure 2), 10% is due to network costs and 6% due to "green schemes", with only 1% due to increased generation costs. Higher peak demand and reliability standards are major factors in driving up network costs. The 6% due to green schemes does not include the cost of the feed-in tariff in NSW – had this been included, it would have added another 6% to the price increase.

The most significant factor is 'poles and wires'. Network charges are regulated by the Australian Energy Regulator, and costs are passed through to electricity retailers. 'Allowed' network expenditure has increased threefold between the 2004–09 and 2009–14 regulatory periods, driven by higher peak demand; replacement of assets; higher standards for reliability; and changes in the regulatory framework and National Electricity Rules (NER). Higher peak demand and asset replacement push up prices. There are no strong incentives for demand management by distributors. There are some concerns that higher reliability standards and the NER are driving up prices unnecessarily.

Currently [as at May 2011, ed.], the Multi-Party Climate Change Committee appointed by the Australian Government

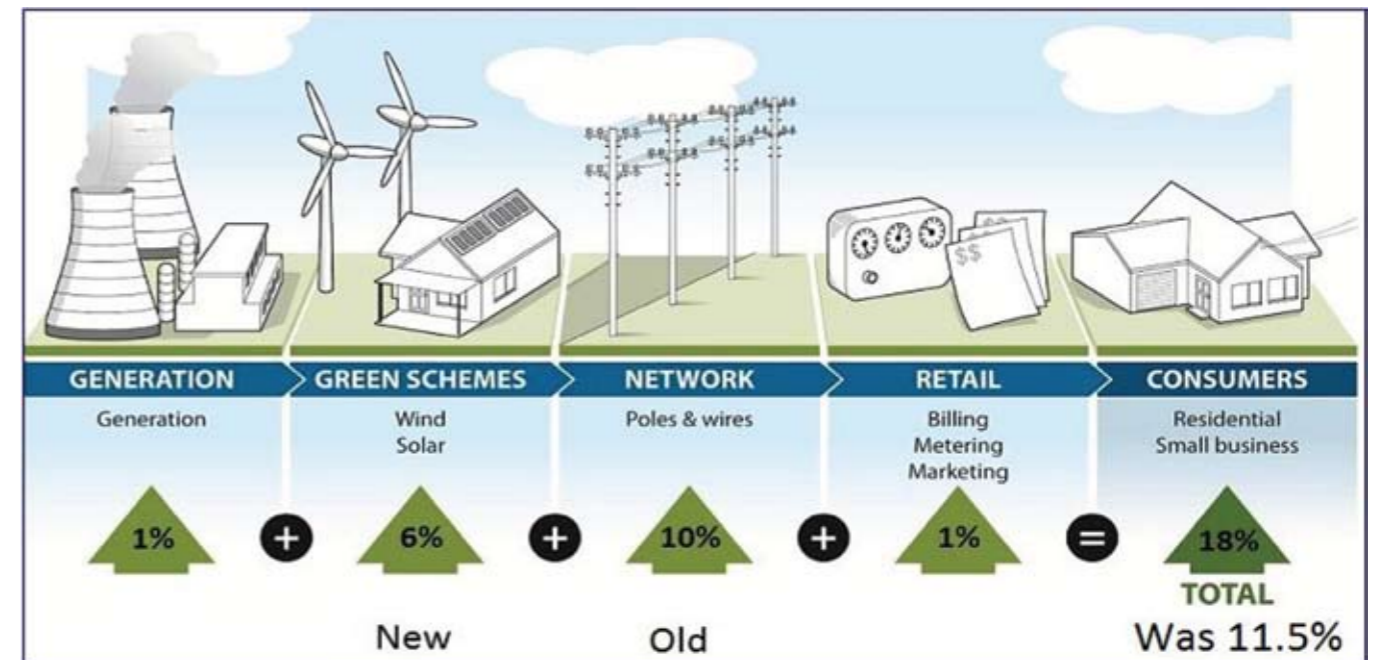


Figure 2. Contributing factors to July 2011 electricity price increases for NSW households
Source: IPART, 2011

is considering the merits of a hybrid carbon tax/ETS scheme. It is not yet clear how investment certainty will be provided to the electricity sector, and Australian industry more generally, without a clear forward price signal. In the end, it

may well be international developments related to climate change mitigation and world carbon prices that prove to be the strongest drivers for investment decision making by Australia's emission-intensive industries. EN

Planning for Electric Vehicles

Presentation to AIE Melbourne Branch, jointly with Engineers Australia Victorian Transport Branch, on 13 July 2011.

As the Victorian Government's Electric Vehicle (EV) Trial gets underway, this timely event featuring three eminent speakers attracted a large crowd. Speakers were:

- Kristian Handberg, Project Manager – Low Emission Vehicles, Victorian Government Department of Transport
- Geoff Zippel, Head of Deployment, Better Place Australia
- Ian McCleave, CEO, EV Engineering.

This article is an abridged summary that focuses on some of the key messages from two of the presentations.

THE TRIAL Kristian Handberg

The Electric Vehicle (EV) Trial will make Victoria an EV-friendly place through improved awareness, understanding and acceptance of electric vehicles. Through the trial, EVs will be rolled out safely and efficiently.

The motivations for EVs are financial – as petroleum

prices are rising, battery prices are falling; climate change – in Victoria, transport accounts for 17% of carbon emissions, mostly road transport; air quality – the Victorian Government Department of Transport estimates the annual cost of motor vehicle related pollution at A\$2.7 billion; and jobs – Australia is one of only 15 countries that can take a car from concept to showroom.



The EV Trial is one part of the EV program, which also includes the development of national EV standards; discounted vehicle registration for EVs; and local EV industry development.

The EV Trial, which will run until 2013, comprises 60 partner organisations, 60 vehicles (24 fleets, 180 households), and 200 charging locations (65 public). By creating a market, the state government aims to make Victoria an EV-friendly place through improved awareness, understanding and acceptance.

LARGE RWD EV PROJECT

Ian McCleave

EV Engineering is a collaborative venture between leading Australian automotive suppliers – Air International, Bosch, Continental and Futuris – and electrical infrastructure provider, Better Place, to develop a proof-of-concept Australian EV. Better Place Australia is part of a global company that is enabling the mass adoption of EVs by providing the infrastructure and services that make it easy, affordable and attractive for motorists to adopt and drive EVs including a network of battery switch stations to overcome ‘range anxiety’.

The goal for the Large RWD EV Project is to demonstrate the technical viability and attractiveness to customers of a large EV. The project will design, develop, and build seven fully-electric vehicles, based on the Holden Commodore, as proof-of-concept to demonstrate technical viability. It aims to demonstrate the attractiveness to customers and of a large EV and develop EV engineering skills and components within the Australian automotive industry. If successful, the project will allow technologies to be considered for possible future mass production. The trial fleet is targeted for completion by end June 2012.

There will be no compromises in safety, features, performance or interior space, and it will be designed for competitive manufacturing cost. The EV Commodore will be capable of recharging at normal EV charge points, DC quick charging and also battery switch for range extension. It will also deliver zero carbon dioxide emissions when powered by renewable electricity.

Large EVs offer the greatest financial and environmental benefits:

1. Large passenger vehicles average 23,000 km/year compared with 14,600 km/year for all vehicles in Australia –fuel cost savings more than offset increased battery and electricity costs.
2. Greater CO₂ reduction – a large petrol car travelling 23,000 km emits six tonnes of CO₂ compared with 2.5 tonnes for a small car travelling 14,600 km.
3. Financial and environmental benefits are attractive to fleet managers – the UK Glass’s Guide forecast 54% residual value for a battery switch EV over three years compared with 43% for a hybrid.

The key requirements and constraints identified at the beginning of the project were:

- driving range ~160 km between recharging
- capable of battery switch for unlimited range
- no compromises in performance, safety or interior space
- minimum engineering and manufacturing investment – no major changes to the key architectural components of the vehicle; capability to build on an existing production line alongside ICE models
- car that is attractive to fleet operators.



Illustration of switchable battery assembly and installation
Source: EV Engineering

RWD (rear wheel drive) was chosen because of the large volume needed for a switchable battery; the ability to package other components in logical locations; sufficient crush space to protect the battery under crash scenarios; no major body engineering program required; and vehicle assembly consistent with existing manufacturing methods. ICE and EV variants could potentially go down the same assembly line using a common body structure.

Replacing the ICE components with EV components adds about 105 kg (or about 6%) to the vehicle’s mass, and shifts the centre of mass only slightly rearwards – less than 25 mm. The CO₂ comparison depends on the primary energy used to generate electricity

Carbon dioxide comparison

Condition	Petrol	EV
Tank to wheel consumption	0.098 l/km	165 Wh/km
Well to wheel consumption	0.098 l/km	185 Wh/km*
Operating cost	12.7 c/km @ \$1.30 / l	3.5c/km @ 19 c/kWh
Tank to wheel CO ₂	234 gm/km	0 gm/km
Well to wheel CO ₂	246 gm/km**	
CO ₂ based on Victorian brown coal @ 1370 gm/kWh***		252 gm/km
CO ₂ based on national average @ 1070 gm/kWh***		197 gm/km
CO ₂ based on national average with 20% MRET @ 910 gm/kWh***		167 gm/km
100% renewable		0 gm/km

* Assumes 10% losses for battery charging
** Assumes 5% upstream emission factor (NGA)
*** NGA 2006 for scope 1 + scope 3

Source: EV Engineering

For more information on the Victorian EV Trial, see <http://www.transport.vic.gov.au/projects/sustainable/ev-trial>

For more information on the Large RWD EV Project, see <http://www.evengineering.com.au/>

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Increasing Competition in the Wholesale Electricity Market

Presentation by Allan Dawson, Chief Executive Officer, Independent Market Operator, Western Australia, to AIE Perth Branch on 17 May 2011.



Allan Dawson

The Western Australian Wholesale Electricity Market (WEM) was established in 2006 to introduce competition by allowing the entry of new electricity generators and retailers that would drive efficient pricing of energy.

The WEM surpassed its initial projected goals, with a significant level of new private sector investment resulting in 2700 MW of capacity added to the market. This new investment has resulted in Verve Energy, the dominant provider of installed capacity, accounting for an estimated 55% of the capacity market by 2012–13 compared with more than 90% in 2006.

Market design did not factor such rapid success into the initial framework, and it is now evident the design has passed its use-by date. Another key issue is Western Australia’s burgeoning economy. Although the WEM has been a success and has facilitated the majority of new energy capacity, the capacity entering the energy market is in direct response to the economic boom.

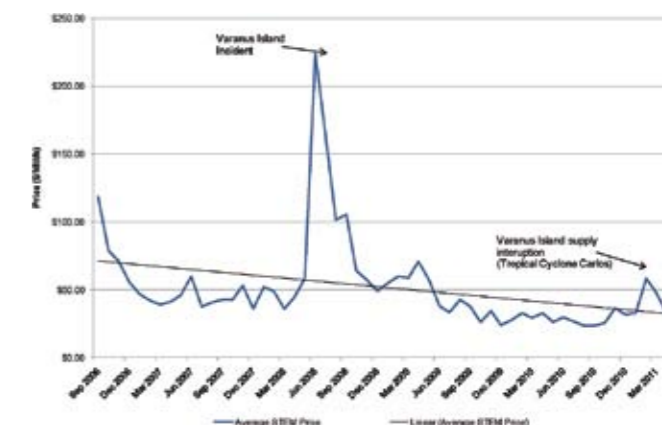
To address this, the Independent Market Operator (IMO) established a Market Evolution Program (MEP) in August 2010. One of the key emergent issues being reviewed by the MEP is the market’s reliance on Verve Energy to provide balancing and ancillary services.

As the WEM has enabled the trading of electricity in a ‘day-ahead’ market, known as the Short Term Electricity Market

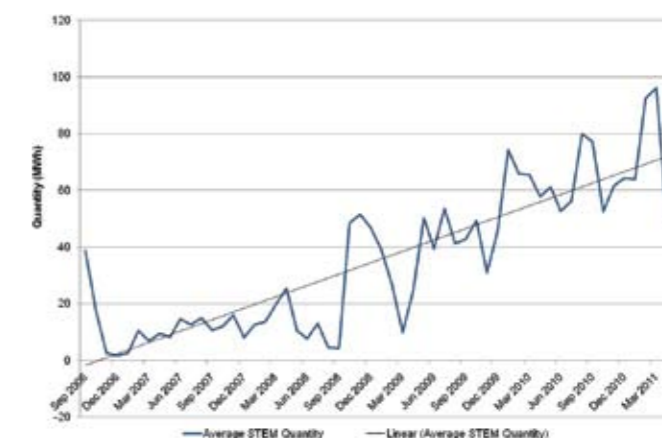
(STEM), there is a shortfall between what has been bilaterally contracted and traded by generators and retailers via the STEM and what is actually required on the trading day. These variances can be due to weather fluctuations, surge or decline in customer needs, and/or changing demand and supply conditions.

This shortfall margin requires an energy generator to provide additional energy to close the gap to ensure customers and the network do not experience any negative side effects or risks. These shortfall services are known as balancing and ancillary services.

Since the inception of the WEM and its subsequent evolution, trading prices have fallen (Figure 1) while the volumes traded have increased (Figure 2).



Average STEM price, 2006–2011



Average STEM quantity traded per interval, 2006–2011

As the dominant market participant, Verve Energy has different rules and obligations than other players in the market. These obligations were not an issue when Verve Energy held 90% of the installed capacity; however, at nearer 55% these obligations have become onerous, and market outcomes appear to be less than optimal.

The concerns regarding the provision of balancing and ancillary services have been increasing with the success of the WEM, and were identified in 2009 by the Market Advisory Committee, comprising representatives of market participants that advise the IMO Board on the workings of the WEM. In light of the market's rapid development and active stakeholder feedback, new arrangements have been approved for balancing and load following ancillary services, while adhering to the industry's wishes to retain some of the current framework to avoid large-scale reforms.

These new arrangements will involve the establishment of markets where other market participants will be able to bid to provide balancing and load following ancillary services in competition with Verve Energy. This regime will provide independent power producers with the opportunity to compete and be exposed to the uncertainties around the provision of balancing that Verve Energy confronts on a daily basis. The new balancing and load following ancillary services market will see generators submit their bids after their STEM submissions each day. The IMO will rank these bids in order of merit and provide this to system management to use for dispatch purposes. This process of bidding will flow into the trading day, with opportunity for market participants to respond to forecast prices and dispatch volumes. The price will be determined by the marginal generator's offer. Verve Energy will still be able to bid on its own portfolio, unlike

other generators that have to bid by facility, as Verve remains the default provider.

An independent cost-benefit analysis assessed the net benefits of the new arrangements, with net benefits in the range A\$8.8–24.8 million, with a three-year payback period.

Unlike other wholesale markets in Australia, the WEM operates on an unconstrained grid. Therefore, these proposed changes can be incorporated without the need for fundamental reforms to the current WEM design. However, if there were a desire to move to a constrained transmission grid policy, the WEM would need to be redesigned. Such a level of reform would take years to introduce due to the initial approval processes and subsequent implementation. The new balancing and load following market arrangements recently approved can be implemented relatively quickly and will allow participants to learn before potentially confronting large-scale reform in the future.

These current approved changes to the system do have risks attached, which has resulted in the appointment of a dedicated team to manage the MEP. The intention is to have a trial of the new arrangements in place by December 2011, and operating by April 2012.

Article prepared by Vanessa Frzop, Director, Red Queen Communications & Marketing. **EN**

It's a Wrap

continued from page 59

- Additional initiatives to support the Clean Energy Future include A\$10 billion for a Clean Energy Finance Corporation, the A\$3.2 billion Australian Renewable Energy Agency and A\$200 million Clean Technology Innovation Program. www.australia.gov.au
- A\$2.6 million was made available for climate change adaptive research. www.nccarf.edu.au
- Professor Quentin Grafton has been appointed the inaugural **Chief Economist** to head up the newly established Bureau of Resource and Energy Economics (formally part of ABARES). www.ret.gov.au
- Updated figures released from the **Energy Efficiency Opportunities** Program show an increase of 25% in energy savings identified by the large energy using corporate sector. www.ret.gov.au
- Funding of A\$4.5 million has been provided to 13 projects to help demonstrate how coastal communities can adapt to the impacts of climate change. www.climatechange.gov.au
- Solar Dawn and Moree Solar Farm have been selected to build two of the largest solar power station plants in the world with funding through the **Solar Flagships** Program. www.ret.gov.au

From our Canberra correspondent, Anntonette Joseph MAIE, Environmental Resources Management

Julia Gillard Headlines All-Energy Australia 2011



The Prime Minister will launch the biggest and most significant clean and renewable energy event in this country.

Julia Gillard will officially welcome delegates and provide introductory remarks to those attending All-Energy Australia at Melbourne's Convention and Exhibition Centre on 12 October 2011.

Ms Gillard's participation adds further weight to the two-day exhibition and multi-stream conference that is expected to attract as many as 4000 participants, 200 exhibitors and more than 100 leading international and local speakers.

Her senior ministers involved in the energy sector will also contribute to the free-to-delegate event, now in its third year.

The Minister for Climate Change and Energy Efficiency Greg Combet will write an article for the pre-show newsletter.

Resources and Energy Minister Martin Ferguson will detail Australia's clean energy future and provide further information about proposed carbon pricing at the closing plenary debate on the second day of the conference.

In the same forum, the Shadow Minister for Climate Action, Environment and Heritage Greg Hunt will outline the Coalition's perspective.

As Parliament is in session during All-Energy Australia, the ministerial presentations will be pre-recorded.

The show's Regional Director Boyd Dale commended the involvement of Australia's most significant political figures.

"This year's event provides a platform for the latest technological advancements and has strong representation from all three levels of government, with the Prime Minister leading the way", Mr Dale said.

"It shows the rapidly increasing importance of clean energy, with All-Energy Australia being the country's major annual industry sector forum."

The event embraces renewable technology such as wind, wave and tidal, hydro, hydrogen and fuel cells, solar and bioenergy, along with clean coal, carbon capture and storage, and energy efficiency.

Speakers will explore and analyse not just the technicalities of clean energy, but the financial, social and political issues associated with their financing, commercialisation and implementation.

Further information and registration details can be found at www.all-energy.com.au

All-Energy Exhibition and Conference 12–13 October 2011

- Includes:**
- A conference stream organised by our Young Energy Professionals
 - AIE Stand in the All-Energy Exhibition hall

*** Free registration at www.all-energy.com.au ***

Equinox Summit: Energy 2030

The Equinox Summit, held 5–9 June 2011 in Ontario Canada was the inaugural conference for the Waterloo Global Science Initiative (WGSi). Founded in 2009, the not-for-profit WGSi is a partnership between Perimeter Institute for Theoretical Physics and the University of Waterloo.

Historically, scientific discoveries have been the greatest single factor leading to health, prosperity and the advancement of our civilization. Scientific and technological advances will be critical to successfully navigating future crises related to energy, water, food, and health. The solutions to these problems will govern our future over the next century.

The Equinox Summit's parallel public-private structure presented an opportunity to engage the public on the science behind global energy issues while facilitating forward-looking, in-camera discussions among a range of specialists working at the intersection of science and policy.

The Summit brought together some of the world's foremost science and technology thinkers who are working to develop viable and secure sources of low carbon energy options. They engaged with a forum of young, emerging, international leaders in policy, industry and civil society. In addition, a team of expert advisors in public policy, economics and industry were present to work with the quorum of scientists and forum of future leaders to gauge the processes and timelines involved in realising these necessary breakthroughs.

The 10-member quorum included Cathy Foley, Deputy Chief – Science, Material Science and Engineering Division, CSIRO, and Maria Skyllas-Kazacos, Professor Emeritus, School of Chemical Sciences and Engineering, University of New South Wales. Advisors included Robin Batterham, President, Australian Academy of Technological Sciences and Engineers, and Barry Brook, Sir Hubert Wilkins Chair of Climate Change, and Director, The Environment Institute, University of Adelaide.



Maria Skyllas-Kazacos presenting at the session on 'Ensuring Electricity: What Happens if the Lights Go Out?'

Equinox Communiqué

Overview

Energy is humanity's largest contributor to greenhouse gas emissions, and our appetite for electricity is growing faster than for any other form of energy. Transforming the ways we generate, distribute and store electricity is among the most pressing challenges facing society today.

Over the next four decades, global energy demand is expected to almost double from 16.5 terawatts to 30 terawatts. If we want to stabilise CO₂ levels in our atmosphere at 550 parts per million, all of that growth needs to be met by non-carbon forms of energy.

Reducing the amount of fossil fuel we burn to generate electricity would make a substantial contribution to the goal of addressing climate change. In the wider context of peak oil and the rapidly growing global population, there is an urgent need for action.

The WGSi was established to help bring science to bear on the most difficult problems facing our world. Over the past week [5–9 June 2011], 36 scientists, engineers, entrepreneurs and future leaders from around the world came together to explore how science and technology might serve as a catalyst for the urgent change that is needed.

Vision For 2030

This Communiqué identifies a group of technological approaches and implementation steps that have the potential over coming decades to accelerate the transition of our energy systems toward electrification and in the longer term toward an energy future where our dependence on fossil fuels is greatly reduced.

Given the right support, the six priority actions identified below can catalyse change on a global scale, from the cities of the developed world, to the billions of people who live in towns and villages that lack adequate access to electricity.

The priorities are:

- replacing coal for baseload power
- urban electric mobility
- making cities energy-smart
- rural electrification with flexible solar cells.

Replacing coal for baseload power

Many of the world's towns, cities and industries rely on a consistent supply of 'baseload' power, most of which is currently generated through the burning of fossil fuels. Among a range of options, the Summit has identified three

alternative means of providing that power that have the potential to significantly reduce greenhouse gas emissions – geothermal power, renewables enabled by storage, and advanced nuclear power to close the fuel cycle.

Geothermal energy is a large resource capable of providing a significant proportion of the global energy demand. Costs for geothermal electricity generation can be a competitive resource if deployed on a large scale. The fundamental challenge is that subsurface resources can only truly be understood by undertaking major drilling programs. Several large demonstration projects would be required to deliver certainty about the exploration techniques, and engender confidence in production costs, potentially advancing geopower to the terawatt scale.

The world needs its sources of power to be reliable and efficient. But wind, waves and sunshine do not always meet these criteria. We could change that by turning our attention to a long-neglected aspect of the power system: storage. Electrochemical batteries, including vanadium redox flow batteries, have proven utility in a limited number of real-world situations, but substantial initial investment is needed to reduce costs and commercialise a range of these technologies. Large-scale demonstration projects in countries with high penetrations of renewable energy sources are recommended.

Nuclear energy has proven capacity to deliver, on a large scale, low-carbon baseload power, but there are still concerns regarding safety and radioactive waste. Accelerating the development of forms of nuclear power that close the nuclear fuel cycle, including an effective solution for managing long-lived nuclear waste, and a widely available fuel supply, would be transformative. To achieve significant and timely uptake of these technologies, we propose international collaborations to develop the first commercial demonstration of the integral fast reactor with a fully closed fuel cycle (full recycling of uranium and plutonium), and experimental demonstration of novel accelerator-driven thorium-based systems.

Urban electric mobility

As countries become more urbanised, demand for transportation will increase. Transportation contributes 40% of humanity's global greenhouse gas emissions currently, a problem only likely to worsen as these cities grow.

Replacing gasoline-fuelled vehicles with electric ones has the potential to reduce emissions significantly. We could amplify this benefit by designing transit and vehicle-sharing schemes that integrate information and communication technologies to enable a shift in focus from ownership of vehicles to access to mobility. Within a short time it could be possible to demonstrate the benefits of combining ICT and battery-powered electric vehicles in a small number of representative cities around the world.

Making cities energy-smart

Expanding, dense urban areas have an unsustainably high carbon footprint. The world is becoming increasingly urbanised, with predictions that by 2040, more than 60% of the world's population will live in cities. Our buildings and infrastructure in cities need to be smart enough to incorporate renewable energy solutions such as innovative quantum-based solar technology, smart metering, superconducting conduits and systems for intelligent data collection about building performance and behaviour. Pilot demonstrations in carefully selected neighbourhoods that combine these technologies could provide the knowledge needed for the developing world to leap-frog the inefficient and unsustainable designs of the past.

Rural electrification with flexible solar cells

Approximately two billion people around the world have no, or very limited, access to electricity or other modern energy services. The negative consequences for their human rights, including health, education, and economic development, have been recognised as a significant barrier to achieving the United Nations Millennium Development Goals. Although many options to alleviate poverty exist, lightweight, durable and flexible photovoltaic technologies that are currently being developed offer a technologically and economically feasible solution for remote, off-grid deployment. Both the photovoltaic and battery storage technologies needed for these applications are three to four years from commercialization, and still searching for markets. Creating partnerships locally and internationally could facilitate the roll-out of integrated micro-grid systems based on renewable resources to provide basic energy needs such as lighting, communications and medical refrigeration.

What's next

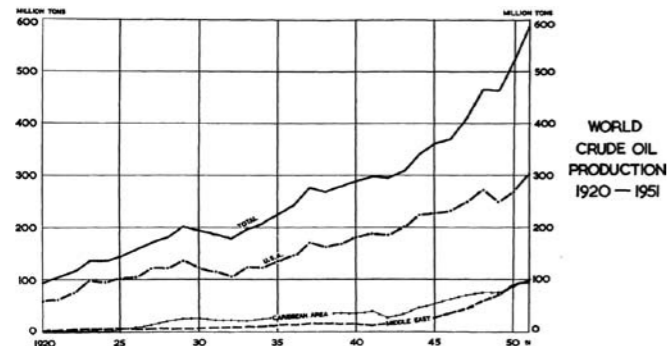
The ideas outlined in this Communiqué will form the basis of a detailed document – the Equinox Blueprint: Energy 2030, which will paint a picture of the challenges faced by society in energy, detail forecasts from various global and national agencies for the likely state of affairs in 2030, and list the Equinox Summit's recommendations and proposals to address these. Equinox Blueprint: Energy 2030 will be aimed at informing, advising and inspiring science and technology influencers, government and industry leaders globally. It will focus on how science and technology can contribute to the challenges faced. It will offer practical, real-world solutions – based on the latest scientific thinking – and offer recommendations for investment and focus, and for the coordination of national and international scientific and engineering efforts which may, over the next 20 years, help address energy challenges in a meaningful way.

For more information on the Equinox Summit and WGSi, see www.wgsi.org

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60 years of stats BP Statistical Review of World Energy 2011

The BP Statistical Review of World Energy is the longest running compilation of global energy statistics. From its humble beginnings in 1951 – six typewritten pages plus one page of graphical illustrations – to a comprehensive internet database of around 300,000 entries today, it is one of the most highly regarded resources in energy.



The graph from BP Statistical Review of World Energy 1951

BP's data on energy production, consumption, trade, reserves and prices tells the story of energy over the second half of the 20th century. It is the basis for analysis in business, policy, academia and journalism, as well as BP's own assessment of energy trends and views on the outlook for energy to 2030.

The 2011 review shows that global energy consumption rebounded strongly in 2010, driven by economic recovery. This growth was broad-based, with mature OECD economies joining non-OECD countries in growing at above-average rates. All forms of energy grew strongly, with growth in fossil fuels suggesting that global CO₂ emissions from energy use grew at the fastest rate since 1969.

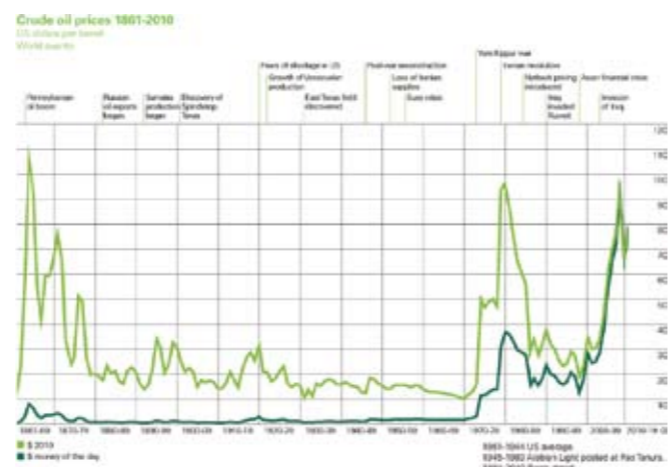
Energy price developments were mixed. Oil prices remained in the US\$70–80 range for much of the year before rising in the fourth quarter. With the OPEC production cuts implemented in 2008–09 still in place, average oil prices for the year as a whole were the second highest on record. Natural gas prices grew strongly in the United Kingdom and in markets indexed to oil prices (including much of the world's LNG); but prices remained weak in North America, where shale gas production continued to increase; and in continental Europe, partly due to a growing share of spot-priced deliveries. Coal prices remained weak in Japan and North America, but rose strongly in Europe.

Energy developments 2010

World primary energy consumption – which this year includes for the first time a time series for commercial renewable energy – grew by 5.6% in 2010, the largest increase (in percentage terms) since 1973. Consumption in OECD countries grew by 3.5%, the strongest growth

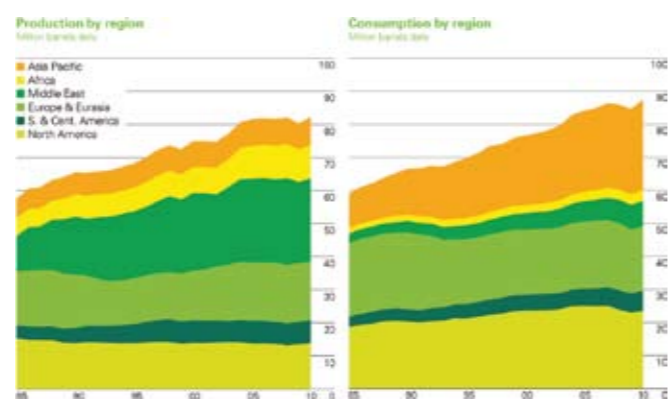
rate since 1984, although the level of OECD consumption remains roughly in line with that seen 10 years ago. Non-OECD consumption grew by 7.5% and was 63% above the 2000 level. Consumption growth accelerated in 2010 for all regions, and growth was above average in all regions. Chinese energy consumption grew by 11.2%, and China surpassed the United States as the world's largest energy consumer. Oil remains the world's leading fuel, at 33.6% of global energy consumption, but oil continued to lose market share for the 11th consecutive year.

Fossil Fuels



Crude oil prices, 1861–2010

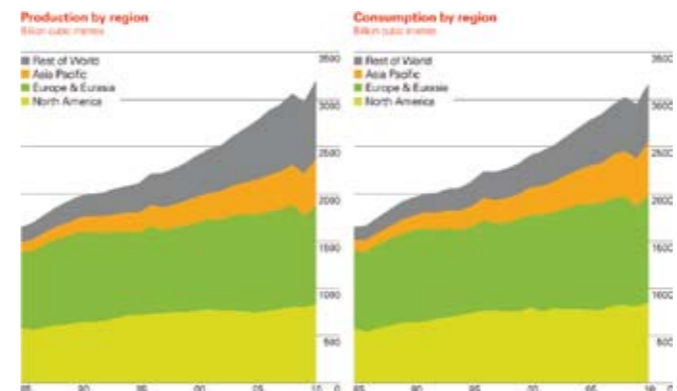
Like other fuels, oil consumption and production rebounded strongly in 2010. Unlike other fuels, prices rose strongly as well: Dated Brent averaged almost US\$80/bbl for the year, an increase of nearly 30% over 2009. Prices started to rise toward the end of 2010 and have continued to do so in 2011, with Brent now [mid 2011] near US\$115. These headline figures hide a somewhat more involved story within the year – a story driven by the economic recovery (a theme shared by all fuels) and OPEC production restraint (a feature unique to oil). The more involved story is explained by BP Chief



Oil production/consumption by region

Economist Christof Rühl in his speech, which is available at www.bp.com/statisticalreview, where an extensive and comprehensive range of information on all sections of the review can be downloaded.

Global natural gas production and consumption both grew exceptionally last year. Demand was driven by the economy, the continued shift towards non-OECD consumption, and weather conditions. The supply side is shaped by unconventional gas and LNG. Underneath the surface we see rapid global integration, competition between spot and contract priced gas, and price-induced fuel switching.



Natural gas production/consumption by region

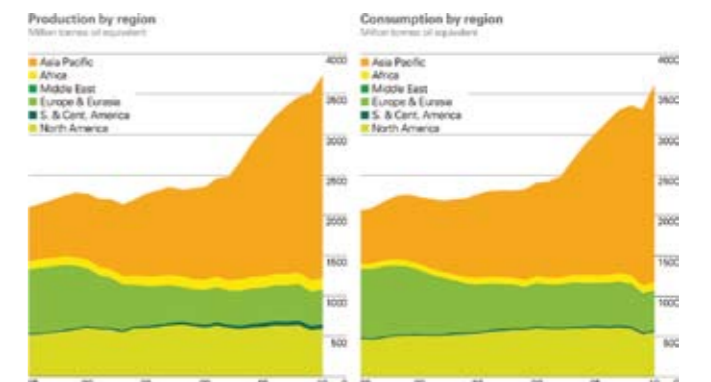
Over the past five years, global LNG supply grew by a cumulative 58% – three times faster than total gas production. Last year, the supply of LNG expanded by an unprecedented 22.6%. Qatar strengthened its position as the world's largest LNG supplier. Its LNG exports rose 53% in 2010, with further growth in 2011.

Not only volumes, also the density of trade increased in response to growing opportunities: Qatar exported LNG to 19 countries in the world in 2010, four more than just a year earlier, and the four largest importers are now tapping into 14 supply sources on average, compared with nine in 2005. Integration proceeds rapidly. In 2010, the rate of expansion of LNG was four times higher than in pipeline trade. The share of LNG in international gas trade moved up to 31%, from 23% in 2005. Such growth can be transformational. Some of the consequences are on display in Europe.



Gas prices

Like all other fuels, coal production and consumption grew above average in 2010 – by 6.3% and 7.6% respectively. The shift toward non-OECD consumption continued, with China and India increasing coal use by 10% and 11% respectively. As with other fuels, OECD coal consumption also shot up – by 5.2%, the fastest rate for 31 years and hard on the heels of a decline of more than 10% in 2009. Among all the fossil fuels, coal consumption grew the fastest.



Coal production/consumption by region

Carbon emissions and renewables

The general picture of strong energy growth translates into bad news for carbon emissions. In aggregate, all the non-fossil sources of power combined grew by 4.9%, less than the growth of primary energy. With coal consumption growing at the highest rate among fossil fuels, global CO₂ emissions from energy – measured by standard conversion rates – grew by 5.8% in 2010, faster than total energy consumption, and the fastest rate of growth since 1969.

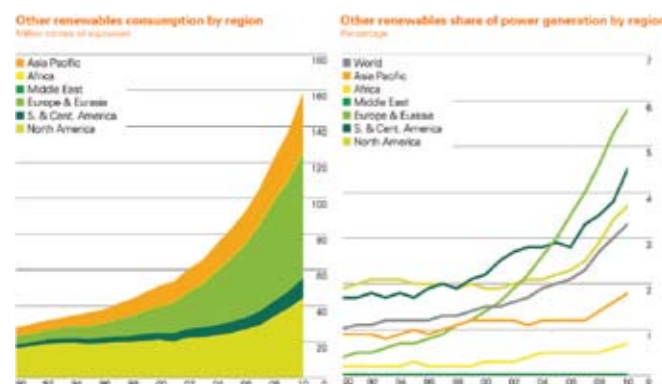
In BP's data, emissions grew strongly in the OECD (3.4%) and non-OECD (7.6%) alike. By country, China had the world's largest emissions increment. It accounted for 43% of the global increase, followed by the United States with 13%. There are a few countries where emissions declined, but these either had special circumstances to claim – for example Australia, where hydro generation replaced coal – or they failed to participate fully in the economic recovery.

Global emissions intensity – the amount of CO₂ released per unit of energy – increased in 2010. The increasing weight of carbon intensive countries (such as China) in global energy consumption may result in an increase of global emission intensity, even though most of these countries (including China) actually achieve declines in their own emissions intensity. It shows how 'joined-up' the world has become.

Renewables

Just when progress on carbon emissions appears difficult and the public purse is empty, renewables – finally – are clawing their way into the statistics on global energy consumption. They still have far to go; but limitations and prospects are becoming clearer along the way.

BP records renewables in power generation – wind, solar, geothermal, biomass and waste – and biofuels in transport (ethanol and biodiesel). Together, they accounted for 1.8% of global primary energy last year, 1.3% from renewables in power generation and 0.5% from biofuels. This is not much; but over the past ten years, their share has almost trebled; and over the past five years, their contribution to primary energy growth was almost 10% – that is, higher than the contribution of petroleum-based products.



Renewable energy consumption/share of power by region
'Other renewables' exclude hydro and nuclear

Energy Outlook to 2030

For the first time, BP has published its World Energy Outlook, which is built to the best of BP's knowledge, reflecting its judgement of the likely path of global energy markets to 2030. It is not a 'business as usual' extrapolation or an attempt at modelling policy targets.

Population and income growth are the two most powerful driving forces behind the demand for energy. The next 20 years are likely to see continued global integration, and rapid growth of low- and medium-income economies. Population growth is trending down, but income growth is trending up. At the global level, the most fundamental relationship in energy economics remains robust – more people with more income means that the production and consumption of energy will rise.

Powerful long-run trends continue to shape the modern energy economy – industrialisation, urbanisation and motorisation. These trends are associated with:

- increasing quantities of energy consumption

- increasing efficiency of energy use, in production and consumption
- increasing diversification of sources of energy
- increasing demand for clean and convenient energy at the point of use.

The three fossil fuels are converging on market shares of 26–27%, and the major non-fossil fuel groups on market shares of around 7% each. Oil continues to suffer a long-run decline in market share, while gas steadily gains. Coal's recent gains in market share, on the back of rapid industrialisation in China and India, are reversed by 2030. The diversifying fuel mix can be seen most clearly in terms of contributions to growth. Over the period 1990–2010, fossil fuels contributed 83% of the growth in energy; over the next 20 years, fossil fuels contribute 64% of the growth.

Taken together, the contribution of all non-fossil fuels to growth over the next 20 years (36%) is, for the first time, larger than that of any single fossil fuel. Renewables (including biofuels) account for 18% of the growth in energy to 2030. The rate at which renewables penetrate the global energy market is similar to the emergence of nuclear power in the 1970s and 1980s.

Overall, energy used to generate power remains the fastest growing sector, accounting for 57% of the projected growth in primary energy consumption to 2030. The diversification of the fuel mix is being driven largely by the power sector, where non-fossil fuels, led by renewables, account for more than half of the growth. Gas accounts for more than half of the growth in fossil-fuelled power. In transport, we are starting to see diversification, driven by policy and enabled by technology, with biofuels accounting for nearly a third of energy demand growth.

Carbon per unit of GDP falls by 42% by 2030, and the rate of decline accelerates steadily. By 2020–30, non-OECD emissions are growing by only 1.3% pa, compared to 5.2% pa growth over 2000–2010. Overall, this implies some progress towards climate change goals, but not enough to put the world on a path to stabilisation at 450 ppm.

The outlook, the review, and much more are available at www.bp.com/statisticalreview

EN

Star Homes

On 29 July, the Building Designers Association of Victoria (BDAV) announced the winner of its inaugural 10-Star Challenge – Lifehouse Design in collaboration with Crosby Architects and Lewin Consulting, for the Flip-Flop House.

BDAV challenged entrants to design a three-bedroom 10-Star energy-rated house on a hypothetical urban site in Melbourne. The winning design adapts to the changing needs of occupants as their living patterns change - the east and west wings can 'flip-flop' in use over time to sustain the building into the future. The design includes a modular portal frame structure, reverse brick walls, maximum insulation, triple glazing and optimisation of passive-solar design principles. Achieving 10 stars indicates that it will require no energy to heat or cool throughout the year. The installation of a grid-interactive solar power system would 'flip the energy bill upside down.'



Graphical interpretation of Flip-Flop House on a hypothetical urban site

The judges of the challenge said that this entry had 'ticked the boxes' and delivered a sophisticated, simple, elegant, house with a two-storey component. The modular wall treatments would facilitate minimisation of construction material waste and reduction of inefficient site labour processes.

For more information see www.lighthouse.design.com.au or www.bdav.org.au

One month later, on 30 August, Queensland Leader of the Opposition in the Senate and Shadow Minister for Employment and Workplace Relations, the Hon. Eric Abetz; Minister for Environment the Hon. Vicky Darling MP; and Bondor General Manager Geoff Marsdon attended the opening of the first eight-star energy efficient home. Called the InsulLiving® Home, it is located in a new estate in Burpengary, north of Brisbane.

The InsulLiving project was developed by Australian building products business, Bondor and utilises InsulWall® and

SolarSpan® insulated products to save energy and achieve a building time estimated to be 34% faster than traditional 'brick and stick' construction.



InsulLiving Home, Burpengary, Queensland

The thermal technology ensures the house stays warm in winter and cool in summer, and the system is resistant to vermin, rot and termites. The modular nature of the product also allows for deconstruction and recycling of the walls and roof. Bondor has been developing the InsulWall solution for the past five years with Bluescope Steel and Dulux Acratex, and this year was awarded A\$50,000 by the Queensland Government Proof of Concept Fund for the project.

The InsulLiving project is another step towards zero energy housing. With the combination of InsulWall structural insulated wall system and SolarSpan all-in-one roof and ceiling system, the InsulLiving system offers a complete thermal envelope exceeding the current thermal efficiency requirements of the Building Code of Australia, for a wide range of climate zones.

The InsulWall panels interlock tightly together to create a high performing and consistent insulation barrier that protects the home from variations in outside temperatures and humidity and maintains a comfortable internal living environment. InsulWall conserves energy by reducing the reliance on air-conditioners or heaters; their effectiveness is normally lost through poor and inconsistent insulation. InsulWall is a light-weight structural panel made with an insulating EPS core and strong BlueScope steel facings.

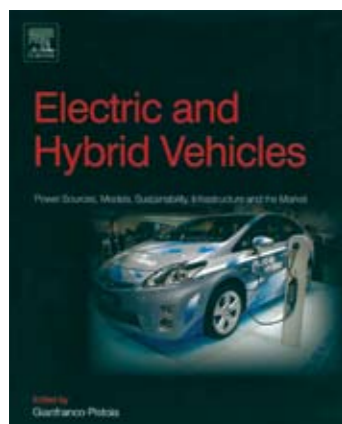
SolarSpan combines roofing, insulation and ceiling in one durable and functional panel. Large spans are achievable, reducing the need for support structures and enabling spacious living areas.

For more information, see www.insuliving.com.au

EN



www.aie.org.au



Electric and Hybrid Vehicles

Edited by Gianfranco Pistoia, Elsevier, 2010, hardback, ISBN 13:978-0-444-53565-8, 670 pages, list price \$US235 online (www.elsevier.com).

Subtitled 'Power Sources, Models, Sustainability, Infrastructure and the Market', this book is a collection of technical papers drawn from

worldwide sources covering, as the title suggests, many aspects of electric and hybrid vehicles. Hydrogen fuel cell vehicles are also covered in a number of chapters. The book seems to be targeting not just engineers and scientists wishing to understand technical aspects of these new and emerging vehicle powertrain technologies, but also people working in positions involving public policy, where an understanding of their benefits and drawbacks will be of interest.

Through modelling and real-world examples, the different chapters explore the respective merits of each technology with regard to GHG reduction, petroleum displacement and overall environmental impact. Economic aspects including lifetime costs are also well covered. As everyone working in this field will recognise, the biggest challenges lie in the area of energy storage. Electric motors and transmission systems may be many times more efficient than the best internal combustion engines; but, despite the recent advances in battery chemistry, there is still some way to go before the overall propulsion system of an electric or hybrid vehicle will be competitive with the best internal combustion engine

vehicles for mass, cost and especially operating range.

It is therefore appropriate that many chapters are devoted to battery technology. The reasons for the evolution from nickel metal hydride batteries in hybrid vehicles to lithium-ion (li-ion) in pure battery electric vehicles are well explained and several chapters touch on technologies still in the research stage such as zinc-air. Battery management systems have emerged as a key technology for optimising the lifetime performance of li-ion batteries and even more importantly, their safety. An entire chapter is devoted to safety of these batteries including a section discussing why li-ion cells go into thermal runaway.

Closing chapters discuss the all important questions of charging infrastructure and an interesting model analysing market prospects of electric vehicles.

It is perhaps inevitable that any book which sets out to publicise the latest research in a fast-moving technology will not always be quite as current as some readers would wish. On the other hand, for readers looking for a more research-based analysis than will be found in application-focused industry publications, this book will be of great interest.

*Ian McCleave FAIE
CEO, EV Engineering*

Have you paid your AIE membership subscription for 2011-12?

If you have, you will continue to enjoy the many benefits of membership, including receiving **ENERGYNEWS** every quarter and discounted registrations at AIE Branch events.

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If you have misplaced your subscription notice, email aie@aie.org.au



The members' section of ENERGYNEWS

ENERGYNEWS welcomes contributions to Membership Matters, including member profiles, corporate member profiles, anecdotes, and advertising. Send ideas and contributions to editor@aie.org.au



New Members

New Members

Name	Grade	Branch	Name	Grade	Branch
Mr Steve Blume	Member	Canberra	Mr David McCluskey	Graduate	Melbourne
Mr Paul Budge	Associate	Sydney	Mr Robert McMahon	Member	Sydney
Sir Roderick Carnegie	Fellow	Melbourne	Mr Nicholas Morton	Graduate	South Australia
Mr Ronald Craggs	Fellow	Sydney	Mr John Pollock	Member	Melbourne
Ms Becana Devencorn	Member	Brisbane	Mr Julius Pucci	Associate	Sydney
Mr Bobby Ditric	Member	Perth	Mr Toby Roxburgh	Member	Canberra
Ms Alison Gibbs	Member	South Australia	Ms Helen Sim	Associate	Sydney
Mr William Hall	Fellow	Sydney	Dr Andrew Simpson	Fellow	Brisbane
Mr Scott Hutchinson	Fellow	South Australia	Mr Joseph Tesoriero	Associate	Sydney
Mr Robert Hutchinson	Associate	Sydney	Mr Giles Whitehouse	Member	Tasmania
Dr Julian Inchauspe	Member	Perth	Mr Roger Wilkinson	Fellow	Sydney
Mr Andrew Jacobs	Graduate	Perth	Mr Gareth Williamson	Student	Melbourne
Mr Charles Laurenz	Associate	Sydney	Mr Ian Wiskin	Member	Sydney
Mr Chani Lokuge	Member	Sydney	Mr Hannes Zandberg	Member	Perth
Mr Christopher Mardon	Associate	Melbourne			

New Corporate Members

Company Name	Representatives	Branch	Company Name	Representatives	Branch
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	Mr Christopher Hughes	Sydney	Pty Ltd	Mr David McFadden	Sydney
	Ms Zoe Rafter	Sydney		Mr Colm Molloy	Sydney
	Mr David Ryan	Sydney		Mr Edmund Smith	Melbourne
Better Place Australia	Mr Mark Landis	Melbourne		Ms Kate Van Namen	Perth
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Dalkia	Mr Bob Norris	Sydney		Mr John Cooper	Tasmania
	Mr Arnaud Perez	Sydney	Tiwest Joint Venture	Mrs Beth Michetti	Perth
				Mrs Vanessa Nicolopoulos	Brisbane

Lost Members

... but not forgotten members!

Please help us find our 'lost' members. The following people are on our database as members of the Australian Institute of Energy. However, all correspondence is being returned to sender. If you recognise anyone here, please ask them to contact the AIE, either by emailing aie@aie.org.au or free call 1800 629 945.

Name	Branch	Name	Branch
Cris Kerrison	Brisbane	Jeremy Carlberg	Perth
John Lasich	Melbourne	Geoffrey McKinnon	South Australia
Andre Kneisel	Melbourne	Tatsuya Nishioka	Sydney
Yusli Yaakob	Melbourne	Peter Dempster	Sydney
David Almond	Perth	James Faulk	Sydney

Brisbane

- AIE Brisbane Branch sponsored the Future Fuels for Australia Conference on 19–20 July 2011. Speakers included Dr Andrew Dicks FAIE.

Canberra

- AIE Canberra branch hosted a networking seminar on the role and responsibilities of Australian Government energy agencies under the title “The Energy State of Play: Untangling government energy agencies” on 20 June 2011.

Melbourne

- AIE Melbourne Branch and the Engineers Australia Victorian Transport Branch jointly organised “Planning for Electric Vehicles” with presentations by Kristian Handberg, Project Manager Low Emission Vehicles, Victorian Government Department of Transport; Geoff Zippel, Head of Deployment, Better Place Australia; and Ian McCleave, CEO, EV Engineering, on 13 July 2011.
- The Hon. Michael O’Brien, Victorian Government Minister for Energy and Resources, presented “Victoria’s New Energy Policy” on 28 July 2011.

Newcastle

- In conjunction with Newcastle Chapter of Engineers Australia, AIE Newcastle Branch presented “Geothermal Energy – Current State of Play and Developments” with a focus on the Hunter Valley and presentations by Alistaire Webb, Geodynamics, and Stephen de Belle, Granite Power, on 2 August 2011.

Perth

- Peter Pudney, Senior Research Fellow, Engineering and Environment, University of South Australia, presented “Electric Cars: Are they the answer?” on 25 July 2011.
- AIE Perth Branch and the Western Australia Government Office of Energy hosted Energy in WA Conference, under the theme “Energy: The next generation” on 17–18 August 2011.

South Australia

- David Smith, Executive General Manager – Business Development & Government Relations, Linc Energy, presented “Underground Coal Gasification: Stranded coal to clean energy” on 9 June 2011.
- Mitch Williams MP, Deputy Leader of the Opposition and Shadow Minister for Energy in South Australia, presented “Energy Policy Issues for South Australia: An alternative perspective” on 14 July 2011.
- Robert Stobbe, Chief Executive Officer, ETSA Utilities, presented “ETSA Utilities: The journey ahead” on 9 August 2011.
- AIE South Australia Branch Young Energy Professionals hosted “Contracts 101” with Lizzie Knight and Mary Seely, Senior Associates, Blake Dawson, as part of their Spring into Learning Series, on 15 August 2011.

Sydney

- AIE Sydney Branch hosted a half-day symposium on “Energy from Waste in New South Wales”, with presentations by Andrew Lewis, David Tanner, Dr Marc Stammach, Frank Klostermann, Paul Howarth and Mark Glover, on 20 June 2011.
- Seb Henbest and Kobad Bhavnagri, Bloomberg New Energy Finance, presented “Signals for Transition: Examining the new ETS and LRET” on 15 August 2011.
- Dr Grayson Heffner, Senior Energy Efficiency Advisor, International Energy Agency, presented “Positioning to deliver on Australia’s energy efficiency potential” on 23 August 2011.

Tasmania

- Marc White, Director, Goanna Energy, presented “What does retail contestability mean for you, the customer?” on 28 June 2011.

- emerging distributed energy technology
- personal energy management
- energy storage
- electric vehicles
- micro-generation (incl. combined heat and power (CHP))
- renewables (incl. geothermal, wind, solar hot water and solar PV).

Energeia was founded by a small group of professionals from the energy infrastructure company EnergyAustralia (EA) – now Ausgrid – which at the time had the largest and most advanced smart metering program in Australia and one of the most advanced in the world. Managing Director Ezra Beeman joined EA in 2003, following five years in energy consulting in the United States and Europe with Cambridge Energy Research Associates.

“At EA we were involved in some ground-breaking research into how customers respond to smart metering, dynamic pricing and in-house displays,” said Mr Beeman. “This interest in how consumers use energy and how they engage with the energy industry, and sharing that interest with others, was the genesis for Energeia.”



ENERGYNEWS asked Mr Beeman what Energeia’s recent research is telling us about the energy sector.

“One of the key challenges facing the energy industry is the rising cost of electricity,” he said. “Consumers are facing price rises of a magnitude not seen for more than 20 years, due to ageing infrastructure and the implementation of environmental programs.

“At the same time, a number of consumer energy devices are being developed that address environmental issues and promise to be more efficient and less costly in the long term. The emerging technologies include fuel cells for micro-generation in the home, electric vehicles, energy storage and renewable energy – all at the household level.

“Technology is taking us towards more decentralised energy systems, even though it is early days. Just like the evolution of the personal computer, the price will come down as the mass market is developed. Using fuel cells to generate a combination of hot water and electricity makes sense because of the very efficient way a fuel cell converts natural gas to electricity. We think that, over time, these systems will be like other household appliances, such as refrigerators, with different sizes and specifications to suit different households.”

Energeia’s research service covers all of the emerging technologies with respect to the mass market – residential

and small business – including demand management, electric vehicles, micro-renewables (solar, wind, hot water). It is releasing a report on micro CHP in September 2011.

“Micro CHP in Australia is the story of BlueGen,” said Mr Beeman. “The technology was developed by CSIRO and, now that the appliance has certification with the Australian Gas Association and sales channels are established, the barriers to more widespread installation are coming down. However, Australia’s policy environment could be more supportive.”

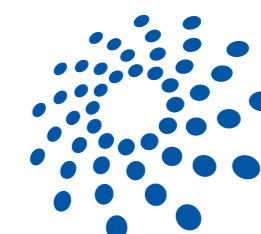
Energeia’s research takes the perspective of the entrepreneur and looks at commercial feasibility – market demand, price signals, and what customers are looking for. “The recent history of the solar PV industry demonstrates that, if it’s a good economic deal, the mass market will adopt it,” said Mr Beeman. “Early adopters may buy a technology because of its environmental benefits, but the mass market buys it if it is cheap. Most people that put solar PV on the roof do so because it is going to pay for itself in three years.

“That is why we need to improve the policy settings. Australia made the same mistake as Europe. We set the support at too high a level and the funds were depleted too quickly. The solar PV supply industry boomed then came to a halt. I think the nation needs to decide which industries it wants to support as strategic industries based on what is in the long-term interest of Australia. For example, programs that reduce costs for renewable technologies on the cusp of becoming commercial would open up the choices for consumers and promote competition in the industry.”

Before Energeia became a corporate member of the Institute, Mr Beeman was an individual member. “The AIE was the first energy association that I joined when I arrived in Australia,” he said. “I appreciated the opportunity to meet with other energy professionals and enjoyed the topics presented at events. When I formed Energeia it was a natural progression to become a corporate member. There are six of us working together at the office in Sydney. We try to send as many along to events as we can.

“The AIE is unique; it facilitates the only honest dialogue on energy technology and policy in Australia. Other organisations take a narrow view based on their constituency – which they should – but we need this broader umbrella group to open up the discussion to a real cross-section of the industry.”

For more information on Energeia, see www.energeia.net.au



ENERGEIA

Corporate Member Profile

Energeia

Energeia provides professional research, consulting and technical services to companies operating in the natural gas and electricity value chains. Founded in 2009, Energeia brings together energy specialists from around the world; experts with a wealth of industry and academic expertise. Their deep understanding of the issues, often based on first-hand experience within industry or as a practitioner applying theoretical economic concepts in an energy context, is

applied across many areas, including:

- smart networks and smart metering
- network planning and design
- policy and regulation
- demand management and energy efficiency
- sustainable energy and development
- energy product development and pricing

AIE Election Time

Over the next few weeks, the AIE Board and most Branch Committees will call for nominations from AIE members for next year.

NATIONAL BOARD

If you think you can make a difference or a contribution at a national level, you should consider nominating. To nominate, you have to be a financial member of the AIE, over 18 years of age, and eligible to act as a director under the Corporations Act 2001. You also need a proposer and seconder who are both members of AIE.

Each year, the Board has three (3) national positions to elect, each with three-year terms. There may also be casual vacancies on the Board to fill. If a Branch is not represented by one of the nine elected directors, it can subsequently nominate a director from the Branch for a one-year term.

A nomination form for the Board positions is available at www.aie.org.au

BRANCHES

Branch Committees have up to 12 positions, including a Board member, to fill each year for one-year terms. Any shortfall can be filled by invitation. Branches are always looking for new committee members and some Branches will be requiring nominations shortly.

If you are interested we encourage you to complete the nomination form for Branch Committees, which is also available at www.aie.org.au

Alternatively you can contact the national secretariat (email aie@aie.org.au or call 1800 629 945) to express your interest. The secretariat will let the relevant Branch Secretary know.

We welcome fresh talent at both national and Branch levels.

New Board and committee members are good for the Institute.

Young Energy Professionals

SA YEPs Spring into Learning

The South Australian Young Energy Professionals (YEPs) are hosting a series of workshops over the second half of 2011. The series started in August with an informative presentation titled *Contracts 101* by Lizzie Knight and Mary Seely, both Senior Associates with law firm Blake Dawson. The workshop comprised a roundtable discussion covering the basics of contracting and contractual principles relevant to the energy sector. Topics covered included allocation of risk "force majeure", change of law clauses in the context of the impending carbon tax, and the variation of contracts. The workshop provided a great platform for YEPs to ask questions on the commercial implications of various issues in energy contracts. Particularly interesting was the discussion around the table about contracting strategies, with representatives from the government and the private sectors debating the different approaches and sharing 'war stories'.

As **ENERGYNEWS** goes to print, SA YEPs are discussing *Career Fundamentals* on 12 September, covering career tips, as well as developing careers through social media and networking. Catherine Cunningham from Career Consultancy and Niki Brunning from Jigsaw People will be presenting, and offering "10 Tips for Career Success".

The final workshop on 10 October will try to answer the question *What do engineers do anyway?* Ash Manna, from Parsons Brinckerhoff, will present on the role engineers play

in the power industry, including those technical aspects that leave non-engineers scratching their heads. Places are still available and you can register at www.aie.org.au

The South Australia YEPs look forward to seeing you.

*Mary Seely, Senior Associate, Blake Dawson
Chair, SA YEPs*

Perth YEPs Roundup

The Perth Young Energy Professionals (YEPs) started the financial year with an evening in mid-July dedicated to what is likely to shape up as the year's biggest policy issue – the Australian Government's *Towards a Clean Energy Future* plan. Michelle Shepherd, General Manager Regulatory Affairs, Alinta Energy, demonstrated how the Commonwealth Parliament's past attempts to enact an emissions trading scheme increased uncertainty for industry participants, particularly as this related to trading in electricity markets. The theme was continued by Brian Innes, Principal Consultant, Energetics, who provided a comprehensive presentation on the policy package, detailing a range of international examples of the application of a price on carbon emissions and how these may have lessons for Australia. James Bruining, Partner, Blake Dawson gave a rundown of the package of support that is proposed to support renewable energy, including the establishment of the Renewable Energy Agency and what might be expected in terms of longer term impacts on the energy industry.

In August, we were lucky enough to host three outstanding international speakers who graciously agreed to speak during their time off from the AIE's Energy in WA conference:

- Dr Grayson Heffner, Senior Energy Advisor, International Energy Agency – opportunities and limitations of government in any attempt to motivate large energy users to save energy
- Prof. Paul Stevens, Senior Research Fellow in Energy, Royal Institute of International Affairs, Chatham House, London – oil prices and the Arab spring
- YoungMeen Eom, General Manager, Korea Power Exchange – development and implementation of smart grid pilot programs in South Korea.

Each of these speakers incorporated technical, political and social factors in their treatment of their diverse and complex topics.

September saw the operator of Western Australia's Wholesale Electricity Market (WEM) and our sponsor, the Independent Market Operator, host a briefing event – presenting *An Introduction to the WEM*. The WEM is Australia's 'other' electricity market and differs in certain fundamental respects from the NEM (National Electricity Market). The session introduced the concept of electricity capacity markets, which are to be distinguished from energy only markets, as well as concepts such as balancing, network



Dr Grayson Heffner delivering his presentation on energy efficiency

support and the role of system management required to maintain system integrity.

The next quarter looks bright for the Perth YEPs as preparation for a number of events now underway. See www.aie.org.au for more details.

*Luke O'Callaghan, Lawyer, Blake Dawson
Chair, Perth YEPs*

Obituary

Vale Bill Morley FAIE

Bill Morley passed away in July at the age of 84 after an extended illness. Bill was a foundation member of AIE (Member No. 207) and will be sadly missed by his many friends and colleagues in the Institute.

Bill graduated with a Dip Mech Eng from RMIT in 1953, worked for four years with Riley Dodds as a boiler design engineer. He then spent 10 years as the senior combustion research engineer at Aeronautical Research Laboratories, working on a major national project to develop a coal-fired gas turbine.

He joined the SECV R&D Department in 1968 as Head of Fuels Section, where he led and mentored a generation of bright young engineers tasked with improving the design and performance of commercial brown coal boilers. This required a team approach to measure the behaviour of the coal and the furnaces at full scale, and develop models to predict the effect of changes to the design on performance.

Following a short retirement (after nearly 20 years with the SECV) Bill joined the Coal Corporation of Victoria in 1988,

which later merged with HRL, the SECV's privatised R&D Department. There he provided a unique service with Len Stafford, manually tuning briquette-fired industrial boilers for clients, while developing engineering improvements. Even when he eventually retired after 50 years in the industry, Bill was still keen to discuss his latest calculations or drawings on an improved feeding or firing system for briquettes.

In 1983, Bill completed a BA and MA at Monash University with a thesis on the history of The Great Morwell Brown Coal Company of the 1890s. In 1990, he co-authored a chapter on "Combustion, Gasification and Oxidation" in the prestigious text *The Science of Victorian Brown Coal*, which was edited by Bob Durie FAIE.

The AIE expresses its condolences to Bill's wife Glen and family. He will be fondly remembered by the many fuel technologists that he encouraged to achieve their potential (as well as helping them develop an appreciation for red wine).

David Allardice FAIE

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Corporate Member Directory



Aurecon provides engineering, management and specialist technical services for public and private sector clients globally.

Aurecon's energy team delivers effective, tailored solutions for clients across the power generation, transmission and distribution, and renewable energy sectors.

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Energeia is a professional services firm of highly credentialed energy specialists dedicated to achieving excellence for our clients in their pursuit of the exceptional.

We offer advisory services and proprietary industry and market research products covering retailing, demand management, electric vehicles, microgeneration, renewables, energy storage and smart grid.

www.energeia.net.au

Forthcoming AIE Events

27 October 2011	Gas in Southeast Australia – AIE Melbourne Branch half-day seminar	http://www.aie.org.au/melbourne
29 November 2011	National AGM To be held in Melbourne – details TBA	

For details of these and all forthcoming AIE events, see <http://www.aie.org.au>

If your branch has organised an event in 2012, send details to editor@aie.org.au to promote the event in the **ENERGYNEWS**.

Other Events 2011: Australasia

5–7 October in Darwin	Southeast Asia Australia Offshore Conference 2011	http://www.seaoc.com/
12–13 October in Melbourne	All-Energy Australia 2011	http://www.all-energy.com.au
19–20 October in Melbourne	12th Annual Australian Gas Turbines Conference	http://www.informa.com.au/gasturbines
25–27 October in Melbourne	Retrofitting for Energy Efficiency	http://www.retro-fitting.com.au
26 October in Brisbane	Australia Electric Vehicle Conference 2011	http://www.evconference.com.au
28 October in Brisbane	Clean Futures 2011	http://innovation-centre.com.au/cleanfutures
31 October–1 November in Sydney	Australia Gas 2011	http://www.cwcaustraliagas.com
8–10 November in Sydney	Smart Utilities Australia and New Zealand 2011	http://www.smartutilities-ausnz.com
8–11 November in Gold Coast	Energy & Meteorology	http://www.icem2011.org
14–15 November in Bendigo	Community Power Conference	http://www.centralvictoriasolarcity.com.au/
17 November 2011 in Melbourne	Energy Efficiency Council National Conference 2011	http://www.eec.org.au/events/National_Conference_2011
21–22 November in Sydney	2nd Emissions Measurement Conference	http://www.iir.com.au/emissions
24–25 November in Sunshine Coast	Bioenergy Australia 2011	http://www.bioenergyaustralia.org
29–30 November in Brisbane	Energy Efficiency in Mining 2011	http://www.energy-efficiency-mining.com.au/
29–30 November in Brisbane	CSG Stakeholder Engagement 2011	http://www.csgengagement.com.au
30 November–1 December in Sydney	Australian PV Solar Energy Conference & Exhibition	http://www.aupvsee.com.au
2–3 December in Brisbane	CNG & LNG Conference	http://www.informa.com.au/conferences
12–13 December in Melbourne	7th Australian Wind Energy Conference	http://www.informa.com.au/conferences

Other Events 2012: Australasia

31 January–2 February in Brisbane	Retrofitting for Energy Efficiency	http://www.retro-fitting.com.au
22–24 February in Perth	Australasian Oil & Gas Exhibition & Conference	http://www.aogexpo.com.au/
1–3 March in Auckland	Smart Electricity World New Zealand 2012	http://www.terrapinn.com/2012/smart-electricity-nz/
28–31 March in Perth	Energising Southeast Asia	http://www.energisingsea.com.au/
2–4 April in New Zealand	NZ Wind Energy Conference & Exhibition 2012	http://windenergy.org.nz/events
17–19 April in Sydney	Retrofitting for Energy Efficiency	http://www.retro-fitting.com.au
30 April–2 May in Brisbane	Energy Networks 2012	http://www.energynetworks2012.com.au/
20–23 May in Broken Hill	Resources & Energy Symposium 2012	http://www.symposium.net.au
24–27 June in Perth	35th International Association for Energy Economics Conference	http://www.iaee.org/en/Conferences/
25–28 July in Sydney	Clean Energy Week 2012	http://cleanenergycouncil.org.au
26–28 July in Perth	Retrofitting for Energy Efficiency	http://www.retro-fitting.com.au
23–26 October in Auckland	Power Systems Technology	http://www.PowerCon2012.com

Please note that the events listed here are based on information provided by event organisers. The AIE does not necessarily endorse the views of the speakers. The events are brought to the attention of members as potentially contributing to discussion on relevant energy issues. If you know of any conferences or other major events in our region that would be of interest to AIE members and will be held in 2012, please email date, location, title and web link to editor@aie.org.au

Other Events 2011–12: International

For global energy events, see the following websites:
<http://www.conferencealerts.com/energy.htm>
<http://www.eia.doe.gov/calendar/meetings.htm>
<http://www.energyiq.co.uk/Energy.aspx>

<http://www.wavec.org>
<http://www.econference.com.au>
<http://www.pmaconference.com>
<http://www.expopromoter.com>

<http://www.terrapinn.com>
<http://www.ieee.org>
<http://www.bvents.com>
<http://www.conferensum.com>