



EESA
THE ELECTRIC ENERGY
SOCIETY OF AUSTRALIA



**ENGINEERS
AUSTRALIA**

The Electric Energy Society of Australia

www.eesa.asn.au

A word from your president



Renewables, Energy Storage & Networks

I've been talking recently to a number of politicians about renewables. They seem to think renewables will be our saviour in meeting future energy needs and cutting greenhouse gas emissions. There is little understanding of the integration issues with our networks and matching the uncontrolled green output with the needs of our time varying loads. There is clearly a massive gap between expectation and reality.

Little thought seems to have been given to the flow on effects of the government's 20% renewable energy targets. When wind and solar power are small compared to surrounding generators and load, their impacts are small and are quite manageable. As the renewable generation grows in magnitude and starts to approach the size of the largest single generators or the capacity of the surrounding network, the uncontrolled nature of the renewables starts to have major detrimental impacts on power system operations.

The most obvious case that I'm aware of is the Victoria to South Australia transmission interconnector. The high penetration of wind generation in South Australia causes additional constraints in the transmission system, adding to both generation and transmission costs. If we want substantially more renewables in our generation mix, we need stronger and more expensive transmission and distribution networks to cater for the "lumps and bumps" and we must expect higher costs from conventional power plants.

To make renewables work at the 20% level and above we need energy storage and lots of it. Without large scale energy storage, renewables will never be competitive with conventional generation or offer a viable alternative. So, for all you inventors and researchers out there, I want some new energy storage devices with capacity in excess of many hundreds of MWhs. While our hydro facilities offer some energy storage capacity, it is a very limited resource that is already being used for meeting short duration peak demands.

The storage issue is so fundamental to renewable generation that I see energy storage research being far more important than trying to get a few more percentage points improvement in wind and solar generation efficiency. So, there is the renewable challenge for all you inventors out there. All I want is a low cost, high energy, high efficiency battery or equivalent. Whoever can deliver this may well be on the way to giving us an opportunity for providing real long-term sustainability.

Dr Robert Barr
EESA National President

Bulletin 2, March - April 2010:

Please email submissions by March 22nd to the Bulletin Editor,
Patrick McMullan on pmcmullan@energy.com.au

EESA National Conference – 1-3 September 2010 at the Australian Technology Park

This year the EESA National Conference will be held at the Australian Technology Park in Eveleigh, Sydney a location which should prove to be very popular and convenient to the conference participants. It is a larger venue and one where our exhibitors can more ably display their wares.

The theme for this year's conference "**Watt's Up.... future- proofing energy networks**" addresses the ongoing evolution in energy networks and the need to ensure they remain flexible to accommodate the emerging technologies that will change grid nature and operation. All this in an environment of changing regulatory structures, an emphasis on overall sustainability, intelligent grid applications, an uptake in embedded generation and an unprecedented public spend by NSW energy utilities to replace aging networks and still cope with ongoing growth in energy demands.

The conference will start with a keynote address looking at the emerging energy picture world wide and will be followed by a series of thought provoking keynote addresses from major energy figures in the electricity supply industry.

Then in the company of fellow utility members there will be one and a half days of industry learning to be enjoyed as current energy concerns and issues are discussed and clarified. Industry experts will provide papers and discussions on topics such as implementing HV DC into networks, Arc Flash containment in switchgear, Large ambitious generation and transmission projects, innovations in substation design, Smart Villages, Smart Customers, Smart Meters and the progress to date, Climate change and its impact on networks, asset management challenges and disaster recovery processes. As the speakers will be drawn mainly from the energy supply industry the problems and solutions discussed are real and current.

The conference will provide an invaluable opportunity to catch up with energy industry developments from a 'macro and micro' view as well as encouraging many networking opportunities with colleagues from other networks and manufacturers. A notable feature of the last conference was the large number of young engineers present and it is to be hoped that this trend continues.

Call for papers

The **EESA National Conference** is one of the only conferences that is exclusively focused on electricity supply, touching mainly on areas of distribution and transmission and associated engineering philosophies.

The areas to be discussed at the conference are outlined below and papers are invited that contribute to our understanding of:

- HV DC Power grid of the future
- Smart Villages, Smart Customers, Smart meters
- Large Ambitious Projects - Generation and Transmission
- Renewables and Fuel Cells revisited
- Climate Change and its Impact on Networks
- Implementing innovations in substation infrastructure
- Asset management - Reactors, regulators and capacitors
- Arc Flash containment - new solutions and new challenges
- Recovery from large scale disasters - lessons learnt

People interested in presenting a paper should submit an abstract of up to 150 words to Helen Mackenzie on meetings@tmm.com.au by **Friday 19 March**. A brief biography of the author/presenter should also be included.



**Watt's up....
future-proofing energy networks
1 - 3 September 2010**

Tuesday March 2 : AIE join with the Energy Retailers Association of Australia to bring our March technical meeting – “Allowing energy to work” starting at 3:00pm to 6:00pm at Credit Suisse, Level 31, 1 Macquarie Place, Sydney. Guest speaker will be Professor James L Sweeney of Stanford University (introduced by Cameron O’Reilly, Executive Director, ERAA). You may recognise the name having read his book “California Electricity Crisis”. Also Edwin D O’Young of Port Jackson Partners Limited. For further information please go to www.aie.org.au

**EESA NSW Seminar and Tour, The University of Sydney Power Engineering Laboratory
Thursday 11 March 2010, Electrical Engineering Building, University of Sydney**

Overview: This seminar will review the work of Australia’s leading research centre in power engineering, intelligent grid technologies and sustainable energy systems. The seminar will be followed by a tour of the University’s state of the art Sir Williams Tyree Laboratory in Power Engineering.

Time: 10.00am - 12.30pm followed by lunch

Date: Thursday 11th March 2010

Venue: Electrical Engineering Building, University of Sydney

Coast: No cost to EESA members, \$50 for non members or \$77 for registration plus EESA membership until June 2011.

For more information and registration from visit the EESA website (www.eesa.asn.au) and go to NSW events.

It is essential to register if you will be attending.

News and Issues from around the Industry

US Eastern Wind Integration and Transmission Study

The U.S. Department of Energy's National Renewable Energy Laboratory has recently released a major study of the technical, operational, and economic issues facing the integration of large amounts of wind energy into the power system.

The Eastern Wind Integration and Transmission Study (EWITS), the largest study of its kind conducted in the United States to date, evaluates the future operational and integration impacts of up to 30% wind energy penetration into the power system in the study year 2024. The study includes a high-level analysis of transmission needed to deliver the wind energy to load centers and a cursory analysis of carbon pricing impacts.

The study found that there are no fundamental technical barriers to the integration of 20% wind energy into the electrical system, but transmission planning and system operation policy and market development need to continue to evolve in order for these penetration levels to be achieved. Without transmission enhancements, substantial curtailment of wind generation would be required for all of the 20% wind penetration scenarios.

Interconnection-wide costs for integrating large amounts of wind generation are manageable with large regional operating pools, because increasing the geographic diversity of wind power projects in a given operating pool generally makes the aggregated wind power output more predictable and less variable, while also reducing the variation in load and increasing the number of generation assets that can be committed and dispatched.

An Executive Summary and Project Overview of the study can be found at:

http://www.eenews.net/public/25/13915/features/documents/2010/01/20/document_gw_01.pdf

The Year in Energy

Liquid batteries, giant lasers, and vast new reserves of natural gas highlight the fundamental energy advances of the past 12 months. Kevin Bullis, 28 December 2009. ©Technology Review 2009.

With many renewable energy companies facing hard financial times, a lot of the big energy news this year was coming out of Washington, DC, with massive federal stimulus funding for batteries and renewable energy and programs such as Energy Frontier Research Centres and Advanced Research Projects Agency-Energy.

But there was still plenty of action both in the United States and around the world. One of the most dramatic developments was the rush to exploit a vast new resource; new drilling technologies have made it possible to economically recover natural gas from shale deposits scattered throughout the country, including in Texas and parts of New York, Pennsylvania, and Ohio. Advances in drilling technology have increased available natural gas by 39 percent, according to an estimate released in June. The relatively clean-burning fuel could cut greenhouse gas emissions by becoming a substitute for coal. Natural gas might even provide an alternative to

petroleum in transportation, especially for buses and taxis--if only policymakers could take advantage of the new opportunity.

Meanwhile a number of technologies promise to cut down on emissions from coal plants. Feeding heat from the sun into coal plants could at once increase the amount of power that can be generated from a given amount of coal and reduce the cost of solar power. And technology for capturing carbon dioxide and storing it is finally emerging from the lab and small-scale projects into larger demonstrations at power plants, even while researchers explore potentially cheaper carbon-capture techniques.

This year was also the year of the smart grid, as numerous test projects for improving the reliability of the grid and enabling the use of large amounts of renewable energy got underway. The smart grid will be enabled by key advances, such as superconductors for high-energy transmission lines and smart networks being developed by companies such as GE.

Cellulosic ethanol--made from biomass such as grass rather than corn grain--moved closer to commercialisation, with announcements of demonstration plant openings and scientific breakthroughs that could make the process cheaper. But at the same time, a number of companies are moving beyond cellulosic ethanol to the production of gasoline, diesel, and jet fuel from biomass--fuels that can be used much more readily in existing infrastructure and in existing vehicles. Exxon-Mobil announced substantial investments in algae-based fuels.

To eliminate carbon emissions and drastically curtail petroleum consumption will require plug-in hybrids and other electricity-powered vehicles. Advances that could double (or more) the energy capacity of batteries and lower their costs could one day make such vehicles affordable to the masses. These include new formulations such as lithium-sulphur batteries, metal-air batteries such as lithium-air batteries and batteries that rely on nanowires and silicon.

Getting the electricity to charge these vehicles--without releasing vast amounts of carbon dioxide--could be made easier by a number of advances this year. A new liquid battery could cheaply store energy from wind turbines and solar panels for use when the sun isn't shining and the wind isn't blowing, making it practical to rely on large amounts of renewable electricity. Vast arrays of mirrors are being assembled in the desert to convert solar heat into electricity, and photovoltaic solar farms for converting light directly into electricity are getting a boost from the federal stimulus money. And researchers are finding ways to increase the efficiency of solar cells and are discovering new photovoltaic materials to make solar power cheaper. And although progress on nuclear power is moving slowly, some advances on the horizon could help this low-carbon source replace fossil fuels. Researchers even fired up the world's largest laser system--one that's the size of a football stadium--for experiments that could lead to a new form of fusion.

Last, and almost certainly least, researchers have decided to look beyond the conventional sources of renewable energy--solar, wind, and waves--to hamsters. Researchers at Georgia Tech fitted the rodents with zinc-oxide nanowire jackets, and watched as they generated an electrical current while scratching themselves and running on a wheel.

The original article including embedded links to individual topics may be found at:

<http://www.technologyreview.com/energy/24280/>

Ceramic fuel cells' bluegen sale in The Netherlands

Ceramic Fuel Cells Limited, a Melbourne based leading developer of high efficiency and low emission electricity generation units has received an order for its BlueGen power and heating unit from Kiwa Gas Technology in The Netherlands for delivery in the second quarter of 2010.

Kiwa Gas Technology, which provides services in the area of gas technology both nationally and internationally, will test and operate the BlueGen unit at its facility in Apeldoorn, The Netherlands, on behalf of leading gas utility GasTerra.

BlueGen is the latest breakthrough in small scale electricity generation. About the size of a dishwasher, each BlueGen unit can produce twice the electricity needed to power an average home, with the surplus electricity sold back to the grid.

The order from Kiwa Gas Technology is Ceramic Fuel Cells' second order for BlueGen units in Europe, following a recent order from German utility EWE. Ceramic Fuel Cells has also deployed fully integrated mCHP products with leading energy companies and appliance manufacturers in France and the United Kingdom.

The company's news release on its recent BlueGen sale can be found at:

http://www.cfcl.com.au/Assets/Files/20100202_CFCL_KiwaGastec_BlueGen.pdf

Leading light will power smart energy

CAMERON COOPER, The Australian 9 January 2010

A NEW generation of researchers and power engineers will have to be groomed as renewable energy systems are rolled out as part of an international embrace of smart grid power production. Amid calls for the energy sector to reduce its carbon footprint, electricity providers across the world are working on ways to overlay solutions across existing networks to incorporate emerging innovations such as wind, wave and solar power.

John Carter, professor and pro vice-chancellor of the faculty of engineering and built environment at the University of Newcastle, says the adoption of new electronic sensing, telecommunications technology and information systems is occurring as part of a radical overhaul of traditional electricity networks. The university has an opportunity to play a key role in this new era.

It has entered a five-year, \$5 million partnership with EnergyAustralia to lead smart grid development and train modern power engineers. A centre of excellence in intelligent electricity networks is being set up at the university for research into and development of such networks.

A second centre of excellence will be established at the University of Sydney. Both centres will be supported by some communications and IT giants, including Alcatel-Lucent, IBM and General Electric.

Carter says there is no doubt renewable energy will play a significant role in powering a more sustainable electricity grid. He notes, however, that smaller and geographically spread generation systems associated with this new technology will create complications for the sector's providers as they try to integrate renewable solutions into the grid.

"The grids were all set up for the days where you had either a coal or a nuclear-fired power station and very little in the way of smaller and much more distributed generation systems," he says. Carter believes the chair has the chance to have a significant influence on how the energy sector operates in the future. "To give you an analogy, it will be to the power generation system what mobile telephones became to the communication networks we have.

[https://hronline.newcastle.edu.au/plsdocs/wssprod/WK8127\\$APP.download?p_file=V1308/F7010/13081.pdf](https://hronline.newcastle.edu.au/plsdocs/wssprod/WK8127$APP.download?p_file=V1308/F7010/13081.pdf)

Could Electricity Grid Become A Type Of Internet?

In the future everyone who is connected to the electricity grid will be able to upload and download packages of electricity to and from this network. At least, that is one of the transformations the electricity grid could undergo.

Dutch researcher Jos Meeuwsen (Technical University Eindhoven) developed three scenarios for the Dutch electricity supply in the year 2050. The starting point is that in this year, 50% of the consumption will originate from sustainable sources.

Due to the security of supply and the connection with the European market, electricity networks will always be necessary says Meeuwsen. Further, due to an increasing demand for electricity it is important to include all possible energy options (including coal and nuclear energy) in the scenario development.

The exact form of future networks will largely depend on the primary energy mix chosen. In all cases engineers face new and considerable challenges in the areas of network and system integration and the development and implementation of new technology. Moreover, in all scenarios the total network capacity must increase. Small-scale networks will adapt characteristics from the current large-scale networks, such as the possibility of 'two-way traffic' and the responsibility to maintain a stable system.

Three scenarios

Meeuwsen's three different scenarios for the future of the electricity grid mainly differ in the size of the electricity generation facilities. The scenario 'super networks' consists of large-scale production locations, transportation via high voltages, a considerable import of sustainable energy (in the form of biomass) and energy from offshore wind farms. The 'hybrid networks' scenario also includes large plants with high voltages that originate from offshore wind parks and large biomass stations.

Additionally, small-scale generation takes place in and around cities and villages (wind, biomass and solar energy). Finally, in the 'local' scenario the number of local generators (in the form of micro-cogeneration units, solar energy panels, small-scale biomass plants at neighbourhood level and land-based wind turbines) is the greatest, yet large industrial processes and small consumers still make partly use of electricity from large-scale production resources.

The postdoctoral research 'Electricity networks of the future: Various roads to a sustainable energy systems' is part of the programme 'Transition and transition paths: the road to a sustainable energy system' funded by the NWO/SenterNovem Stimulation Programme Energy Research. The programme aims to develop knowledge in the natural sciences and humanities for the transition towards a sustainable energy supply.

The original article can be found in Science Daily at:

<http://www.sciencedaily.com/releases/2007/10/071024102656.htm>