

# National Bulletin

Bulletin 8 | 2019

## Reflections

**Author: Jeff Allen, National President of the Electric Energy Society of Australia**

**Date: August 2019**

Have you thought about why you became an electrical engineer? My answer is I think it was because of my father's involvement in the electrical area as I grew up – or may be because of all the interesting "developments" that were happening in this area at that time – or both. Growing up in the 1950's I saw lots of changes due to electricity making an impact on peoples' lives. In particular the introduction of television in the mid 1950's. But there were many other changes affecting how people were using electricity – driven by the many new electrical appliances that were becoming available to change people's lives. Much of this was driven by the electricity companies at the time selling electrical appliances (and providing an appliance repair service) and promoting the use of electricity in the home to "housewives". I can recall that the milkman who used to deliver milk each day to a container at our house was no longer required as you could now buy bottled milk from shops and keep it in an electric refrigerator in your home – very radical!

It is interesting to look back even further than the 1950's and understand how people lived in the early 1900's when electricity started to be "rolled out" in New South Wales. The "roll out" started as a result of electric street lighting being installed to replace gas street lamps. In 1888 Tamworth in NSW became the first city in the southern hemisphere to install public street lighting. By 1890 the NSW Railways opened its own power station in Sydney and began electrifying the tram service in Sydney. Trains weren't electrified until 1926.

By 1891 the NSW towns of Young, Penrith, Moss Vale and Broken Hill had all set up their own electricity supply systems. In 1896 a Sydney Electrical Lighting Bill became law, giving the Sydney City Council the right to light up the CBD with electricity. Yet Sydney was to remain gas-lit for a further eight years. In early 1904, the Sydney City Council's Electricity Undertaking came into being and on Thursday 8th July 1904 the electric streetlights of the inner city were turned on for the first time – supplied by a coal burning power station at Pyrmont. In 1904, although the street lighting was being extended to areas across Sydney, the general population had no conception of the future uses of electricity. They still cooked on fuel stoves (wood or coal) or with gas, they still lit gas lamps or candles in their homes, they still stoked their coppers with wood and coal, and manufacturers still used steam to drive their machinery.

Soon private companies began setting up generators across Sydney, mainly to light streets initially. Companies also started to supply major buildings. In Sydney, Parliament House in Macquarie Street and the Sydney GPO also had their own generators. A few wealthy people installed generators in their homes. Also during this period many "companies" across NSW commenced operation to initially supply electric street lighting and then supply customers with electricity as residential and commercial customers took up the use of electricity.

On 22nd April 1924, seven Electrical Engineers met in Sydney to discuss the idea of forming an Industry Association to further the education and co-operation between engineers working in the Electricity Supply undertakings spread across NSW – the start of the Electricity Supply Engineers Association of NSW which later became EESA.



**Jeff Allen**  
EESA National President

## Affiliations



---

Coming back to the 1940's and 1950's - my father was working for the meter manufacturer Email that emerged as a manufacturer of electricity meters to measure the electricity consumption for the growing number of electricity customers across Australia from the early 1900's.

Electricity Meter & Allied Industries Ltd (Email) was formed 1934 (adopting the Email name in 1951) from the merger of Electricity Meter Manufacturing Co Pty Ltd (established in 1912) and New System Telephones Pty Ltd (established in 1920). I understand that during this period of growth there would have been very few houses in Australia which did not have an Email meter.

In the 1950's my father moved from Email to one of these private electricity companies that emerged from the roll out of electric street lighting. The Parramatta and Granville Electric Supply Company Limited commenced business in February, 1913, under the name of the Parramatta Electric Supply Company Limited. The name of the Company was changed in October, 1929, to Parramatta and Granville Electric Supply Company Limited to reflect its enlarged area. Electricity was generated at the "Power House" in Macquarie Street, Parramatta until the year 1921 when the electricity supply was obtained by the company in bulk from the New South Wales Railway Commissioners. This privately owned company was taken over by the local councils it was supplying and thus Prospect County Council was founded in 1957. I joined the Prospect County Council as a cadet engineer in 1963.

The Prospect County Council grew to supply the rapidly developing area of western Sydney and was administered by local councils until 1989 when the state government began to take control of electricity suppliers. Mergers occurred during this period and the PCC expanded to include the areas of Nepean River, the Blue Mountains and Hartley.

Local government control was fully ended in 1991 when Prospect Electricity, a government business enterprise, was formed. Many other similar businesses across NSW were also impacted by these moves.

On 1 March 1996, Prospect Electricity was merged with Illawarra Electricity to form Integral Energy (now Endeavour Energy) - resulting in 3 network businesses covering NSW compared to well in excess of 100 in the 1950's.

Thus – whilst we talk about all the changes currently occurring in the electric energy area, I suggest that the electric energy area has been constantly impacted by change (driven by new technology, customer's changing needs, "re-regulation" and changes in ownership) for more than 100 years. And there is still more to come!

# Contents

Opinions	Page 4
AEMO's Gloomy Forecast for Supply/Demand Balance	Page 6
Redbank Power Station Recommissioning has Environmentalists	Page 8
Inquiry into Whether Nuclear Energy is Feasible ...	Page 10
What is the Future for Engineering Education in Australia?	Page 12
Business Cautiously Welcomes Government Plan to ...	Page 14
International Articles	Page 20
History	Page 33
Humour Corner	Page 34
Cired Paper	Page 35
Updates on Working Groups	Page 35
Event Recaps	Page 37
Awards	Page 38
Announcements	Page 38
What's on at EESA	Page 40
Thank You	Page 43

Disclaimer: The views and opinions expressed in the articles in this bulletin are those of the author and do not necessarily reflect the official policy or position of the Electric Energy Society of Australia (EESA).

## OPINIONS

### The Future of Nuclear Energy in Australia – an EESA Member's Perspective

**SA Member and Chapter Committee Volunteer Tom Bannann has written to President Jeff Allen with the following contribution to the nuclear energy debate. Comments are welcome and will be published, with permission, in future Bulletins.**

Dear EESA,

Following on from the response to ANA regarding EESA's publicised nuclear power support, I'm pleased for our President to be inviting members to write in to comment. These are my personal thoughts.

Yes, I would like to understand more about the latest nuclear technologies, safety and reliability, and where they fit compared with other forms of energy generation on LCOE curves.

However, are LCOE curves the most suitable method to compare with other (clean or fossil-based) technologies? My understanding is the LCOE method doesn't include the significant cost of transmission/distribution augmentations. Among the many noteworthy benefits of the new \$1.73b SA-NSW interconnector, it's highlighted by various sources that it will make renewables more cost effective. I believe this demonstrates that the holistic cost of electricity is worthy of further consideration rather than just LCOE when comparing technologies. I'd like EESA to help me better understand the relationship between the state of our existing infrastructure and these additional costs when shifting from fossil fuel to clean technologies.

Since the introduction of the EPBC Act of 1999 Section 140A(1)(b), banning any form of nuclear power generation in Australia, there have been many advances with thorium and uranium power generation, FBRs, MSRs, SMRs and my latest interest, GE's BWRX-300. It promises to be cost competitive when mass produced compared with gas turbine generation. I wonder if it could be an efficient player in various locations of Australia's existing network.

A quarter of the world's known thorium reserves are in Australia. We're mining it out of the ground, processing it out of ore, and then putting it straight back into the ground. About ten years ago, inspired by Kirk Sorensen's work from his time at NASA relating to power in space and subsequent promotions of the LFTR, and the subsequent original 'Thorium Remix' YouTube clips full of interesting history and facts about thorium power ideas, I began the [thoriumaustralia.org](http://thoriumaustralia.org) website. It was intended to be an educational resource for Australians to learn about thorium power generation technologies. I'd thought that since we've already located a quarter of our planet's known thorium reserves within Australia, it's worthy of consideration; in lieu of our world's perceived lack of suitability elsewhere. Most fellow engineers discouraged the concept of thorium as a fuel, arguing that if it was such a good idea, then it would already have been done. Meanwhile, many chats with non-engineers spurred a keen interest to read and learn, leading to self-reflection of their emotive bias against nuclear power technologies. At the end of the day, [thoriumaustralia.org](http://thoriumaustralia.org) suffered from Error 403 "domain shamed out of cyberspace" and I took it out of its misery. Now some 10 years later, many countries have proposals, development plans, or are undergoing construction of thorium reactors.

Australia's absolute quantity of fossil fuels consumed is continually increasing, despite the percentage of fossil fuels decreasing. Meanwhile, despite best intended sentiments and understandings, there is at least 99.9% of Australians that, with all due credit, aren't suitably nuclear power, safety, and electricity network learned enough to competently assess the suitability of nuclear technologies. Or, they hold dramatic emotive bias when forming an opinion on the matter. These factors alone are enough to convince me that we need to drive change of the public's knowledge of nuclear power technologies. EESA has the opportunity to kick-start this. It can start with EESA members through appropriate CPD activities. We can invite the ANA to participate in this movement, and mutually promote joint CPD seminars.

The assertion in the newsletter that repealing 140A(1)(b) can in any way allow for production of nuclear weapons, I believe is incorrect and misleading. It only bans nuclear power generation. This is the law that ANA is proposing to repeal; not law relating to weapons production. Repealing it also won't mean that it will suddenly be legal to safely construct and operate a reactor! If EESA don't support the repeal of 140A, then we're effectively complacent with the current trajectory of our industry. If we don't take action or question the course of direction, then we as members, participants, leaders, enthusiasts, students, or generally interested people, are supporting the ban. We should oppose laws that serve to discriminate against incredibly wonderful clean and safe technologies for energy; and instead be promoting a more advanced and considered legal framework for safety of electric power generation that takes the whole lifecycle into account. I'm certain that ARPANSA already has experts to help with this, and so would many other nations. It's okay to lean on others for help, advice and knowledge in the war on climate change. We are all allies.



---

We need the peak body of engineers to support EESA in becoming involved in these matters. Currently, members of the public, media, and politicians might be looking to the peak body of engineers and its electric energy technical society, and there's really not much to work with. It might not be the primary purpose for EESA's establishment, but if EESA can't support all forms of safe power generation, then we'll forever rely on politicians and media to guide us. Can we not be bold and outspoken to help drive change and our nuclear education? At least collect and publish statistics of our members' opinions on what we can or should do? Thoughts from our members could be a notable addition with our response to ANA.

I would be most pleased if EESA can position themselves as bold leaders in the education of nuclear power generation technologies, rekindling knowledge and interest among engineers and society in the exciting developments of nuclear reactor technologies since 1999.

Cheers,  
Tom Bammann  
SA Chapter Committee Volunteer

## AUSTRALIAN ARTICLES

### AEMO's Gloomy Forecast for Supply/Demand Balance

**Author:** Terry Miller

**Date:** August 2019

**Source:** AEMO Statement of Opportunities 2019

AEMO's Statement, issued late in August, forecasts tight supply/demand balance in the coming summers, with Victoria facing immediate problems in Summer 2019/20 and NSW in 2023/4 following the closure of Liddell power station. Here are the key findings and required actions from the Statement:

#### KEY FINDINGS

##### Summer 2019-20:

- **AEMO forecasts** tightly balanced supply and demand in several NEM regions for summer 2019-20, **with all regions other than Victoria expected to meet the current reliability standard of expected USE not exceeding 0.002%.**
- **In Victoria, if extended into the peak summer period, the unplanned outages of two major power stations**, Loy Yang A2 (500 megawatts [MW]) and Mortlake 2 (259 MW), pose a significant risk of insufficient supply that could lead to material involuntary load shedding.
  - These units have announced a planned return to service in late December 2019. Based on historic experience with similar plant failures, and in light of the extended repairs that are required, AEMO's analysis assumes a 30% likelihood that the Loy Yang A unit outage will extend over the summer and a 60% probability that the Mortlake unit outage will extend into the summer months.
  - The assumed extended outages of either of these units, in combination with a number of other operating risks, including the continued deterioration of the reliability of aging brown coal units, result in Victoria having an expected USE of 0.0026% for the coming summer.
  - **The additional resource capability required in Victoria is projected to be between 125 MW and 560 MW**, to close the gap to the current reliability standard or reduce the likelihood of exceeding the standard to a 'one-in-10 year' event, respectively. However, if both power station outages were extended over the summer, and **if no additional supply was secured, involuntary load shedding may be experienced in Victoria during extreme weather events**, potentially over multiple events, equivalent to between 260,000 and 1.3 million households being without power for four hours.
- AEMO is working with industry to secure the maximum permissible reserves via the Reliability and Emergency Reserve Trader (RERT) to ensure Victoria's reliability of supply meets the reliability standard this summer. AEMO is being supported to meet its responsibilities by the Victorian Government.

##### Forecasts beyond 2020:

- **Beyond 2020, AEMO forecasts only slight improvements in reliability for peak summer periods until new transmission and dispatchable supply and demand resources become available.** AEMO's 2019 ES00 reaffirms the message in the 2018 ES00 that additional investment will be required in a portfolio of resources ahead of time to replace retiring capacity.
- This ES00 analysis includes nearly five gigawatts (GW) of committed new generation projects and upgrades to existing generators expected to become available over the next three years, in addition to Snowy 2.0 (2,040 MW), which has been assumed to be fully operational by March 2025.
- Most of the announced new generation projects are variable renewable energy generators, which often do not generate at full capacity during peak demand times or may be positioned in a congested part of the network. As a result, while providing significant additional energy during many hours of the year, these projects are forecast to only make a limited contribution to meeting demand during peak hours
- The announced staggered closure of Torrens Island A Power Station will reduce available capacity in South Australia, causing a slow increase in expected USE to 0.0004% by 2021-22. The new proposed interconnector between South Australia and New South Wales is not modelled in this assessment, as it is not yet a committed project, but would reduce this risk by improving the sharing of resources across the NEM.
- **Impact of Liddell closure 2022-24**
- AEMO forecasts that the **level of USE in New South Wales will increase following the gradual closure of Liddell Power Station, but remain slightly below the current reliability standard, reaching 0.00174% USE in 2023-24 after Liddell's full closure.** This analysis presumes no new investments in generation, transmission, or demand response, beyond what is already committed. It specifically does not include the benefits of the Queensland to New South Wales Interconnector (QNI) and the Victoria to New South Wales Interconnector (VNI) projects, because both projects are yet to receive full regulatory approval. Governments, the Energy Security Board (ESB), and the Australian Energy Regulator (AER) are working proactively on delivering both projects before the Liddell closure.

- The impact of the retirement of one unit at Liddell Power Station in April 2022 leads to an expected USE of 0.0002% in New South Wales in 2022-23. This USE level does not meet the “material reliability gap” threshold of 0.002%. **AEMO will therefore not request a T-3 reliability instrument under the newly introduced Retailer Reliability Obligation (RRO).**
- However, as in Victoria this summer, following the gradual closure of Liddell, **a combination of high summer demand and unplanned generator outages will leave New South Wales exposed to significant supply gaps and involuntary load shedding if no mitigation action is taken.** In 2023-24, AEMO forecasts a risk to between 135,000 and 770,000 households in New South Wales being without power for three hours during an extreme heat event (that is, a 1-in-10 year peak demand event).
- The commissioning of Snowy 2.0 (assumed in this analysis to be fully operational by March 2025) will improve the reliability outlook, provided additional transmission necessary to serve load centres in Sydney and Melbourne is constructed. This transmission infrastructure has not yet received regulatory approval, so it is not included in this analysis. Work on these enabling transmission projects is being progressed by transmission network service providers (TNSPs), and will be further investigated in AEMO’s 2019-20 Integrated System Plan (ISP).

## REQUIRED ACTIONS

AEMO has identified a number of prudent and least-cost actions that should be taken to avoid consumer exposure to an unreasonable level of risk of involuntary load shedding during peak summer periods. Some of these actions are currently underway and should be pursued without unnecessary delay. Others will require changes to rules and/or additions to AEMO’s authority. AEMO will seek to implement these recommendations through its continued work with the Commonwealth and State Governments, the ESB, the Australian Energy Market Commission (AEMC), and the AER.

**1. Summer readiness plan** – as it does every year, AEMO is already working proactively with industry and governments to prepare for the coming summer by implementing a comprehensive summer readiness plan to minimise risks as much as possible within the current rules framework. This year, AEMO is also working in depth with generators and industry experts to gain a better understanding of forced outage rates of aging generators to improve future reliability assessments, in particular in light of the increasing frequency of hard to predict but high impact events such as unplanned outages of dispatchable supply resources.

**2. Commissioning of targeted transmission augmentation** – the supply-demand balance in New South Wales will be significantly improved with the addition of the QNI and the New South Wales component of the VNI upgrades and, once completed, through Humelink and EnergyConnect, as identified in the 2018 ISP. This ESOO reconfirms the importance of the work now underway to complete QNI and VNI ahead of the closure of Liddell Power Station, involving significant undertakings by governments, industry, the ESB, and the AER. To enhance the resilience of the NEM against the growth of systemic risks during the energy transition (for example, to enable the system to absorb the impact of deteriorating performance of aging plants), a new mechanism will be required for the fast-tracked delivery of ‘no regrets’ transmission infrastructure and transmission infrastructure that could deliver important reliability and resilience benefits. The 2019-20 ISP will identify essential ‘no regret’ and resilience projects, and AEMO will work with governments, industry, market bodies, and the ESB to develop a process by the end of 2019 to implement them.

**3. Dispatchable resources** – once the above transmission infrastructure is in place, AEMO’s analysis projects that new dispatchable supply of approximately 215 MW would be required to ensure New South Wales only has a one-in-10 year risk of a significant involuntary load shed event in summer 2023-24, following the full closure of Liddell Power Station. Over the coming two months, AEMO will work with industry and governments to identify the attributes and location of dispatchable resources that will address this risk and available mechanisms to assure the necessary investment.

**4. Reliability standard** – the current reliability standard is based on the expected USE within a given financial year not exceeding 0.002%. Because applying this standard requires the averaging of annual USE over all possible outcomes, it effectively averages out the risk of experiencing the rapidly growing number of events which can cause severe load shedding over the summer period. While AEMO has attempted to ‘operationalise’ the risks within the existing standard as much as possible, a modified reliability framework that enables AEMO to ensure customers are not exposed to significant involuntary load shedding in nine out of 10 years is necessary. AEMO will accordingly pursue the development of a modified standard over the coming three months that can more cost-effectively and reliably provide the requisite level of dispatchable resources.

**5. Three-year strategic reserve** – in view of the current risk in Victoria, AEMO believes its inability to procure reserves over a three-year duration is imposing unnecessary risks and costs on Victorian consumers. AEMO will therefore continue look to obtain the necessary and prudent flexibility that maintains reliability at the lowest cost.

**6. Wholesale demand response** – AEMO is reviewing the recent decision of the AEMC to support the introduction of wholesale demand response in the NEM. As envisioned by the AEMC, AEMO will look for ways to accelerate participation by customers as a mechanism to support future reliability.

**7. Market reform** – the current forecast reliability risks, and the need for market-based investments, demonstrate the imperative to implement reforms in the NEM covering a number of areas. They include, for example, short-term forward markets, firming and security services markets, and markets to support investments at the right time and the right location, including nodal pricing and improved reliability mechanisms. AEMO will continue to work with the ESB and the other market bodies to help prioritise and progress market reforms that will improve how market participants can address consumer demands for reliable, secure, and affordable power.

**8. Notice and mechanism of closure** – the current three-year notice of closure rule for generators does not fully protect consumers from potentially significant high price and load shedding risks in the lead up to, and following, a major generator closure. As generators approach decommissioning, the risk of a major outage or unforeseen early exit due to economic consideration increases. Furthermore, the three-year closure period may not provide sufficient time to implement the most cost-effective replacement option, leading to higher cost outcomes for consumers. AEMO will work with governments, the ESB, and other market bodies to develop a proposal over the coming six months to refine the current rules to enhance long-term certainty of generator exit dates, while ensuring plant reliability in the lead up to the planned closure date.

**9. Information transparency** – AEMO is working with industry to increase the frequency and improve the content of information it publishes, to provide greater transparency and thereby improve decision-making. Improvements will include quarterly updates on generator commissioning and commitment in Generation Information Page updates<sup>4</sup>. AEMO will also investigate further generation, storage, demand side participation (DSP), and transmission measures in its upcoming 2019-20 ISP.

---

## Redbank Power Station Recommissioning has Environmentalists Fired Up

**Author:** Terry Miller

**Date:** August 2019

**Source:** ABC News

**Background:** The looming generation capacity shortage in NSW is clearly driving entrepreneurs to reexamine mothballed power stations to see if they can live again in a market with different commercial drivers to a decade ago.

One such station is the 151 MW Redbank power station near Singleton, which was commissioned in 2000 to burn “beneficiated”, dewatered tailings from the nearby Warkworth coal mine. It ran into financial difficulties and was shut down in 2014.

In 2015, Redbank Energy sold the land, plant and equipment and water rights to its fully owned subsidiary Biogreen Energy, with the intention of raising funds to recommence operation of the station (source:Wikipedia).  
(source:Wikipedia).

**JUMP TO TODAY**

## ABC news report: Redbank Power Station has Environmentalists Fired Up over Restart Plan

**Author:** [Giselle Wakatama](#)

**Date:** 22 August 2019

**Source:** [ABC Newcastle](#)

The company planning to recommission a mothballed coal-fired power station says it will be cleaner and greener than it was before it shut down five years ago.

Hunter Energy has bought the former Redbank power station near Singleton in the NSW Hunter Valley and is planning to acquire existing generation assets to help shore up power supplies.

The plant started operating in 2000 but closed in 2014 after racking up close to \$200 million in debts.

It is not far from AGL's ageing Liddell plant, which is due to shut during the 2022-23 summer months.

This impending closure of Liddell has escalated fears of an energy crisis, due to other coal-fired plants shutting down in other states.

Redbank could power 250,000 homes and potentially operate for at least 20 years, according to Hunter Energy chief executive James Myatt.

"There is an absolutely impending need for more baseload power in NSW in particular," he said.



---

"When Liddell comes out it is a massive gap that will be created.

"We have seen high prices occur in Victoria on the back of Hazelwood coming out and New South Wales faces the absolute same challenge."

#### **Plan to reduce emissions**

Before its closure, Redbank was known for being Australia's dirtiest plant per unit of electricity generated.

But Hunter Energy said its plans included a feasibility study on the integration of waste wood products into the fuel mix, which was predicted to reduce the emission intensity of the plant.

Mr Myatt said the plant should be back in action early next year.

"The type of fuel it was burning was a very wet-mix coal tailing and now the availability of those tailings isn't the same as what it was when the plant first started in 2000," he said.

"So we are looking at burning a much drier coal mix and then ultimately, reducing coal emissions down by adding biomass into the mix and making the plant run more efficiently."

There are also plans for solar, with coping studies already done for a grid-scale solar plant situated on the adjoining used coal mine lands.

The company said a pre-existing grid connection and Redbank's location among other key generation assets meant the site was also well situated for the installation of a grid-scale storage battery, potentially NSW's first.

#### **Environmentalists slam plan**

Jeff Angel, director of the Total Environment Centre, said he was sceptical about claims the plant would run more efficiently with reduced emissions.

"At a climate change policy level, it is certainly a reversal of where we should be going; that is, to cleaner renewable sources," he said.

"Secondly, I really think this proposal needs to have a much more objective environmental assessment that the community and environmental groups can have a good look at, because at the moment there is a just a lot of hype."

Mr Angel said there needed to be a comprehensive independent assessment of any plan to restart Redbank.

"It should be fully assessed independently and should not run off an old DA [development application]," he said.

"Reversing our trajectory to cleaner power sources is a very serious question, and I am sure the local community would want to know about its pollution potential."

#### **'Committed to cheap and reliable power'**

NSW Minister for Energy, Matt Kean, said the proposal came at a time when the Government wanted to ensure power supplies were secure.

"The NSW Government shares the Federal Government's commitment to ensuring reliable and affordable power for all families and businesses," he said.

"The people of NSW expect the lights to stay on and power costs to start falling as the energy market transitions.

"NSW is working closely with the Federal Government and industry experts to ensure sensible market-based solutions for future energy supply are driven by science and economics."

Mr Kean's federal counterpart, Angus Taylor, told the ABC that restarting Redbank was a decision for private investors.

But he said developing strategies to shore up future power supplies was a focus.

"The Australian Government, along with the NSW Government, has established the Liddell Taskforce to assess the impacts of Liddell's announced closure on prices and supply in the region," Mr Taylor said.

"The taskforce will work closely with stakeholders to investigate the extent of these impacts and options for addressing them."

---

Last year, the Australian Energy Market Operator (AEMO) warned that coal must be part of the national energy mix for the next two decades to ensure people's power bills did not skyrocket further.

It said the power network would not be reliable if coal-fired power stations closed before the end of their technical life.

The AMEO estimated that 30 per cent of current coal resources would shut down over the next 20 years, but did not recommend expanding coal-fired power generation beyond what already existed.

---

## Inquiry into Whether Nuclear Energy is Feasible and Suitable for Australia

**Author:** Terry Miller

**Date:** August 2019

**Source:** [Ted O'Brien MP, Federal Member for Fairfax](#)

The Standing Committee on the Environment and Energy is set to investigate the nuclear fuel cycle at the request of Energy Minister Angus Taylor.

As Committee Chair, Sunshine-Coast based MP for Fairfax Ted O'Brien will be tasked to lead the inquiry after the Minister's request is considered and adopted by the Committee.

"This will be the first inquiry into the use of nuclear energy in Australia in more than a decade and I believe it's the first time the Australian Parliament has ever undertaken such an inquiry," Mr O'Brien said.

"Clearly there are very passionate views on either side of this debate.

"Like any inquiry, it will be important that as a Committee we hear all views, take into account all expert opinions and dispassionately assess all evidence put before us.

"The Committee will be asking a range of questions to establish whether nuclear energy would be feasible and suitable for Australia with account for economic, environmental and safety issues," Mr O'Brien said.

"There are new and emerging forms of nuclear energy technology that are very different from the old smoke stack reactors people tend to picture when they think nuclear energy and it's on these newer technologies that we'll focus.

"Our job will be to determine the circumstances under which future Coalition or Labor Governments might consider nuclear energy generation.

"Nonetheless, the Government's moratorium on nuclear energy generation in Australia remains and the Morrison Government has no plans to change that."

Energy Minister Angus Taylor has requested the Committee - which consists of government, opposition and cross bench MPs - undertake the landmark investigation.

See the Terms of Reference for the Inquiry:

## HOUSE OF REPRESENTATIVES

### STANDING COMMITTEE ON THE ENVIRONMENT AND ENERGY

#### INQUIRY INTO THE PREREQUISITES FOR NUCLEAR ENERGY IN AUSTRALIA

##### Context

The Australian Government supports an energy system which delivers affordable and reliable energy to consumers while fulfilling Australia's international emissions reduction obligations.

Successive Labor and Coalition governments have maintained a bipartisan moratorium on nuclear electricity generation in Australia. Australia's bipartisan moratorium on nuclear energy will remain in place.

Australia's energy systems are changing with new technologies, changing consumer demand patterns and changes in demand load from major industries. At the same time the National Electricity Market is seeing a significant increase in capacity in intermittent low emissions generation technologies.

##### Terms of Reference

I request that the Committee specifically inquire into and report on the circumstances and prerequisites necessary for any future government's consideration of nuclear energy generation including small modular reactor technologies in Australia, including:

- a. waste management, transport and storage,
- b. health and safety,
- c. environmental impacts,
- d. energy affordability and reliability,
- e. economic feasibility,
- f. community engagement,
- g. workforce capability,
- h. security implications,
- i. national consensus, and
- j. any other relevant matter.

The inquiry will have regard to previous inquiries into the nuclear fuel cycle including the South Australian Nuclear Fuel Cycle Royal Commission 2016 commissioned by the Labor Government in South Australia and the 2006 Switkowski nuclear energy review.

The inquiry will be finalised by the end of 2019.

## What is the Future for Engineering Education in Australia?

**Author:** Terry Miller

**Date:** August 2019

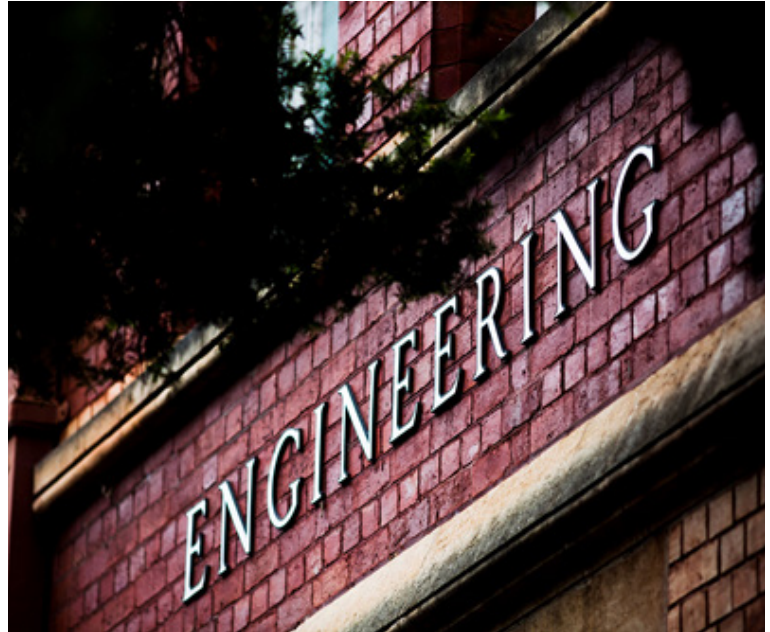
**Source:** [WEC 2019 Melbourne](#)

Back in 1861, Australia's first engineering school opened at the University of Melbourne with just 15 students. In the 150 years since, global market forces and changing expectations have continuously redefined what is needed to prepare the profession's future leaders.

According to Professor Mark Cassidy, Dean of Melbourne School of Engineering and a keynote speaker at the upcoming [World Engineers Convention](#), engineering is the 'action' arm of the STEM professions – the application of science and technology and maths to find solutions to the world's greatest challenges.

He said today's engineering students identify strongly with this ethos and are hungry for opportunities to leave a positive mark on society.

"They can see what the issues facing the world are and they really want to make a difference," he said.



According to Professor Cassidy, the challenge this sets for universities is to create programs that meet this desire for practical experience while also laying a strong theoretical foundation.

Another thing that sets today's young engineers apart is many have more of a 'problem-finding' mindset, Professor Cassidy said, and they want to pursue solutions to issues they are passionate about. He said this entrepreneurial spirit is a big shift from when he was an engineering student.

"We all just wanted to work for a major corporation or government, but now this entrepreneurial spirit is very strong in a lot of students," he said.

"They see it as a different pathway, and that's something that bodes well for the future of Australia."

### **A precinct approach**

Providing this balance is the driving force behind the university's \$1 billion investment to see the Melbourne School of Engineering 2025 (MSE2025) strategy to completion. This includes two new large-scale developments devoted to the discipline. Melbourne Connect will focus on data science and digital technology, including artificial intelligence and machine learning, and co-locate academia, industry and students. MSE's new campus at Fishermans Bend will be an innovation precinct, a place for large-scale interdisciplinary research and project-based teaching.

"Both precincts are looking at where engineering will go in the future, and we're hoping to co-locate with industry to give our students experience" Professor Cassidy said.

"We also want to make sure our academic work is really focused on the challenges that are facing the world into the future to ensure we are making a difference with what we do in our research and our teaching."

When asked what the university is currently known for, biomedical engineering immediately sprung to Professor Cassidy's mind. University of Melbourne Professor Graeme Clark's work on the bionic ear is a well-known example, and more contemporary projects include creating a brain-computer interface that allows a prosthetic to be manipulated with just a thought. Robotic exoskeletons are another promising project.

On the cyber side, the school is moving more into cutting-edge technologies, such as artificial intelligence. This work is applied in many sectors, again linking back to health. As a biomedical example, Professor Cassidy mentioned the use of sensors plus machine learning to predict the likelihood of someone having an epileptic seizure.

"Can we have sensors connected to the brain that are able to predict in real time when someone might have a seizure?" he said.



A precinct-based approach is representative of the shift to project-based teaching. In this way, industry and academia have a symbiotic relationship: more engineering students are asking for and expecting this industry-relevant training, and for its part, industry is looking for graduates who are ready to apply what they've learned to real-world scenarios.

"Industry are looking for graduates who are industry-ready, and hungry to apply their fresh perspectives and skill sets to the new organisations they join. We're ensuring our graduates are prepared to do just that," Professor Cassidy said.

This means universities can no longer do what Professor Cassidy refers to as "postbox work", where industry and academia conduct their work separate from each other and researchers send their work to industry in a postbox, never to be applied to solve a challenge or deliver an outcome.

"A lot of the grand challenges engineers are facing are multidimensional and multidisciplinary. They need larger teams to come together – teams comprising academics and industry," he said.

"We're trying to really put those together. Our strategy is much more about engagement, it's much more about partnerships and it's much more about building larger teams together to work on these issues."

On top of that, engineering careers – and the skills required to undertake them – are changing at a rapid pace. How can students entering school now prepare for a profession that might look quite different by the time they graduate?

Professor Cassidy said one way he thinks Melbourne School of Engineering is answering that question is by giving students a broad range of electives to build out a diverse skill set. For example, he said the new precincts will look to marry data science and engineering to prepare students for Industry 4.0.

"There's much more emphasis on the ability to interpret data, so we look at adding computer science applications to all of our degrees," he said.

#### **City living**

Being a CBD-based university also gives Melbourne School of Engineering an opportunity to place this work in terms of benefit to society, Professor Cassidy said. Melbourne is undergoing a period of immense change, from large city-shaping infrastructure projects to steep population growth – all while trying to maintain its crown as the country's most liveable city.

Professor Cassidy said the engineering school's new precincts will play a key role in helping Melbourne navigate through these looming challenges. He sees the University of Melbourne's role as a convener, uniting startups, academics, entrepreneurs, industry and the future workforce to flesh out ideas and tap one another for expertise. Melbourne itself also serves as a living lab and testing ground for these ideas and technologies.

One example of field testing ideas in this way is [AIMES, or the Australian Integrated Multimodal EcoSystem](#). Located in Carlton, adjacent to the University of Melbourne's Parkville campus, on 6 square kilometres is the "most highly sensed area of roads, footpaths, intersections and traffic lights in the world", Professor Cassidy said.

Nearly 50 companies joined together with the university to test how sensors and smart technology can be used to improve the way we move around the city. Everything from traffic lights to parking meters to cameras are being used to test pain points and gauge how people move through an urban environment.

"Anyone who has been in Melbourne knows there's quite a bit of traffic, but all cities are going through that," Professor Cassidy said. "If you look around the world, with the desire to keep cities moving and enhance liveability, we need to design better systems for transport, traffic and vulnerable road users. It's the use of data like that from AIMES that will make a big difference."

#### **A mirror to society**

As the world becomes more connected and collaborative, Professor Cassidy said engineering educators need to lean into the challenge of making sure the profession reflects this.

"The design of society is affected by who creates it. And if engineers are creating society through the application of science, then we need to have diversity in the student cohort, so that our future engineering professionals are a true representation of our society," he said.

Boosting the number of women in engineering is an imperative for educational institutions and private organisations alike. Australia's engineering workforce is only 12 per cent female, and while issues like workplace recruitment and retention affect that number, establishing a robust talent pipeline is firmly within a university's remit.

Across engineering and IT, Professor Cassidy said women make up 34 per cent of Melbourne School of Engineering's student body, a number he is particularly proud of.

"That is the highest in Australia, and we've been nudging that up a per cent or so a year," he said.

Getting there has been and remains a concerted effort by a team of professional and academic staff. The school employs a suite of programs to attract diversity of gender and culture into engineering degrees and keep them there. One of its most successful programs for girls is the three-day Girl Power engineering camp for Year 9 students at the Parkville campus.

But beyond gender, Professor Cassidy said diversity in all its forms is important for shaping the future of the profession. For example, the Melbourne School of Engineering is working to increase the number of Indigenous engineering students. The school hosts and coordinates the Victorian Indigenous Engineering Winter School (VIEWS) program alongside three other universities, which brings Indigenous Australian students from around the country to Melbourne to showcase opportunities in STEM education through the lens of problem-finding and hands-on experience.

The school is also focused on rural and regional impact. One initiative, the Mallee Regional Innovation Centre (MRIC) taps into the creativity and drive of students in the Mallee district of Victoria to work on projects that more directly affect their communities and local economy, particularly agriculture.

"Agriculture is a big industry in Australia, and there are really interesting problems to solve in that space. How can we apply tech tools including automation, computer vision, robotics and drones to farming?" Professor Cassidy asked.

The Melbourne School of Engineering is halfway through its MSE2025 transformation strategy, and it has "massive ambitions" for the future, said Professor Cassidy.

So, where will the school be by 2025? Professor Cassidy said by then he wants the University of Melbourne to be internationally known for the quality and contributions of its engineering and IT research – and for its outstanding graduates.

"Whether it's in the transport system, or biomedical engineering ... I see demonstrable examples of how our work is contributing to society," he said.

*What are the major trends influencing engineering education? How can today's professional prepare the next generation of engineers? This will be a theme at the upcoming World Engineers Conference in Melbourne.*

## Business Cautiously Welcomes Government Plan to Shore Up Gas Supplies

**Author: Terry Miller**

**Date: August 2019**

**Source: [Sydney Morning Herald 8 August 2019](#)**

Business groups have cautiously welcomed the Morrison government's plans to shore up gas supplies for domestic use in a bid to bring down power prices and secure manufacturing jobs.

Australia's gas lobby, which has been highly critical of demands to reserve more gas for local use, now says "sensible reforms" could improve the efficiency of the market and its operation.

But Victorian Premier Daniel Andrews has hit out at federal Energy Minister Angus Taylor's "combative" approach to dealing with state governments over the issue.

Mr Taylor and federal Resources Minister Matt Canavan announced on Tuesday the [Commonwealth would plan for a domestic gas reservation scheme](#), similar to that in Western Australia, where consumers pay considerably lower prices than on the east coast.



*APPEA said the industry was committed to ensuring Australia had a secure, sustainable and competitive natural gas supply for households and businesses. Credit: Michele Mossop*

They also challenged state governments to overturn [bans on new gas exploration](#) amid warnings of **winter shortfalls** in 2023 from the Australian Energy Market Operator.

Mr Andrews, who has overseen a temporary ban on onshore conventional gas and a **permanent ban on controversial fracking**, said he discussed the matter with Prime Minister Scott Morrison when they met in Canberra last week.

He insisted Victoria did not have a gas shortage and produced twice the amount that was used.

"The problem is that every household in Victoria, every business in Victoria, is competing against the world for every bit of gas they need. We should have a reserve," he said.

"Keep for us, our businesses, our households the gas that we need. And then what we don't need, sell it to the world and get the best price you can for it."

Mr Andrews said Victoria would not compromise its image, export opportunities or agricultural land by allowing fracking. A moratorium on conventional gas exploration would remain in place until June next year.



*Resources Minister Matthew Canavan and Energy Minister Angus Taylor announced a suite of measures for the domestic gas market on Tuesday. Credit: Alex Ellinghausen*

The Australian Petroleum Production and Exploration Association said the industry was committed to ensuring Australia had a secure, sustainable and competitive natural gas supply for households and businesses.

Chief executive Andrew McConville said his body would work closely with the government to ensure confidence was restored.

"We have consistently highlighted that while governments may seek to intervene in markets for political purposes, there should be no illusion that intervention is without costs – not least of which that sovereign risk can adversely affect confidence in the sector," he said.

Mr McConville said the best way to put downward pressure on gas prices was more supply.

"Eastern Australian gas users have paid a high price for unnecessary, unscientific restrictions on gas development in Victoria, NSW and, until recently, the Northern Territory," he said.

Manufacturing Australia chief executive Ben Eade urged state governments to work with the Morrison government and help revive the sector and protect local jobs through lower gas prices.

"By showing the courage to reform Australia's gas market, the Morrison government has an opportunity to power a resurgence in Australian manufacturing, get gas prices down for Australian households and make renewable energy more reliable," he said.

Business Council of Australia chief executive Jennifer Westacott said Australians were feeling the pressure of high gas prices in their homes and employers were struggling under high energy costs.

"Putting downward pressure on gas prices, providing reliable supply and keeping Australia globally competitive must be the priority," she

---

said.

Senator Canavan rejected suggestions the measure was part of a [deal struck with Centre Alliance senator Rex Patrick](#) in exchange for his party's support on the federal government's income tax cuts package last month.

Labor's energy spokesman, Mark Butler, said while the opposition supported a domestic reservation of gas, the government's timeline did not fill it with confidence.

"We've said since 2015 that there should be action taken by the federal government to ensure there are secure and affordable supplies of gas," Mr Butler said on Tuesday.

"If you read the fine print, there's no real action till 2021 at the earliest. We need real action now"

---

## AGL Delays Closure of Liddell Power Station for One Year to 2023

**Author:** Terry Miller

**Date:** 1 August 2019

**Source:** [Sydney Morning Herald](#)

AGL has delayed the closure of the Liddell coal-fired power plant in a bid to shore up grid reliability, while global mining giant Rio Tinto warns it might seek government intervention to keep its energy-intensive aluminium smelters viable.

The AGL plant in NSW's Hunter Valley was scheduled to end operations in 2022, taking 1680 megawatts out of the grid. AGL has come under intense pressure over the plan, with the government warning the company to renovate the plant or sell it to ensure ongoing energy reliability.

On Friday, AGL announced it would push back the closure of the 50-year-old plant to 2023 to meet energy demands over the summer months.

"AGL has today informed [the Australian Energy Market Operator] that the first unit at Liddell will close in April 2022," the company said in a statement to the sharemarket.



*The Liddell Power Station. Credit: Jonathan Carroll*



## AER Sues Four Wind Farm Companies over South Australian Blackout Powerhouse

Author: Terry Miller

Date: August 2019

Source: [Renew Economy](#)

The Australian Energy Regulator has begun court proceedings against four of Australia's largest wind farm companies over the role of wind farms in the [2016 South Australian blackout](#) that left 850,000 homes and businesses without power as the entire state experienced a "system black".

The AER said in a statement on Wednesday that it has commenced proceedings in the Federal Court against AGL Energy, Neoen Australia, Pacific Hydro and Tilt Renewables, in connection to the wind farms the companies operate in South Australia.

The court action by the regulator – which will be fought by the wind companies involved – could lead to a more widespread "class action" from people and parties affected by the blackout which could then lead to significant claims if it succeeds.

The regulator's action has already re-ignited the furious political debate around the performance of wind farms, and raised questions as to why the regulator has not sued the fossil fuel generators and the "black-start" installations that failed to work as required.

Privately, some have branded this action as a "witch-hunt." Some suggest the logical conclusion of this is that coal generators that have adjusted their settings, or which fail at critical moments and lead to load-shedding, should also be a target.

As [RenewEconomy](#) revealed last September, the potential court action had been flagged by Neoen, which disclosed in its prospectus that action from the regulator was possible and could lead to a broader class action should it succeed. Neoen said at the time it would defend any such claims, but warned the legal battle could be drawn out and expensive.

When the AER report came out in December, when it also attributed [multiple errors by the Australian Energy Market Operator](#), it said it did not intend to take any court action.

[RenewEconomy](#) understands the decision to issue court action followed further investigation of issues around the actual event that were not included in the December report. But these new investigations will not be released.

### 1.6 Recommendations

While we have found some areas of non-compliance with administrative requirements in the Rules, we do not intend to take formal enforcement action in respect of these matters, as we consider that it would be more effective to focus on remedial recommendations for improved processes. Further, we have noted the unprecedented circumstances as part of our consideration of all the available information.

The decision to take action against the wind farms, and not the fossil fuel generators that were supposed to provide "black start" capabilities but failed, extending the length of the blackout, has shocked many in the industry.

In its statement on Wednesday, the AER says the companies cited in its case carry some responsibility for the cause and scale of the 2016 South Australian blackout, due to a failure by the companies to ensure the wind farms

had sufficient protections and 'ride-through' capabilities during system interruptions.

It says these breached their generator performance standards and also the National Electricity Rules.

The wind farm operators are expected to argue that the rules were in no way clear, and there were differing views, even within energy institutions, about the benefits of multiple ride-through settings. In some cases, they may cause more problems than they solve.

The 2016 South Australian blackout was triggered by a severe storm that hit the State on September 28, 2016. The storm caused the failure of multiple transmission lines that caused voltage disturbances throughout the South Australian grid, that caused a snowball effect leading to the entire state losing power.

The voltage disturbances triggered protection systems within several South Australian wind farms, causing them to shut down. In its [investigation of the event](#), AEMO found that these protection systems were set to more sensitive settings than it was aware of.

The loss of power from the wind farms caused further disruptions, including an overloading of the Haywood interconnector between South Australia and Victoria, which, controversially, was running at full capacity at the time.

When the interconnector then failed, the entire state was plunged into blackout. Criticism has been levelled at AEMO about why it took no precautionary measures in the lead up to the storms, such as reducing the load on the interconnector and giving advanced warning to generators.

The [regulator itself said in its report issued last December that AEMO made multiple errors in the lead up to the blackout](#), although it said it was not to blame.

Investigations have found multiple contributing factors to blackout, including a [failure of other generators in South Australia to respond to the drop in supply](#), and substantial damage to network infrastructure from the storm itself, which caused a recorded 263 lightning strikes in the 5 minute window leading up to the blackout, and tornadoes in the vicinity of failed transmission lines.

It should be noted that the reports from both AEMO and the AER said it was not the nature of wind energy that was the issue, but the settings of the wind farms which have now been corrected.

That, however, will count for little in the likely political and media debate, given the hostility of the Coalition government and the Murdoch and other conservative media to wind energy in particular and renewables in general.

Sure enough, energy minister Angus Taylor, who has campaigned vigorously against wind farms since before he entered parliament, said he welcomed the court action and said the wind farms "weren't generating as they should have".

"People are going to bring wind and solar farms into the system, that's fine, but they have to be properly integrated," Taylor told reporters in Sydney.

"They have to be backed up so that when the wind doesn't blow and the sun doesn't shine, we have the power we need to keep the lights on, to keep the wheels of industry turning. And they have to perform," Taylor said.

"The AER has brought these proceedings to send a strong signal to all energy businesses about the importance of compliance with performance standards to promote system security and reliability," AER Chair Paula Conboy said in a statement.

"These alleged failures contributed to the black system event, and meant that AEMO was not fully informed when responding to system wide failure in South Australia in September 2016."

"Providing timely and accurate information to AEMO is critical in ensuring power system security and the effective operation of the wholesale energy markets," Conboy added.

The decision to initiate the legal proceedings was slammed by Greens MP Adam Bandt, who pointed to repeated failures of coal generators as a more pressing issue in the electricity market.

"Ageing coal-fired power stations are regularly failing in the heat and they get off scot-free, but wind farms get taken to court by the very same body that investigated and cleared them just a few months ago," Bandt said.

"According to The Australia Institute, Australia has experienced 195 coal and gas breakdowns since December 2017, but the Minister and his regulators turn a blind eye to fossil fuel failures."

The AER has said that it will seek "declarations, penalties, compliance program orders and costs" through the legal proceedings. The maximum penalty is \$100,000, or \$10,000 for every day that the breach continues.

The proceedings relate to all five stages of the AGL owned Hallett wind farm, Neoen's Hornsdale 1 wind farm, Pacific Hydro's Clements Gap wind farm, and Tilt Renewable's Snowtown 2 wind farm.

In its prospectus, Neoen noted that only the 100MW first stage of its 307MW Hornsdale facility – where the Tesla big battery is now also located – was operating at the time.

---

"These system protection measures led to a reduction or even stoppage of such wind farms' output and hence an increase in imported power flowing into the network, specifically from the neighbouring state of Victoria, through an inter-connector that overloaded and was tripped, leading to a complete system shut-down," Neoen wrote in its prospectus.

Neoen flagged potential fines of up to \$20,000 to Hornsdale – and other wind farms – for "non-compliance" but said it believed it had "a strong basis to contest any infringement notice that may be issued."

But it also noted that any legal battle could be drawn out and expensive.

"The imposition of a penalty would increase the risk of a class action lawsuit against (Hornsdale 1) by claimants requesting compensation for damage incurred in connection with the blackout. Defending against such legal action would be costly and any related losses could be significant."

AGL said in a statement on Wednesday that it did not accept the AER's conclusions and said it will strongly defend the proceedings on the basis that it complied with the National Electricity Rules.

"The SA Black System event involved a catastrophic storm that occurred on 28 September 2016. We understand and acknowledge the impact that this event had on communities, services, organisations and businesses across South Australia," it said.

"Weather experts described the event as a once in 50-year storm, with 80,000 lightning strikes and tornadoes with wind speeds reaching up to 260 kilometres an hour.

"AGL has worked closely with the SA Government and regulators following the event, to identify the lessons and potential improvements that could be made."

In a separate statement, Tilt – which is seeking to sell its Snowtown 2 wind complex as part of a strategic review (that process may potentially be affected by the court action) – said it believes it acted in good faith and in accordance with the applicable National Electricity Rules.

It indicated it would seek a settlement before the court action goes further. "The company will continue to engage with the AER in an endeavour to resolve this matter."

---

## ANU Says Photosynthesis Could Unlock Endless Supplies of Renewable Hydrogen

**Author:** Terry Miller

**Date:** August 2019

**Source:** [Renew Economy](#)

Australian scientists have helped unlock a key step in the photosynthesis reaction of plants that could have applications in the production of potentially limitless supplies of renewable hydrogen fuels.

Australian National University researchers believe that the finding could be a crucial step towards producing potentially 'endless' supplies of renewable hydrogen fuels.

During the photosynthesis process, plants use sunlight to split water cells in the production of compounds that provide it with energy. The photosynthesis reaction involves numerous steps but, crucially, the process involves the splitting of the hydrogen and oxygen atoms that combined to form water.

The research led by scientists working between the ANU in Canberra and the Max Planck Institute for Chemical Energy Conversion in Germany has identified a crucial step in the photosynthesis process undertaken by plants that allows water to be split up into its hydrogen and oxygen components.

Scientists have discovered how an enzyme involved in the photosynthesis reaction carefully regulates the introduction of water into the reaction.

"Half-way through its reaction cycle the enzyme develops the ability to stretch like a concertina, which enables the orderly uptake of water to begin the splitting process," Max Planck Institute researcher Dr Maris Chyrsina said.

"Without the careful, sequential binding of water, more reactive oxygen molecules can potentially be released that could unravel the whole water-splitting process," the ANU's Dr Eiri Heyno added.

Currently, the most common processes for hydrogen production either involve the splitting of water through electrolysis, or the splitting of hydrocarbons such as natural gas using steam reforming.

The discovery is a step forward in research that could allow the water-splitting process utilised by plants to be used in the production of hydrogen and other renewable fuels directly from sunlight, effectively shortcutting the existing hydrogen production processes.

"Enough sunlight hits the Earth in a single hour to power all human activity for over a year, ANU Researcher Dr Nick Cox said.

"Plants use this harvested energy to split water and make complex carbohydrates which provide food for the plant to grow and thrive. This process also enriches our atmosphere with oxygen for animals, including humans, to breathe."

"Copying this process from nature would lead to new and improved renewable energy storage technologies."

Australia is well placed to become a global leader in renewable fuels, with researchers at the CSIRO highlighting Australia's abundant renewable energy resources and existing connections with international export markets meaning [Australia could come to dominate a market for renewable hydrogen](#).

Australia's chief scientist, Dr Alan Finkel, argued that coal and gas could be used in the production of hydrogen fuel, and used to displace liquid fuel supplies predominantly met by oil products.

In his [keynote speech to the Clean Energy Summit](#), Finkel said that the use of coal and gas, when combined with carbon capture and storage, may be necessary to provide a greater diversity of energy supply in a future decarbonised energy system dominated by wind and solar.

The research is to be published in the journal Proceedings of the National Academy of Sciences of the United States of America.

## INTERNATIONAL ARTICLES

### NREL: Storage a Big Challenge for Peaking Plants

**Author:** Perry Sioshansi

**Date:** August 2019

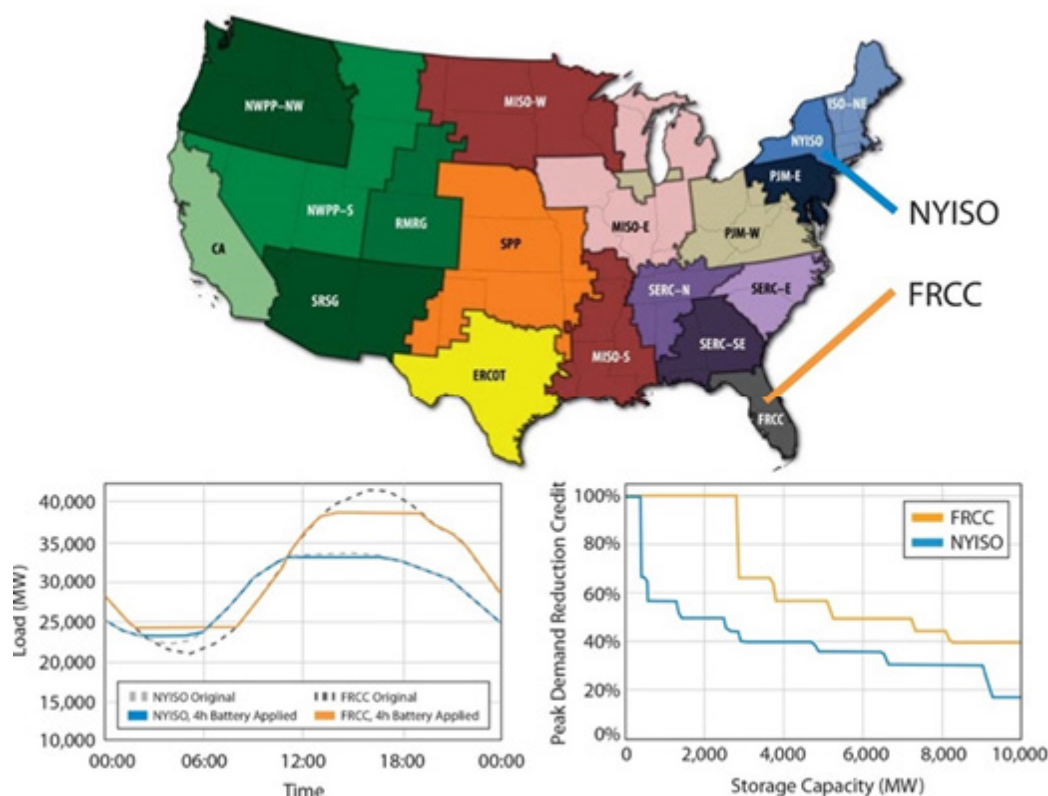
**Sources:** [National Renewable Energy Laboratory \(NREL\)](#) and [September issue of EEnergy Informer](#)

Perry Sioshansi in the September edition of the EEnergy Informer writes that as the costs fall and technology improves, storage can replace gas-fired peakers as renewable resources gain market penetration in rising double digit percentages across many states in the US – and across the globe – the demand for flexible resources to fill in the gaps in variable renewable generation multiplies.

While historically much of the shortfall were filled by peaking units – typically gas-fired plants that are not necessarily clean, efficient or cheap to maintain and operate – many grid operators are looking into energy storage systems (ESS) to pair with variable renewable generation.

**Storage needed virtually everywhere in the US – and beyond**





Source: *The Potential for Battery Energy Storage to Provide Peaking Capacity in the US*, Paul Denholm, Jacob Nunemaker, Pieter Gagnon and Wesley Cole, NREL, June 2019

With the exception of pumped hydro storage, most other forms of ESS have been – and many still are – too expensive to use in utility-scale applications and/or have limited storage capacity, further limiting their use. But the costs of storage technologies continue to fall, and are expected to fall even faster as economies of scale begin to kick in. Many types of ESS now offer 1-, 2- and even 4-hour storage capacity at costs that already make them attractive in special applications. Longer duration ESS are on the drawing board as are super-capacitors, which can provide a big jolt but typically for extremely short duration. As a rule, ESS provides faster response than typical peakers and can follow signals from the grid operators in near real-time making them particularly attractive.

A recent report from the National Renewable Energy Laboratory (NREL) concludes that 4-hour storage could meet peaking capacity across the US, with the potential to exceed 50 GW. Four-hour is a “sweet spot” for ESS since it allows many networks to get through much of the variation in renewable generation – say covering the critical evening window in places such as California where the massive solar output rapidly falls as the sun goes down while the peak demand typically occurs in the 6-10 pm hours; the so-called California “Duck Curve.”

Not surprisingly, the NREL report says the booming US ESS market will continue to grow to a size much bigger and faster than previously thought. The report, *The Potential for Battery Energy Storage to Provide Peaking Capacity in the US*, published in June 2019, concluded that every region of the country can benefit from short-duration ESS to meet peaking capacity requirements. Moreover, 4-hr storage provided by batteries whose costs continue to fall while their performance improves, can substitute for peaking units currently used to meet peak demand.

“The results show significant potential for energy storage to replace peaking capacity, and that this potential grows as a function of [solar] deployment.”

The report, however, notes that at current conditions, energy storage would only be able to replace a fraction of total peaking capacity in the US. Perhaps gas-fired peaking units will be around for a while longer.

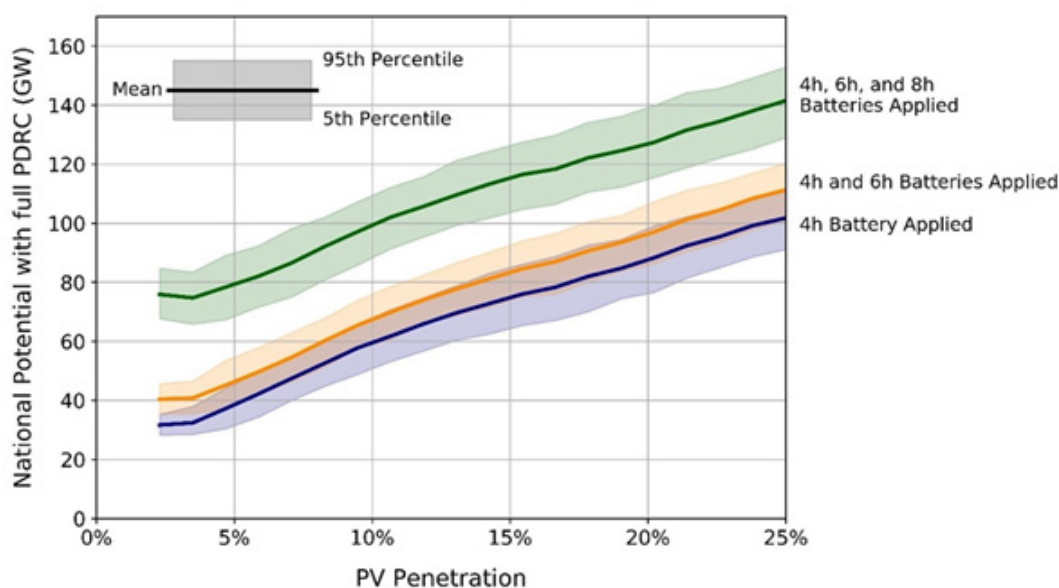
NREL’s executive summary says,

“Providing peaking capacity could be a significant US market for energy storage. Of particular focus are batteries with 4-hour duration due to rules in several regions along with these batteries’ potential to achieve life-cycle cost parity with combustion turbines compared to longer-duration batteries.”

The authors of the report, Paul Denholm, Jacob Nunemaker, Pieter Gagnon, and Wesley Cole note:

"We find that the addition of renewable generation can significantly increase storage's potential by changing the shape of net demand patterns; for example, beyond about 10% penetration of solar photovoltaics (PVs), the national practical potential for 4-hour storage to provide peak capacity doubles. The impact of wind generation is less clear and likely requires more detailed study considering the exchange of wind power across multiple regions."

Which do you prefer, 4-, 6- or 8-hr battery?



Source: *The Potential for Battery Energy Storage to Provide Peaking Capacity in the US*, Paul Denholm, Jacob Nunemaker, Pieter Gagnon and Wesley Cole, NREL, June 2019

NREL's analysis concludes that roughly 28 GW of peaking capacity in the US offers the practical potential to be converted to 4-hr energy storage, given current grid conditions and demand patterns. An increase in solar deployment, which NREL expects could be enabled by the deployment of storage for peaking capacity, pushes the practical potential for 4-hr storage to 50 GW or beyond assuming that solar meets 10% of the US electricity demand.

Total installed generation capacity in the US is about 1,187 GW with fossil-fueled peaking capacity accounting for roughly 261 GW, mostly natural gas fired plants. Clearly, many of the older, less efficient and more polluting peaking units will be at risk of being replaced by ESS over the next decade and beyond. This phenomenon is already happening in California, which is slowly phasing out most fossil-fueled plants over time as it tries to electrify everything to be supplied by renewable generation



Source: [https://www.utilitydive.com/user\\_media/cache/2f/fe/2ffefa53873c5ba83733bacdd3a12dbf.jpg](https://www.utilitydive.com/user_media/cache/2f/fe/2ffefa53873c5ba83733bacdd3a12dbf.jpg)

---

The Utility Dive (10 Jul 2019) article also quotes Ray Hohenstein, market applications director at Fluence, who is pleased that the NREL study is giving credibility to a phenomenon that has been known within the industry for a long time: namely shorter duration energy storage holds tremendous value for the grid. He said,

"What the NREL report really shows is that there are gigawatts of capacity value in every wholesale market in every region of the US," adding, "In other words, there's a lot of room for storage to be deployed before we run up against the situation where we have to really look for longer duration than 4-hrs."

Would ESS be the death knell of peaking gas-fired peakers? Denholm says not necessarily.

"This study should not be confused or misinterpreted as being that final detailed reliability analysis. It's really important that each region does its own (study). This was an approximation of the more detailed studies that are needed. I think this is a very encouraging sign that there'll be opportunities for 4-hr storage in most of the US."

According to John Zahurancik, CEO of Fluence,

"Alamitos energy storage will stand as the first of a new generation of energy storage procured as stand-alone alternatives to new gas plants," adding, "Its size, flexibility and long duration stand as a benchmark, and showcase energy storage as a mainstream option for peaking power and grid support."

The rise of ESS comes at an opportune time. Not only are renewables gaining market share across the US, but roughly 150 GW of peaking capacity in the US is expected to retire over the next 20 years. The NREL report notes:

"The fraction of this capacity that could potentially be replaced with storage of various durations is determined in part by the ability of storage to actually serve peak demand."

While 4-hr ESS is sufficient for many needs, 6- and 8-hr batteries offer the potential for storage to replace about 70 GW of peaking capacity in the US, roughly a third of the 261 GW total installed peaking capacity and represents less than half of the anticipated 150 GW in peaking capacity that will be retired over the next two decades. The NREL study says that faster growth in renewables could increase the prospects for storage.

---

## What is the future of the utility?

**Author:** Tim Holder, Director of Strategic Business Development, ReNew Petra

**Date:** 13 August 2019

**Source:** [Renewable Energy World](#)

Many of us are somewhat familiar with what an electric utility does. Our house receives electricity, and we get a bill in the mail each month for it. Here in North Carolina, that bill is likely coming from Duke Energy. In other parts of the country it may be PG&E or Dominion Power. For at least a century, these utility monopolies have built power plants, installed transmission and distribution lines, billed customers for their electricity use, and the utility made a predictable margin for their work.

The number one responsibility for an electric utility has long been to reliably generate energy and manage the grid that distributes that energy to consumers. But as generation shifts from traditional energy to renewable and clean energy, the role of the utility will also need to change. That will be no easy task given that the utilities framework is different from state to state.

In some states, the utilities are regulated by a state utility commission of some kind, while in other states there is a deregulated system. In the states that are regulated, customers have zero choice of who they buy from, while in states that are deregulated, consumers are given few choices on who they buy energy from. Because of these jurisdictional differences, the country is facing challenges associated with how the energy markets of the future will form. To further complicate the landscape, some states have different rules about the percentage of renewables that must be provided with mandatory state enforced Renewable Portfolio Standards (RPS) goals. For instance, North Carolina's Renewable Energy and Energy Efficiency Portfolio Standard (REPS) requires investor-owned utilities in the state to have 12.5 percent of their energy needs met through renewable energy or energy efficiency measures.

As renewables continue to become cost competitive and available independent of the utility, it changes the practicality of monopolistic utilities. Especially now, corporations and manufacturers can create their own power through the installation of solar or wind on their facilities and properties. However, unlike the current utility, solar and wind is an intermittent source of energy because they can only provide energy when the sun is shining, or the wind is blowing. Until independent generators can store energy, they will still require the utilities to offset load requirements by providing stand by service. But as storage capacity and availability grows, we will see a shift away from dependency on the electric grid and the utilities.

What's more, with increased energy efficiency measures, and more efficient appliances and electronics, energy demand is falling independent of third-party, renewable generation. We're even seeing this trend penetrate the residential market with individual households producing their own power through technologies like solar panels and using low-scale energy storage. With new innovations like Tesla's solar roofing, solar energy producing residential roofs may become the norm of the future. In 2018, energy demand from the grid dropped for the first time since the recession in 2008. These transformations are changing the supply and demand of energy markets, leaving an opening for new energy market opportunities.

As demand decreases in the coming years, it will drive down the utility's margins, which will complicate the utility's ability to meet their returns and maintain their current business model. Plus, as demand slides and replacement resources become viable, utilities will no longer be able to set the price for generation and distribution but will have to abide the same market pressures that other commodities must adhere to. Utilities can adapt to the changing landscape by integrating more distributed resources and acting in a network administrative role, balancing numerous generators, including their own generation and the generation coming from consumers.

Coordinating and facilitating the creation of third-party generation, and providing services, will be key for the utilities of the future. But beyond that, it is also the realization that as a utility, they will no longer hold the power of the energy generation monopoly. The expansion of renewable energy will bring many positive environmental impacts, such as reduced emissions, but it will also bring the democratization of energy. No longer will households be forced to purchase energy from the local utility, but they will be able to make the choice to create it themselves, as a community, or purchase it as a service from a nearby utility.

*Tim Holder is director of strategic business development at ReNew Petra. Mr. Holder's background covers two decades in the electric utility and energy industry with emphasis on strategic planning, emerging technology, economic development and customer service. Mr. Holder earned an MBA from the University of North Carolina at Charlotte and a bachelor's degree from the University of North Carolina at Chapel Hill.*

## Investigation Launched into Cause of Last Week's Massive Power Cut

**Author:** Jack Loughran

**Date:** 14 August 2019

**Source:** [E&T](#)

An investigation has been launched into the cause of a widespread power cut on Friday 9 August that resulted in travel chaos and left almost one million electricity customers without power.

Electricity generation from a gas-fired plant and an offshore wind farm was lost, resulting in the closure of two of London's busiest train stations which included Clapham Junction, often claimed to be the busiest station in Europe.

Business secretary Andrea Leadsom said the incident was not linked to the variability of wind power but that the cut demonstrated the need for a diverse energy mix.

National Grid called the power cut "a highly unusual event without precedent in the past ten years".

The frequency of the grid is supposed to stay at 50Hz and will automatically cut off for safety reasons if this deviates by one per cent either way.

A gas-fired power plant at Little Barford and the Hornsea offshore wind farm went out almost simultaneously, causing the grid frequency to drop below safe levels and triggering a shutdown.

While the grid has a safety net composed of a matrix of privately owned small generators, the power they provided on this occasion was not enough to maintain optimal grid frequency.

A committee met for the first time on Monday to look into the causes of the outage and whether correct procedures were followed, as well as whether improvements are needed in future.

Much of the infrastructure underpinning the grid was built before renewables became a major contributor to the UK's energy mix and questions remain as to whether National Grid has done enough to ensure that the intermittent power from these sources has been satisfactorily integrated into the system.



---

The committee will report its initial findings in five weeks, and provide a full report within 12 weeks, the government said.

Leadsom said: "Friday's power outages caused significant chaos and disruption to hundreds of thousands of people.

"National Grid is urgently reviewing what happened and will shortly report to Ofgem to consider what action may need to be taken.

"National Grid has already confirmed that the incident was not linked to the variability of wind power, a clean, renewable energy source that the Government is investing in as we work towards becoming a net zero emissions economy by 2050.

"Friday's incident does however demonstrate the need to have a diverse energy mix.

"I have formally commissioned the Government's Energy Emergencies Executive Committee to review the emergency response and recovery procedures for our energy system."

---

## Global Insight: the All-Electric Jet Powered Air Taxi

Date: 23 July 2019

Source: [AEMO](#)



The Lilium jet powered air taxi, with fully electric engines and zero operating emissions, has just completed its maiden flight. This German start up aims to take passengers 300kms in just 60 minutes.

Imagine being on holidays in London in the near future, and you decide in the spur of the moment that you'd like to see an English Premier League game in Liverpool (288km from London). There's a new German start up that might be able to get you there in approximately 58 minutes, skipping the traffic in the most dramatic of ways.

Enter the [Lilium Jet](#), a five seater, fully-electric aircraft (fitted with 36 pioneering, all-electric engines) that takes off and lands vertically in even densely populated urban areas, removing the need for complementary infrastructure on the ground. Their vision is to provide an on-demand air taxi service city-to-city or suburb-to-city, with prospective passengers using an app to locate their nearest 'landing pad' and then booking their trip.

The ducted engine design of the jet doesn't produce the same level of noise as a helicopter or commercial jet. [According to Lilium](#), there's 'no tail, no rudder, no variable pitch, no folding propellers, no gearboxes, no oil circuits' and there will also be zero operational emissions, making them the first ever electric jet engines with commercial certification.

It's expected to be fully operational by 2025 and available to the public in various cities around the world. Lilium has described their service as 'combining the remarkably efficient Lilium Jet with digital scheduling and smart operations, we will deliver journeys that are four times faster than going by taxi, yet competitive in price'.

The German company is committed to sustainable principles, recognising that nearly a quarter of all carbon emissions are caused by transportation, and aims to become 100% CO2 neutral.

With the recent announcement of [Uber Air](#) and their plans to trial a shared air transportation service in Melbourne (in addition to Dallas and Los Angeles) by 2023, the future of city-to-city air travel looks set to get disrupted in a significant way. And what impact will these technologies have on electricity grids globally? We will continue to closely monitor these exciting developments.

# What happened to our electricity system on Friday August 9th 2019?

**Author:** Keith Bell

**Date:** 14 August 2019

**Source:** [UKERC](#)

## Balancing the system

An AC power system must be operated within a certain band of frequency, in our case near to 50 Hz. This requires that, moment by moment, the generation of power and demand for it are matched. If they aren't, the system frequency falls (when there is not enough generation) or rises (when there is too much). It is intended that market participants schedule their own generation to come on and switch during the day to match the changing pattern of demand. However, National Grid's Electricity System Operator (ESO) function brings on extra generation or reduces it to get the broad balance right. The ESO also buys 'dynamic' services: automatic controls on generators where system frequency is monitored and power outputs are adjusted to fine tune the balance. This is known as 'frequency response'. There are some energy storage facilities that also provide frequency response and, increasingly, large users of electricity can adjust their demand to contribute to the overall balance.

## Friday 9th August

The basic general rule used by many system operators around the world is not only to make sure that everything on the system is within acceptable limits but also that that will be true even after any single unplanned event, such as a short circuit fault on a branch of the network. They therefore carry enough frequency response to cover for the sudden loss of the single largest generator or interconnector import. Unfortunately, on Friday afternoon at soon after 16:52, two sources of power were lost within less than a minute of each other: 790 MW from Hornsea 1 offshore wind farm and 660 MW from Little Barford gas-fired power station, the latter due to what its owner, RWE, said was a '[technical fault](#)'. The combined total loss of 1430 MW was significantly greater than what appears to have been the largest single infeed loss risk at the time.

A frequency trace to which we have access at Strathclyde shows that the fall in system frequency was arrested by the combination of responses on the system but dropped to below 49.2 Hz (Figure 1). However, the trace also shows a second drop in frequency about a minute after the first one. With much of the scheduled frequency response capacity having been exhausted and not yet replaced, system frequency subsequently fell to less to 48.8 Hz at which point the first stage of 'Low Frequency Demand Disconnection' (LFDD) operated.

## The triggering of a defence mechanism

LFDD (known in other countries as 'under frequency load shedding') is an automatic 'defence measure' installed on the distribution networks and designed to save the system from a complete collapse. It does so through restoring the balance between generation and demand by opening circuit breakers on portions of the distribution network to disconnect demand. It works in 9 successive tranches, each triggered if system frequency continues to fall.

The first tranche of LFDD, the only one that was triggered on Friday, is intended to disconnect 5% of demand under [Operating Code No. 6 \(OC6\)](#). However, on Friday, the disconnected demand seemed to include supplies to Network Rail signalling facilities. This, in turn, caused interruptions to train services. Even though system frequency was restored to around 50 Hz within 10 minutes of the initial generation losses (partly as a result of the demand disconnection) and National Grid said that "[By 6.30pm, all demand was restored by the distribution network operators](#)", restoration of rail services seemingly took much longer.

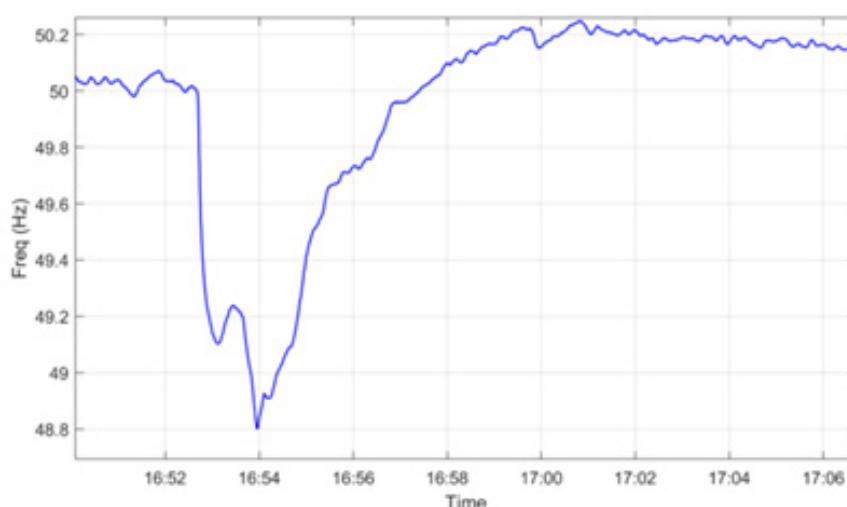


Figure 1: GB system frequency before and after the disturbance on August 9th 2019

---

## Some questions

Given that system frequency was falling, it could be said that LFDD succeeded in saving the system from a complete collapse, albeit at the expense of some disconnected demand. However, it seems to me that there are some particular questions that might now be asked:

1. What caused the losses of power from Hornsea and Little Barford? Were they independent random events or was there, somehow, a connection between them?
2. Why did system frequency fall as much as it did for the initial loss?
3. Would it have been possible for the Distribution Network Operators (DNOs) to have implemented LFDD in such a way as to have avoided disconnecting Network Rail supplies?
4. What level of resilience against losses of power supplies do Network Rail facilities have?

One of the most common causes of electricity network faults is lightning and we know that there was significant lightning activity in the East of England on Friday evening. One wonders if that might have had any influence on what happened on the electricity system.

One further thing that the electricity regulator, Ofgem, is likely to want to explore is the quality of information provided by the different parties, in particular what the ESO told the DNOs, what the DNOs understood, and what they told their customers, notably Network Rail. There is also the question of what Network Rail told the train operators and what the train operators told passengers. It seems to me that a key part of what different parties could and should have been told was when they might expect electricity supplies to be restored.

Some politicians and trades unionists have suggested that the incident is a sign of lack of investment in the electricity system. However, there's no indication that I can see that this event is a result of any lack of major infrastructure such as transmission lines or generation capacity.

Also, there is no indication that the event had anything to do with the characteristics of wind as a source of electrical energy. The reduction in power from Hornsea was much faster than would be expected due to any changes in wind speed. Hornsea's owner, Ørsted, said on Saturday that "automatic systems" had "[significantly reduced](#)" power. Another report said that Ørsted had confirmed that problems had occurred and that they are "[investigating the cause, working closely with National Grid System Operator](#)". This suggests something particular to Hornsea 1 rather than connected to wind in general. It may or may not turn out to be significant that, although Hornsea 1 is exporting power onto the system, part of it is still under construction.

## Inertia

[Some reports](#) have suggested that, at the time of the incident, the system's inertia was too low or the ESO had not procured sufficient 'flexible capacity' such as frequency response.

The inertia of a power system refers to the kinetic energy stored in the rotating masses of generating plant that, through electro-magnetic interactions within the type of generator used in large, thermal power stations, is drawn upon automatically when there is a mismatch between total generation and demand. It helps to slow down a fall in system frequency and has become a topic of debate as the kind of equipment used in wind farms, HVDC interconnectors and arrays of solar panels doesn't naturally provide it.

The ESO is obliged to operate Britain's electricity transmission system in compliance with the [Security and Quality of Supply Standard \(SQSS\)](#). This sets out the basic rule that everything should still be ok even after one significant fault event. It includes the requirement that system frequency should stay within 50.5 and 49.5 Hz although, if there is a particularly large loss of infeed, it can go outside that but for no more than a minute. Contrary to some reports, 49.5 Hz is not "[dangerously low](#)" and excursions below it are [extremely rare](#). The practical lower limit for system frequency as [defined in the Grid Code](#) is 47.5 Hz. As noted above, LFDD starts to operate at 48.8 Hz.

In its assessment of compliance with the supply standards, the system operators should take account of any impact of a transmission system disturbance on generation connected to the distribution network. It needs to work together with the network operators in order to do that.

If inertia or the volume of response are so low that the single largest infeed loss would lead to a breach of defined frequency limits, the ESO is obliged either to procure more response or re-dispatch generation via the Balancing Mechanism. This latter action might either reduce the size of the largest loss or ensure that the system has more inertia. If Ofgem launches an enquiry into the incident, it may well want to know whether the state of the system at the time of the incident was compliant with the SQSS.

One of the points of debate within the electricity sector as we see growing amounts of renewables on the system and increasing imports from the rest of Europe is whether the market arrangements currently in place for the procurement of frequency response are quite right for the future system. It is being asked whether, with some different product definitions, sufficient response might be bought more cheaply than would otherwise be the case.

On August 12th, Ofgem [asked the ESO](#) for an urgent interim report into the August 9th incident by August 16th and a final, detailed technical report by September 9.

---

### The bigger picture

The incident on August 9th arguably highlights a range of wider issues. It might be argued, for example, that the ESO should carry enough reserves of frequency response to deal with two large losses of generation rather than just one. That is, it should cater for what's called an "N-2" event rather than just, as is common around the world, "N-1".

However, almost coincident losses of generation are very rare with only two examples – Friday's and one on May 27th 2008 – that I can remember in Britain in the last 25 years, and frequency response and reserve is already quite expensive: together, 'response' and 'reserve' cost [more than £270 million](#) in 2018/19.

When considering whether any procedures should change, the additional costs of securing to "N-2" losses of infeed could be compared with those of measures that would significantly reduce the impact of demand disconnections on the rare occasions that they occur. On the global scale of electricity system disturbances, e.g. in Jakarta and Western Java on August 4th and in Argentina in June when practically the whole country was blacked out, last week's event in Britain was relatively small. However, it was still massively disruptive for lots of people – largely, it seems, due to the impact on the railways. For example, there have been [reports of certain trains' power supplies failing and operators struggling to restart them](#). In the meantime, they would have been in the way of other trains. Finally, as a result of all the disruption, many trains will have been in the 'wrong places' relative to the normal timetable.

A worst-case outcome of any disturbance for an electricity system operator is that the whole system goes down. Recovery is then hugely challenging, not just for users of electricity such as the railway companies but also the power system operators. Friday's event is perhaps a reminder that, even though we have never suffered a whole system blackout in Britain and many of our system design and operation procedures have stood the test of time, restoration plans need to be regularly reviewed.

The nature of the system continues to change with, quite rightly in view of our emissions reduction commitments, more low carbon sources of power being used. This means that the normal operating procedures and the codes and standards that govern the system also need to be kept under review, especially in light of our increasing dependency on electricity.

That increasing dependency on electricity raises perhaps the biggest societal questions. It is impossible to guarantee perfectly reliable electricity supplies. By international standards, supplies in Britain are, on average, very reliable. How much are we prepared to pay to make them more reliable? And, because they will never be perfect, do we – individuals, institutions and service providers – know how to cope when we experience an outage?

---

## AC-powered LEDs Could Cut the Cost of Lighting

**Author: Samuel K. Moore**

**Date: 13 August 2019**

**Source: [IEEE Spectrum](#)**

Integrated gallium nitride diodes and LEDs mean lighting needs no separate power converters.

Engineers at Pennsylvania State University have demonstrated a practical way to integrate gallium nitride LEDs and their power supply circuits onto the same chip using industry-standard manufacturing processes. The result is a lighting chip that runs directly from the AC electricity supplied by a wall outlet, with no need for the intermediate step of converting the electricity to low-voltage DC on separate [silicon chips and other components](#).

The Penn State engineers describe the work in [IEEE Transactions on Electron Devices](#).

According to Penn State engineering professor [Jian Xu](#), who led the research, integrating the LED's driver system onto the [gallium nitride](#) chip could cut the cost of manufacturing LED lighting as well as the cost of maintaining that lighting. As much as 60 percent of the cost of an LED bulb comes from the driver electronics, he says. And because those silicon driver electronics are typically less robust than gallium nitride, they tend to fail before the LED itself does.

The existing driver circuits in an LED lamp perform three main functions: They convert the AC to DC (rectification), smooth out ripples in the resulting DC, and lower the voltage to a more LED-friendly level.



Photo: Shutterstock



The on-chip driver system that Xu's group constructed only performs the first function (rectification) while eliminating the need for the third (lowering the voltage).

The driver consists of four Schottky barrier diodes (SBDs) arranged into a [bridge](#) rectifier circuit. SBDs are diodes formed by the junction between a metal and a semiconductor. They are common in [power electronics](#), because they have a low forward voltage drop. Gallium nitride is an especially good material with which to make them, because it has a high breakdown voltage; that prevents the flow of current in the reverse direction.

In order to get the right voltage to the LEDs, the devices are built as an array and cascaded in a chain of 22 to 40 pixels per rectifier. In that way, the total voltage drop is the 110-120 V from the wall socket, but each LED pixel sees only a few volts.

A white LED lamp using the prototype integrated chip produced a respectable 89 lumens per watt. However, because the SBD bridge outputs a rectified version of the AC input rather than a roughly constant voltage, the LED has a 120-hertz flicker, which would make it more suitable for outdoor lighting applications such as lamps for parking lots and roadways, where low maintenance cost is critical but light quality is less important.

Integrating an LED light's driver circuits might seem like an obvious idea, but it's been out of reach until recently. "Gallium nitride is a fairly new material system," Xu says. "The technology has become mature only recently, that's why integration on a single chip is a very new idea." Previous attempts have required the use of either specialized LED structures or manufacturing processes that were too complex to scale up or were too damaging to LED efficiency.

Solving that last problem was the key to Xu's lab's achievement. In silicon chip manufacturing, etching away material to form devices can be done with "wet" chemistry, such as treatment with hydrofluoric acid. But gallium nitride is too tough for that to work, explains Xu. So instead "dry etching" —inductively coupled plasma etching—is used. Unfortunately, that process can leave efficiency-sapping defects on the surface.

"We spent two years trying to decrease defects using a mixed etching technique," says Xu. Although wet etching isn't strong enough to remove much of the semiconductor surface, given time, it can help remove the defective layer left by dry etching. His team eventually hit upon a sequence of dry etching and wet etching that produced low-defect, high quality devices. Even better, this "cyclic etching" procedure could be used to boost the efficiency of microLEDs [for displays](#), according to Xu.

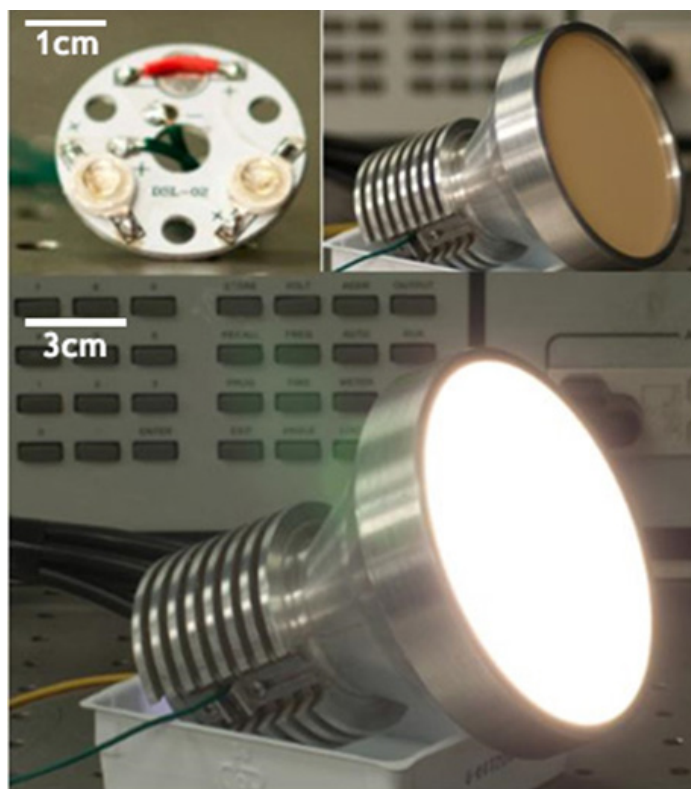


Photo: IEEE Xplore



## 'Nuclear has never been economic and is dangerous': study the Cost of Lighting

Author: [Bernd Radowitz in Berlin](#)

Date: 25 July 2019 - updated 26 July 2019

Source: [Recharge](#)

The German Institute for Economic Research calculates new nuclear plants will face losses of €4.8bn on average.



Nuclear power is economically unviable, dangerous and should not be labelled as a clean form of energy, the renowned German Institute for Economic Research (DIW Berlin) said, pointing to [research](#) it has carried out on the profitability of investments in nuclear power plants. DIW Berlin is one of the leading economic think tanks in Germany.

According to "numerous scientific studies," none of the world's more than 600 nuclear power stations have ever been economically viable, and the plants could only be operated for years due to government subsidies, the institute claims.

"That nuclear energy has never been economically competitive comes as no

surprise as electricity production has always only be a by-product. Military and geo-strategical interests have always come first and this energy source has been massively subsidised," the study's author Christian von Hirschhausen said.

"Now it is also certain that it won't be profitable in the future either to invest in atomic energy – neither in new nuclear power plants, nor in the extension of existing ones.

"If in addition you consider that nuclear power absolutely isn't safe, the fairy tale of a climate friendly alternative to fossil energy sources completely collapses."

According to DIW's business model research, every nuclear power plant being built now can expect to generate an average loss of €4.8bn (\$5.37bn). The model takes current and future power prices into account, as well as investment and capital costs. Under no realistic circumstances can nuclear power plants create a positive net present value, DIW insists, and at best will only generate a loss of €1.6bn.

Germany is exiting nuclear power by the end of 2022, and renewables during the first half of this year have already [met 44%](#) of its power needs. But the country has been criticised for emitting more CO<sub>2</sub> per capita than European peers such as the UK or France, which currently have less coal- and lignite powered generation while they kept their nuclear fleet running.

"The idea to fight climate change with nuclear power isn't new, but we show how false and misleading it is," DIW energy expert and co-author of the study, Claudia Kemfert, nevertheless said.

"We must also consider that in addition to the business calculations we have made, there are also horrendous costs on top that need to be carried by society, for example for the storage of nuclear waste."

DIW's findings are in stark contrasts to those of other experts in the renewable energy sector, such as BloombergNEF founder and senior contributor Michael Liebreich, [who claims](#) a decarbonisation of national economies cannot be achieved credibly without dealing explicitly with nuclear power. Liebreich proposes extending the life span of current nuclear plants, and speeding up the development of small modular reactors (SMR's).

## ABB & Siemens Test Subsea Power Grids for Underwater Factories

Author: Amy Nordrum

Date: 22 May 2019

Source: [IEEE Spectrum](#)

Putting a power-distribution station on the ocean floor could allow more raw materials to be processed down there



Photo: Siemens

**Submersion:** Siemens performed a shallow-water test for its subsea power-distribution system off the coast of Trondheim, Norway.

**Slowly but surely, oil- and gas-drilling** technology is migrating from floating platforms to the seafloor. Pumps moved down there [decades ago](#). More recently, [compressors](#) (which boost pressure in a well to keep gas flowing) and [separators](#) (which isolate oil from water and silt) have relocated to the murky depths.

Putting this equipment closer to wells makes them more productive and [energy efficient](#). Some oil and gas companies even aspire to build subsea factories that extract and process oil and natural gas directly on the seafloor. These factories would be safe from hazards such as icebergs and hurricanes. They would be controlled remotely, reducing labor costs. Eventually, some believe, offshore platforms could be phased out entirely.

However, all of this sunken gear requires electricity. Today, operators typically string power lines from power plants or diesel generators aboard nearby oil rigs to every piece of subsea equipment they install. That works for a few machines, but it's impractical to string dozens of umbilicals, as they're known, to the ocean floor.

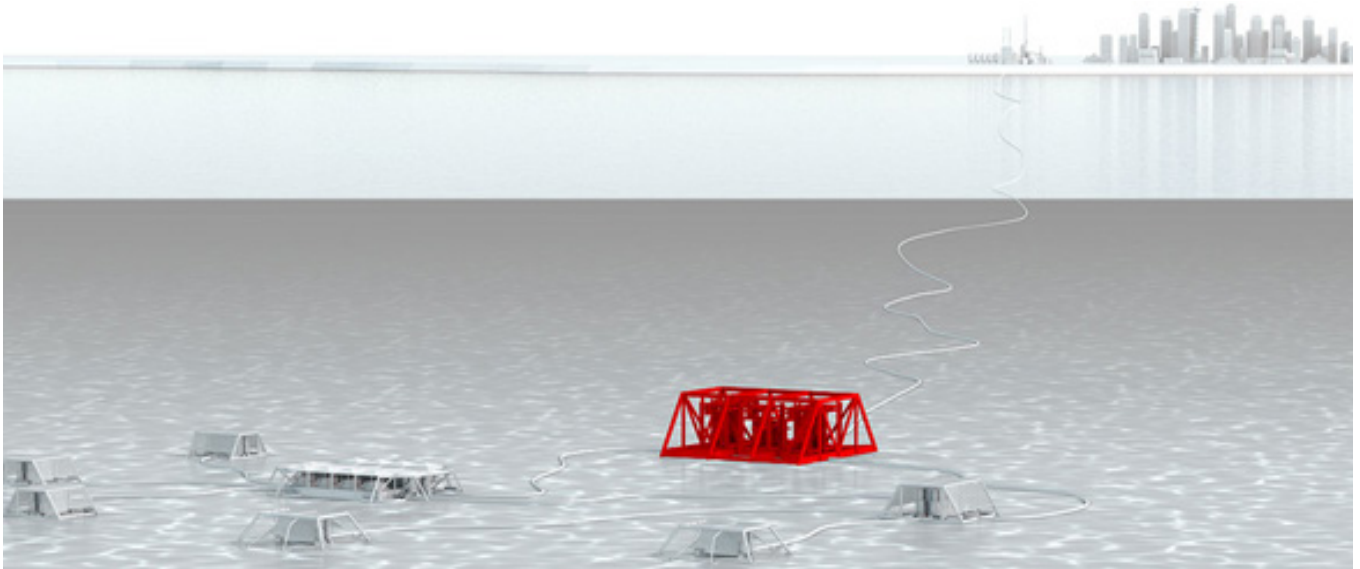
Industry suppliers [ABB](#) and [Siemens](#) are now putting the finishing touches on competing versions of the world's first subsea power-distribution stations. Once installed, these stations would connect via a single line to a "topside" (maritime parlance for above water) generator, wind turbine, or power plant, and redistribute electricity to underwater equipment. "Our technology is an enabling technology for the subsea factory," says [Bjørn Rasch](#), head of subsea power for Siemens.

Both projects have been in the works for more than five years. ABB will complete its final round of testing in June and expects to install its first [subsea power system in 2020](#). Siemens [tested its version](#) in shallow water in Norway last November and is now talking with clients about putting its first unit in the field. "We're getting close to where we're actually deploying this technology in a real project," Rasch says.

Siemens's model, which the company calls its Subsea Power Grid, consists of a transformer, a medium-voltage switchgear, and a variable-speed drive. Its distribution voltage is around 30 kilovolts, while its variable-speed drive puts out 6.6 kV. The system can provide electricity to devices with power ratings between 1 and 15 megawatts. The umbilical that hooks it to a generation station also includes an embedded fiber-optic cable so operators can run everything from afar.

One of the hardest parts of building the station, Rasch says, was ensuring it could withstand the high water pressure of the seafloor. Instead of encasing all the equipment in a pressurized chamber, engineers flooded the electronics with a synthetic fluid called Midel. This biodegradable fluid inside the equipment maintains the same pressure as the seawater, which alleviates stress. The fluid also passively cools the device by transferring heat from equipment to the chilly seawater.





*Illustration: ABBABB has developed a subsea power-distribution system (red) that can be placed up to 600 kilometers away from an onshore power plant. The company expects to install it at a commercial site in 2020.*

Chevron, Eni Norge, Equinor, and ExxonMobile have all worked with Siemens to get the company's project this far. The next step for both ABB and Siemens will be to deliver the first model for installation at an active production site.

[Brian Skeels](#), professor of subsea engineering at the University of Houston and director of emerging technology for the offshore design and consulting firm [TechnipFMC](#), has seen many attempts to "marinize" technologies to work underwater. Dealing with heat is a common stumbling block. If water can't flow freely around a device, the heat it generates prompts marine life to grow on the equipment, which shortens its life-span. And, Skeels cautions, "what may work in shallow water may not work at deeper depths."

Both systems are expected to work at depths of up to 3,000 meters and operate for 30 years with minimal maintenance. At the end of their lives, the units can be removed from the seafloor.

A power-distribution center would be just one piece of any future subsea factory—a vision that has captivated the industry [for more than a decade](#). Skeels says the future of subsea processing will depend largely on whether such projects can add more value to the industry than they drain in expense. Investment into subsea processing dried up when oil prices crashed in 2014. Looking ahead, Skeels thinks the technology holds the most potential for remote wells more than 160 kilometers from other facilities.



*Photo: ABBABB tested a subsea variable speed drive by submerging it for 1,000 hours near Vaasa, Finland in 2017.*

[Hani Elshahawi](#), digitalization lead for deepwater technologies at Shell, says there are clear benefits to having power readily available on the seafloor. But he doesn't think subsea factories will supplant all platform activities, or replace any of them in the near future. "It will require decades, in my view," he says. "We foresee a more gradual and lengthy transition."

To Rasch at Siemens, though, the industry's vision of subsea factories does not seem as far out as it once did. "There are many technologies in many companies that are in place or close to being in place," he says. "This can be realized in the close future, that's for sure."

*This article appears in the June 2019 print issue as "ABB and Siemens Test Subsea Power Grids."*

*This article was updated on 22 May 2019.*

*Editor's note: this article was included in issue 6, 2019 of the EESA bulletin under an incorrect author name and source. Our apologies to the author, Amy Nordrum.*

## HISTORY

### A Small Hydro Electric Installation

**Author:** Tony Patterson

**Date:** August 2019

**Paper:** A Small Hydro Electric Installation

**Author:** D J Byles

**Date:** January 1936

Hydro based electricity generation, whether from natural resources or pumped storage, is a very relevant topic these days. Its importance is based on its renewable energy power source and the growing need for renewable energy. Australia's passed history has been dominated by the magnificent Snowy Hydro scheme and the brilliant foresight and engineering that was associated with it. Snowy 2.0, with its pumped storage proposal, would be a welcome addition to it.

However, the opportunities for Hydro based generation are limited, because of the limited water resources we have in this country. But there are opportunities and these need to be explored further.

If we go back in the history of Hydro based generation, there were locations where this form of generation was the only source of power. It did not matter whether it was renewable or not, it was a source of electricity.

Take yourself back to 1936 where you are given the task of providing hydro electricity to a town for the very first time. There are very limited resources and you need to engineer almost everything. How would you go about it?

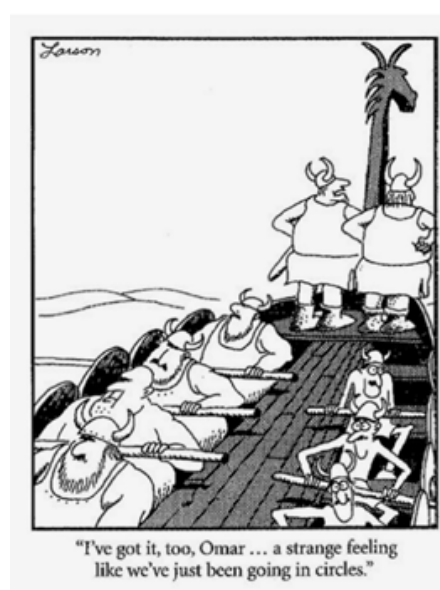
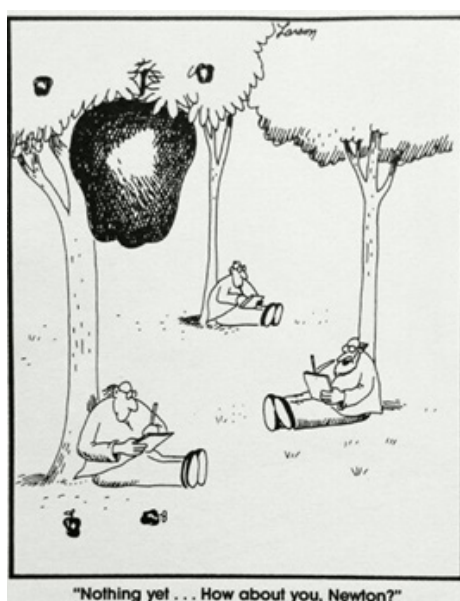
If you need some assistance, please read the downloadable paper.

Read the paper to see if the predictions made in 1944 have been realised.

[Download Paper](#)

## HUMOUR CORNER

Curated by Terry Miller





## CIREP PAPER

# The Thor Hammer Tester – A Step Change in The Management of Wooden Utility Poles

Paper 569 from the Madrid CIREP Workshop held on 3-6 June 2019.

### Abstract

With over two million wooden utility poles in use across the United Kingdom (UK), assessment and management of wood pole decay has been an issue for many years. Various techniques and approaches exist for this, but each has disadvantages, such as subjectivity in the results, or time implications associated with the test. At present, there is no suitable technique for obtaining an accurate consistent pole health assessment, including below ground assessment, with enough efficiency for mass-scale deployment across the UK networks.

Recently, SP Energy Networks has trialled a new, non-destructive seismic pole tester, "THOR". The device is considered to have great potential, combining an innovative use of technology with real practical application. This paper presents the outcome of the trials to date; considers the device's applicability to the UK networks; and outlines the proposed future development work to integrate the device as a Business as Usual inspection method for the UK industry.

[Download Paper](#)

## UPDATES ON WORKING GROUPS

### CIGRE

**NEW CIGRE SCIENCE AND ENGINEERING AVAILABLE**  
June 2019



#### IN THIS ISSUE:

- Study Committee C2 – System operation and control power system restoration – World practices & future trends
- Study Committee C4 – System technical performance - The use of battery energy storage systems for system integrity protection schemes in South Australian power system
- An aggregate dynamic model for distributed energy resources for power system stability studies
- Wire displacement of AAAC overhead line conductors at wedge tension clamp
- Seismic response of high-voltage cables in ducts – A preliminary study
- A novel Wavelet selection scheme for partial discharge signal detection under low SNR condition
- Real-time co-simulation model using electromagnetic transient and dynamic phasor simulations
- IDtools: An automated tool for modal identification from time-domain simulation results for establishing system operating limits
- A direct calculation of locational marginal value of distributed energy resources
- Effect of Earth surface on lightning electromagnetic pulse propagation
- Material and emerging test techniques general overview of AC and DC current injection on high voltage potential for HVDC long-term tests

- Application strategies for externally gapped line arresters against lightning outages on the 400 kV overhead transmission lines in Hong Kong

By joining CIGRE, you will become part of a global network of experts and build lasting partnerships with electrical industry organisations connected to our Association, [Join us!](#)

[Download Paper](#)

## NATIONAL LIVE WORK FORUM

Launched in May 2005 the Australian Live Work Forum is a coming together of the most passionate and experienced Live Work minds from across Australia and New Zealand.

Guided by the Forum Charter, biannual meetings are held review live work conducted by Electricity Supply Industry (ESI) personnel working in Australia and New Zealand. The meetings are aimed at:

- Promoting nationally consistent practices.
- Proposing solutions for improving HV & LV live work practices.
- Accessing, reviewing and reporting on technology and equipment changes.
- Encouraging & supporting innovative field practices.
- Providing a formal communication network to share ideas, research and development and operational experience information.
- Providing an informal communication channel with regard to product / equipment failures, incidents, accidents and safety issues.

All Australian Electricity Utilities are represented at the Forum with delegates bringing expertise in both distribution and transmission high voltage live work practices and more recently, live low voltage work practices. Live Work training providers and energy safety experts from both Australia and New Zealand are also regular contributors to the meetings.

Since its inception, the Live Work Forum has also contributed to the electrical supply industry by

- Forming a working group to write Australian Standard AS5804 HV Live Working that was officially endorsed by Standards Australia and published in 2010.
- Forming a working group to write a guideline for the mechanical inspection of live work equipment.
- Forming a working group to write a guideline for the inspection and testing of HV live work sticks
- Forming a working group to review Australian Standard AS5804

Recently, the Live Work Forum became an endorsed EESA working group. The Live Work Forum will be a valuable contributor to EESA, providing assistance in "Advancing the understanding of the ongoing developments across the Australian Electric Energy Industry".



CAPTION: Transmission HV Live Work



CAPTION: Distribution HV Live Work

## EVENT RECAPS

### Cresswell Prize Winner Crosses the Ditch

Summary of the 2019 New Zealand Electricity Engineers Conference.

Mathew Holden is a senior commissioning and maintenance paraprofessional with Ergon Energex, and Cresswell Prize Winner. Part of that prize is attendance at the EEA New Zealand annual conference. Mathew recently wrote to President Jeff Allen recounting his experience of the conference:

Dear Jeff,

Firstly, I would like to again thank the EESA for the opportunity to share my experience and presentation at EECON 2018. Subsequently being awarded the Cresswell prize was a welcome and unexpected surprise. When Dr Robert Barr contacted me to ask if I would like to present at the New Zealand EEA conference as part of the Cresswell prize I eagerly cleared my schedule and made all necessary arrangements to ensure I could attend. My employer, Energy Queensland, was very supportive of this opportunity and agreed to let me attend without need for any leave provisions. I am grateful to work for an organisation that recognises the value of its employees attending events such as EECON and EEA conference.

I flew out of Townsville on the "Red Eye" to Brisbane Monday, 24th June. I was in downtown Auckland that afternoon around 3:30pm. I spent a few hours exploring the city and getting myself acquainted with the conference venue. The next morning was registration, a complimentary coffee off one of the two baristas working overtime and settling down for the first of the keynote speakers. The two keynote speakers immediately set the tone for the majority of the conference. It was evident that New Zealand is taking a proactive approach to climate change and the electricity industry is definitely along for the ride. As my own presentation focused on connection of a large scale renewable generator, I was engaged in these keynote presentations and attentive to the similarities and differences to the focuses in Australia.

Over the following 3 days I attended a variety of presentations. A large number of these presentations were centred on solutions to what New Zealand engineers are considering as potential challenges due to the carbon emissions targets being proposed by their government. I was bemused by the numbers being quoted regarding the existing NZ electricity infrastructure, 80% renewable source already. In comparison to Australia I couldn't help wonder what they are worried about. It was evident that the two main issues being discussed and dissected was the impact of electric vehicles to grid capacity and the influence of small-scale distributed generation.

I remember walking away from EECON 2018 in Brisbane optimistic about the future requirement of the electricity network in Australia. A major reason for that was the discussions about, and forecast of electric vehicle uptake. We had been hearing about the death spiral and redundancy of the network for a couple of years previously, now it seemed that EV's would be our savior. In contrast, at the EEA conference in Auckland there was a general sense of apprehension around the potential increase of electric vehicles. There was a lot of discussion around hosting capacity of the existing network and where the extra power would come from, given the commitment to lower emissions. Some of the talk around encouraging fleet owners to go electric was interesting and seemed a viable strategy to counteract the dreaded duck curve anticipated with residential EV uptake.

Overall, I had a great time at EEA Auckland. The dinner on Wednesday night was superb and I got to meet some great people during the breaks and exhibition social hours. I was able to broaden my own understanding of another countries electricity industry; it was pointed out more than once that we Aussies don't know anything about the NZ network. I'd like to think I can now debunk that trend a little. Again, many thanks to the EESA for the opportunity to present and I hope I represented your organisation well.

Regards,

**Mathew Holden**

Senior commissioning and maintenance paraprofessional  
Operations - Substations, Distribution  
Ergon Energy Network – Energex

## AWARDS

### Electrical College Awards

**Spring Award Nominations are Now Open**

**Closing 16 October 2019**

It's time to celebrate amazing industry achievement by recognising our best and brightest engineers and engineering students. You or a colleague could be eligible for any of the thirteen awards now open for nomination. If you know a brilliant engineer in the fields of civil, electrical, information, telecommunications and electronics engineering, or engineering education and research, nominate them!

**Nominations are now open for the following awards:**

National Professional Electrical Engineer of The Year  
M A Sargent Medal  
Young Electrical Power Engineer of The Year Award  
John Madsen Medal

**Nominate Now**

## ANNOUNCEMENTS

### EESA Special General Meeting

A special general meeting will be held on Wednesday 4 September 2019 in Sydney to vote on the proposed changes to the EESA constitution. Event details are listed in the events section of this bulletin.

[Click here for more info on the 2019 EESA constitution review.](#)

[Click here to register for the SGM event.](#)

---

### Victorian Registration: Update

**Date: 28 August 2019**

**Source: Engineers Australia**

Last night, legislation to introduce compulsory registration of engineers in Victoria passed Parliament, meaning it will shortly become law. This is a historic development and one which is set to bring broad and long-lasting benefits to the engineering profession and the broader community, which is consistent with the Engineers Australia Royal Charter.

The outcome is also a testament to the many members of Engineers Australia who have been unwavering in their support for compulsory registration of engineers and the significant amount of time and hard work that our members, together with the Engineers Australia team have put in on this issue.

While more comprehensive information will be provided to you by Engineers Australia in the coming weeks and months, in summary, the major changes are:

- It will be compulsory for civil, structural, mechanical, electrical and fire-safety engineers to be registered to provide professional engineering services in Victoria; and
- It will be an offence for a person to call themselves a professional engineer in the above categories if they do not have the right qualifications and they are not registered (before the legislation passed, anyone was able to call themselves an engineer).

---

Through the extensive consultation with members we have conducted on registration of engineers, Engineers Australia is aware there are some who have concerns about compulsory registration of engineers. The reality is community confidence in the engineering profession is at its lowest level for some time and any engineer who is not prepared to conduct regular continuous professional development should not be able to call themselves an engineer.

After the legislation formally becomes law, which should be in the next few weeks, the Government has indicated that it will conduct extensive public consultation, including with the engineering profession, to develop the regulations that will support the Act. Among other things, these regulations will outline exactly how the new laws will be implemented. To complement this, Engineers Australia will undertake new, exhaustive consultation with the engineering profession to enable you to provide your views as the regulations are developed. As soon as we are able to, we will provide fresh information about how you will be able to take part in this consultation.

In the interim, if you have any queries or concerns, please don't hesitate to make contact with a member of the Engineers Australia team.



## UPCOMING EVENTS

### Major Customer and Generator Connections: Challenges and the Future + QLD Chapter AGM

Tuesday 3 September 2019

QLD

[VIEW EVENT](#)



**Overview:**

Glenn Springall will speak about customer centric, customer connections. He will give an overview of the role that Energy Queensland plays in connecting loads and generators; the exciting and the challenging for the evolution of the distribution network.

**Time:**

3-5pm

**Venue:**

Brisbane Room, 26 Reddacliff Street  
Newstead QLD 4006

**Cost:**

EESA/EA members: \$0  
Non-members: \$30

### Successfully Managing Change in the Electric Energy Industry + EESA National SGM

Wednesday 4 September 2019

NSW

[VIEW EVENT](#)



**Overview:**

Jeff Allen will discuss why engineers need to understand the all the details of their area of expertise as well as the "big picture" overview of the changes that are occurring and the impact of these changes on the transmission and distribution system so that they can successfully make the transition to this much more complicated world.

**Time:**

Registration: 4:30pm  
Presentation: 5pm - 6pm | SGM: 6pm

**Venue:**

Endeavour Energy, Warragamba Room  
51 Huntingwood Drive  
Huntingwood NSW

**Cost:**

EESA members: \$0  
Non-members: \$30

### Managing electrical power distribution to reduce extreme bushfire risk

Wednesday 11 September 2019

NSW/WEB

[VIEW EVENT](#)



**Overview:**

The Black Saturday bushfires which devastated Victoria in 2009 led to the death of 173 people and the loss of over 2000 homes with damages estimated to cost over \$4.4 billion. A Royal Commission was tasked with investigating the effectiveness and completeness of the threat reduction measures implemented since the bushfires of 1977 and 1983.

**Time:**

05:30 pm to 07:30 pm ( AEST )

**Venue:**

Engineers Australia Newcastle  
Suite 3 Tonella Commercial Centre  
125 Bull Street  
Newcastle West - Webinar available

**Cost:**

EESA members: \$0  
Non-members: \$30

## UPCOMING EVENTS

### Battery of the Nation: the Role of Tasmania in the Australian Future Power System

Thursday 12 September 2019

VIC

[VIEW EVENT](#)



**Overview:**

Not one, but two links to mainland Australia! The Battery of the Nation initiative is about investigating and developing a pathway of future development opportunities in renewable energy.

**Time:**

6pm - 8pm

**Venue:**

Engineers Australia  
Level 31, 600 Bourke Street  
Melbourne VIC 3000

**Cost:**

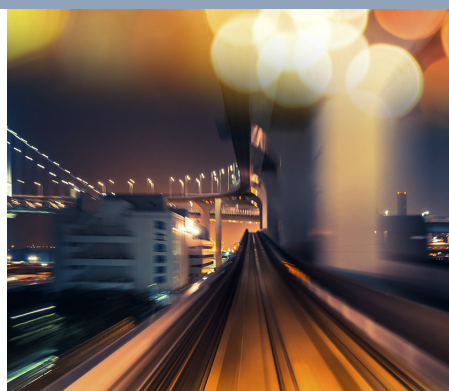
EESA members: \$0  
Non-members: \$30

### EESA Industry Event: Energising Our Future

Friday 13 September 2019

VIC

[VIEW EVENT](#)



**Overview:**

Over the course of a full day, experts from industry will outline how the innovations in energy sectors are revitalising our forthcoming future towards an increasingly efficient system. This event will highlight the key behind these innovations and the ongoing challenges required to the Australian network in order to successfully integrate new and emerging technologies.

**Time:**

8:30am - 5:30pm

**Venue:**

Monash University  
New Horizons Building, Level 4,  
20 Research Way  
Clayton VIC 3800

**Cost:**

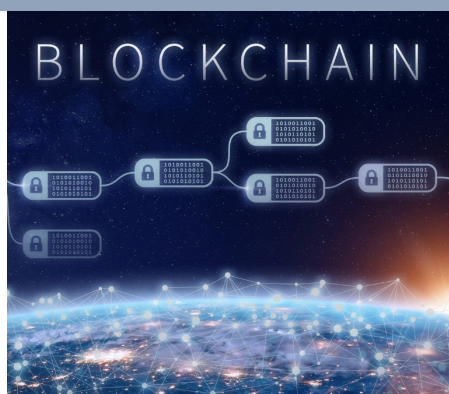
EESA members: \$0  
Non-members: \$30

### Blockchain: The Era of the Energy Internet

Wednesday 18 September 2019

WA

[VIEW EVENT](#)



**Overview:**

Our energy networks are a work in progress. We are now seeing the accelerated uptake of distributed generation, storage and blockchain applications transforming legacy electricity networks into community owned economic engines. Interconnected local energy markets have emerged as an anticipated outcome of a monumental shift in the electricity industry away from centralized network planning. complemented with

**Time:**

5pm - 7:30pm AWST

**Venue:**

Engineers Australia Perth Auditorium  
712 Murray Street West  
Perth WA 6005

**Cost:**

EESA/EA members: \$0  
Non-members: \$30

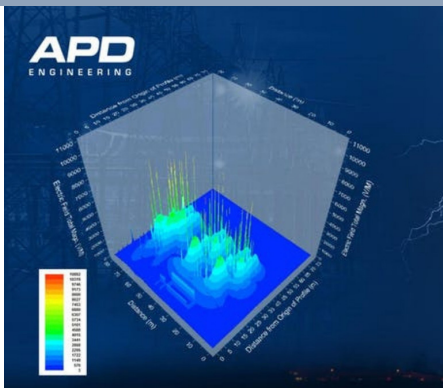
## UPCOMING EVENTS

### Electromagnetic Coordination Management for Substations

Monday 23 September 2019

SA

[VIEW EVENT](#)



**Overview:**

This presentation covers electromagnetic coordination issues within substations; what they are, how they're created, how we know it can be problematic, what the consequences are, and solutions for mitigating the issues.

**Time:**

5:30pm - 7pm ACST

**Venue:**

University of South Australia, City West Campus  
Bradley Forum, Level 5, Hawke Building, 55 North Terrace  
Adelaide 5000

**Cost:** EESA members: \$0  
Non-members: \$30

### 2019 EESA National Virtual University Student Poster Competition

VIC

[VIEW EVENT](#)



**Overview:**

The Electric Energy Society of Australia (EESA) is hosting a virtual poster competition for undergraduate and postgraduate students. The goal of this competition is to introduce students to the power engineering industry by sharing their research with EESA members and the wider industry.

**Entries open:** 2 Sep 2019  
**Entries close:** 15 Oct 2019

**Venue:**

New Horizons Building, Level 4,  
20 Research Way  
Clayton VIC 3800

### The Next Generation Technology Project Showcase & Awards

Monday October 28th, 2019

WA

[VIEW EVENT](#)



**Overview:**

We are calling for entries of project posters related to the electric energy field by students of: Electrical Power Engineering, Electronic Engineering, or Renewable Energy Engineering; from: Murdoch University, Edith Cowan University, University of Western Australia or Curtin University.

**Time:**

1pm - 4:30pm AWST

**Venue:**

Western Power  
Ground Floor Auditorium, 363 Wellington St  
Perth WA

**Cost:**

Entry is free and refreshments are available.



## UPCOMING EVENTS

### EECON 2019

November 26th - 27th, 2019

AUS

[VIEW EVENT](#)**Overview:**

The Electric Energy Society of Australia (EESA) takes great pleasure in inviting you to EECON 2019 at the International Convention Centre in Sydney on 26th and 27th of November 2019.

The theme of EECON 2019 - our annual national conference - is "Engineering leadership providing sustainable, customer-centric electric energy solutions through the interactive grid".

**Time:**

8am, 26 Nov - 3:30pm, 27 Nov

**Venue:**

International Convention Centre Sydney  
Level 4, Convention Centre, 14 Darling Drive  
Sydney NSW

**Cost:**

Early-bird fee: \$850  
(until 5pm 17 September 2019)  
Standard fee: \$1050

### Keeping up with EESA events

To see an up-to-date list of EESA events, check under **EVENTS** on the EESA website or [CLICK HERE](#)

### Missed an event?

Recordings and papers are available under **RESOURCES** on the EESA website or [CLICK HERE](#)

## THANK YOU



The Electric Energy Society of Australia (EESA) is a non profit Technical Society of Engineers Australia, established to advance interest in the field of Electric Energy. The key objective of EESA is to provide a continuous professional development program to its members.

The successful functioning of EESA is owed to the support of EESA members and especially those who volunteer their time, effort, skills and expertise for the society. We thank our members and volunteers for their contribution.

We thank our corporate members for their support.

## Gold Members



### Essential Energy

At Essential Energy we look after the poles and wires that deliver electricity to 95 per cent of regional, rural and remote NSW and parts of southern Qld.



### Horizon Power

Horizon Power is a State Government-owned, commercially-focused corporation that provides safe and reliable power to about 100,000 residents and 10,000 businesses across Western Australia.



### AMSC Australia

AMSC generates the ideas, technologies and solutions that meet the world's demand for smarter, cleaner, better energy.



### Western Power

Western Power's vision is to deliver on the changing energy needs of Western Australians, powered by community trust and the passion of our people.

## Silver Members



### Evoenergy

Evoenergy is owned equally by Icon Water Limited and Jemena Ltd via subsidiary companies. Evoenergy owns and operates the ACT electricity network, and owns the gas networks in the ACT, Queanbeyan, Jerrabomberra, Bungendore and Nowra.



### nVent

We are a \$2.1 billion, high-performance electrical company with a dedicated team of 9,000 people and trusted brands. Known for innovation, quality and reliability, our products connect and protect, consistently delivering value to industrial, commercial, residential, energy and infrastructure customers.



### APD Engineering

APD Engineering have been providing Specialist Electrical Engineering Design and Consultancy Services to Power Utilities, Local Government Authorities, Land Developers, Mining, Construction and other industries for nearly 20 years.



### Wilson Transformer Company

Wilson Transformer Company is a leading specialist in the delivery of transformer solutions. In a changing world, organisations are increasingly turning to our specialist skills to meet their technical, safety and environmental challenges.

## Bronze Members



















