

National Bulletin

Bulletin 1 | 2020

President's Article

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

Date: January 2020



The significant bushfires that have occurred in many locations across Australia over the past few months have been as a result of the extremely dry weather conditions over the past few years – and particularly the past few months.

These fires have created significant damage affecting many communities across Australia. National parks, farms, homes and businesses and all types of infrastructure including electricity, telecommunications, roads, railroads, water, sewerage etc have been affected. There has also been significant impact on wildlife and farm animals. The overall cost in fighting the fires has been significant – and the rebuilding costs will also be very significant.

The cause of the bush fires appears to have been due to a number of reasons – but certainly the very warm days, lack of rainfall and significant amounts of very dry vegetation has meant that the fires have been very fierce and very destructive –and very difficult to contain – let alone extinguish.

To all the people who have been involved in directly responding to these fires – many of them being volunteers – a big thank you – and well done for all your great work.

Unfortunately, there have been a number of fatalities as a result of these fires and my thoughts go to the families and friends of these people who paid the ultimate price.

I have been very impressed with the management of the response phase for these fires. The various organisations across each of the states appear to have done a great job in responding in a timely and safe



Jeff Allen
EESA National President

Affiliations



manner to manage as best as possible the effect of these fires on the communities involved. They have been assisted by many different organisations at all levels of government in this response phase. There has been very good communication to the community from the various fire organisations as well as organisations like the ABC and commercial broadcasters via radio and television broadcasts, news websites and specialised fire apps.

It could be argued that more work could have been done on reducing the risk of fires by reducing the amount of vegetation and I am sure this area will be any area of focus and much debate over the coming months.

As someone who has been involved in the day to day management of a major electricity network that was impacted by severe weather events (fires, floods, lightning and extreme winds) from time to time I appreciate the challenges involved in the response and recovery phases.

As some further background to this involvement I had the role of System Control Engineer at Prospect Electricity where I was responsible for the day to day control and operation of the electricity network in western Sydney from 1972. This required managing the call centre and the system operators and field staff for the safe and reliable operation of the electricity network. I undertook this (very "operational") role for approximately 12 years before moving to a number of management and executive roles that were about ensuring the correct policies, standards and procedures were in place to ensure the safe and reliable performance of the network for the benefit of customers and the overall community under normal and all adverse conditions likely to impact on the network.

These days there is much more monitoring and automation associated with network elements and thus information (via network management systems) that can assist in understanding the severity of the impact on the networks and the tasks that need to be undertaken for the timely and safe restoration of supply to customers. Also good asset management and mapping systems offer great support in managing the response and recovery phases.

Notwithstanding all the great data and information regarding network element status, an important factor that always needs to be considered when working in the field is that the network assets will have been affected in many ways by the bushfires or their by-products (dust etc) and that there will be a need for careful assessment (often by the asset specialists) before they can be returned to service. This can be time consuming – but is a necessary step to ensure the integrity of the network and the safety the network staff and contractors and that of customers and the community – and ensuring that there are no electrical incidents that may start another fire – or endanger people involved in the response or recovery phases.

The management and operation of electrical assets of diverse types and ages spread over a large area and subject to extremes of weather as well as other events – such as bushfires – is extremely complex and requires sophisticated business processes and information systems and sufficient expert, knowledgeable and experienced people able to balance the best engineering and commercial judgement to ensure prudent risk management is achieved to satisfy the customers, the communities and the owner. Not a simple task!

Whilst the network of today is much "smarter" and there are now very good decision support systems in place compared to what there were in my days in System Control, I am of the view that the issues are much more complex and that the response and recovery actions – particularly during such recent events – need very detailed and careful management to ensure the safety of staff and the community.

I suggest that given the likelihood of such extreme weather events is much higher than it used to be, safely managing network assets in electricity infrastructure related businesses to achieve appropriate reliability outcomes for customers has never been more challenging.

Contents

Improvements in Lithium Sulphur Battery ...	Page 4
'Like New York after Sandy': Bushfires a 'wake-up call' for ...	Page 5
AEMO Releases Energy Summer Readiness Report	Page 7
New energy storage solution: A mountain of an idea ...	Page 9
Nuclear Still off the Agenda as Energy Minister Rejects ...	Page 11
Marinus Link Project Assessments Released	Page 12
Humour Corner	Page 13
International Articles	Page 14
History	Page 20
Cired Paper	Page 21
Updates	Page 21
Awards	Page 27
What's on at EESA	Page 28
Thank You	Page 30

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AUSTRALIAN ARTICLES

Improvements in Lithium Sulphur Battery Promise Longer Travel Distances for Electric Vehicles

By Terry Miller

Date: January , 2020

Source: [Science Advances](#)

Lithium-sulphur batteries have a higher specific energy than lithium-ion batteries and have substantial potential to improve the range of electric vehicles.

A drawback to date with the high capacity sulphur cathode used in these batteries has been the severe volume change (around 78%) during the charge/discharge cycle. This is about eight times higher than that of the electrodes in lithium-ion batteries.

Researchers at the University of NSW, inspired by "the classical mechanisms and bridging architectures in particle agglomeration theories", have overcome this problem by developing an improved binder used in the construction of the sulphur cathodes.

The process involves controlling the dispersion of Na-CMC (a sodium salt of carboxymethyl cellulose) that is commonly used as a binder between the colloidal sulphur and conductive carbon fillers in the cathodes.

These improved cathodes have very large reaction surfaces, can efficiently accommodate cycling stresses, and have high ion and networking mechanisms.

The researches have demonstrated that this new approach, while apparently subtle, generates radically improved energy density,

Australia and Japan Agree on Shared Hydrogen Future

By Terry Miller

Date: January 2020

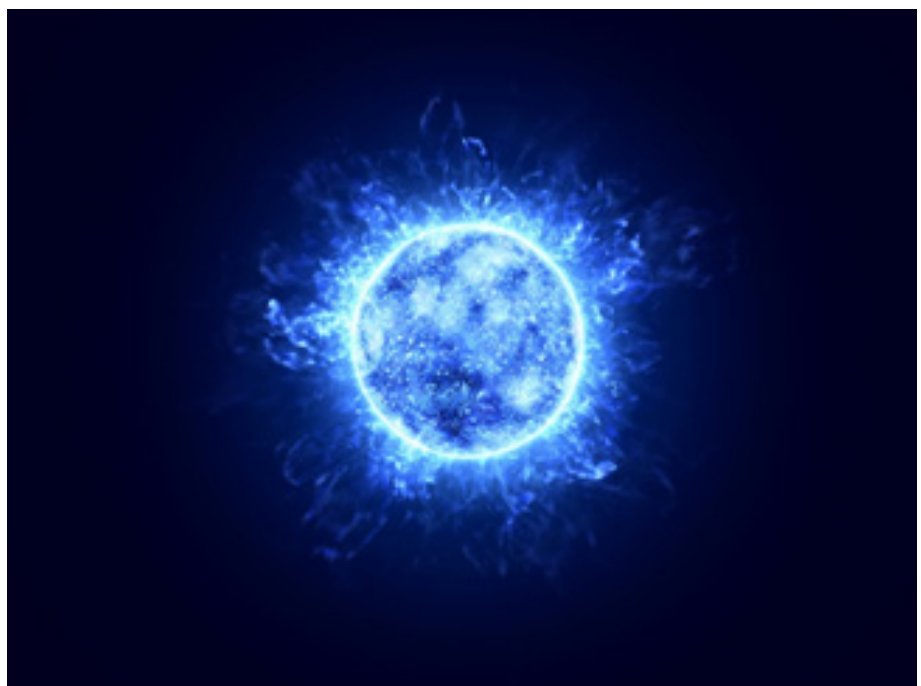
Source: AEMO

During the Australia-Japan Ministerial Economic Dialogue in early January, Australia and Japan signed the Joint Statement on Cooperation on Hydrogen and Fuel Cells.

Minister for Resources and Northern Australia, Matt Canavan, said Australia and Japan are well placed to maximise the opportunities presented by hydrogen, based on a long history of successful energy and resource trade.

The Minister noted that the scenarios developed for the National Hydrogen Strategy indicate an Australian hydrogen industry could generate about 8000 jobs and \$11 billion a year in GDP by 2050. Australia's National Hydrogen Strategy, released in November 2019, may be downloaded

[here](#).



'Like New York after Sandy': Bushfires a 'wake-up call' for power grid

Author: [Nick Toscano](#)

Date: 10 January 2020

Source: [Sydney Morning Herald](#)

Australia's energy market operator has likened the impact of this summer's catastrophic bushfire season to New York's Hurricane Sandy in 2012, saying the crisis exposes the frailty of the grid and must be a wake-up call for urgent investment.

Days after rolling blackouts were narrowly avoided when bushfires took out the vital electricity link connecting Victoria and New South Wales and another joining NSW to Queensland, chief executive of the Australian Energy Market Operator (AEMO) Audrey Zibelman said this summer was underscoring the need to better integrate the east-coast grid through transmission upgrade projects.



*AEMO is warning of 'multiple' risks to transmission lines as bushfires worsen.
Credit: Paul Jones*

Ms Zibelman said a series of proposed transmission upgrades and interconnectors joining state grids in dispersed locations would strengthen system-wide resilience against "predictable but uncontrollable" threats such as bushfires by ensuring stable electricity supply in the event one link was knocked out of service.

She called on state and federal government leaders to "eliminate the risk of delay" in rolling out the new interstate links, particularly those that have been previously committed to and are considered "actionable".

"This summer, I have to say, is reminiscent to me of the experience we had in New York after Sandy," Ms Zibelman said, referring to the deadly and destructive Hurricane Sandy that swept the north-east of the United States in 2012 and forced days-long blackouts for hundreds of thousands of homes.

Power has been cut to more than 30,000 homes as fire crews are unable to inspect the extent of the damage.

"We had many, many storms in New York, and we understood what it's like when a storm hit the city, but nothing of the magnitude of Sandy, and that began a wake-up call to the government and to the industry that things needed to be done differently."

Ms Zibelman was the former head of New York's Public Service Commission.

Summer presents the most challenging time of the year for the stability of the National Electricity Market. On sweltering days power demand peaks as households switch on their airconditioners all at once. At the same time supply is often stretched as extreme heat strains the nation's fleet of ageing coal and gas power generators sometimes causing sudden breakdowns, and bushfires pose the risk of bearing down on critical transmission lines.

Last weekend AEMO was forced to contract emergency back-up power to avoid enacting large-scale involuntary power cuts across NSW when a fire in the Snowy Mountains knocked out two substations in the state's south and cut the NSW transmission link with Victoria. Days earlier, a similar blackout threat was narrowly overcome in Victoria amid scorching temperatures of more than 40 degrees.

Ms Zibelman said the effect of the recent interconnector outages revealed the need for a much more "enmeshed" network. "We can take advantage of the diversity we have in Australia so that the size of the country becomes an advantage rather than a disadvantage," she said.

Especially with the amount coal-fired power set to exit the market in the next decade, Ms Zibelman said the energy system required a "rebuild". "And we have to do it in a way that makes the most sense economically and is good for the future in dealing with the situations we find ourselves in."

Her calls come after AEMO last month released its draft Integrated System Plan – a roadmap for the development of the grid which

identifies investments needed. Among AEMO's priorities is a network upgrade in western Victoria to increase transmission and "unlock" renewable energy resources in the region, and a system-strengthening project in South Australia which AEMO states is "urgently required".

Also in the draft report is a proposed 530-kilometre KerangLink transmission line allowing more energy to flow between Victoria and NSW. According to AEMO, the project would improve the resilience of the grid to the risk of ageing and increasingly unreliable coal-fired power plants in Victoria's Latrobe Valley retiring earlier than expected.

Victorian Energy Minister Lily D'Ambrosio has been pushing her state and federal counterparts for approval of the project to be fast-tracked, calling for a decision to be reached by February. "We want to see KerangLink built as soon as possible," she said.



*Australian Energy Market Operator chief executive Audrey Zibleman says "we can take advantage of the diversity we have in Australia so that the size of the country becomes an advantage rather than a disadvantage".
Credit: David Porter*

Representing the nation's power transmission companies which operate power poles and wires, Energy Networks Australia chief executive Andrew Dillon on Thursday backed calls for greater interstate connectivity to increase the resilience of the grid.

"This can be critical during natural disasters," he said.

"More transmission infrastructure and interconnection will support new renewable generation investment, increase reliability and better link markets to keep costs down for customers."

Power restoration has been progressing since the catastrophic bushfires on New Year's Eve, but thousands of households in the NSW south-coast and south-east are still without electricity.

Federal Energy Minister Angus Taylor on Thursday said the government's first priority was restoring electricity to customers who were without power

"Electricity network and generation businesses have mobilised hundreds of staff and are working closely with the Australian Defence Force and emergency services personnel to assess and repair damage and prepare to defend key assets from future bushfire threats," he said.

"Their efforts have seen power restored to tens of thousands of customers across bushfire-affected communities in New South Wales, Victoria and South Australia."

AEMO Releases Energy Summer Readiness Report

Date: 17 December 2019

Source: [AEMO](#)



We have today released our 2019/20 summer readiness report, setting out plans and actions AEMO, the industry and government jurisdictions have taken to prepare Australia's power system for the summer ahead.

[The 2019/20 summer readiness report](#) follows months of collaboration with governments and industry stakeholders to proactively manage heightened risks to power system operations identified in AEMO's 2019 Electricity Statement of Opportunities (released in August). It is focused on four pillars:

- Sufficient available resources
- Continuing operational improvement
- Contingency planning
- Collaboration and communication

"The Bureau of Meteorology (BoM) is forecasting both warmer than average and extreme temperatures this summer, and an ongoing and significant risk of bushfires with drier than usual conditions. These risks add to the deteriorating reliability of some of the older coal generation plants," said AEMO Managing Director and Chief Executive Officer Audrey Zibelman.

"Whilst unexpected events can and do happen, particularly when the power system is under significant pressure and most prone to failure, AEMO has worked diligently to prepare the power system appropriately, including the procurement of emergency resources."

Since last summer, AEMO is pleased to see 3,700 megawatts (MW) of increased generation in the National Electricity Market, with rooftop and grid-scale solar generation representing approximately 90 per cent of this increase.

"The introduction of these resources delivers a welcomed improvement to reliability and reduces the need to procure further out of market reserves," said Ms Zibelman.

For the 2019/20 summer, AEMO has secured 125 MW of reserves through off-market generation, along with demand management programs where customers are paid to shift or reduce their energy usage. The reserves include 61 MW of long notice Reliability and Emergency Reserve Trader (RERT) contracts and 64 MW through the joint AEMO/Australian Renewable Energy Agency (ARENA) demand side participation trial.

Additionally, AEMO has entered into a total of more than 1,500 MW of short and medium notice RERT agreements across the NEM, which

allow AEMO to more rapidly enter into reserve contracts if required. Of this, more than 1,000 MW is available for Victoria and South Australia, and the remainder in NSW and Queensland, to cover risks associated with extreme heat and system scenarios.

"AEMO remains focused on the real risk to power system operations this summer. It is pleasing to see the level of interest from RERT providers, as this initiative enables AEMO to have sufficient resources to manage possible high-risk scenarios that can occur in summer, such as extreme or extended heatwaves, bushfires and unplanned generation or transmission outages.

"With the majority of these resources purchased under arrangements where payment is only required when AEMO needs them to avoid load shedding, they are a necessary and cost-effective insurance policy for the reliable operations of the system," said Ms Zibelman. AEMO has also been working closely with generators across the NEM to identify whether there are existing or anticipated fuel supply risks to operations. Current drought conditions are projected to have minimal impact on supply adequacy this summer.

Looking beyond this summer, AEMO will continue to work closely with the Australian Energy Market Commission, the Australian Energy Regulator, industry and governments to progress developments that will enable an affordable, reliable, and secure energy system for Australian energy consumers now and into the future.

AEMO will continue to use the Energy Live online media portal to provide the community with live updates on events, as and when they occur, throughout summer. In the meantime, check out our [latest Energy Live podcast](#) which goes into detail about how AEMO prepares for the summer season from an operational standpoint.

AEMO summer operations

A snapshot of how we manage the world's longest power grid during its heaviest demand period.

This infographic demonstrates the actions taken by AEMO before, during and after the long, hot Australian summer.

What impacts electricity supply levels in summer?

AEMO plans extensively to secure adequate generation supply for the summer period. However, unplanned events can impact our available resources.

- High demand**
High usage of air conditioners on hot days contributes to summer being the highest demand period for the year.
- Extreme weather**
Prolonged heatwaves, torrential rain, flash flooding, lightning and damaging winds.
- Natural disasters**
Bushfires, hurricanes, tornadoes.

- Reduced weather-related generation**
Extensive cloud cover, dust storms, wind droughts, water droughts.
- Critical equipment maintenance**
Urgent maintenance that is required to keep equipment safe or operational.
- Generator outages**
Unplanned outages due to an event or technical fault.
- Transmission outages**
Unplanned outages due to an event or technical fault.

Planning and preparation

Pre-summer

June



Summer planning commences
This includes working with industry members and government to align maintenance timelines and schedules to reduce the number of planned transmission and generation outages in summer.

August



AEMO releases its annual Electricity Statement of Opportunities (ESOO) report
This report looks at the supply-demand outlook for the National Electricity Market over the next ten years and flags any forecast risks to supply levels.

Sep-Dec



AEMO negotiates Reliability Emergency Reserve Trader (RERT) resources, using forecasts in the ESOO
RERT is a mechanism available to AEMO to maintain power system reliability and system security by using off-market generation and demand management contracts (reducing usage).

Resource management and event response

Summer

December



Issue Summer Readiness Plan
This report details the plans and actions AEMO and the industry have taken to prepare Australia's power system for the summer ahead.



Lack of Reserve (LOR) and controlled load shedding
AEMO plans extensively to secure adequate generation supply for the network throughout the year. However, the summer period remains the most challenging, with an increased risk of LOR conditions. AEMO defines forecast LOR and actual LOR as follows; a forecast LOR occurs when AEMO's forecasts show a reduced amount of electricity reserves. Once a LOR is forecast, AEMO issues a market notice encouraging generators to provide more electricity. An actual LOR is when the market response to the forecast LOR has not been adequate to clear the LOR thresholds, and the LOR becomes an operational reality. LORs are categorized over three tiers;



LOR 1 - This condition exists when reserve levels are lower than the two largest supply resources in a state.



LOR 2 - This condition exists when reserve levels are lower than the single largest supply resource in a state. Once a forecast LOR 2 is declared, AEMO has the power to direct generators or activate the RERT mechanism to improve the supply-demand balance.



LOR 3 - This condition exists when the available electricity supply is equal to or less than the operational demand. This means there are no reserve supplies available. Controlled load shedding may be required as a last resort.



Controlled load shedding
As a last resort, controlled load shedding occurs to protect system security, and prevent long-term damage to system infrastructure. To do this, AEMO will inform the regional transmission network service provider of how much load needs to be shed and when. The transmission network service provider will then work with distribution businesses to action this, including rotating outages if required.

Review and report

Post-summer

1st June



(If required) Incident report
AEMO will conduct an in-depth investigation of the events before, during and after controlled load shedding has occurred. This report will be published on the AEMO website, and the lessons learned will be incorporated into the next Summer Preparedness report.

1st June



Planning for next year's summer begins



For more information, please visit aemo.com.au

New energy storage solution: A mountain of an idea

Mountain Gravity Energy Storage: is This the Answer?

Author: Justine Lovell

Date: 5 December 2019

Source: [Australian Energy Council](#)

A recent study proposes an interesting take on batteries. Researchers from the Austrian-based International Institute for Applied Systems Analysis have devised a new concept called Mountain Gravity Energy Storage (MGES), a novel take on battery storage that uses mountain gravity.

The study recently published in *Energy*, and led by researcher Julian Hunt and his colleagues [\[1\]](#), proposes that MGES can fill a gap in storage services particularly for grids up to 20 MW, and provide a solution for seasonal storage where there is no water for pumped-storage solutions.

So what's MGES all about? We take a look here...

Mountain Gravity Energy Storage

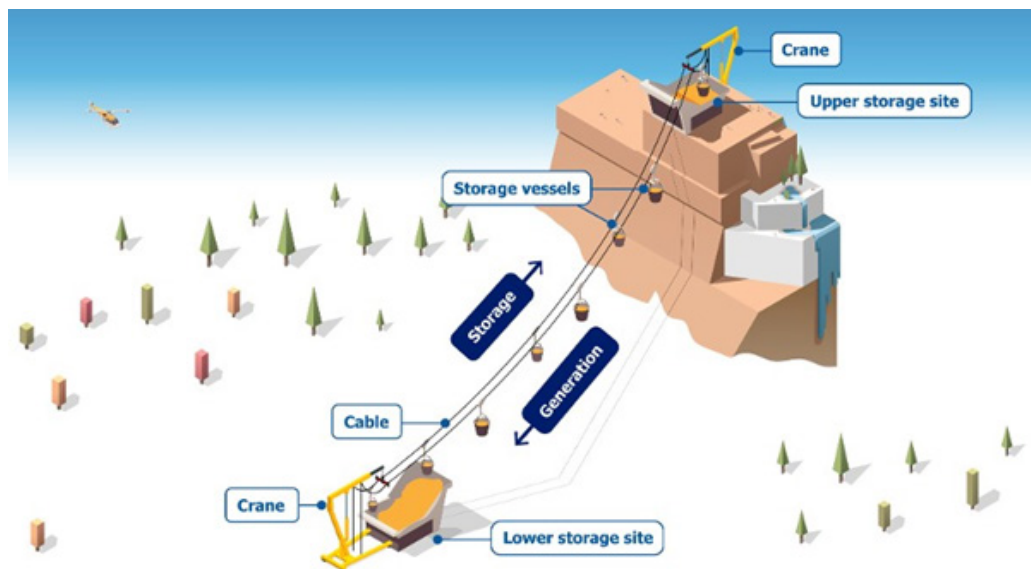
The researchers state that MGES could be a feasible option for micro-grids and power systems where electricity costs are high, demand for energy storage is less than 20MW, and there is a need for seasonal storage – like in rural and remote areas.

While renewable sources such as wind and solar have the potential for lowering electricity costs in micro-grids, they state that renewables require a “flexibility solution” due to their intermittent nature, and there is currently no viable technology offering affordable long-term energy storage with a low generation capacity. However according to the paper, mountains could be used to help meet this task, with gravity (and also hydropower) making MGES a possible solution.

Shown in Figure 1, the paper states that this can be achieved by:

- Building cranes on the edge of a steep mountain with enough reach to transport sand or gravel from a storage site located at the bottom to a storage site at the top.
- A motor or generator moves storage vessels filled with sand from the bottom to the top, similar to a ski lift. During this process, potential energy is stored.
- Electricity is generated by lowering sand from the upper storage site back to the bottom.
- If there are river streams on the mountain, it can be combined with hydropower, where the water would be used to fill the storage vessels in periods of high availability instead of the sand or gravel.

Figure 1: MGES technology



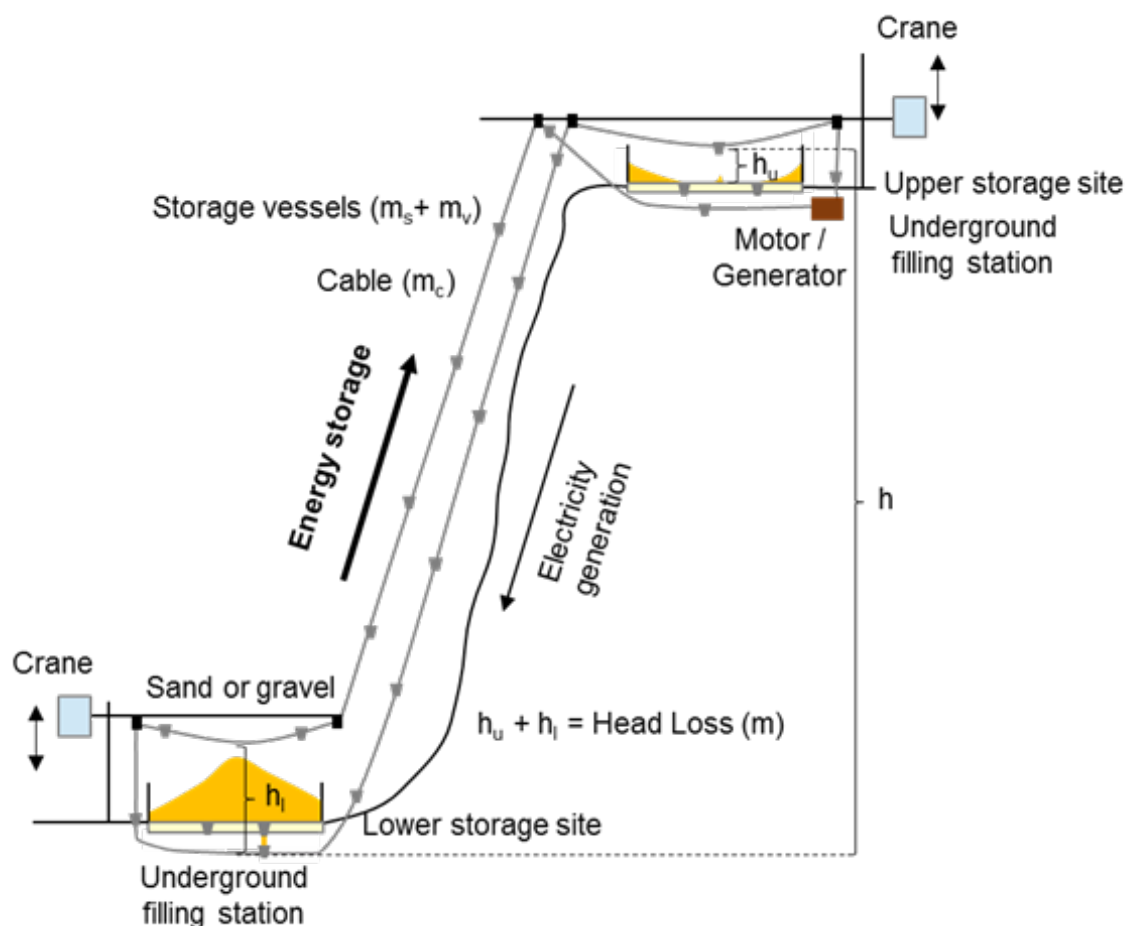
Source:
*International Institute for
Applied Systems Analysis*

MGES cost varies from US\$50-100/MWh of stored energy and US\$1-2 million/MW of installed capacity. The higher the height difference between the lower and upper storage sites, the lower the potential cost of the project.

The paper notes that storage capability of batteries in a yearly cycle may not become economically viable, due to the high cost of stored energy (\$/MWh) and a high rate of losses and/or self-discharge per day. Yet it states that pumped-hydro storage technologies can help to resolve this, by storing a large amount of energy in the form of potential energy stored as the mass of water in high elevations.

The paper notes that MGES has the additional benefit that water can be added at any height of the system, increasing the possibility of catching water from different heights which is not currently possible in conventional hydropower.

Figure 2: Mountain Gravitational Energy Storage sketch, showing the upper and lower storage sites and the storage vessels moving up (storing energy) and down (generating electricity).



Source: International Institute for Applied Systems Analysis

MGES can continuously store energy for months and then generate power continuously for months (or when there is water available for hydropower). In the Institute's media release, lead researcher, Hunt said [iii]:

"One of the benefits of this system is that sand is cheap and, unlike water, it does not evaporate – so you never lose potential energy and it can be reused innumerable times. This makes it particularly interesting for dry regions."

However, Hunt believes that MGES should not be used for peak generation, daily storage cycles or the provision of ancillary services, with these being more suited to batteries (especially with decreasing battery costs). Instead MGES could fill a gap for locations with long-term storage requirements and especially in dry regions.

"It is important to note that the MGES technology does not replace any current energy storage options but rather opens up new ways of

storing energy and harnessing untapped hydropower potential in regions with high mountains".

The paper also looks around the world, and at what regions could be viable to have a future energy mix using only wind, solar, batteries, and MGES to supply demand.

"Additionally, pumped-hydro storage plants are limited to a height difference of 1,200 meters, due to very high hydraulic pressures. MGES plants could have height differences of more than 5,000 meters. Regions with high mountains, for example, the Himalayas, Alps, and Rocky Mountains, could therefore become important long-term energy storage hubs. Other interesting locations for MGES are islands, such as Hawaii, Cape Verde, Madeira, and the Pacific Islands with steep mountainous terrain," Hunt said.

What next?

The authors note that their main contribution is to show that gravitational energy storage technologies are interesting for long-term energy storage in systems with small energy storage demand. The technology used for MGES is already being applied in industries such as construction and mining, with the main difference being that the MGES motor also generates electricity when lowering the elevation of the mass.

They note that while the generation cost of MGES is relatively high, it could offer an interesting solution for small islands or mini-grids due to the high cost of electricity supply, seasonal demand variations, and the challenges of incorporating renewable energies.

The researchers state that MGES can serve as a storage solution to balance seasonal variations in electricity supply from wind and solar sources, however, also note that mountainous regions, where the potential for MGES is higher, also tend to favour wind power.

[i] Hunt J, Zakeri B, Falchetta G, Nascimento A, Wada Y, & Riahi K (2019). Mountain Gravity Energy Storage: A new solution for closing the gap between existing short- and long-term storage technologies. Energy DOI: <https://doi.org/10.1016/j.energy.2019.116419>

[ii] <https://www.iiasa.ac.at/web/home/about/news/191111-MGES.html>

Nuclear Still off the Agenda as Energy Minister Rejects Call for Partial Lift of Ban

By Terry Miller

Date: 13 December 2019

Source: [Sydney Morning Herald](#)

Energy and Emissions Reduction Minister Angus Taylor has rejected calls from a Coalition dominated parliamentary enquiry to partially lift Australia's moratorium on nuclear power to allow investigation of emerging technologies.

The enquiry found that new technologies such as small modular reactors (SMRs) should be explored for use in Australia.

The House of Representatives Standing Committee on the Environment and Energy acknowledged public controversy around the nuclear debate in the title of its report – Not without your approval; a way forward for nuclear technology. The report proposes a partial lift for new and emerging technologies subject to a technology assessment and a commitment to community consent as a condition of approval for nuclear facilities.

Labour committee members issued a dissenting report, arguing that there was no basis for lifting the prohibition and no need for additional investigations into the science or economics of nuclear energy.

Labour MP Josh Burns said it was "madness" to consider nuclear generation given SMRs were not yet available, renewable energy was becoming cheaper and existing technology would need to be located in populated areas with an abundance of water supply. The full report can be read [here](#).

Marinus Link Project Assessments Released

Date: 5 December 2019

Source: [Energy Networks Australia](#)

Energy Networks Australia has welcomed the release of the Business Case Assessment and Project Assessment Draft Report for Marinus Link.

The analysis by TasNetworks shows the project will provide an economic advantage to Australia, outweighing the expected costs of the project.

Marinus Link is the proposed 1,500 MW capacity second undersea electricity transmission interconnector between Tasmania and Victoria.

Energy Networks Australia Chief Executive Officer Andrew Dillon said Marinus Link would help deliver a more stable and sustainable national electricity grid.

"A more interconnected grid is a more efficient and reliable grid," Mr Dillon said.

"Interconnection between markets provides greater flexibility, better reliability and can deliver more affordable electricity for customers. "This project will allow up to 1,500 MW of renewable generation to be supplied to the National Electricity Market.

"With the rise of variable solar and wind generation, unlocking the hydro capacity of Tasmania to store and generate electricity will help keep the lights on and businesses running."

The business case estimates that Marinus Link will deliver 1,400 jobs in Tasmania and 1,400 jobs in Victoria at peak construction. The economic contribution from the construction of Marinus Link and supporting transmission is estimated to be \$1.4 billion to the Tasmania economy and \$1.5 billion to the Victorian economy.

It is also estimated that Marinus Link and supporting transmission will unlock a pipeline of investment in renewable energy and long-duration energy storage development with an estimated value of up to \$5.7 billion and 2,350 jobs.

(More details of the project can be found at marinuslink.com.au. Editor)

Proposed SA-NSW Interconnector Identified as Priority Project

Source: [Electranet](#)

Project EnergyConnect, the proposed new interconnector between South Australia and New South Wales, has been listed by the Australian Energy Market Operator (AEMO) as a Group 1 (Priority Project) in its [Draft 2020 Integrated System Plan](#) (ISP) released today.

The ISP identifies investments needed for Australia's future energy system: in distributed energy resources; variable renewable energy; supporting dispatchable resources and power system services; and the transmission grid. Group 1 Priority Projects listed in the plan are those which are critical to address cost, security and reliability issues.

Project EnergyConnect is anticipated to reduce power bills for residential and business customers in South Australia and New South Wales, lower wholesale electricity costs in both states, improve network and energy security and support Australia's energy transformation towards a low carbon emissions future.

It would also unlock renewable generation development and allow greater market exports, which delivers on the draft ISP's need for targeted and strategic investment in the grid to balance resources across states and unlock much needed Renewable Energy Zones. In releasing the plan, AEMO's Managing Director and Chief Executive Officer, Audrey Zibelman, said the 2020 Draft ISP outlines the future requirements of the energy system to achieve a cost-effective, secure and reliable system that meets consumer needs and government policy objective.

"To maximise economic benefits, as traditional generators retire, Australia must invest in a modern energy system with significant consumer-led distributed energy resources – such as rooftop solar – and utility-scale variable renewable energy, supported by sufficient dispatchable resources and well targeted augmentations to the electricity network," Ms Zibelman said.

South Australian Minister for Energy and Mining, Dan van Holst Pellekaan, welcomed the Priority 1 project classification under the ISP. "In essence AEMO has labelled the SA-NSW interconnector a 'no brainer' to deliver cheaper, more reliable electricity for South Australian households and businesses," Minister Pellekaan said.

Project EnergyConnect is currently undergoing the final stage of review of its Regulatory Investment Test for Transmission (RIT-T), with a decision by the Australian Energy Regulator on whether the project meets the requirements of the RIT-T anticipated in early 2020.

For more information about the project visit www.projectenergyconnect.com.au

HUMOUR CORNER



EFFECTIVELY EARTHED



"All I'm saying is we plug these into Excel, let it do its thing, and then we can all play until lunch!"



INTERNATIONAL ARTICLES

Meet the VoloCity

Source: [IEEE Spectrum](#)



No more prototypes, ready for take off! German startup Volocopter presented this summer its first air taxi destined for production. Here is how the solution has been tailored-made for inner-city hops.

Presented in last August, the VoloCity is the latest solution proposed by Volocopter, the first designed for actual commercial use. All of its features (number of seats, range, speed...) are related to its mission: to be an inner-city flying taxi and nothing else. The choice of simplicity, for instance (such as direct-drive motors and fixed pitch rotors) makes the solution less costly to manufacture, more reliable (less expensive maintenance and easier to certify), lighter, so more economical and less noisy. Everything is closely linked.

1. Drive

The wide span and a large number of battery-powered engines and rotors (18 of each) reduce the noise level and generate a frequency that is softer and more pleasant on the ear. It also improves safety: the VoloCity is capable of flying even if several engines are inoperative. The aircraft will fly at "only" 110kmph, which is safer (better collision avoidance) and less noisy than rapid eVTOLs.

2. Cabin

The passenger and the pilot have access and are seated comfortably (Volocopter's analyses show that the large majority of intra-urban passengers travel alone). There is space for hand luggages, air conditioning, silence and a stunning view. Once the regulations will authorise it, the VoloCity will also be able to fly autonomously.

3. Batteries

The VoloCity embarks 9 Lithium-ion exchangeable battery packs. These are recharged on the vertiports. Whenever the aircraft lands in between two flights, batteries can be changed in five minutes to fresh batteries and can take off. Its 35km range makes it possible to connect the most popular destinations (city centres, airports, business centres ...).

4. Skids

Vertical take-off and landing, so no need for wheels nor retractable landing gear. The skids are part of the rationalisation process to reduce weight, breakdowns, production and maintenance costs. Ground operations are ensured by conveyor belts or platforms.

The Crazy Story of How Soviet Russia Bugged an American Embassy's Typewriters

By Robert W. Lucky

Date: 30 December 2019

Source: [IEEE Spectrum](#)

Every engineer has stories of bugs that they discovered through clever detective work. But such exploits are seldom of interest to other engineers, let alone the general public. Nonetheless, a recent book authored by Eric Haseltine, titled [The Spy in Moscow Station](#) (Macmillan, 2019), is a true story of bug hunting that should be of interest to all. It recounts a lengthy struggle by [Charles Gandy](#), an electrical engineer at the United States' [National Security Agency](#), to uncover an elaborate and ingenious scheme by Soviet engineers to intercept communications in the American embassy in Moscow. (I should say that, by coincidence, both Haseltine and Gandy are friends of mine.)

This was during the Cold War in the late 1970s. American spies were being arrested, and how they were being identified was a matter of great concern to U.S. intelligence. The first break came with the accidental discovery of a false chimney cavity at the Moscow embassy. Inside the chimney was an unusual [Yagi-style antenna](#) that could be raised and lowered with pulleys. The antenna had three active elements, each tuned to a different wavelength. What was the purpose of this antenna, and what transmitters was it listening to?

Gandy pursued these questions for years, not only baffled by the technology, but buffeted by interagency disputes and hampered by the Soviet KGB. At one point he was issued a "cease and desist" letter by the CIA, which, along with the State Department, had authority over security at the embassy. These agencies were not persuaded that there were any transmitters to be found: Regular scans for emissions from bugs showed nothing.

It was only when Gandy got a letter authorizing his investigation from President Ronald Reagan that he was able to take decisive action. All of the electronics at the embassy—some 10 tons of equipment—was securely shipped back to the United States. Every piece was disassembled and X-rayed.

After tens of thousands of fruitless X-rays, a technician noticed a small coil of wire inside the on/off switch of an IBM Selectric typewriter. Gandy believed that this coil was acting as a step-down transformer to supply lower-voltage power to something within the typewriter. Eventually he uncovered a series of modifications that had been concealed so expertly that they had previously defied detection.

A solid aluminum bar, part of the structural support of the typewriter, had been replaced with one that looked identical but was hollow. Inside the cavity was a circuit board and six magnetometers. The magnetometers sensed movements of tiny magnets that had been embedded in the transposers that moved the [typing "golf ball"](#) into position for striking a given letter.

Other components of the typewriters, such as springs and screws, had been repurposed to deliver power to the hidden circuits and to act as antennas. Keystroke information was stored and sent in encrypted burst transmissions that hopped across multiple frequencies.

Perhaps most interesting, the transmissions were at a low power level in a narrow frequency band that was occupied by intermodulation overtones of powerful Soviet TV stations. The TV signals would swamp the illicit transmissions and mask them from detection by embassy security scans, but the clever design of the mystery antenna and associated electronic filtering let the Soviets extract the keystroke signals.

When all had been discovered, Haseltine recounts how Gandy sat back and felt an emotion—a kinship with the Soviet engineers who had designed this ingenious system. This is the same kinship I feel whenever I come across some particularly innovative design, whether by a colleague or competitor. It is the moment when a technology transcends known limits, when the impossible becomes the doable. Gandy and his unknown Soviet opponents were working with 1970s technology. Imagine what limits will be transcended tomorrow!

This article appears in the January 2020 print issue as "The Ingenuity of Spies."

Inertia Is a Growing Challenge for the Grid, But There Are Solutions

Authors: Aidan Tuohy and Adrian Kelly

Source: [EPRI Journal](#)

An EPRI [study](#) looks at the potential impacts of reduced inertia on frequency stability in the world's electric power grids and reviews emerging solutions.

Turbines, generators, and motors in fossil, nuclear, and hydro power plants spin at speeds proportional to grid frequency. The rotational energy of these massive devices provides significant inertia that can counteract changes in grid frequency due to disturbances. For example, if one power plant in a region goes offline, grid frequency will decrease. Other spinning generators can respond by speeding up slightly to resist the frequency shift and stabilize the grid.

Because solar energy plants don't have any moving parts (and thus inertia), the power system's inertia declines as solar penetration grows—potentially leading to rapid frequency changes. If left unchecked, such changes can cause electricity service interruptions. Wind generation likewise does not contribute inertia because most modern wind turbines transmit energy through power electronics and are not connected directly to the grid. According to the EPRI study, smaller, islanded grids already face inertia-related challenges. Grid operators in Ireland and Nordic countries regularly adjust power plants' output based on predictions that low inertia will cause service interruptions.

"These operators are monitoring inertia on a second-to-second basis and *re-dispatching power plants to maintain frequency stability*," said EPRI Principal Project Manager Aidan Tuohy.

The study identifies numerous potential technological, operational, and market-based solutions for grid operators, such as:

- Controlling the *inverters* of solar and wind power plants and battery energy storage systems to provide frequency support during disruptions
- Requiring an inertia "floor" or minimum that results in the operation of additional spinning generators
- Compensating generators for providing inertia to encourage them to stay online

According to the study's authors, these and other solutions need to be evaluated for their effectiveness in maintaining grid stability. In addition, operators need more real-time data on the impacts of reduced inertia along with analytical tools to evaluate those impacts.

Key EPRI Technical Experts: **Aidan Tuohy, Adrian Kelly**

For more information, contact techexpert@eprijournal.com.

Judge approves PG&E wildfire settlements, bringing utility closer to exiting bankruptcy

Author: [Kavya Balaraman](#)

Date: 18 December 2019

Source: [Utility Dive](#)

Dive Brief:

- The federal judge supervising Pacific Gas & Electric's (PG&E) reorganization proceeding on Tuesday approved two settlement agreements — totaling \$24.5 billion — between the utility and committees representing Northern California wildfire victims and insurance companies, bringing PG&E much closer to exiting bankruptcy.
- The agreements include an \$11 billion payout to holders of subrogation claims against PG&E as well as \$13.5 billion to the tort claimants committee. They were approved despite concerns raised by California Gov. Gavin Newsom, D, about the feasibility of PG&E's restructuring strategy and provisions in the deal "limiting competition."
- Also on Tuesday, the California Public Utilities Commission's (CPUC) safety division, PG&E and other parties proposed a \$1.67 billion settlement to resolve the utility's role in causing wildfires in 2017 and 2018.

Dive Insight:

PG&E's [\\$13.5 billion settlement](#) with the wildfire victims' committee marks a significant milestone in its bankruptcy proceeding. The deal resolves claims from the 2015 Butte Fire, 2017 North Bay fires and the Camp Fire in 2018, and could jeopardize the progress of a competing reorganization plan [filed by the company's bondholders](#) – which the committee had previously supported. With the \$11 billion subrogation settlement and a \$1 billion payout to cities and counties affected by the fires, PG&E has come a lot closer to resolving the liabilities that pushed it into bankruptcy in the first place.

U.S. Bankruptcy Judge Dennis Montali agreed to approve both settlements with “lock-up language” – provisions that prevent the settling parties from negotiating with the competing bondholders – in large part because he trusts the judgment of the wildfire victims, he said. He noted that while many of the creditors in PG&E's bankruptcy had chosen to do business with the utility, the fire victims “didn't choose to be creditors and didn't choose to be anything other than people who live their lives normally.”

Montali's approval comes despite reservations [expressed by Gov. Newsom](#) in a strongly-worded letter to PG&E Corp. President and CEO Bill Johnson last Friday. The company's current reorganization plan is not compliant with AB 1054 – legislation passed by the state in July that outlines conditions for the utility to access a newly-created wildfire insurance fund – according to Newsom, since it would not result in a reorganized PG&E “positioned to meet the compact of providing safe, reliable, and affordable service to its customers.”

Newsom's attorneys elaborated on his views in a filing with the court Monday, saying that while “fair treatment of victims is good,” provisions in the agreement that prevent the tort committee from throwing their support behind a different reorganization plan suggest that it is more about “an illusion of momentum.”

“We think the parties need to recognize that AB 1054 is not a rubber stamp and we need to get to the changes [in the plan] necessary,” Nancy Mitchell, an attorney for Newsom, said at the hearing.

But tort claimants committee attorney Cecily Dumas listed the variety of reasons the committee decided to enter into an agreement with PG&E, despite previously endorsing the bondholders' plan: the [looming June 30 deadline](#), placed by AB 1054, for PG&E to emerge from bankruptcy; their calculation that PG&E's plan is more likely to be confirmed than the bondholders', and the need to move quickly, given that some victims have been awaiting compensation from PG&E since 2015.

Montali also preserved the “lock-up” provisions after PG&E attorney Stephen Karotkin said the deals would vaporize without them. The utility would then have to go through an extensive process to estimate its total liabilities.

“I can assure you if that scenario unfolds, we will never meet the June 30 deadline and the \$13.5 billion for the tort claimants will not be there,” Karotkin said.

Meanwhile, the proposed [\\$1.67 billion settlement](#) from the CPUC's Safety and Enforcement Division (SED), PG&E and other parties would, if approved, wrap up another pending investigation against PG&E. The commission launched the investigation in June, following reports from the SED that the utility had committed several violations in operating its infrastructure, which caused the 2017 and 2018 fires.

If approved, the settlement would be the largest sum imposed by the CPUC on a utility for alleged wildfire-related violations. It would require PG&E to set aside \$50 million to strengthen its infrastructure and engage with local communities, including by holding Town Hall meetings and providing quarterly reports on maintenance work.

Parties have 30 days to comment on the settlement. The parties have asked the commission to move expeditiously on the proposal so it can be resolved before the June 30 deadline.

How alternative storage solutions are breaking into the lithium-ion-dominated market

Author: Tom Armistead

Date: 26 November 2019

Source: [Utility Dive](#)

The U.S. power industry has been under growing pressure since the late 1990s to reduce greenhouse gas emissions. The subsequent growth in renewable energy, spurred by state mandates, federal tax incentives, and increasingly attractive costs, has shifted attention to the use of energy storage to ensure that variable wind and solar generation reliably serve load and provide ancillary services.

In this domain, lithium-ion currently dominates. But some analysts don't see it as economically-efficient enough at scale to fully support the amount of renewable energy expected to come onto the grid, and other options are on the rise, including rail-based gravity systems, hydrogen and flow batteries.

Bulk energy storage

Since the 1890s, pumped hydropower has been the overwhelming choice for bulk energy storage, and at the end of 2017, about 22 GW of pumped hydro was installed in the United States. After pumped hydro, compressed air energy storage (CAES) is the choice for bulk power management, said Nate Blair, manager of the Distributed Systems and Storage Analysis Group at the National Renewable Energy Laboratory.

But both systems are capital-intensive and constrained by geography. To serve the booming demand for reliable, widely available and inexpensive storage on a smaller scale, batteries have been the default for power producers.

Huge banks of lithium-ion (Li-ion) batteries have been the go-to for energy storage, but an April explosion at an Arizona Public Service 2 MW Li-ion battery energy-storage facility highlighted the technology's fire-safety issues. Some developers are looking at alternative storage systems to support what used to be called alternative energy.

Lithium-ion alternatives

At the end of 2017, 708 MW of large-scale battery capacity were operating in the U.S., according to the U.S. Energy Information Administration. The future of energy storage can be seen in the plans Arizona Public Service announced last February – by 2025, the utility intends to add 850 MW of energy storage to its existing 6 MW fleet.

But can alternatives make inroads?

There are a large number of energy storage systems besides electrochemical batteries, including thermal, kinetic and gravity, among other technologies. In November 2018, Switzerland-based Energy Vault rolled out its utility-scale gravity system, one of the newest entrants to the energy-storage market.

The Energy Vault system consists of a crane with two to six arms mounted on a lattice-steel tower 90 to 140 meters tall. Operating on the same principle as a pumped-hydro system, the crane hoists 35 metric ton concrete "bricks" into stacks surrounding the tower to charge the system. To discharge stored energy, software algorithms direct the crane to lower bricks to the ground.

Typically, an Energy Vault system would be powered by a nearby solar farm or other renewable energy. The system can respond in milliseconds to fluctuations in power demand or other support required by the grid operator, CEO and co-founder Robert Piconi told Utility Dive via email. And like pumped hydro, the system offers long-duration energy storage.

The system enables renewables to deliver baseload power for less than the cost of fossil fuels 24 hours a day, according to a company news release.

"Since our November [2018] launch, we received a tremendously positive market response from customers across the globe," Piconi wrote. Investors Cemex Ventures and Softbank Vision Fund also are supporting it. "We recently announced the Series B investment from Softbank Vision Fund of \$110 million, which closed in July 2019," he wrote. "Now we can scale on a global, multi-continent basis."

More gravity-based systems

One company, Advanced Rail Energy Storage (ARES) North America, aims to provide what it calls advanced rail energy storage. The

company has two gravity systems in the works – Trainline and Ridgeline.

ARES is developing a 50 MW Trainline shuttle system in Nye and Clark counties in Nevada, using distributed electric locomotives running 5.5 miles on an average 7% slope. Six "consists," or trains, each composed of two locomotives and seven mass cars weighing 1,550 tons each, will draw electric power from the grid using a third rail to drive the consist's motor on the uphill storage run. On the return, regenerative braking systems generate power and the motor becomes a generator discharging the power back via the third rail.

"The response time for Trainline itself is 10-15 seconds," said Russ Weed, ARES chief development officer. "It's not quite as fast as an electrochemical battery, but the Trainline would be paired with either supercapacitors or a small battery, such that response time could go to four seconds or less."

Trainline was piloted in California, so the Nevada development is a demonstration, he added. "By the end of 2020, we are aiming to complete construction." The plan is for Trainline ultimately to be powered by renewable energy.

Ridgeline will operate in the same way as Trainline but with centralized electric pulleys and cable on a steeper grade. It is not yet sited, but "we're in discussions with some utilities about it," Weed said. He expects completion of the Ridgeline by Q1 2021 at the latest. And researchers are examining other potential sources of gravity-based energy storage.

Using mountains could be a viable way to store electricity for longer durations and at larger scales than lithium-ion batteries and prove to be economically attractive for microgrids, islands and areas with high electricity costs, according to a [study recently published in the academic journal Energy](#).

Hydrogen as a storage proxy

Author: Tom Armistead

Date: 26 November 2019

Source: [Utility Dive](#)

Mitsubishi Hitachi Power Systems (MHPS) and partner Magnum Development last May announced what they claim will be the world's largest renewable energy storage system. The Advanced Clean Energy Storage (ACES) project will develop 1,000 MW of 100% clean energy-based storage using renewable hydrogen.

The ACES project will deploy four types of clean energy at utility scale: renewable hydrogen, compressed air energy storage (CAES), large-scale flow batteries and solid oxide fuel cells. "The technologies we are deploying will store electricity on time scales from seconds to seasons of the year," said Paul Browning, President and CEO of MHPS Americas, in a statement.

The project will be in central Utah, where Magnum Development owns salt domes adjacent to the Intermountain Power Project. Magnum currently operates five salt caverns for liquid fuels storage and is developing CAES and renewable hydrogen options.

For ACES, MHPS will "create hydrogen from variable, renewable resources," said Mike McManus, MHPS senior director.

Hydrogen is "an excellent medium to store energy long-duration because it doesn't degrade over time, like a battery if you just let it sit," he added. "For example, we can use solar energy through electrolysis, which uses water, to separate oxygen and hydrogen. We would take the hydrogen, now in a pure form, store that in a cavern at pressure, then, when we need it, we can bring it back out, combust it in a gas turbine or in a fuel cell."

"We can also blend that hydrogen with a natural-gas supply to reduce the carbon footprint of that natural-gas supply," McManus said. The hydrogen stored in salt domes thus is a proxy for energy storage. It is used to generate carbon-free power in the fuel cell and to reduce the emissions profile of the combustion turbine.

The flow battery will store renewable energy from solar and wind to be released back to the grid as electrical energy when desired. It will be used typically for six to 12 hours of energy storage. But the various storage systems in this project are better for mid-term to long-term storage than Li-ion at superbulk level, McManus said.

"As soon as you get out of load-shifting from the middle of the day to evening, the economics are overwhelmingly better for a solution like this," said McManus. "We can store hydrogen equivalent to 100,000 MWh of electricity in one cavern" and then create more than 70 of those caverns, creating "a very significant amount of storage capability" that can be used as dispatchable power.

HISTORY

Notes on the Wollongong Electricity Supply System

Author: Tony Patterson

Date: January 2020

As the name of this segment of the Bulletin states, this paper is devoted to pure history. This paper takes us back to the days prior to the formation the County Councils.

This paper was prepared at the time of 100+ supply authorities in NSW alone. Small organisations, with massive technical problems, as they launched Australia into the world of electricity.

This paper is about the electricity distribution system in Wollongong. In 2021, this system will celebrate its 100th anniversary. This is about the days of the Wollongong Municipal Council and its Electricity Department. This formula for electricity distribution was very common across NSW, with the exception that many also had their own local power generation station.

The paper is a great insight into the engineering and technical capability of our "pioneers".

In addition to the paper I can advise that I worked for the Illawarra County Council in Wollongong in the late 60's. I had many discussions with Eddie Vormister, (and I do not know the exact relationship with the Author) about the "good old days". These were the days when a line vehicle was a motor bike and the assistant on the back carried a ladder on one shoulder and a coil of wire on the other. Broad shoulders and individual responsibility accounted for OH&S. Distribution areas were geographically dived into zones and the use of an "electric" iron was only permitted on one day per week, during specific hours. I only wish that I could recall the many hours of history-based discussions that we had.

If you are part of our great electricity industry; I strongly recommend that you read this paper to expand your historical understanding of its development.

Paper: Notes on the Wollongong Electricity Supply System

Author: C E Vormister

Date: This paper was presented to our annual conference in 1940.

[Download Paper](#)

CIREP PAPER

Scheduled Charging of Electric Vehicles and the Increase of Hosting Capacity by a Stationary Energy Storage

Paper 0196 from the Madrid CIREP Workshop held on 3-6 June 2019.

Abstract

The advancing electrification of the transportation and heating sector is expected to cause several operational challenges for distribution system operators (DSO), mainly in the form of thermal overloading of assets and voltage limit violations. Especially, low voltage (LV) networks are prone to failure.

In order to integrate electric vehicles (EVs) into LV networks, two charge scheduling algorithms for EVs are presented. The scheduling algorithms, namely "Basic-Scheduling" and "Time-Of-Use (TOU)-Scheduling" distribute the power demand of EVs pro-actively to prevent detrimental effects on power grids.

A simulated case study of a residential area including 20 households has shown that both, "Basic-Scheduling" and "TOU-Scheduling" can effectively mitigate asset overloading. Different examinations regarding the environmental conditions have been carried out.

Another objective pursued was the examination on how a stationary battery energy storage system (BESS) can increase the hosting capacity of a network. Commercially available Vanadium-Redox-Flow batteries (VRFB) are virtually integrated in the network of the residential area. A 30 kW/100 kWh VRFB was able to relieve transformer overloading in three out of four cases for uncontrolled EV charging. Only in a modified scenario, transformer overloading occurred. A 50 kW/200 kWh VRFB mitigated transformer overloading in every scenario considered.

[Download Paper](#)

UPDATES

CIGRE INTERNATIONAL

WG B2.45 VEGETATION FIRE CHARACTERISTICS AND THE POTENTIAL IMPACTS ON OVERHEAD LINE PERFORMANCE.

The current spate of bushfires raging across the east coast of Australia provides a timely reminder of the destructive capacity of these fires and the critical need to manage their impact on power line infrastructure and minimise the risk of fires being caused by faults on the network. The economic cost, environmental damage and social impact of the fires can be very significant and there is therefore clear justification for investment to reduce risks.

WG B2.45 was established to examine the many related areas associated with vegetation fire characteristics, the potential impacts on overhead line performance, the costs of fires to society and the costs to utilities stemming from fires. It has recently published Technical Brochure 767, which is comprehensive and will serve a wide group of readers, from the design engineer in a utility, to the Operations and Maintenance staff. It may also serve as a reference for persons who wish to do further study on this subject.

The Australian members of the working group were Francis Lirios, Henry Hawes and Michael Lee and the Australian reviewer was Peter DulHenty. Significant contributions were provided by Australian utilities including Ergon Energy, Transgrid, Western Power and Aurora Energy.

The Technical Brochure begins with a general discussion on the subject of fires and this is followed by a high-level discussion of the costs of the fires to society and to the electric utility. In recent times there have been a number of very significant fires across the world

including in Australia, Canada, the USA, South America, China, Russia and parts of Europe. The costs of these fires are very difficult to estimate but are in the order of many hundreds of millions of dollars.

The risks brought about by the fires, as they burn closer to live conductors, tower and wood pole structures and other electrical equipment, are examined together with ways that the risks can be reduced.

This is particularly important for system operators. There is also a discussion of the safe distances that personnel should maintain from the infrastructure during a fire.

A review of the extensive research that has been carried out on the insulation breakdown of gasses during fires is supplemented by an examination of the associated biochemical processes and the theory of insulation breakdown and conductivity of fires is presented in an appendix.

Further work has included a novel method to predict the relative probability of flashover as a function of height, an overview of terminology and a description of the anatomy of fire.

A review of fire behaviour provides important information for the planning of vegetation management strategies and the design and placement of towers for new lines in fire prone areas.

Finally, the impact of climate and weather on the occurrence and behaviour of fires is reviewed together with how this information can be used to predict the onset of fires by the use of weather forecasts. An enhancement to traditional methods of predicting dangerous fire conditions is described. This is used to predict conditions that would lead to fire induced flashovers instead of just dangerous fire conditions.

The subject matter covered in this Technical Brochure is extensive.

Download the technical brochure

Cigre member price: Free
Non-member price: 300 €

CIRE D

For the first time in CIRE D history, a CIRE D event will be organised outside Europe. A workshop dedicated to "Smart Power Distribution for Sustainable and Fast Evolving Cities" will be held on 26-27 October 2020 in Shanghai, China.

Potential authors are called to submit a paper for the CIRE D Workshop 2020 Shanghai. **Papers should be submitted by 28 February 2020.**



SMART POWER DISTRIBUTION FOR SUSTAINABLE AND FAST EVOLVING CITIES

CALL FOR PAPERS

Fast evolving cities will drive the transformation of the energy systems, with 60% of humanity expected to live as city-dwellers in 2030. Cities will use two-thirds of the world's energy and produce a similar proportion of global carbon emissions. This places cities at the heart of the climate change discussion and sustainability. City authorities, planners and utilities are investigating how to develop the electrical infrastructure in a way that supports economic growth and high quality-of-life while also integrating more renewable energy sources (RES) than ever before, and radically reducing cities' impact on the environment.

The answer is in the smart city paradigm that leverages data and digital connectivity to rethink the city planning and management for the long-term sustainability and wellbeing of cities. To scale up rapidly and substantially, most cities will need to increase their focus on decarbonizing buildings, factories with electrification solutions, and smart mobility. In buildings, rooftop solar PV and solar water heating are easy to install and offer significant economic gains. In transport, electric mobility, when powered by renewable sources, reduces air pollution and is increasingly cost competitive.

Electric mobility and RES will be the main drivers for power distribution development. As renewable energy technologies spread, buildings and transport will become increasingly interconnected with the power system as well as the electricity, heat, water and waste management sectors. Thus cities need to plan for integrated urban energy systems, using expertise from multiple sectors from urban planning to waste management. In this context, the digitalization - the increasing interaction and convergence between the digital and physical worlds – is crucial for enabling the fast, resilient and sustainable development of cities. Digitalization with the three main areas on Data, Analytics, and Connectivity will inevitably play a key role in the transition towards smart cities.



IMPORTANT DATES

28 February 2020: Deadline for receipt of abstracts

4 May 2020: Notification of authors

3 July 2020: Full papers to be uploaded



1 PLANNING AND DEVELOPMENT OF SMART CITIES

Digitalization enables the convergence of several services in such a way that can completely reshape the urban texture of large cities. Data analytics techniques, such as machine learning and artificial intelligence, can produce the data for detailed planning studies that consider different energy and services by exploiting the real time information on the consumption of energy in its different forms, on the traffic flows, on people habits, on city economy, on geography and orography, etc. The integrated planning of services and networks will be crucial to make the fast growing of large cities in different time horizons possible.

... PREFERRED TOPICS FOR PAPERS ARE:

- Planning the development and the upgrade of power distribution
- Planning the RES integration in fast growing cities
- Impact of E-mobility on distribution planning
- Integrated urban planning (power, gas, thermal, water, communication, transportation and waste)
- Integrated planning of digital infrastructures (e.g. integrated data centers)
- Inclusion of Cyber security in distribution planning and development
- Artificial intelligence, machine learning, expert systems for planning smart city distribution networks
- Smart buildings, smart districts, smart factories, microgrids
- Business models, markets and regulatory framework impact on the smart city development

2 EQUIPMENT AND COMPONENTS FOR THE SMART CITIES

Fast growing smart cities require special components and technical solutions to cope with fast increasing demand and to integrate high shares of renewable and widespread e-mobility by meeting high quality levels of service continuity and resiliency. Standardized, pre-built stations and sub-stations equipped with sensors and digital communications should be considered for the day-by-day development of smart cities. New digital conceived smart grid components will be the backbone of any smart city and permit the seamless fast growth of large urban areas.

... PREFERRED TOPICS FOR PAPERS ARE:

- Smart, compact and eco-friendly substations, and smart transformers
- Pre-built power stations and substations
- High ampacity underground cables and superconductivity cables
- Fault current limiters (for sub-grids connections, energy demanding transport infrastructure, etc.)
- Components for active network operations (e.g., fault location, isolation and service restoration, dynamic load Management, power flow management, power quality conditioners)
- DC distribution and AC/DC hybrid solutions
- AC and DC charging stations for private and public transportation
- Distributed and centralized storage
- Technical solutions for upgrading existing assets
- Innovative condition monitoring



3

DIGITALIZATION ENABLING NEW SERVICES, OPERATION SCHEMES AND CUSTOMER ENGAGEMENT

The digitalization of the city distribution system can enable new services and new markets for consumers, producers, and energy service providers, and impact the operation of distribution systems. Many services have the potential of postponing the need of infrastructural investments for reinforcing existing assets or building new ones, optimizing existing infrastructures associated with power distribution in a fast growing city. The digitalization enables aggregation, smart districts, and buildings,

as well as the transition towards electric mobility and full electric cities (e.g. smart charging and/or V2G) that can significantly impact on the distribution system operation.

The incoming Internet of Energy, with the emerging community systems operator (CSO) responsible for planning and operational control of the automated, blockchain-enabled energy community, can significantly change the distribution business. The

distribution network could be used for providing security and adequacy to local energy communities, having their own local production, generation, storage and a local market. Finally, the Internet of Things (IoT) will offer plenty of data that can be used for harvesting the inherent flexibility not only of electrical prosumers and active consumers but also from the integration of other services and systems.



PREFERRED TOPICS FOR PAPERS ARE:

- Aggregators and demand response in fast growing cities (e.g. Virtual Power Plants, flexibility mechanisms)
- Multi energy/multi services networks and systems
- Operation and energy management of smart districts and buildings (e.g. community systems operator, etc.)
- Integration and operation of E-mobility in large cities, smart public lighting and distributed storage
- Peer to peer energy transaction and local markets (blockchain)
- Interoperable digital platforms for the integration of city services
- Big data to improve and optimize the operation of smart distribution systems
- Innovative operation of the distribution system (e.g., IoT integration, etc.)

4

RELIABLE AND RESILIENT SMART POWER DISTRIBUTION

Digitalization increases the level of reliability and resilience in smart cities and improves the quality and wellbeing of citizens, which must be in the center of the digitalization process. In this context, condition based asset management can benefit from the use of interconnected sensors and devices, artificial intelligence and machine learning for better reliability and continuity of service. The use of decision support systems helps to mitigate the impact of natural disasters or climate effects by increasing the level of awareness and enabling the fast implementation of recovery plans.

Digitalization brings many benefits, but it also opens the door to increasing risks for energy security, both from natural hazards such as geomagnetic storms and from unintended cyber incidents and intentional cyber-attacks. Attacks on energy systems are likely to be particularly disruptive since power systems must operate in real-time and cannot simply

install patches or updates, or shut down and reboot as in the typical response to digital failures or breaches. Cybersecurity and resilience need to be made a central part of energy research, development and deployment. Finally, the growing use of digital technologies in the energy sector raises questions about data privacy and ownership. Smart grids and demand response technologies rely on vast quantities of consumer-specific, real-time electricity usage data.

Viewed from an overall systems perspective, policymakers might consider that there is a wide public interest in making aggregate data publicly available, but at the same time they must also take into account the privacy concerns of their constituents. An appropriate balance between consumers' privacy concerns and the operational needs of utilities and new market players should be found by using appropriate data management techniques to foster demand response, customer engagements and local markets.



PREFERRED TOPICS FOR PAPERS ARE:

- Digitalization and Asset Management
- Decision Support Systems and Risk Awareness for Resilient Distribution Systems
- Citizen awareness and resiliency
- Cyber security techniques for digital power distribution
- Cyber physical modelling and simulation for smart cities
- Microgrids and smart districts for resiliency
- Cyber-attacks as high-impact low-probability events
- Managing data protection and open data
- Impact of innovative market arrangements on resiliency

SUBMIT

Prospective authors are invited to submit an abstract by **28 February 2020** directly via the Workshop website.
Successful authors will be invited to submit a full paper by 3 July 2020.



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More information and submission : <http://cired2020shanghai.org/>



AWARDS

Uni SA

The Electric Energy Society of Australia Prize

Awarded to the student with the best overall performance in the course "Power System Analysis" in the Bachelor of Engineering (Computer Systems), (Electrical & Mechatronic), (Electronics and Communications) or associated double degrees program.

Tim Coulter who is studying Bachelor of Engineering – Electrical and Mechatronics, having achieved a High Distinction in the course "Power System Analysis". He has had the best grade for a domestic student and has also successfully completed the first 3 years of the degree while maintaining a GPA of 6.8 (out of 7).

The Electric Energy Society of Australia Prize - Final Year Project

Awarded to the team for the best overall performance in the final year electrical power engineering project in the Bachelor of Engineering (Computer Systems), (Electrical & Mechatronic), (Electronics and Communications), (Networking and Communications) or associated double degree program.

Dharambir Singh received this award having achieved a Distinction for his project in electrical power generation, "Solar PV and Battery Storage for Commercial and Industrial Applications and their integration to South Australian Power Network".

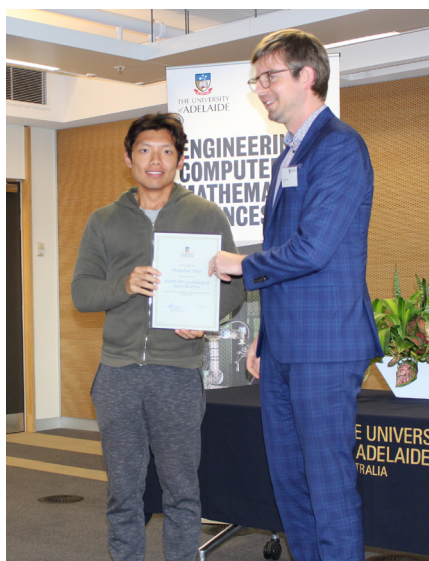
University of Adelaide

The University of Adelaide's School of Electrical & Electronic Engineering, 15th Annual Student Award Ceremony, for the 2018 Academic Year Award Presentations.

The EESA Prize for the best result in the course "Electric Energy Systems" was awarded to Ms Emily Lauritsen, Mr Hongzhou Chen, and Mr Daniel Mignanelli.



Emily Lauritsen Applied Systems



Mr Hongzhou Chen



Mr Daniel Mignanelli Applied Systems

UPCOMING EVENTS

Internet of Things (IoT) using 5G Technologies

Wednesday 12 February 2020

NSW/WEB

[VIEW EVENT](#)



Overview:

The Internet of Things (IoT) is a distributed ICT (Information and Communication Technology) system that integrates sensors, computing devices, algorithms and physical objects known as the Things which are uniquely identifiable. IoT is becoming a key industrial technology which is now deployed in many industrial and service sectors.

Time:

5:30 pm to 7:30 pm

Venue:

Engineers Australia Newcastle
Suite 3 Tonella Commercial Centre
125 Bull Street (entry via Dick Street)
Newcastle West - Webinar available

Cost:

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

Transformation in Energy Networks

Wednesday 19 February 2020

WA

[VIEW EVENT](#)



Overview:

Where the South West Interconnected Network in Western Australia once delivered electricity generated at transmission level to supply most customers connected at distribution level, it is now also facilitating a substantial amount of energy generated from a variety of sources connected to the distribution network.

Time:

5pm until 7pm

Venue:

Engineers Australia Western Australia
Division
WA Auditorium 712 Murray Street
West Perth WA 6005

Cost:

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

Network Value from Advanced Customer Metering

Wednesday 19 February 2020

QLD

[VIEW EVENT](#)



Overview:

EESA is pleased to present David Sheppard of Energy Queensland who will present one Network Value from Advanced Metering Infrastructure.

The talk will cover:

Origins of Advanced Meter Rollout.
Deployment of Advanced Meter Volumes
and the network capabilities to be unlocked.

Time:

Registration from 3pm
Talk from 3:30pm - 5pm

Venue:

Energy Queensland
Level 1 Brisbane Room, 26 Reddacliff Street
Newstead QLD 4006

Cost:

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

UPCOMING EVENTS

Dry Type vs Oil Type Transformers - Horses for Courses

Thursday 27 February 2020

VIC

[VIEW EVENT](#)



Overview:

Join us on Thursday, 27th February at 6:00pm to learn more about the use of both types of Transformers as power system professionals share their knowledge and expertise.

Time:

6pm - 7:30pm

Venue:

Engineers Australia Victoria Division
Level 31, 600 Bourke Street
Melbourne VIC 3000

Cost:

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

Tribute Power Station Alternator Failure

Thursday 2 April 2020

TAS

[VIEW EVENT](#)



Overview:

Tribute power station was the last of the major hydro power schemes to be developed in Tasmania. The station was commissioned in 1995 and comprises of a single underground 92MVA generating unit. 13.8kV busbars are used to connect the alternator to the above ground setup transformer for connection to the 220kV transmission system.

Time:

5:30pm - 7pm AEST

Venue:

Engineers Australia Tasmania Division
Level 5, 188 Collins Street
Hobart TAS 7000

Cost:

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

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.



EATON

We're dedicated to improving people's lives and the environment with power management technologies that are more reliable, efficient and safe.



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.

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