

## NATIONAL BULLETIN

Bulletin 8 | 2023

### EECON 2023 AND CALL FOR NOMINATIONS (EL-065)

by Terry Lampard, National President of the Electric Energy Society of Australia

Preparations for EECON 2023 are proceeding at a rapid pace and by the time this article is published a technical program will have been released. The EECON Technical Committee received over 60 great abstracts so it was a challenging task to select those that best fit in with the Conference Theme. But for those who missed out– we have your contact details and there is every chance we will be in touch to see if you are able to present in our Webinar program or future events.

I am delighted to announce that Dr Alan Finkel AC will be a keynote presenter at EECON. Dr Finkel, Australia's Chief Scientist from 2016 to 2020, is an electrical engineer who serves as a role model to us all and his ongoing insights into low emissions technology should make for a fascinating open to the conference.

I am currently reading Dr Finkel's latest book: "Powering Up – Unleashing the clean energy supply chain" and I think it is a publication that will leave a lasting impression on anyone who reads it. Unlike many writings in this area, it is not overburdened with technical detail, not does it seek to over-complicate or over-simplify issues. As the title suggests, this book concentrates on supply chain matters and brings together many strands including raw materials, power infrastructure, the workforce, transportation and end customers.

But at no time does it lose sight of the fundamental principle that technology is a servant, not a master and that participants in the energy transition must constantly remind themselves that their social license is a privilege, not an entitlement.



**Terry Lampard**  
National President of the  
Electric Energy Society of Australia

#### Affiliations





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We engineers use a vocabulary when communicating with each other that is often opaque to the general community. So when we are asked a casual question at a social event sometimes we struggle to provide an answer in simple terms – and whether we like it or not, we come across as smug or aloof even though we are trying to respond positively to genuine interest. Dr Finkel's book does not fall into that trap – I strongly recommend that EESA members read this book before attending their next BBQ because it will help you talk about complex issues associated with the Energy Transition in a way that members of the wider community will understand and appreciate.

I'm greatly looking forward to meeting Dr Finkel at EECON 2023 and I keenly anticipate his keynote address.

## Call for nominations: EL-065 – Management of Network Assets in Power Systems

A vacancy currently exists for a nominee to EL-065 – Management of Network Assets in Power Systems.

EL-065 is responsible for the determination of common methods and guidelines for coordinated lifetime management of network assets in power systems to support and standardise good asset management.

The development of new methods and guidelines that incorporate translating data into asset decisions is within the scope of this committee, which also actively participates and votes on the committee IEC (International Electrotechnical Commission) ballots.

Nominees are expected to demonstrate expertise in these areas of practice.

Nominations should be sent to [terrence.lampard@bigpond.com](mailto:terrence.lampard@bigpond.com) using the Nominating Organisation Representative Nomination Form on the following link:

<https://www.standards.org.au/standards-development/developing-standards/participate>

Nominations close on 15 September 2023

## Affiliations





# EECON2023

LEADING THE ENERGY TRANSITION THE AUSTRALIAN WAY

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## KEYNOTE SPEAKERS



**Tony Wood**  
Energy & Climate Change  
Director, Grattan Institute



**Dr. Alan Finkel**  
Special Advisor to the Australian  
Government & Former Chief Scientist



**Prof. Julie Arblaster**  
School of Earth, Atmosphere  
& Environment, Monash Uni

## WITH SPECIAL ADDRESSES BY:



**The Hon. Lily D'Ambrosio**  
Minister for Energy



**Mr. John Pesutto**  
Leader of the Victorian Liberal Party

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## LOCAL NEWS

# AUSTRALIA WILL FALL WELL SHORT OF 82 PER CENT RENEWABLE ENERGY BY 2030, ANALYSTS PREDICT, AS PROBLEMS MOUNT

By Daniel Mercer | 6 Aug 2023 | Source: [ABC](#)



*The market operator says new transmission lines are vital to connect green energy in remote areas.  
(ABC Illawarra: Justin Huntsdale)*

As part of ambitious plans unveiled last year, the federal government has set a renewable electricity target of 82 per cent by 2030.

Australia currently generates between 30 and 35 per cent of its power from renewable sources such as wind, solar and hydro power.

The forecasts that Australia will undershoot the goal come as resistance grows to a number of major high-voltage power lines that backers say are essential to connecting ever greater amounts of wind and solar generation.

### **Analysts say mounting problems mean Australia will fall well short of 2030 renewable energy target**

Plans by the federal government for Australia to generate more than four-fifths of its power from renewable sources by 2030 are coming under pressure amid claims the country is way off track.

Renewable energy advisory Nexa has joined global analyst Rystad Energy in finding Australia's green energy share is likely to be barely 60 per cent by the end of the decade under the current rate of progress.





## LOCAL NEWS

Opponents of planned transmission lines in Victoria have stepped up their attacks on the proposals, which they claim would cause needless social and environmental damage while saddling consumers with billions in extra costs.

At the same time, calls are growing louder for some ageing coal-fired power stations to be kept open for longer to ensure a shortfall in new green energy does not jeopardise the stability of the grid.

Tony Wood, the director of the Grattan Institute's energy program, said it was looking increasingly unlikely Australia would be able to hit its 2030 target.

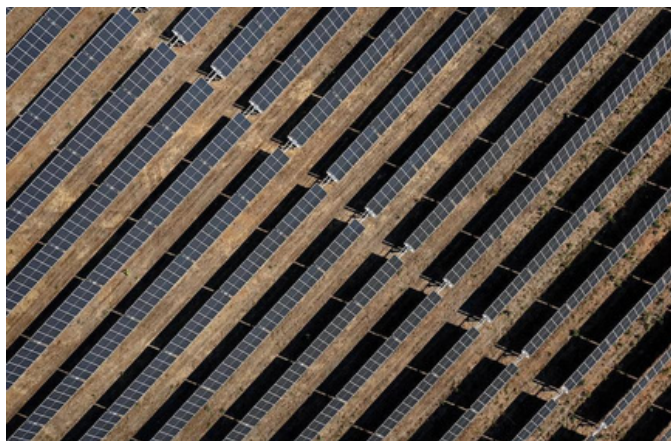
"On the current trajectory, we're going to fall short," Mr Wood said. We're already halfway through 2023."  
"The fact is we haven't been building the transmission."

### Money 'not the problem'

According to Mr Wood, delays holding up the construction of high-voltage power lines are at the heart of Australia's slowing progress.

He noted that a key plank of the federal government's renewable energy agenda was its so-called rewiring the nation scheme, which had set aside \$20 billion in low-cost loans to help kickstart the development of transmission lines.

However, Mr Wood said the policy looked incapable of solving the underlying problem.



*Solar farms are being added to Australia's grids, but experts say not nearly fast enough.(ABC News: Michael Franchi)*



*Planned transmission lines have emerged as the front in resistance against the transition.(ABC News: Peter Curtis)*

"Rewiring the Nation Corporation is an interesting idea because the idea there was to provide low-cost finance," he said.

"But low-cost finance isn't the problem."

"There's plenty of money around."

"The problem is approvals."

In a recent report, energy analysts Nexa Advisory found about 60 per cent of the electricity generated in Australia's biggest grid was likely to be renewable by 2030, based on the current trajectory.



## LOCAL NEWS

Rystad Energy, a global consultancy headquartered in Norway, forecasts "that just 64 per cent" of Australia's electricity will be renewable by the end of the decade under a "business-as-usual approach".

David Dixon, the firm's vice-president of Australian renewable energy research, said congestion in the transmission network was throttling the country's ability to achieve its goals.

Mr Dixon said Australia needed to add about four gigawatts of large-scale wind and solar power a year to meet its target – the equivalent of two large coal-fired generators.

But he said the country was falling short of the required pace, hindered by a lack of transmission and storage capacity to soak up and move around excess electricity.

### Policy changes needed: Rystad

What's more, he said Australia's renewable energy output would continue to be stifled so long as the grid ran largely on coal-fired power.

While coal plants could be turned down to accommodate surges in wind and solar power at windy and sunny times, he said they typically had to run at between 30 and 50 per cent of their maximum output for technical reasons.

"This results in the curtailment of renewables, which could otherwise generate more power," Mr Dixon said.

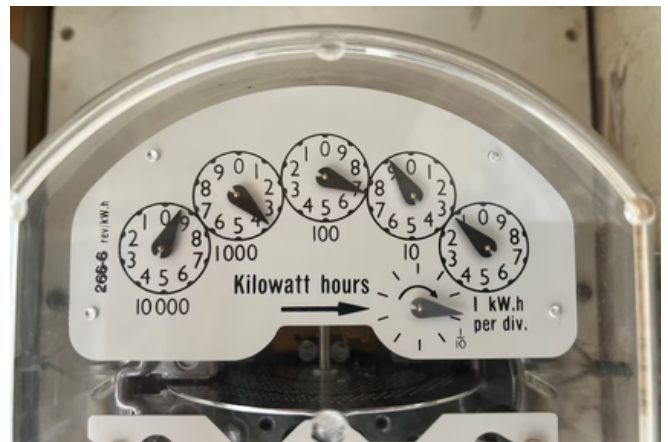
For Mr Dixon, governments could pursue relatively straightforward policy changes that could help to ease some of the pressure on Australia's transition.

Among these were moving the subsidies flowing to households to install rooftop solar panels to instead encourage them to fit batteries.

He said this would "stimulate demand for battery storage to soak up excess rooftop solar generation and reduce peak demand in the evening".

"The current economics favour installing rooftop solar only," he said.

On top of this, Mr Dixon said there needed to be more certainty for investors looking to build large-scale batteries, suggesting this could be done via "auctions to de-congest the existing transmission network".



*Keeping the power flowing and supplies stable in a high-wire act. (ABC News: Daniel Mercer)*





## LOCAL NEWS

In the absence of such measures, he said governments may be left with few other options than to delay the closure of coal-fired power plants such as Origin's giant 2880MW Eraring, which is the country's single biggest generator.

Eraring is scheduled for closure in August 2025, but NSW Energy Minister Penny Sharpe is coming under increasing pressure to keep at least some of the plant online in a move that would reportedly cost taxpayers hundreds of millions of dollars a year.

"In short, if we are unable to construct adequate transmission, firming, and renewable capacity before the scheduled coal plant closures, it would be reasonable to delay the retirements of coal generators," Mr Dixon said.



*Calls are growing louder for the giant Eraring coal plant to be kept open beyond 2025. (AAP/Greenpeace)*

### Developer interest 'massive'

Marija Petkovic, the boss of consultancy Energy Synapse, said the sputtering nature of Australia's transition had nothing to do with investor enthusiasm.

Ms Petkovic noted there was "massive" interest from developers keen to build generation, storage and transmission projects.

She pointed to a pipeline of proposed wind and solar projects amounting to 150GW of capacity as evidence of the money "lining up" to be invested in Australia's move to renewable energy.

It was a similar story with batteries, with projects totalling about 50GW on the drawing boards.

"Obviously, not all these projects will be built," Ms Petkovic said.

"Throughout their development process, companies might decide that they might not be feasible or they might not be in the best spot.

**"But given that these numbers are huge what it does show is there is massive interest in building these projects from the renewable energy sector.**

"The renewable energy sector is very much willing, able and capable of stepping up to meet that target.

"The challenge is it's simply taking too long from conception to construction and having these projects be operational."

Ms Petkovic said the time it was taking for projects to be approved and connected to the grid was the most significant "bottleneck" jamming up Australia's transition.



## LOCAL NEWS

### Governments facing 'choices'

She said it was here – rather than the provision of money – where governments could make the biggest difference.

"If they could accelerate that process, we would be seeing these projects come online much faster," she said.

"It's a huge task that's ahead of us, especially when you think of how much transmission has to go into the grid to hit that target."

Federal Climate Change and Energy Minister Chris Bowen has maintained the government can meet the 2030 target, saying it was "ambitious ... but achievable".

During a recent visit to Japan, Mr Bowen acknowledged the difficulties facing the government, but insisted it was not about to abandon its goals.

"This is a hard task," Mr Bowen said.

"It's a little fashionable in Australia to say it's too hard, that we won't lift from 35 per cent renewable energy today to 82 per cent by 2030.

"I completely acknowledge it's a big job with many road bumps on the way. Of course it is.

"If it was easy, someone else would have done it."

Mr Wood queried whether governments may eventually have to make difficult decisions about whether to step in and force through controversial projects such as transmission lines.

"They've got a choice," Mr Wood said.

**"If they don't, you say goodbye to the targets we have and you probably say goodbye to how we get our emissions down."**



*Rystad believes policy changes are needed to spur the development of large-scale batteries.(Telsa Motors: Timothy Artman)*



*The Grattan Institute's Tony Wood says Australia is on track to miss its renewable energy targets.(ABC News: Steve Keen)*



## LOCAL NEWS

### LOCAL CLIMATE-FIGHTING ENGINEERING SOLUTIONS

By Chloe Hava | 17 Aug 2023 | Source: [Create](#)



From microbes to efficient battery storage, these home-grown start-ups have come up with innovative technologies to tackle climate change.

#### Methane-busting cow food

Cows are one of the biggest greenhouse gas producers, with a single bovine emitting 154 to 264 lb of methane gas per year through flatulence or belches.

To help to reduce the environmental impacts of this gaseous species, synthetic biology start-up [Number8Bio](#) found a way to engineer microbes in animal feed.

The product tackles methane production at the source by influencing cows' digestive process, known as enteric fermentation.

“Also used by other ruminant animals such as sheep and goats, enteric fermentation allows the animals to extract nutrients from plant material that other mammals cannot. However, throughout this process, copious amounts of methane are produced as a byproduct, in a stomach compartment known as the rumen, which is typically expelled through burps.

By bioengineering naturally occurring yeasts as an additive in cow feed, the co-founders estimate up to a 90 per cent emissions reduction per cow.

“We’re looking at locking in increased feed conversion efficiency,” said CEO and co-founder [Tom Williams](#). “If you can stop those methane emissions, there’s actually more of the food available for the animal to grow and produce things like wool and meat and milk.”

#### Calculating complex scope 3 emissions

Scope 3 emissions, indirect emissions occurring in an organisation’s value chain, are difficult to measure and reduce. These emissions can come from myriad sources, for example business travel or emissions produced by a company’s suppliers, and can often make up the lion’s share of an organisation’s emission profile.

With Australia introducing [mandatory climate reporting](#) in 2024, including material scope 3 emissions, organisations will soon need to come up with a strategy to calculate them.

To help them in this pursuit, [Avarni](#), which counts big four consulting firm KPMG among its clients, has produced AI-powered and data-driven carbon accounting software that calculates scope 1–3 emissions.

The platform aggregates supply chain and spending data into a single dataset that uses AI to help organisations calculate and report their emissions, who can then work with suppliers on carbon reduction strategies.



## LOCAL NEWS

“We can map transactions and calculate scope one to three emissions in real-time at a 95 per cent efficiency rate,” [said co-founder Tony Yammine](#).

“When an end customer wants to take action, they can use Avarni’s platform to decarbonise more efficiently.”

### Upcycling used solar panels

While solar panels are an efficient and renewable energy solution, they are typically relegated to landfill when end of operational life is reached – leading to heavy metal leaching.

But Melbourne based company [ElecSome](#) – in collaboration with University of Melbourne, RMIT University and Melbourne-based company OJAS – has developed a circular economy approach that recovers valuable materials from old solar photovoltaic (PV) modules, such as clean glass, silicon cells and polymers.

When upcycled, these materials can be transformed into high-value products such as nano-engineered concrete aggregate SolarCrete – launched by ElecSome Managing Director Neeraj Das last year.

The world-first pre-mixed concrete product uses glass fines from PV panels to partially replace sand.

Replacing raw materials has additional environmental benefits, given the world is [quickly running out](#) of sand, which has led to ecological issues such as erosion and flooding.

“This [solution] puts Australia ahead of everyone else to find an environmentally friendly process for upcycling PV modules,” [Das said](#).

### Sustainable battery storage

As the world switches towards more renewable sources of energy, including high-powered batteries, superchargers are becoming more commonplace to ensure these energy sources are tapped faster.

For example, superchargers may be used for acceleration in an electric car or to balance supply and demand in power grids.

Ironically, superchargers are made with toxic and corrosive electrolytes, which are not environmentally friendly.

But Newcastle-based company [Allegro Energy](#) has developed a supercapacitor using water-based electrolytes, making its product recyclable, non-flammable, non-corrosive and rare -material- free.

Allegro’s supercapacitors can be used to power electric vehicles big and small – from cars and bikes to light rail, e-buses, and mining trucks.

Its second product, the redox flow battery, is a large-scale energy storage solution that also uses the patented water-based technology. [Origin Energy](#) recently acquired a five per cent stake in Allegro, and will pilot the redox flow batteries at its Eraring Power Station.

“Our supercapacitors have similar cycling characteristics to current products, and we rate our redox flow batteries for a minimum 20-year life span,” [said Allegro Energy founder Thomas Nann](#).

“However, given the characteristics of all of our materials, all of our products are set apart because they are much easier to recycle and fully compatible with a circular economy.”

### Boosting an ancient carbon capture technique

Solving the climate crisis involves going back to nature, according to this soil carbon start-up’s founders.



## LOCAL NEWS

Loam is using microbes as a carbon removal solution in the form of a microbial seed coating. When farmers apply the CarbonBuilder fungal to seeds before sowing, the natural ability of plants to store carbon is “supercharged”. The product is designed for agricultural applications, both removing carbon from the atmosphere and empowering farmers to harness carbon capture.

“With Loam’s technology we’re able to open a door for farmers in the cropping sector – that wasn’t necessarily open before – to genuinely participate in carbon farming,” said Co-Founder and Chief Product Officer, Tegan Nock.

“By applying Loam seed treatment, farmers can accelerate a path towards healthier, more productive soils by driving more rapid increases in soil carbon, which benefits resilience and productivity,” said Loam co-founder Guy Hudson.





## LOCAL NEWS

### INDUSTRY CALLS FOR POLICY CONSULTATION

By ENA | July 2023

#### **Energy Networks Australia acknowledges today's announcement by the Victorian Government to phase out gas connections in new homes from 2024.**

The decarbonisation of Victoria's energy system, including its electricity, gas and transport infrastructure, is a complex issue with many moving parts.

Energy Networks Australia CEO Dominique van den Berg warned this decision is premature in the absence of a thorough and transparent process.

"It is critical to carefully consider, with the benefit of all stakeholder perspectives, the whole of energy system implications of significant policy decisions, including impacts on costs, emissions and the most vulnerable," she said.

Ms van den Berg said Energy Networks Australia is keen to work collaboratively with the State Government and other stakeholders to ensure that the policy is fully understood and the transition to renewable energy is smooth, fair, and minimises unintended consequences for energy customers.

"We stand ready to participate in open dialogue and consultation, offering our expertise and perspective to help shape a balanced, sustainable energy future for Victoria and Australia more broadly."

Media Contact: Jemma Townson | 0438 534 111 | [jtownson@energynetworks.com.au](mailto:jtownson@energynetworks.com.au)

Energy Networks Australia is the national industry body representing Australia's electricity transmission and distribution and gas distribution networks. Our members provide more than 16 million electricity and gas connections to almost every home and business across Australia.

## LOCAL NEWS

# OP-ED: HOW ULTRA LOW-COST SOLAR WILL UNLOCK AUSTRALIA'S SUPERPOWER VISION - AUSTRALIAN RENEWABLE ENERGY AGENCY

By Arena | 27 July 2023 | [Arenawire](#)

**A new ARENA white paper, *The Incredible Potential of Ultra Low-Cost Solar in Australia*, highlights huge opportunities if we can boost solar efficiency and cut costs. ARENA CEO Darren Miller explains why urgent action is needed.**



*ARENA's Solar 30 30 30 goal is to realise solar module efficiency of 30 per cent and an installed cost for solar farms of 30 cents per watt by 2030 (Image: Supplied)*

Darren Miller is CEO of the Australian Renewable Energy Agency (ARENA)

Forty years ago, Australian scientists invented the [modern-day solar cell](#) and kickstarted a global solar PV industry. So successful has solar become that the [International Energy Agency](#) has declared it as the cheapest form of energy generation the world has ever seen.

Current solar and wind technology is already mature enough to transform our electricity system, support the growth of electric vehicles and make the switch to all-electric homes and businesses. This is a worthy and important task. As such, it has considerable grassroots support and increasing investment from all levels of government.

However, it is clear the impressive renewable energy technologies currently at our disposal are not able to be produced and installed in the enormous volumes and at a sufficiently low cost to outcompete fossil fuels for many important end uses such as heavy industry, hydrogen production and long-distance transport.

Australia's key assets include our vast land mass, low population density, and an abundance of sunshine. All of this points to ultra low-cost solar as the hero in our superpower vision.

### What is ultra low-cost solar?

ARENA recently published a white paper, [The Incredible ULCS: How Ultra Low-Cost Solar Can Unlock Australia's Renewable Energy Superpower](#).

Ultra low-cost solar will more efficiently convert sunlight to energy. It will be manufactured from affordable, abundant, safe and stable materials. And finally, it will be deployed in the field at low cost and in a highly efficient, automated way.

Once operational ultra low-cost solar will require little ongoing maintenance and have a longer lifetime than today's solar technology. Its low risk will attract financial backing from private investors and our financial institutions

Unless we make ultra low-cost solar a reality in Australia, we may never unlock our renewable superpower potential. We will limit the Australian economy's options to adapt and thrive in the 21st century.

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“In the decades ahead, as the world decarbonises, our trading partners will seek low emissions sources of metals, chemicals and other materials that will be the backbone of the net zero global economy. Highly energy intensive commodities like lithium, steel and ammonia will need power from cheap renewable energy or low carbon sources. Ultra low-cost solar will fill that gap.

There is no question that cheap solar alone is not the whole answer. We also need other components such as cheap wind energy, low-cost firming, transmission and demand-side flexibility.

However, without cheap solar, the transition to net zero will be more expensive and carry significant risks to Australia's resource dependent economy.

### How will we realise ultra low-cost solar?



ARENA CEO Darren Miller launches the ultra low-cost solar white paper at the Australian Clean Energy Summit (Image: Dylan May)

We can make ultra low-cost solar a reality by focusing on three crucial endeavours.

Firstly, our scientists and researchers must keep innovating and improving solar cells and module design. We must find new materials and technology to turn more of the sunlight that hits the solar panel into electricity.

Current modules for rooftop and large-scale deployment convert about 22% of the available energy into electricity. We need to push this beyond 30%.

Secondly, our engineers and entrepreneurs need to find lower cost ways to install solar. Current methods would require hundreds of workers connecting solar modules to mounting systems by hand in far-flung locations across Australia.

If it sounds expensive, that's because it is.

We must move into the digital age with factories pre-assembling modules and GPS-guided robots installing them in the field.

Thirdly, we must work with Australian communities, First Nations people and landowners to make available the amount of land required to host these facilities and the new high-capacity transmission lines we'll need to connect these solar farms to the end users.

In addition, we need to take a serious look at opportunities to manufacture more of the components needed.

Currently, China dominates the global supply chain for solar. We must increase our resilience to future supply chain shocks by building local capabilities.

### What is Solar 30 30 30?

Having led the way with the first competitive auctions for solar farms back in 2016, which kickstarted our large-scale solar industry, ARENA has set an ambitious ultra low-cost solar goal we call Solar 30 30 30. We want to achieve solar module efficiency of 30 per cent and an installed cost for solar farms of 30 cents per watt by 2030.





## LOCAL NEWS

This goal is within reach if governments, private investors and society as a whole commit to solving this particular challenge.

With the right focus we can leverage Australia's comparative advantages to achieve our ultra low-cost solar vision without sacrificing today's urgent decarbonisation challenges.

Now is the time to invest in the technologies we need for future economic success in a net zero world.

## LOCAL NEWS

# TRANSGRID SIGNS \$100 MILLION CONTRACT IN GLOBAL RACE TO SECURE VITAL TRANSMISSION EQUIPMENT

11 Aug 2023 | Source: [Transgrid](#)



Transgrid is leading the global race to secure critical transmission equipment as it prepares to deliver the Federal Government's priority grid projects and enable a clean energy future for millions of Australians.

CEO Brett Redman said: "We continue to build our global supply chain to secure the specialised kit needed to build the future clean energy grid and ensure competitive and efficient delivery of the Federal Government's energy plans."

"Transgrid has finalised a \$100 million contract with ZTT Australia Pty Ltd to supply 17,500 kilometres of high voltage conductors - enough to stretch from Sydney to Dublin. We are also finalising a separate contract with another Australian company to supply other locally-produced conductor elements."

The contract is part of Transgrid's Powering Tomorrow Together program, bundling procurement for major projects [HumeLink](#), [VNI West](#) and [EnergyConnect](#), which will save up to \$500 million.

The program is enabling Transgrid to purchase materials like substation equipment, earlier and at a lower cost, enabling limited resources to be used across multiple projects. The orders are also supported by \$385 million Australian Government underwriting as part of the Rewiring the Nation program.

Transgrid Executive General Manager, Delivery, Craig Stallan, travelled to Asia recently to sign the agreement which will see ZTT Australia Pty Ltd (a subsidiary of ZTT International Ltd) supply the conductors.

"Transgrid is investing \$16.5 billion in transmission infrastructure in NSW over the next decade to accelerate the Federal Government's vision. Our major transmission projects involve a long shopping list for big kit, and we are competing with the likes of Europe, the USA and the United Kingdom to secure highly sought after slots on production lines.

"The new conductors will be used on HumeLink and VNI West and by securing supply now, we can deliver projects faster and cheaper for consumers.

"It's also reducing risk as we compete with other energy companies and nations to secure critical, large-scale equipment, materials and skilled labour to deliver the projects Australia needs," Mr Stallan said.

Dean Farrar, ZTT Australia General Manager, said the conductors will be manufactured in ZTT Group's Hekou manufacturing campus and will be delivered to Australia in 2024 and 2025.

"We are honoured to be partnering with Transgrid for their current and future major projects. This contract builds on our ongoing commitment to support the Australian energy and telecommunications markets, now and into the future," Mr Farrar said.

This year Transgrid has also secured 15 shunt reactors and 25 single phase transformers worth approximately \$150 million, with arrival commencing in late 2024.



## LOCAL NEWS

### WHAT IS OPEC, OPEC+?

By Energy Informer | Aug 2023

#### **Perry Sioshansi in the August edition of EEnergy Informer writes that is not easy to know who is friend or foe when it comes to the oil business**

The Organization of the Petroleum Exporting Countries (OPEC) was formed in 1960 originally with Iran, Iraq, Kuwait, Saudi Arabia, and Venezuela as members. The organization has since expanded to 13 members who meet every now and then to set production levels and coordinate output to help manage global oil prices (visual below). OPEC's stated objective is to "co-ordinate and unify petroleum policies among Member Countries to secure pricing for producers, supply for consumers, and return on capital for investors."

The increase in US oil production following the shale oil revolution led to lower prices and prompted OPEC to join with 10 other oil-producing countries in 2016 to create what is now known as OPEC+. The new member countries include Russia which was the world's third-largest oil producer in 2022, before invading Ukraine with 13% of the world output, currently around 10.3 million barrels per day (b/d). It has always been an uneasy alliance for OPEC and OPEC+, made more fractious since the Ukraine war.

OPEC produced an estimated 32.2 million b/d of crude oil in 2022, which was 40% of total world oil production with Saudi Arabia as the biggest. The US is the second biggest oil producer.

According to the Energy Information Administration (EIA) oil production in Russia remained above 10 million b/d in 2022 despite the Western imposed sanctions. Following the invasion of Ukraine, the decisions of the OPEC+ appear to be primarily driven by coordination between Saudi Arabia and Russia, another uneasy alliance. OPEC+ countries combined produced about 60% of global oil production, around 48 million b/d in 2022.

In addition to extending the existing OPEC+ cuts of 3.66 million b/d, the group agreed in early June 2023 to reduce overall production targets from January 2024 by a further 1.4 million b/d versus current targets to 40.46 million b/d.

Saudi Arabia, once a dependable US ally, is neither dependable nor necessarily an ally. With the Russian invasion of Ukraine, many other former allies and non-aligned countries have forged new trade relationships with present and former friends and foes. It is no longer easy to know who is on whose side, especially when it comes to the oil business. In June, Pakistan proudly announced the receipt of its first shipment of discounted oil from Russia in Karachi – apparently with no qualms about the Russia's atrocities in Ukraine.

Pakistan is sorely short of foreign reserves and seeks the cheapest oil from anywhere it can get. The same applies to India and numerous others who do not seem troubled buying Russian oil, especially if it comes at a discounted price.

As for the price of gasoline, it is generously subsidized and/or underpriced nearly everywhere. Assuming a cost of \$600 per ton to capture and sequester CO2 emissions from a gallon of gasoline would add roughly \$6 per gallon to the retail price making it \$9.50 rather than the current average US price of \$3.5/gallon, according to the Climate Capitalist.

It says that while the cost of carbon capture and sequestration is likely to come down as the technology evolves and is scaled up, it is hard to imagine the real price of a gallon of gasoline to fall below \$8.50 any time soon. Many European drivers already pay twice the US average price – for example \$7.30 per gallon in the Netherlands – which is closer to what the actual price should be.

<https://theclimatecapitalist.com/articles/gas-should-cost-13-59-a-gallon>



## LOCAL NEWS

# BUILDING THE FUTURE GRID: RESHAPING AUSTRALIA'S LARGEST MACHINE

By Ruth Watkins and Scott Walker | 14 July 2023 | Source: [CSIRO](#)

We've been working alongside the [Australian Energy Market Operator](#) (AEMO) and nine other research partners on an important roadmap to support Australia's transition to a stable, decarbonised power system.

Launched last year, [Australia's Global Power System Transformation \(G-PST\) Research Roadmap](#) incorporates work on nine pressing research topics, including inverter design, new control room technologies, and tools to ensure grid stability. This research is part of a [broader consortium](#) of countries working to accelerate the transition to reliable low emission power systems across the globe.

We have now published a [G-PST Stage 2 summary report](#) which encompasses key findings and progress updates from the research program. Individual reports from each of the project partners have also been published. Six of the project themes are common to the global consortium, while three (reports 7, 8 and 9) have been designed specifically for the Australian energy context.



*The complexities introduced by EV charging infrastructure and EVs requires further testing, especially as EVs are expected to drive major load growth in distribution networks.*

### Why is Australia's G-PST research so important?

A global energy transition to net zero by 2050 is well underway. Drivers including lower-cost renewables, retirement of fossil fuel plants, emissions reduction targets, geopolitics and consumer demand are driving this transition at unprecedented speed and scale.

According to the [International Energy Agency's World Investment 2023 Report](#), global investment in clean energy will rise to an all-time high of USD \$1.7 trillion in 2023, a figure about the same as Australia's Gross Domestic Product. The biggest spend is on solar energy, which is expected to draw investment of USD \$380 billion.

It's a good news story, but it also generates complexities. Around the world, changes to power system design, operation and management are urgently required as countries and regions accelerate their uptake of electricity generated by a variety of renewables. And industry, businesses and households are participating in a more decentralised energy exchange across their respective grids.



## LOCAL NEWS

### What is unique about energy transition in Australia?

Traditionally, electricity grids were built to transfer electricity from large, centralised coal-fired power stations with assistance from natural gas and hydro. The transfer was in one direction to end-users, and the system excelled in providing dispatchable electricity at any given time.

While households continue to draw power from the grid – for heating, appliances and electric vehicles – some people are now also supplying energy back into the system from rooftop solar.

[Dr. Thomas Brinsmead](#) is our technical coordinator of the GPST work. He said this shift presents unique challenges that need to be addressed, especially in Australia.

“There are two major differences between Australia and a lot of other countries,” Thomas said.

“First, we don’t have the density of interconnections of grids as in places like Europe. Our eastern grid is essentially a long, skinny line around the coast, which leads to less spatial diversity in resources. If there were more interconnectivity, you could often re-route around the loss of a link in the network. A network that’s a long line is more vulnerable.

“The other major aspect where Australia differs is that we are much further along than most places in our uptake of distributed energy like rooftop solar and batteries. Other grids are moving in that direction, but we are at the forefront in terms of installation and implementation.”

The growth of renewables in Australia has taken place at an extraordinary rate. In 2010, there was 480 MW of utility scale renewable generation installed across the National Electricity Market (NEM). At present, there is 19,000 MW of utility scale renewable generation installed. The AEMO estimates by 2030 this figure could reach 35,000 MW, representing more than half the utility scale generation capacity at the time.

A key aim of Australia’s G-PST research program is exploring how these distributed energy resources can best be monitored, coordinated and aggregated. And how we can ensure the security, stability and reliability of the country’s energy supply.



*The rise of renewable generated energy into our power system needs to be complemented by an expansion of storage capacity to mitigate dispatchability issues.*

### What are some of the findings from the Stage 2 reports?

Detailed Stage 2 reports are now available for each research area, and these outline the work completed to date, the remaining knowledge gaps, and the high priority tasks to be delivered in the short term.

Unsurprisingly, given the rapid uptake of solar photovoltaics in Australia, which is expected to continue over the coming decades, there is a major focus on what this might mean for the power system.



## LOCAL NEWS

This includes the inverter technology itself, as well as dispatchability and grid stability.

"In the decarbonised world that Australia is heading towards, the types of generation technology that provide electricity have different stability characteristics," Thomas said.

"In essence, they produce electricity through power electronics rather than rotating machines. That requires new ways of managing and controlling how everything works so grid connected devices don't interfere with each other in a disruptive way.

"The new technologies are also not as dispatchable. We can't choose when the sun will shine and the wind will blow, so that means we need to make sure there's enough storage and transmission to build up reserves of energy when there's an excess of wind and solar and use those reserves at times when it's deficient," he said.

Researchers are helping address both issues by developing methods and tools to evaluate and improve system stability and ensure reliable grid integration as renewable electricity continues to expand.

Another interesting area for researchers is black start capability: the ability of a power system to get back up and running after a blackout. Thankfully, such an occurrence is a rare event in Australia, and the processes for restoration are well planned in advance. But with significant changes occurring to our power system, it's important to explore what adaptations may need to happen.

Thomas said this research is largely related to problems that most people shouldn't ever have to worry about.

"The role of power engineers and researchers is to look at potential problems coming down the pipeline and make sure those are dealt with well before there is any drama. Blackout recovery is that type of problem. Hopefully it's something you'll never have to worry about," Thomas said.

"So what we are doing now is looking into the extent that new technologies can reliably replace all the functions of traditional technologies, or whether we'll need to retain some existing devices in the system as backup."

### What comes next? Stage 3 reports and beyond

The Stage 2 G-PST reports provide a useful midstream update on how this enormous and vitally important body of work is progressing.

The program of research that began with the launch of the Australia's G-PST Roadmap in mid-2022 is anticipated to take three to five years to complete. However, the research partners will revisit the G-PST Roadmap on an annual basis to update the direction as circumstances change.

There is other related work taking place in parallel to the G-PST process, including [AEMO's Engineering Roadmap to 100% Renewables \(PDF, 4.3MB\)](#). Taken as a whole, these initiatives provide the necessary foundation for Australia's transition to a stable, secure and affordable low-emissions power system.

"Although Australia is moving quickly along our renewable electricity generation journey, and facing some unique challenges, we are not alone. By sharing experience and analysis within a global community of countries in a similar transition, working together rather than independently, we will learn from each other to bring about a more secure and reliable outcome," Thomas said.





## HISTORY

# NEW EVIDENCE SUGGESTS THE WORLD'S LARGEST KNOWN ASTEROID IMPACT STRUCTURE IS BURIED DEEP IN SOUTHEAST AUSTRALIA

By Andrew Glikson | 10 August 2023 | Source: [The Conversation](#)

In [recent research](#) published by myself and my colleague Tony Yeates in the journal *Tectonophysics*, we investigate what we believe – based on many years of experience in asteroid impact research – is the world's largest known impact structure, buried deep in the earth in southern New South Wales.

The Deniliquin structure, yet to be further tested by drilling, spans up to 520 kilometres in diameter. This exceeds the size of the near-300km-wide [Vredefort](#) impact structure in South Africa, which to date has been considered the world's largest.

### Hidden traces of Earth's early history

The history of Earth's bombardment by asteroids is largely concealed. There are a few reasons for this. The first is erosion: the process by which gravity, wind and water slowly wear away land materials through time.

When an asteroid strikes, it creates a crater with an uplifted core. This is similar to how a drop of water splashes upward from a transient crater when you drop a pebble in a pool.

This central uplifted dome is a key characteristic of large impact structures. However, it can erode over thousands to millions of years, making the structure difficult to identify.

Structures can also be buried by sediment through time. Or they might disappear as a result of subduction, wherein tectonic plates can collide and slide below one another into Earth's mantle layer.

Nonetheless, new geophysical discoveries are unearthing signatures of impact structures formed by asteroids that may have reached tens of kilometres across – heralding a paradigm shift in our understanding of how Earth evolved over eons. These include pioneering discoveries of impact "ejecta", which are the materials thrown out of a crater during an impact.

[Researchers think](#) the oldest layers of these ejecta, found in sediments in early terrains around the world, might signify the tail end of the Late Heavy Bombardment of Earth. The [latest evidence](#) suggests Earth and the other planets in the Solar System were subject to intense asteroid bombardments until about 3.2 billion years ago, and sporadically since.

Some large impacts are correlated with mass extinction events. For example, the [Alvarez hypothesis](#), named after father and son scientists Luis and Walter Alvarez, explains how non-avian dinosaurs were wiped out as a result of a large asteroid strike some 66 million years ago.

### Uncovering the Deniliquin structure

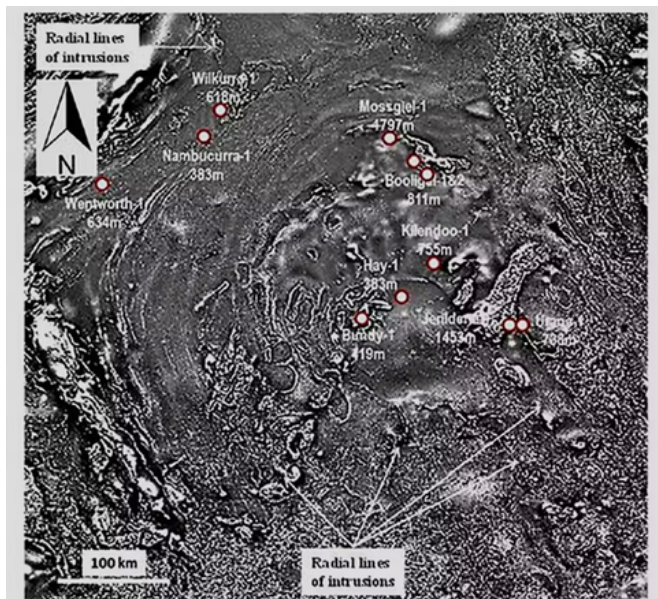
The Australian continent and its predecessor continent, [Gondwana](#), have been the target of numerous asteroid impacts. These have resulted in at least 38 confirmed and 43 potential impact structures, ranging from relatively small craters to large and completely buried structures.

## HISTORY

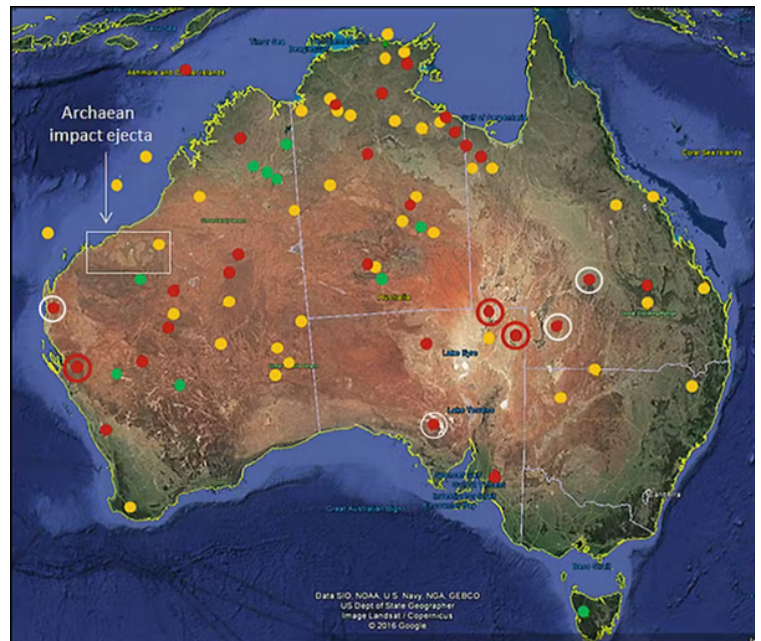
As you'll recall with the pool and pebble analogy, when a large asteroid hits Earth, the underlying crust responds with a transient elastic rebound that produces a central dome.

Such domes, which can slowly erode and/or become buried through time, may be all that's preserved from the original impact structure. They represent the deep-seated "root zone" of an impact. Famous examples are found in the Vredefort impact structure and the 170km-wide Chicxulub crater in Mexico. The latter represents the impact that caused the extinction of the dinosaurs.

Between 1995 and 2000, Tony Yeates suggested magnetic patterns beneath the Murray Basin in New South Wales likely represented a massive, buried impact structure. An analysis of the region's updated geophysical data between 2015 and 2020 confirmed the existence of a 520km diameter structure with a seismically defined dome at its centre.



This 'total magnetic intensity' image of the Deniliquin impact structure portrays its 520km-diameter multi-ring pattern, the central core, radial faults and the location of shallow drill holes. Data from Geoscience Australia, published in Glikson and Yeates, 2022



This map shows the distribution of circular structures of uncertain, possible or probable impact origin on the Australian continent and offshore. Green dots represent confirmed impact craters. Red dots represent confirmed impact structures that are more than 100km wide, whereas red dots inside white circles are more than 50km wide. Yellow dots represent likely impact structures. *Andrew Glikson and Franco Pirajno*

The Deniliquin structure has all the features that would be expected from a large-scale impact structure. For instance, magnetic readings of the area reveal a symmetrical rippling pattern in the crust around the structure's core. This was likely produced during the impact as extremely high temperatures created intense magnetic forces.

A central low magnetic zone corresponds to 30km-deep deformation above a seismically defined mantle dome. The top of this dome is about 10km shallower than the top of the regional mantle.

Magnetic measurements also show evidence of "radial faults": fractures that radiate from the centre of a large impact structure. This is further accompanied by small magnetic anomalies which may represent igneous "dikes", which are sheets of magma injected into fractures in a pre-existing body of rock.

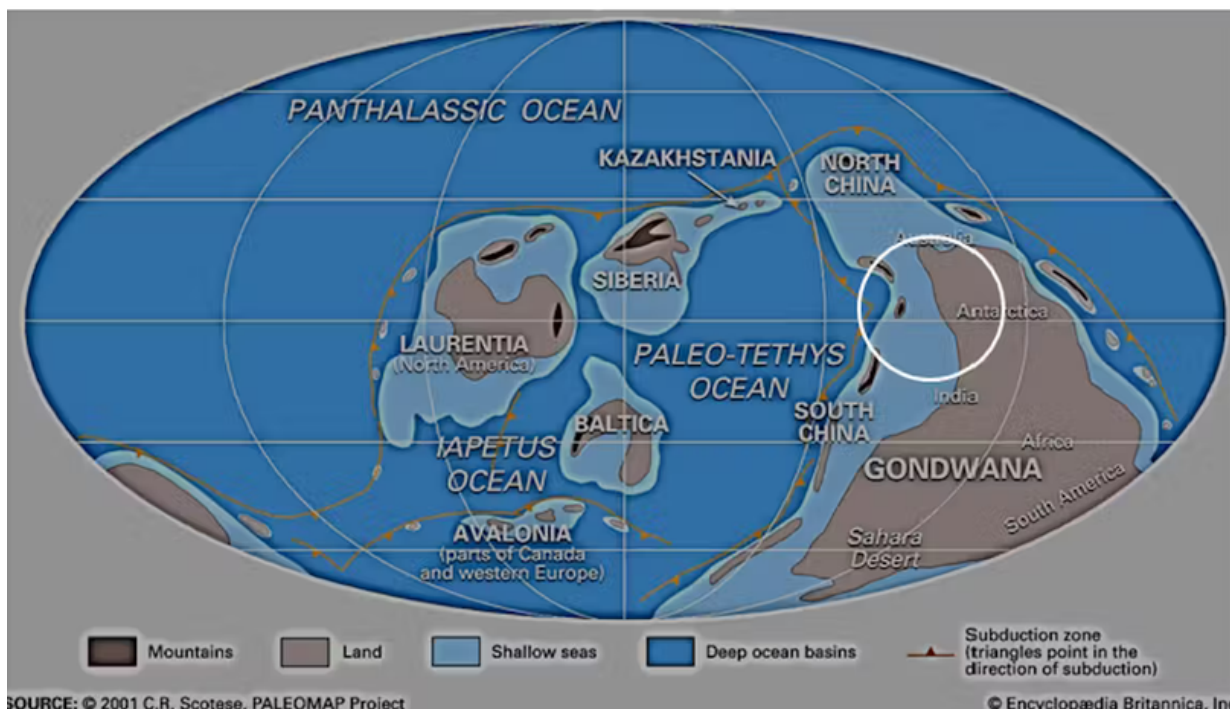
## HISTORY

Radial faults, and igneous sheets of rocks that form within them, are typical of large impact structures and can be found in the Vredefort structure and the [Sudbury impact structure](#) in Canada.

Currently, the bulk of the evidence for the Deniliquin impact is based on geophysical data obtained from the surface. For proof of impact, we'll need to collect physical evidence of shock, which can only come from drilling deep into the structure.

### When did the Deniliquin impact happen?

The Deniliquin structure was likely located on the eastern part of the Gondwana continent, prior to it splitting off into several continents (including the Australian continent) much later.



The Deniliquin structure was likely created in eastern Gondwana during the Late Ordovician. [Zhen Qiu et al. 2022, CC BY](#)

The impact that caused it may have occurred during what's known as the Late Ordovician mass extinction event. Specifically, I think it may have triggered what's called the [Hirnantian glaciation stage](#), which lasted between 445.2 and 443.8 million years ago, and is also defined as the [Ordovician-Silurian extinction event](#).

This huge glaciation and mass extinction event [eliminated](#) about 85% of the planet's species. It was more than double the scale of the [Chicxulub impact](#) that killed off the dinosaurs.

It is also possible the Deniliquin structure is older than the Hirnantian event, and may be of an early Cambrian origin (about 514 million years ago). The next step will be to gather samples to determine the structure's exact age. This will require drilling a deep hole into its magnetic centre and dating the extracted material.

It's hoped further studies of the Deniliquin impact structure will shed new light on the nature of early [Paleozoic](#) Earth.



## EV NEWS

# HOW A SINGLE DEVICE HELPS EVS PROVIDE COST-EFFECTIVE BACKUP POWER TO HOMES

By Chris Warren | 31 May 2023 | Source: [EPRI Journal](#)

## The Smart Power Integrated Node (SPIN) delivers backup power along with cost savings and grid support in one small box

In the summer of 2020, California's grid strained to keep up with demand for electricity during a scorching heat wave. In August of that year, rolling [outages](#) impacting hundreds of thousands of customers were initiated because not enough capacity was available to keep up with demand. The outages triggered the California Independent System Operator (CAISO), the California Public Utilities Commission (PUC), and the California Energy Commission (CEC) to issue a joint root cause [analysis](#) that found that extreme weather, market practices, and resource adequacy and planning processes combined to necessitate the power shutoffs.

At the individual household level, however, the experience of rolling blackouts and the potential for more triggered many people to investigate the potential for energy storage to provide backup power during outages. "What people are doing if they already have solar on the roof is to start to install storage," said Sunil Chhaya, an EPRI senior technology executive who leads electric vehicle (EV) and energy system integration efforts. "Solar companies do it now, and an income tax credit incentivizes it. So, when the lights go out, you can automatically switch over to storage."

Pairing rooftop solar with energy storage is a practical and reliable solution to deliver backup power during infrequent grid outages. But it's also a pricey solution that is well outside of the financial reach of many. For example, a typical behind-the-meter energy storage unit that provides about 10 kilowatt-hours of capacity – enough to deliver two to three hours of backup power to the typical home – costs about \$15,000 to install.

But there's another potential backup power solution that may already be available to Californians and other Americans: the EV sitting in their driveway. "There are a lot more people who have EVs than have storage," Chhaya said. "So, the question is this: can we use EV batteries that have 60, 80, or 100 kilowatt-hours and have already been paid for to provide backup power to the home?"



## A New SPIN on Bidirectional Charging

There is no lack of research and discussion today about the future potential of EV batteries to provide backup power. But there are not yet any commercially available bidirectional chargers able to take electricity out of an EV battery and use it to provide backup power directly to a building. "Today, you can find vehicle-to-grid technology that only works when the grid is on," Chhaya said. "It doesn't work when the grid is off, and it only sends power from the vehicle to the grid, not to the home where it's needed."





## EV NEWS

But there is another potential solution for both tapping EV batteries for backup power and enabling EV owners to earn revenue for providing grid services and helping utilities reduce their peak load. Since 2016, EPRI has worked with Flex Power Control on developing and testing the Smart Power Integrated Node, or SPIN. SPIN is a single device with the intelligence to automatically manage a business or household's solar, EV, and stationary storage assets to achieve the building owner's priorities. For example, SPIN can automatically sense a power outage, instantly provide backup power, and send power back to the grid.

Each SPIN includes multi-port bidirectional inverters that connect both to the grid and to a home or business's solar, EV, and storage units. Each device also has a power routing matrix comprising multiple switches that connect each of the DERs and the grid in multiple configurations. Importantly, SPIN also has a brain in the form of control and coordination software that optimizes how each asset operates in grid-tied and standalone modes. Initially supported with EPRI Technology Innovation (TI) funding, SPIN has since received funding from the U.S. Department of Energy (DOE), the California Energy Commission (CEC), and the National Renewable Energy Laboratory (NREL).

For example, DOE funding supported the initial prototype development using commonly available electronic components. After demonstrating its ability to control power flow, Flex Power Control built a more sophisticated prototype that was then tested at DOE's Oak Ridge National Laboratory. There, the device was able to perform fast EV charging, dispatch an EV battery's electricity to the grid, and deliver backup power during an outage using rooftop solar and EV batteries.

Over the course of numerous projects with EPRI, DOE, and other researchers, SPIN has repeatedly demonstrated its functionality, including support for the grid. For example, in one study, the University of Kentucky researchers simulated a feeder with 70 houses. Each of the simulated houses included a 7-kilowatt solar system, a 10-kilowatt-hour energy storage system, an EV charger, and a SPIN to manage the DERs. SPIN was able to reduce the feeder's peak load by 42 percent. "Our initial challenge was to develop the technology, improve it, and show that it works and delivers value," said Greg Smith, a founder of Flex Power Control, who formerly worked as an engineer at General Motors. "We have proven the technology works and shown the potential value proposition."

### **How SPIN Provides Backup Power With Minimal EV Battery Impacts**

EPRI summarized the research results funded by DOE and the CEC in the report [Battery Performance Assessment of Vehicle-to-Grid Capable Electric Vehicles: Testing Methodology and Experimental Results](#). Among other things, the report confirms SPIN's ability to deliver backup power from an EV battery. The report also quantifies how much battery degradation would result when the battery powered an EV and was used in a home.

To do that, researchers at NREL tested two 17-kilowatt-hour battery packs made by LG Chem that are used in Pacifica plug-in hybrid minivans. One of the batteries was charged and discharged three times each day for over 12 months to simulate an EV used for driving and delivering energy to a home. That translated into about 11.7 kilowatt-hours for transportation and 5 kilowatt-hours to the building. To compare the degradation impact of those vehicle-to-building discharges, the second battery was cycled an equal number of times daily for the same duration of time. But its discharges only simulated what was needed for driving.

By cycling the batteries three times per day, the NREL researchers were able to collect data representing about four years of operation. The test results showed that using the EV battery for typical driving and vehicle-to-building discharge had a small impact on battery degradation. For instance, the battery that provided energy for driving and a building had about 90 percent of its original capacity at the end of the testing period; by comparison, the driving-only battery had about 95 percent of its original capacity. Using these degradation rates, the researchers concluded that over 10 years, the driving-only battery would retain 82 percent of its original capacity. In contrast, the battery pulling double duty would have 77 percent of its capacity.



## EV NEWS

### Benefits Beyond Backup Power

Clearly, an EV battery won't be called on daily to provide backup power to a home as power outages remain rare. But testing the battery as if it was being dispatched from the vehicle to a building daily also provided insights about the ability of a SPIN-managed EV to deliver additional benefits.

For example, the soon-to-be-published EPRI report includes an analysis of the potential bill savings that could come from using SPIN to shift EV charging to times when electricity rates are lowest. The potential annual bill savings for a residential customer were estimated to be almost \$1200. Commercial customers using SPIN to manage charging could save over \$2000 annually from lower energy costs and avoided demand charges.

The report also detailed a range of other utility, grid, and societal benefits EVs managed by SPIN can deliver. For example, 200 EVs equipped with bidirectional charging could reduce annual peak load by 750 kilowatts. By assuming an avoided cost of infrastructure of \$25 per kilowatt, that would result in savings of more than \$280,000 over 15 years.

Large numbers of EVs with bidirectional charging capabilities could also substantially reduce the amount of renewable energy that must be curtailed. According to EPRI, about 1500 gigawatt-hours of renewables were curtailed in 2020. But if 500,000 EVs were to charge when electricity prices are low in the late morning and late night and then discharge when demand and prices are high in the early morning and late afternoon, the curtailment would be far lower. According to EPRI's analysis, 332 gigawatt-hours would not need to be curtailed. A [bill](#) recently introduced to the California state legislature would mandate that all EVs sold in the state be bidirectional capable by model year 2027.

For utility customers – particularly those that have already purchased an EV and solar – integrating SPIN also promises to dramatically reduce the costs associated with securing backup power. By eliminating the need to install stationary storage and an inverter, SPIN can eliminate the \$15,000 needed to purchase a 10-kilowatt-hour battery. In addition, with SPIN, there is no need for either a \$1750 solar PV inverter or an EV charger. According to the EPRI report, these components cost \$28,000, compared to the \$7000 to purchase and install SPIN. EPRI will be publishing three more SPIN-related research papers in the next year.

### The Road Ahead

Sunil Chhaya has been deeply involved in helping SPIN move through the many development and testing stages over the past seven years. He believes the device is ready to begin delivering benefits to utility customers, utilities, and the grid. "This is one step away from large-scale deployment," Chhaya said. "That's because it's a no-brainer. It removes a lot of hardware from the house needed for DERs. Especially for new construction, it's a no-brainer because you would just need to put it in as part of the electric panel."

For SPIN to move towards the large deployment Chhaya envisions, the next step is to receive Underwriters Laboratories (UL) certification. UL certification is expensive, and Flex Power Control is currently seeking funding to achieve certification. "Certification is really about starting a production line because for certification to occur, it's done with the products you are actually going to produce," Smith said. "It's really a product launch."

Flex Power Control now has two versions of SPIN to simplify and speed up the certification and production process. The initial focus will be on the SPIN-EVO, a bidirectional charger that can provide backup power to a home during outages. For homes already equipped with PV or storage backup, EVO adds the EV backup component only. Its addition is akin to a retrofit.

## EV NEWS



The second version, SPIN-MPX, is a bidirectional charger but also integrates inverters for solar, stationary storage, and the EV and manages all the assets according to a customer's priorities. The SPIN-MPX is more suitable for new construction or new installations because it removes the need for duplicative hardware and complexity. Instead of a separate EV charger and solar and storage inverter, new installations only require a single SPIN-MPX. Once certification is secured, Smith says SPIN devices will be available to customers through a distributor able to install and service the device.

As Flex Power Control continues to pursue the funding needed to become UL certified, the company is also actively pursuing opportunities to collaborate with utilities on pilot projects. One of the main reasons to engage with utilities is to elevate awareness about how SPIN functions and what benefits it can provide. "We want to get people to experience it so that they know it is what we say it is," Smith said. "We would first want to work with utilities in their own lab because we think it's important for them to get comfortable with it. Then we would want to do a field pilot with a limited number of customers to help determine the best use for the device at their location."

## EV NEWS

# FORD PATENTS HINT AT EV CHARGING WHILE DRIVING

By Stephen Edelstein | 2 Aug 2023 | Source: [Motor Authority](#)

Ford is exploring patent technology that could allow EVs to charge while driving, using hardware embedded in the road.

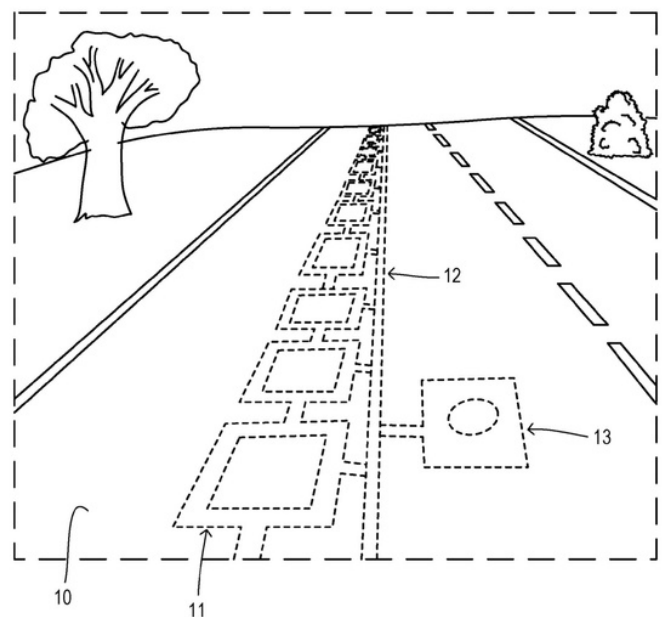
Published by the United States Patent and Trademark Office (USPTO) on July 20, 2023, and originally filed Jan. 20, 2022, a Ford patent application titled "Roadway Charging Coil Alignment and Monitoring" aims to apply wireless inductive charging to vehicles in motion.

Wireless inductive charging uses coils mounted in a transmitter (connected to a source of electricity) and a receiver mounted on the vehicle to transmit electricity wirelessly. Some companies have developed wireless-charging systems based on this principle for stationary applications—and Ford has filed [a separate patent application](#) for that use.

In this application, though, Ford discusses embedding inductive-charging coils in the road and using them to charge moving vehicles. This requires the receiver on the vehicle to be aligned with a line of coils in the road surface. Ford notes that drivers could maintain alignment by following lane markings, or be guided by a camera or other sensors designed to read lane markings.

However, this still leaves room for misalignment of the car and in-road charging coils, which reduces charging efficiency, according to Ford. So the automaker proposes equipping vehicles with ground penetrating radar to home in on the coils. Radar data could then be fed into a control system that would automatically adjust steering for optimal charging.

In-motion wireless charging has been tried before. In 2017, Renault and Qualcomm (which subsequently sold its wireless charging patents to WiTricity) claimed to have [charged a car at 60 mph](#) on a test track. In 2020, electric trucks were [successfully charged](#) while driving down a short stretch of road in Sweden. If it reaches production, Ford's radar system might make this type of charging more reliable. However, such a system would also require a large infrastructure investment, and the roads would have to be chosen wisely for greatest impact.



Ford in-road wireless EV charging patent image

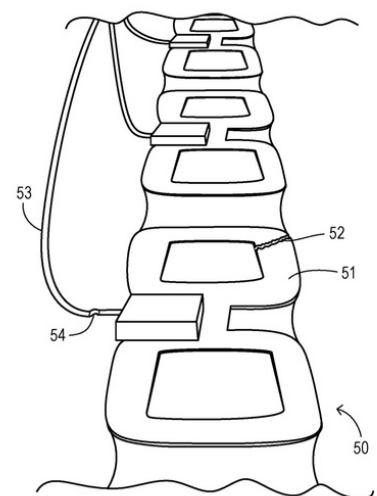


Fig. 4

Ford in-road wireless EV charging patent image



## EV NEWS

# CUSTOMERS TO BE PAID BY NETWORK TO CHARGE EVS IN AUSTRALIAN FIRST TRIAL

By Jacinta Bowler | 10 Aug 2023 | Source: [The Driven](#)

Customers who are part of AusNet's distribution network may be eligible to join a three-year trial to be paid to charge their EVs at certain times of the day.

The trial is being described as an Australian first and will run from July 2023 to June 2026 with up to 300 people taking part per year.

"The aim of this trial is to see if EV customers respond to network pricing signals and to get a better understanding of customers charging patterns," says Liz Ryan, AusNet's head of strategy, regulation and corporate affairs.

"From this, we hope to gain the knowledge to better manage potential network issues which may arise as the take-up of electric vehicles increases."



ELECTRIC VEHICLE CHARGING. SOURCE: UNSPLASH – ED HARVEY

The AusNet developed tariff will pay 1 cent per kWh for every kWh charged between 10 am and 3pm. There will also be a separate, SMS rebate system to alert people when is best to start or stop charging.

This will be a payment of \$1 for every kW the customer decreases or increases their use. This will be a minimum of 3kW and capped at 6 kW. A spokesperson told TheDriven that they may call up to 10 such events per financial year.

"AusNet will provide customers participating in the trial with a rebate when they respond to SMS requests to change their charging behaviour," said Ryan.

"The SMS would be activated to help AusNet manage high excess solar capacity in the network or when there is high electricity demand."

Most electric vehicle charging happens at homes. Charging during the day – specifically between the hours of 10am and 3pm – [is better for the grid](#) because of the extra solar power produced, and also when less power is being used in homes. Grid systems need to be set up so they can pump enough energy through the system to satisfy our energy use at peak demand. But with many of our appliances and products electrifying – like stoves, heating and cars – networks are making sure that EVs at least are charged out of peak times.

If energy companies can convince people to undertake energy intensive activities during off-peak times, or times when there's more solar energy available to be used, it will mean less battery storage is required, less grid infrastructure and hopefully lower premiums.

[A report published by Ergon and Energex earlier this year](#) found that most EV owners are happy to be flexible about charging their cars, using more solar and less grid power during peak times.

"We encourage AusNet's distribution network customers with EVs to contact their retailer and ask about this trial," said Ryan.

"Learnings from the trial will help inform the development and design of tariffs to complement the adoption of electric vehicles and other emerging technologies."



## EV NEWS

# EPRI LAUNCHES COLLABORATIVE INITIATIVE TO SUPPORT WIDESCALE NATIONAL EV ROLLOUT

7 Aug 2023 | Source [EPRI](#)

Amazon, U.S. Department of Energy Among Leading Participants PALO ALTO, Calif. (Aug. 7, 2023) -- Industry and U.S. government goals continue to drive the volume of electric vehicles (EVs) on the nation's roads---from cars to heavy-duty trucks. EPRI is leading a new, three-year initiative - EVs2Scale2030TM - that will collaborate with more than 500 stakeholders including Amazon, the U.S. Department of Energy, and leading electric companies to ready the electric grid in support of the accelerated development of EV charging infrastructure.

EVs2Scale2030TM includes electric companies, fleet operators, auto and truck manufacturers, and charging providers, in coordination with federal agencies and national labs, the Edison Electric Institute, the American Public Power Association, the National Rural Electric Cooperative Association, and the Alliance for Transportation Electrification.

Amazon is the first logistics provider to join the initiative. Founding electric company members include: Austin Energy, CenterPoint Energy, Con Edison, FirstEnergy, Great River Energy, National Grid, New York Power Authority, Omaha Public Power District, Pacific Gas & Electric, Portland General Electric, Sacramento Municipal Utility District, Salt River Project, Seattle City Light, Southern California Edison, Southern Company, and Xcel Energy. Additional data collaborators include Daimler Truck North America, PACCAR, Volvo Group North America, and World Resources Institute.

"Collaboration, coordination, and standardization will be critical for the U.S. to meet its 2030 EV targets," said EPRI President and CEO Arshad Mansoor. "EVs2Scale2030TM will bring together all of the key industry stakeholders to identify and address the challenges and opportunities needed to drive toward an affordable, equitable, and reliable clean energy future."

Among key resources, the initiative plans to create:

- A 50-state visualization and 2030 roadmap identifying the aggregated and anonymized electric vehicle loads, grid impacts, utility lead times, workforce requirements, and costs;
- An online platform that defines the cross-industry processes needed to support the pace of activity and investment required to meet large-scale electrification by 2030; and
- A secure data exchange platform for fleet operators and charging providers that allows energy companies to better plan and prioritize investments in grid upgrades.

"Amazon is committed to decarbonizing our transportation network, and we're rapidly rolling out thousands of electric vehicles to help us reach net-zero carbon by 2040," said Udit Madan, vice president of Amazon Transportation. "No one company can solve the climate challenge alone, and stakeholders across the industry need to come together to transform fleets at an unprecedented scale and speed to meaningfully impact emissions. We are proud to join EPRI's EVs2Scale2030TM initiative and will continue to work to give utilities the tools and information they need to successfully electrify the transportation sector."



## EV NEWS

"For the U.S. to meet its ambitious electric vehicle goals, the public and private sectors must unite to address what's needed," said Brett C. Carter, chair of EVs2Scale2030™ and executive vice president and group president, utilities, and chief customer officer of Xcel Energy. "From wires to wheels and everything in between, consumers need to have confidence in EV charging availability, reliability, and affordability, without compromising current energy resources. EVs2Scale2030™ will be essential as we address challenges on behalf of the customers and communities we are privileged to serve," he added.

"DOE is partnering with EPRI, vehicle makers, and fleets to develop tools that utilities can use to inform the deployment of chargers," said Michael Berube, deputy assistant secretary for Sustainable Transportation and Fuels in the Department of Energy. "Through this partnership, we are combining the technical expertise of the DOE national labs with EPRI's knowledge of the industry and data to accelerate decision-making towards a clean, reliable, and accessible EV future."

## EV NEWS

# CHINA IS PROPELLING ITS ELECTRIC TRUCK MARKET BY EMBRACING BATTERY SWAPPING

By Hongyang Cui, Yihao Xie, and Tianlin Niu | Aug 2023 | Source: [The Driven](#)

China is widely known as the world's largest market for electric cars and buses, but did you know that it's also leading in the race to electric trucks?

Indeed, based on data from EV-volumes.com, in 2022, China sold 36,000 electric trucks, 91% of the global total. And no country except China has ever sold more than 1,000 new electric trucks in a single year.

In recent years, China gradually shifted its vehicle-electrification policy efforts to trucks, which are responsible for a disproportionate share of nitrogen oxides (NOx), particulate matter (PM), and carbon dioxide (CO2) emissions in the nation's vehicle fleet.



Besides various fiscal and non-fiscal incentives offered to electric trucks, support for battery swapping is playing a key role. The Chinese national government and several local governments have encouraged battery-swapping technology since 2020 and the share of swap-capable vehicles in China's electric truck sales has been increasing.

In 2022, 49.5% of the electric trucks sold in China were swap-capable. These swap-capable electric trucks are mainly used for short-haul applications at ports, mining sites, and in urban logistics. They are typically equipped with a 141 kWh or 282 kWh battery and have a typical one-way trip length of less than 100 km.

Compared with today's plug-in charging technologies, the key advantage of battery swapping is the short time required to recharge. With plug-in charging, it usually takes 40 minutes with DC fast charging or several hours via regular charging to recharge an electric truck.

In contrast, battery swapping only takes 3–6 minutes. This speed can be appealing for truck owners because trucks are used for commercial purposes; faster charging leaves more time to deliver goods and generate profits.

To collect firsthand information, we visited several battery-swapping stations for electric trucks in China this summer. We saw that electric trucks usually pulled into the battery-swapping station with a battery state of charge (SOC) of 20%–30%. A robotic arm reaches down from above, takes out the depleted batteries—these weigh approximately 3 tons and are stored behind the driver's cab—and puts them into storage for recharging. Then the robotic arm takes out fully charged batteries stored by the station and inserts them into the vehicle. After that, the vehicle can drive away and return to operation.



## EV NEWS



On the left, a battery-swapping station in Hainan province used by electric concrete mixers and on the right, a station in Shaanxi province used by electric tractor-trailers. Photos by Tianlin Niu.

The battery-swapping stations we visited typically store seven batteries. Depleted batteries swapped from vehicles are charged using DC fast chargers and recall that these need about 40 minutes to get fully recharged.

By the time all seven batteries are swapped and the eighth vehicle comes to the station, the first swapped battery has completed recharging and can be used to swap the depleted battery of the eighth vehicle.

Though battery swapping is gaining in popularity in China today, there are still some hurdles to clear before it becomes widely commercialized. The first is a lack of standardization of batteries. Batteries produced by different manufacturers can vary in shape, size, and how they are connected with vehicles.

Thus, at present, truck drivers can only swap batteries at certain battery-swapping stations that can meet their needs. Next is high cost.

Based on our interviews with station owners, setting up a battery-swapping station costs around ¥7–8 million (~US\$1–1.1 million) today; half of the cost is the batteries stored in the station and the other half comes from equipment, cables, and transformers.

In October 2021, the Chinese national government initiated a [two-year pilot program](#) to promote battery swapping. Eleven cities were selected as the first batch of pilot cities, and three of them are expected to fully focus on swap-capable truck applications.

The other eight cities are expected to demonstrate battery swapping on both electric cars and trucks. The program aims to put at least 100,000 swap-capable electric vehicles on the road and build at least 1,000 battery-swapping stations.

As mentioned above, some Chinese provinces and cities are also using their own funds to subsidize the construction of battery-swapping stations. Hainan province, for example, provides subsidies equal to 15% of the total construction cost of a battery-swapping station.

With this strong policy support, it's likely we'll see more swap-capable trucks and battery-swapping stations deployed in China in the coming years.

At the same time, China is not putting all of its proverbial eggs in the battery-swapping basket. Indeed, it's among the markets that are most actively developing ultra-fast (i.e., megawatt-level) plug-in charging technologies, as evidenced by the [Chaoji standard](#) that China is developing in collaboration with Japan.

As the largest truck market and also the largest electric truck market in the world, China's engagement with diverse charging solutions will provide valuable learning for other markets as they seek to transition to electric trucks.

## EV NEWS

# WHICH AUSTRALIAN POSTCODES HAVE THE HIGHEST EV UPTAKE?

By Rachel Williamson | 14 Aug 2023 | Source: [The Driven](#)



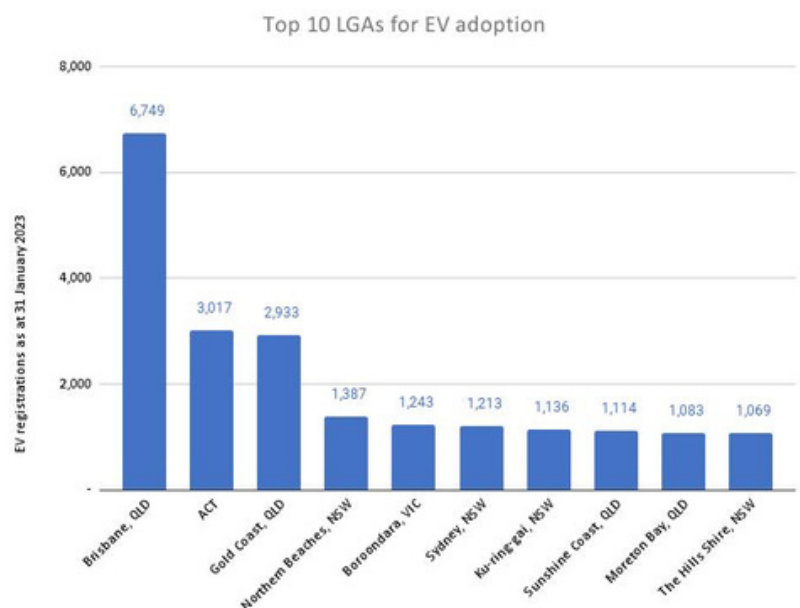
New data has revealed that Brisbane and the Gold Coast make up two of the top three Local Government Areas in Australia with the highest number of total electric vehicles (EVs) registered, as at the end of January 2023.

The data, collected by the Australian Automobile Association (AAA), paints a mixed picture of who is buying and registering EVs and where. But to find the ACT (predictable) sandwiched between the two Sunshine State locales is a bit of a surprise.

But while Brisbane and the Goldie's surging EV registrations are the backbone for Queensland's total EV adoption figures, penetration of battery cars into other parts of the state isn't as strong as in NSW and Victoria, where strong uptake of EVs is spread more evenly across LGAs in the major centres.

It means these two states are still leading as the country's EV uptake, in spite of government policies in Victoria that are actively disincentivising electric adoption.

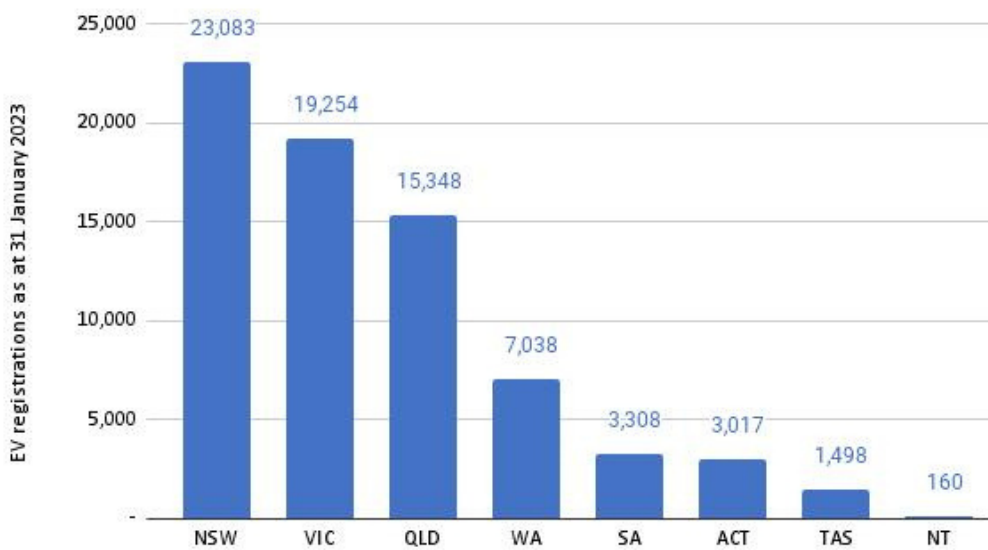
Both states are funding the rollout of EV chargers.





## EV NEWS

EV adoption across Australia



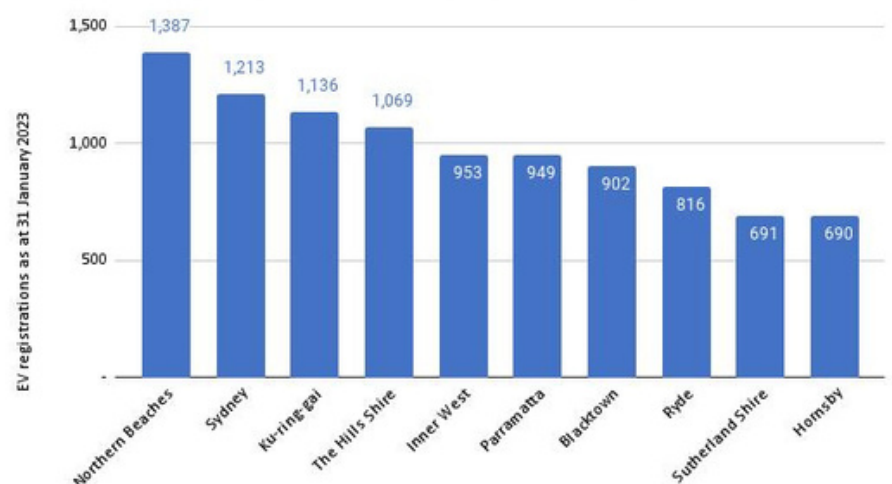
National vehicle registration figures show that BEV penetration of the Australian light vehicle fleet doubled between 31 January 2022 and 2023, rising from 0.18 per cent to 0.38 per cent.

The ACT has the country's highest BEV penetration of 0.97 per cent of all light vehicle registrations as at 31 January 2023 — a milestone that's easier to reach with its small population than the next closest, NSW with 0.41 per cent and Victoria with 0.39 per cent.

Well-heeled Sydney LGAs on the outskirts of the city – the Northern Beaches, Ku-ring-gai, and Hornsby – led the state in EV adoption but Blacktown, one of the country's most diverse areas according to the 2021 census and a suburb one redditor last year called “boring but mostly pleasant”, rounded out the top 10.

Victoria's top 10 however were almost entirely clustered in Melbourne's east, with only Melbourne city deviating from that norm.

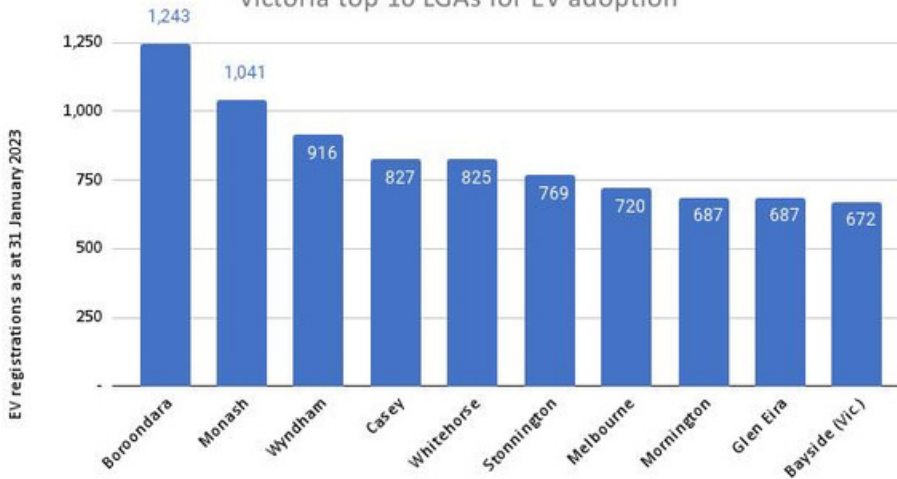
New South Wales top 10 LGAs for EV adoption





## EV NEWS

Victoria top 10 LGAs for EV adoption

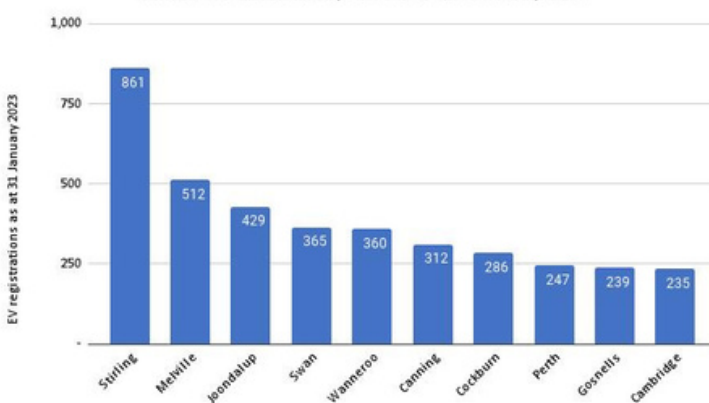


Although Brisbane and Gold Coast are the national hotspots in terms of Local Government Areas for EV adoption, not much else is happening outside the main centres.

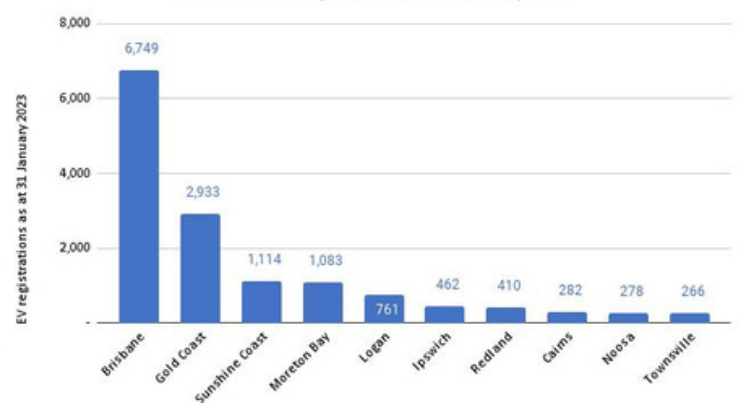
Queensland and Western Australia have below-average penetration rates of battery electric vehicles and hybrids, the AAA found.

Since this data was collected, Queensland has doubled the size of the rebates available for EVs to \$6000 but also muddied the waters on how owners can charge them by restricting more powerful chargers from using electricity from an owner's own rooftop solar panels.

Western Australia top 10 LGAs for EV adoption



Queensland top 10 LGAs for EV adoption



In Tasmania, EV registrations were below the national average at the end of January this year at 0.31 per cent compared to 0.38 per cent nationally, but sales in the June quarter as a proportion of all cars sold made it second only to the ACT.

EV sales reached 9.98 per cent in the June quarter compared to the national average of 8.67 per cent.

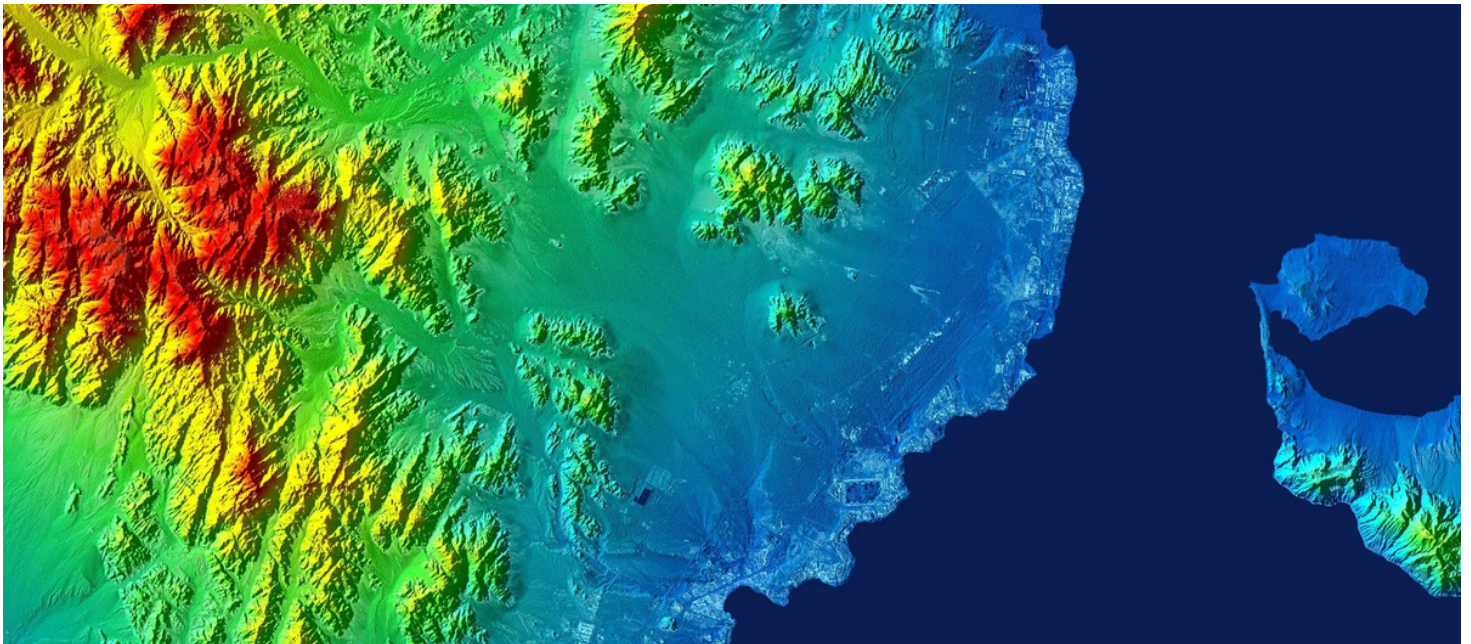
In the vast Northern Territory, hybrid vehicles are preferred over pure battery electric ones. In the June quarter, NT hybrid sales grew faster than BEV sales even though they were coming from an already much higher base, with 248 hybrid vehicles sold versus 63 EVs.



## INTERNATIONAL NEWS

### RADAR IMAGING COULD BE THE KEY TO MONITORING CLIMATE CHANGE

By Joanna Goodrich | 30 June 2023 | Source: [IEEE Spectrum](#)



*A digital elevation map of Sharm El Sheikh in the Sinai Peninsula, Egypt, generated in 2018 by a space-based interferometric synthetic-aperture radar system. The system's development was led by Alberto Moreira, director of the German Aerospace Center's Microwaves and Radar Institute, in Oberpfaffenhofen, Bavaria.*  
GERMAN AEROSPACE CENTER

As a child, [Alberto Moreira](#) discovered his passion for electronics from the kits for exploring science, technology, engineering, and mathematics that his father bought him every month. The kits taught him not only about electronics but also about chemistry and physics.

As he got older, he and his brother began making their own electronic circuits. When Moreira was 15, the duo built high-fidelity amplifiers and control panels for neon signs, selling them to small companies that used such displays to advertise their business.

Those early experiences ultimately led to a successful career as director of the [German Aerospace Center](#) (DLR)'s [Microwaves and Radar Institute](#), in Oberpfaffenhofen, Bavaria, where the IEEE Fellow developed a space-based interferometric synthetic-aperture radar system.

That InSAR system has generated digital elevation maps of the Earth's surface with unparalleled accuracy and resolution. The models now serve as a standard for many geoscientific, remote sensing, topographical, and commercial applications. Moreira's technology also helps to track the effects of [climate change](#).

For his "leadership and innovative concepts in the design, deployment, and utilization of airborne and space-based radar systems," Moreira is this year's recipient of the [IEEE Dennis J. Picard Medal for Radar Technologies and Applications](#). It is sponsored by [Raytheon Technologies](#).



## INTERNATIONAL NEWS

Moreira says he's honored to receive the "most prestigious award in the radar technologies and applications field." "It recognizes the 20 years of hard work my team and I put into our research," he says. "What makes the honor more special is that the award is from IEEE."

### Using radar to map the Earth's surface

Before Moreira and his team developed their InSAR system in 2010, synthetic-aperture radar systems were the state of the art, he says. Unlike optical imaging systems, ones that use SAR can penetrate through clouds and rain to take high-resolution images of the Earth from space. It can also operate at night.

An antenna on an orbiting satellite sends pulsed microwave signals to the Earth's surface as it passes over the terrain being mapped. The signals are then reflected back to the antenna, allowing the system to measure the distance between the antenna and the point on the Earth's surface where the signal is reflected. Using data-processing algorithms, the reflected signals are combined in such a way that a computationally generated, synthetic antenna acts as though it were a much larger one—which provides improved resolution. That's why the approach is called synthetic-aperture radar.

### **"The system is documenting changes taking place on Earth and facilitating the early detection of irreversible damage."**

While leading a research team at the DLR in the early 1990s, Moreira saw the potential of using information gathered from such radar satellites to help address societal issues such as sustainable development and the climate crisis. But he wanted to take the technology a step further and use interferometric synthetic-aperture radar, InSAR, which, he realized, would be more powerful.

SAR satellites provide 2D images, but InSAR allows for 3D imaging of the Earth's surface, meaning that you can map topography, not just radar reflectivity.

It took Moreira and his team almost 10 years to develop their InSAR system, the first to use two satellites, each with its own antenna.

Their approach allows elevation maps to be created. The two satellites, named TerraSAR-X and TanDEM-X, orbit the Earth in almost circular orbits, with the distance between the satellites varying from 150 to 500 meters at any given time. To avoid collisions, Moreira and his team developed a double helix orbit; the satellites travel along an ellipse and corkscrew around each other.

The satellites communicate with each other and with ground stations, sending altitude and position data so that their separation can be fine-tuned to help avoid collisions.

Each satellite emits microwave pulses and each one receives the backscattered signals. Although the backscattered signals received by each satellite are almost identical, they differ slightly due to the different viewing geometries. And those differences in the received signals depend on the terrain height, allowing the surface elevation to be mapped. By combining measurements of the same area obtained at different times to form interferograms, scientists can determine whether there were subtle changes in elevation in the area, such as rising sea levels or deforestation, during the intervening time period.

The InSAR system was used in the DLR's 2010 TanDEM-X mission. Its goal was to create a topographical map of the Earth with a horizontal pixel spacing of 12 meters. After its launch, the system surveyed the Earth's surface multiple times in five years and collected more than 3,000 terabytes of data.



## INTERNATIONAL NEWS

In September 2016 the first global digital elevation map with a 2-meter height accuracy was produced. It was 30 times more accurate than any previous effort, Moreira says.

The satellites are currently being used to monitor environmental effects, specifically deforestation and glacial melting. The hope, Moreira says, is that early detection of irreversible damage can help scientists pinpoint where intervention is needed.

He and his team are developing a system that uses more satellites flying in close formation to improve the data available from radar imaging.

“By collecting more detailed information, we can better understand, for example, how the forests are changing internally by imaging every layer,” he says, referring to the emergent layer and the canopy, understory, and forest floor.

He also is developing a space-based radar system that uses digital beamforming to produce images of the Earth’s surface with higher spatial resolution in less time. It currently takes radar systems about 12 days to produce a global map with a 20-meter resolution, Moreira says, but the new system will be able to do it in six days with a 5-meter resolution.

Digital beamforming represents a paradigm shift for spaceborne SAR systems. It consists of an antenna divided in several parts, each of which has its own receiving channel and analog-to-digital converter. The channels are combined in such a way that different antenna beams can be computed a posteriori to increase the imaged swath and the length of the synthetic aperture—which allows for a higher spatial resolution, Moreira says. He says he expects three such systems to be launched within the next five years.

### A lifelong career at the DLR

Moreira earned bachelor’s and master’s degrees in electrical engineering from the [Instituto Tecnológico de Aeronáutica](#), in São José dos Campos, Brazil, in 1984 and 1986. He decided to pursue a doctorate outside the country after his master’s thesis advisor told him there were more research opportunities elsewhere.

Moreira earned his Ph.D. in engineering at the [Technical University of Munich](#). As a doctoral student, he conducted research at the DLR on real-time radar processing. For his dissertation, he created algorithms that generated high-resolution images from one of the DLR’s existing airborne radar systems.

### “Having students and engineers work together on large-scale projects is a dream come true.”

After graduating in 1993, he planned to move back to Brazil, but instead he accepted an offer to become a DLR group leader. Moreira led a research team of 10 people working on airborne- and satellite-system design and data processing. In 1996 he was promoted to chief scientist and engineer in the organization’s SAR-technology department. He worked in that position until 2001, when he became director of the Microwaves and Radar Institute.

“I selected the right profession,” he says. “I couldn’t imagine doing anything other than research and electronics.”

He is also a professor of microwave remote sensing at the [Karlsruhe Institute of Technology](#), in Germany, and has been the doctoral advisor for more than 50 students working on research at DLR facilities.

One of his favorite parts about being a director and professor is working with his students, he says: “I spend about 20 percent of my time with them. Having students and engineers work together on large-scale projects is a dream come true. When I first began my career at DLR I was not aware that this collaboration would be so powerful.”



## INTERNATIONAL NEWS

### The importance of creating an IEEE network

It was during his time as a doctoral student that Moreira was introduced to IEEE. He presented his first research paper in 1989 at the International Geoscience and Remote Sensing Symposium, in Vancouver. While attending his second conference, he says, he realized that by not being a member he was “missing out on many important things” such as networking opportunities, so he joined.

He says IEEE has played an important role throughout his career. He has presented all his research at IEEE conferences, and he has published papers in the organization’s journals. He is a member of the [IEEE Aerospace and Electronic Systems](#), IEEE Antennas and Propagation, [IEEE Geoscience and Remote Sensing \(GRSS\)](#), [IEEE Information Technology](#), IEEE Microwave Theory and Techniques, and IEEE Signal Processing societies.

“I recommend that everyone join not only IEEE but also at least one of its societies,” he says, calling them “the home of your research.”

He founded the [IEEE GRSS Germany Section](#) in 2003 and served as the society’s 2010 president. An active volunteer, he was a member of the IEEE GRSS administrative committee and served as associate editor from 2003 to 2007 for [IEEE Geoscience and Remote Sensing Letters](#). Since 2005 he has been associate editor for the [IEEE Transactions on Geoscience and Remote Sensing](#).

Through his volunteer work and participation in IEEE events, he says, he has connected with other members in different fields including [aerospace](#) technology, geoscience, and remote sensing and collaborated with them on projects. He received the IEEE Dennis J. Picard Medal for Radar Technologies and Applications on 5 May during the [IEEE Vision, Innovation, and Challenges Summit and Honors Ceremony](#), held in Atlanta. The event is available on [IEEE.tv](#).



## INTERNATIONAL NEWS

### VIRAL NEW SUPERCONDUCTIVITY CLAIMS LEAVE MANY SCIENTISTS SKEPTICAL

By Dan Garisto | 27 July 2023 | Source: [Scientific American](#)

If rumor has wings, extraordinary scientific claims have a jet engine. Within hours of appearing on the preprint server arXiv.org, [two papers](#) by a team of scientists in South Korea generated enormous viral buzz. The researchers' extraordinary claim is that they have discovered a room-temperature ambient-pressure superconductor, a material that can conduct electricity perfectly under everyday conditions.

A genuine ambient-condition superconductor is often touted for its potential to transform many technologies. It could enable a perfectly efficient power grid, levitating trains, commercially viable fusion reactors—the typical list goes on. The authors wrote that their discovery “will be a brand-new historical event that opens a new era for humankind.” But their experiment has yet to be properly scrutinized by the scientific community, and the quest for breakthrough superconductors has a long history of big claims that end up falling flat.

#### What's superconductivity anyway?

When electrons flow through a standard conductive material, such as an aluminum wire, they act something like bumper cars, bouncing off atoms. All this bouncing creates resistance, reducing the electric current. But if that aluminum wire is cooled down to about one kelvin above absolute zero (−459 degrees Fahrenheit), something bizarre happens: the rules of traffic change so that electrons join together into pairs that glide frictionlessly among the aluminum atoms with zero resistance.

In 1987 researchers discovered the first “high-temperature” superconductors—materials that only needed to be cooled down to 77 kelvins (−321 degrees F), a temperature easily reachable via cheap and plentiful liquid nitrogen. These materials were literally and figuratively electrifying, sparking a jolt of enthusiasm among scientists [and the public](#) about the possibilities of warmer superconductivity. But much of the enthusiasm faded as advances slowed, and “high-temperature” superconductors stayed stuck at cold temperatures and remained impractically brittle.

During the past decade, researchers have pursued an interesting alternative: They discovered hydrogen-based compounds that are superconductors at relatively warm temperatures—but only while squeezed to pressures greater than one million atmospheres. And maintaining such high pressures is even more impractical than sustaining superlow temperatures.



*In a demonstration of superconductivity, a special material is cooled with liquid nitrogen. Credit: [Forance/Alamy Stock Photo](#)*



## INTERNATIONAL NEWS

### What are the latest claims?

In their new preprint papers, the researchers say that LK-99, a compound of lead, copper, phosphorus and oxygen, is a superconductor at temperatures above 400 kelvins (260 degrees F) and ambient pressure. They also include a detailed recipe for making raisin-sized pellets of the compound, which requires mixing precise ratios of the powdered ingredients and then baking the mixture at high temperatures.

The authors also report performing tests of LK-99 and say they found the electrical resistivity dropping sharply around 378 kelvins (220 degrees F) and then reaching nearly zero around 333 kelvins (140 degrees F). Although zero electrical resistance is superconductivity's hallmark, other tests are required to confirm a genuine superconductor. One such test is for the Meissner effect: because a superconductor expels magnetic fields, it repels other magnets, producing an [iconic levitating effect](#). The South Korean researchers provided a [video](#) of what they say is LK-99 exhibiting the Meissner effect, but superconductors aren't the only things that float above magnets—graphite, for example, also levitates.

### Why are many scientist dubious?

Extraordinary claims that did not survive scrutiny have long plagued the field of superconductivity. In 1987, after a compound called YBCO was discovered to be a high-temperature superconductor, some researchers thought they saw hints of the compound developing superconductivity at room temperature—but those disappeared on closer inspection. The list of once-promising failures goes on and on: sandwiches of aluminum and carbon, copper chloride, ammonia-based compounds, and more all teased room-temperature superconductivity that ultimately proved illusory.

Ranga Dias, a physicist at the University of Rochester, has recently made [multiple claims](#) about room-temperature superconductors. But [retractions](#) and [allegations](#) of scientific misconduct have marred the credibility of those findings.

All of this means that strong skepticism is the default for new reports of room-temperature superconductivity—especially ones that are as yet largely unvetted by peer review. In this latest case, several details in the South Korean team's preprint papers have raised concern. James Hamlin, a physicist at the University of Florida, points out oddities in a measurement of LK-99's magnetic properties that gave him pause. "It doesn't really look much like my experience of measuring" these properties, he says.

Doug Natelson, a physicist at Rice University, spontaneously spotted something even stranger while going over the preprints during an interview for this story. Both papers include a data plot detailing LK-99's magnetic properties. Both plots were sourced from the same dataset and should thus be identical—but the plot in one paper has a y-axis with a scale that is about 7,000 times larger than the other. This kind of inconsistency does not prove anything, but at minimum, it suggests a worrisome shortfall in proofreading. Scientific American reached out to the South Korean team for comment but did not receive a response by the time of this story's publication.

Getting definitive answers about what's really happening in LK-99 demands patience, as eager independent teams attempt to replicate the South Korean team's work. Because the recipe for LK-99's synthesis is straightforward, results could come in the next few days or weeks. Natelson is interested, but he isn't holding his breath. "It's not rare for people to see weird stuff which in the end doesn't pan out," he says.

## INTERNATIONAL NEWS

### GRID DELAYS THREATEN ITALY'S SOLAR, WIND GOALS

By Neil Ford | 26 July 2023 | Source: [Reuters](#)

Italy must follow permitting reforms with faster grid connections to achieve installation rates that meet its climate targets, industry experts said.

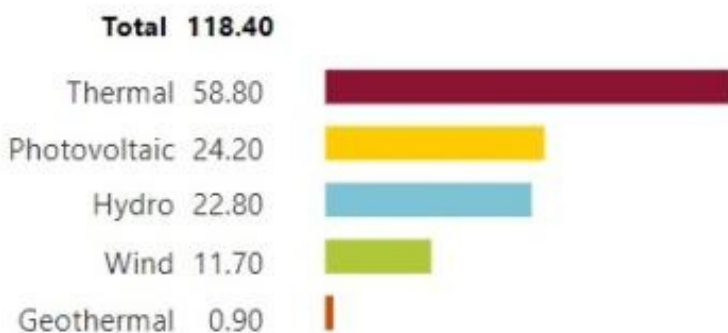
Italy's pledge to accelerate solar and wind capacity in the wake of Russia's invasion of Ukraine will severely test power authorities across the country.

Italy generates over 50% of its power from fossil fuel power plants, mainly gas-fired, and has committed to end gas imports from Russia by 2025. The government has pledged to supply 65% of the country's power from renewable energy sources by 2030 and, under an agreement with the G7 group of industrialised nations, decarbonise its entire power sector by 2035.



Italian grid operator Terna has been inundated with solar and wind applications, creating bottlenecks. (Image: REUTERS/Alessandro Garofalo)

#### Italy's installed power capacity in 2022 (GW)



Source: National grid operator Terna

Much of Italy benefits from strong solar resources and demand for projects has remained high despite bureaucratic permitting processes and long grid connection delays that add years to project timelines.

Italy is implementing European Union [permitting reforms](#) that could speed up projects but surging demand will pile further pressure on grid authorities already inundated with requests.

Solar and wind installations hiked 120% in the first half of 2023 to 2.5 GW, data from national grid operator Terna showed.

There is currently over 130 GW of solar projects under development, Matteo Coriglioni, Market Lead, Italy at Aurora Research, told Reuters Events.

Italy must install a further 190 GW of renewable energy by 2035 to meet its targets, according to a recent report by climate change think-tank ECCO and consultancy firm Artelys. The country installed only 2.5 GW of solar and minimal wind in 2022, bringing solar capacity to 25 GW and wind capacity to 12 GW.

Installation rates will need to "multiply by seven by 2030, and by more than eight by 2035," ECCO and Artelys said.



## INTERNATIONAL NEWS

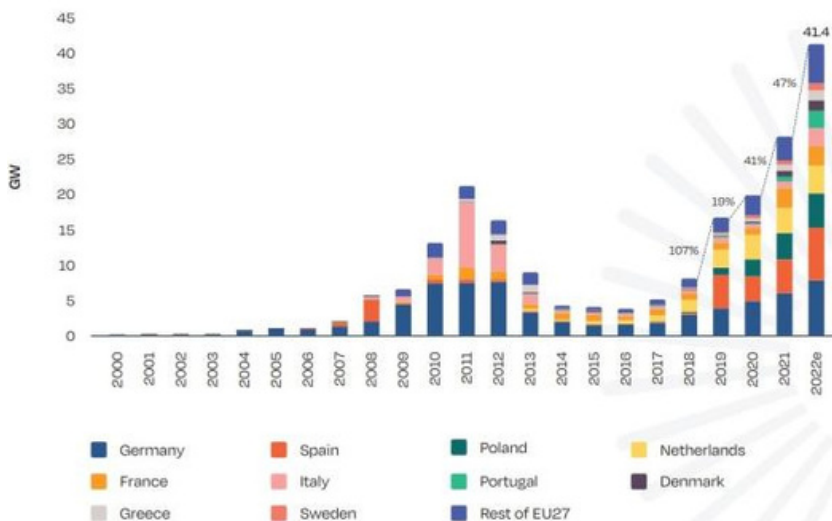
"Compared to the last decade of anaemic growth in deployment, we should expect a decisive acceleration in the coming years," he said.

### Permit progress

Italy's solar development to date has been concentrated on the islands of Sicily and Sardinia and in the southern regions of Puglia and Lazio, mainly due to strong solar resources and land availability. Higher power prices in Sicily have boosted the business case there.

Recent investments include Capital Dynamics' acquisition of three projects totalling 323 MW in March 2023 that will be completed by late 2024, following previous project acquisitions in Sicily. Last October, Octopus Energy Generation created a joint venture with Milanese developer Nexta to develop 1.1 GW of solar, onshore wind and energy storage in southern Italy by 2025.

### Annual Solar installations by EU country:



Source: SolarPower Europe

Projects are often delayed during permitting in Italy due to bureaucracy and disagreements between central and regional governments. To accelerate deployment, the central government has passed a range of measures over the last 18 months that have simplified permitting and set stricter timelines for environmental assessments, in line with pending EU reforms.

EU officials have provisionally agreed to reform permitting procedures in a revised renewable energy directive that targets 42.5% of gross energy from renewable sources by 2030. The reforms, yet to gain full legislative approval, require all permitting procedures for new projects to be completed within two years and requires states to set aside accelerated development areas by 2025 in which permitting must be completed within one year.

Italy recently mandated its regional authorities to define the accelerated development regions within 180 days. Developers could still face pushback by any regional governments that oppose the measures, Michele Governatori, ECCO Power & Gas Programme Lead, told Reuters Events.

"Regions are not constitutionally obliged to support the central government's energy strategy," he said.

In general, Italy's permitting actions should help with environmental and construction permits, Zoisa North-Bond, CEO of Octopus Energy, said.





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However, like in many parts of Europe, "the time it takes to connect projects to the grid remains a hurdle everywhere," she said.

### Grid delays

Grid operator Terna is being presented with an "enormous" number of connection requests and often issues expected connection dates "years into the future," Corigliani said.

Terna is "overloaded," says Alessandro Savini, Senior Executive Consultant at energy technology firm Trailstone, "resulting in delays in the approval process."

One driver is the low cost of applying which increases the volume of applications. In the U.S., some grid operators inundated with requests have introduced a filtering process to reduce the number of less developed projects clogging up the connection queue. Others are using forward bulk transmission planning, assessing projects in clusters or using data automation to streamline processes.

Grid operators are also expanding permitting teams to manage a growing volumes of renewable energy applications. Terna aims to increase its total workforce by around 20% to 5,900, the grid operator said in a multi-year investment plan in 2021.

Rising demand in Italy is also making it difficult to procure experienced engineering procurement construction (EPC) companies as the industry tools up after years of low activity, Savini said.

Wider growth

As more renewable energy is brought online, regional grid constraints will become a key driver of deployment strategies. Italy's power market is split into seven regional market zones and grid restraints could see prices diverge. Limitations in South to North capacity will curb growth in some southerly areas and incentivise more development nearer the large consumption centres in the north.

To reduce bottlenecks, Terna plans to double interconnection capacity between the seven markets by 2030 under its Hypergrid package of grid upgrades. This includes the installation of a new 1 GW subsea Tyrrhenian Link by 2028 that will run from Sardinia to Sicily to the mainland region of Campania.

Italy must also adapt its market regulations to improve the business case for renewable energy and incentivise the development of energy storage, Governatori said.

The government must end schemes that require fossil plants to run and allow renewable energy to participate in ancillary services markets that help to balance the grid, he said.

According to Governatori, Italy should also launch auctions for new energy storage capacity so that output from new solar installations can be optimised.

A lack of storage increases the risk of price erosion during high solar periods, which could undermine investments, he said.

"This is why we think central procurement of storage is a good idea."



## INTERNATIONAL NEWS

### FIRST GRID-SCALE GRAVITY ENERGY STORAGE SYSTEM UNDERGOES COMMENCEMENT IN CHINA

By Sean Wolfe | 2 Aug 2023 | Source: [Renewable Energy World](#)

Energy Vault, along with its partners Atlas Renewable and China Tianying, announced that what it's calling the world's first grid-scale gravity energy storage system (GESS) has entered the first phases of commissioning.

Located outside of Shanghai in Rudong, Jiangsu Province, China, the 25 MW/100 MWh GESS is built adjacent to a wind farm and a national grid interconnection site to augment and balance China's national energy grid through the storage and delivery of renewable energy.

Commissioning began in June on the power electronics and new "ribbon" lifting systems. The system is expected to be fully grid interconnected in Q4 as planned with local state grid authorities, making EVx the world's first commercial, utility-scale non-pumped hydro gravity energy storage system. Building on the round trip efficiency (RTE) results (above 75%) of the first 5 MW EV1 Tower that was grid interconnected in Switzerland in mid-2020, the new EVx system with its efficiency chain design enhancements is expected to have RTE above 80%, Energy Vault said.

Highlighting the market adoption of Energy Vault's gravity technology, China Tianying's subsidiary, Jiangsu Nengying New Energy Technology Development Co., Ltd., announced last week that it has entered into an agreement with the People's Government of Huailai County to build an additional 100 MWh gravity energy storage project in Huailai County, Hebei Province, China. The project, to be located in Cunrui Town, will provide green electricity to data centers in the region.

## INTERNATIONAL NEWS

### THESE MOISTURE-SUCKING MATERIALS COULD TRANSFORM AIR CONDITIONING

By Casy Crownhart | 26 Jul 2023 | Source: [MIT Technology Review](#)



A surprising set of materials could soon help make more efficient air conditioners that don't overtax the electrical grid on hot days.

As extreme heat continues to shatter records around the globe, electricity demand for air conditioning is expected to triple in the next few decades—an increase of about 4,000 terawatt-hours between 2016 and 2050, according to the [International Energy Agency](#), or roughly the same electricity demand as the [entire US electrical grid in 2022](#).

That's why the race to build more efficient air conditioners has become increasingly urgent. While some companies are focused on improving existing designs, others are looking to entirely new systems that use materials called desiccants. These systems could cool more efficiently, even in extreme heat and humidity, reducing stress on the grid.

A typical air conditioner cools indoor spaces by pumping a refrigerant around in a cycle and through heat exchangers, soaking up heat from the inside air and releasing it outside. ([Heat pumps work in the same way](#), either running the opposite direction, or in reversible systems that can both heat and cool.)

That approach, called vapor compression, is over 100 years old, and the basic design hasn't changed much since its invention, says [Ankit Kalanki](#), a manager in the carbon-free buildings program at the Rocky Mountain Institute, a nonprofit energy think tank. Pumping refrigerant around and compressing it enough to shuttle heat outside requires a lot of energy, especially when temperatures are very high.

Vapor compression systems also deal with humidity and heat together, which is another drawback. Keeping a building comfortable has a lot to do with maintaining a low humidity environment, Kalanki says, but air conditioners must cool down air to pull moisture out of it. Without a designated system to tackle humidity, he says, buildings are often "over-cooled," which can add a huge energy burden.

Systems that tackle dehumidification and cooling separately could keep building temperatures comfortable with less energy and allow for more flexibility in different environments. And a growing number of startups are looking to desiccants to accomplish just that.



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### Hot take

Desiccants are materials that suck up moisture. The silica beads in those little packets that accompany new purses and shoes are a type of desiccant, designed to keep products dry as they're shipped around the world.

Other types of desiccants could be added to existing designs for air conditioners, absorbing water from the air and cutting down on the energy required to keep rooms comfortable. [Transaera](#), an MIT spinout founded in 2018, is developing a [hybrid system](#) that uses a type of material called metal organic frameworks. Adding the materials to vapor compression-based air conditioners could allow the company's system to use 35% less energy than average models, according to Transaera CEO Sorin Grama.

But other companies are looking to use desiccants in cooling systems that would replace traditional air conditioners altogether. Florida-based startup [Blue Frontier](#), for example, is using liquid desiccants to build cooling systems. The key ingredient is different from the silica beads in shoe packaging, but the comparison is a common one—"We get that a lot," says Matt Tilghman, the company's co-founder and chief technology officer.

Rather than small silica beads, Blue Frontier's cooling technology relies on a salt solution that's so concentrated, it can pull moisture from the air.

Here's how Blue Frontier's cooling system works: first, a stream of air passes through a channel and over a thin layer of desiccant, which pulls moisture out of the air. Next, the now-dry air goes through an evaporative cooling step, which lowers the temperature of the air (basically the same way sweat cools your skin).

In the evaporative cooling step, the air is split into two streams. One runs past a thin layer of water, which absorbs energy and drops the air's temperature. That cooler, humid air is used to cool a metal surface, which in turn sucks heat out of the other stream of still-dry air. The humid air gets funneled outside, and the cool, dry air is blown into the building.

Evaporation is an efficient cooling method, one that's employed in low-cost devices called air coolers (also referred to as swamp coolers or evaporative coolers), which can use 80% less electricity than standard air conditioners. These devices usually add moisture to the air to cool it, which only works when starting with dry air, so their use is typically limited to dry environments, like the southwestern US.

By pairing evaporative cooling with desiccants, Blue Frontier's system can work in virtually any climate, Tilghman says. Its operations can be tweaked to handle changes in the weather or in the thermostat set point, altering the balance between cooling and dehumidifying, which could help unlock further efficiency gains. The company's approach should be able to cut annual electricity use by a total of between 50% and 80% compared with a conventional air conditioning system, depending on the environment, Tilghman says.

### On thin ice

Liquid desiccants are sometimes used today to dehumidify warehouses or factories that need to keep strict controls on moisture in the air, such as in pharmaceutical or electronics manufacturing. But they haven't been widely used in cooling partly because they're expensive. One industry standard, lithium chloride, has been subject to price hikes and supply limitations because of demand for it in lithium-ion batteries. The materials can also be corrosive. (Blue Frontier is using a new desiccant that should address those concerns, Tilghman says.)

One of the biggest roadblocks to widespread desiccant cooling has been the need for a method to recharge the materials efficiently. Desiccants are like sponges—they can suck up a limited amount of water before they need to be wrung out, or regenerated.





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So in addition to the parts that dry and cool air, a desiccant cooling system needs a section that can regenerate the desiccant, releasing the water into another stream of air that in turn is released outside.

Most desiccants can be regenerated through heating, which releases water from the material, but that step can be energy-intensive and often involves fossil fuel-powered boiler systems.

Blue Frontier instead uses a heat pump to regenerate its desiccant. The heat pump adds energy demand, but while the cooling system can run continuously during a hot summer day, the regeneration system can run in the evening or overnight, when there's less stress on the grid and electricity prices are lower, Tilghman says. Offsetting the regeneration will mean that Blue Frontier's system could help reduce peak power demand by between 80% and 90%.

Other startups are looking to get rid of the need for heat altogether. Boston-based [Zephyr](#) is hoping to use membranes to filter water out of liquid desiccants to regenerate them, similar to the process used to pull salt out of water in desalination facilities.

Zephyr demonstrated parts of its system in July and plans to assemble a full lab-scale prototype of a cooling system later this year. Its desiccant cooling device could use about 45% less electricity than the best vapor-compression air conditioners on the market today, says Jacob Miller, Zephyr's co-founder and chief technology officer.

Blue Frontier has two demonstration cooling systems running, one in Florida and one in Canada, and the company has plans to install several dozen more in late 2023 and 2024, Tilghman says.

Both startups are focusing first on systems for larger commercial buildings, but down the line the systems could be adapted for houses and even individual apartments, Tilghman says. Blue Frontier's first systems will be more expensive than existing air conditioners at the outset, he adds, though they should be able to make up for it in energy savings within three to five years.

Access to efficient cooling technology could be crucial to helping more people live and work in safe environments without overloading grids. "If you look at the warming world, the way temperatures are rising, you need people to have access to cooling," Kalanki says. "It's not just an issue of thermal comfort or feeling productive, it's also an issue of equity now."



## INTERNATIONAL NEWS

### **GAS LOBBY LAUNCHES NEW SCARE CAMPAIGN ON ELECTRIFICATION, SAYING IT WILL BREAK THE GRID**

By Giles Parkinson | 3 Aug 2023 | Source: [Renew Economy](#)



No words, and no claims, appear too outrageous for the Australian gas lobby. Having lost its total control over the Australian federal government when the Coalition lost power last year (remember the gas-fired recovery?), it is ramping up its scare campaigns against the path to electrification.

The latest salvo is prompted by the Victoria state government's welcome decision to ban gas appliances in new homes from the start of 2024. The gas industry doesn't like it because it means it can't install gas networks in new suburbs which would then lock in a related return for decades to come, even if they do – as expected – become redundant.

And if new homes create more demand for electric appliances, then that will make it easier for existing homes to make the switch, and also quit the existing gas networks.

But the gas industry is nothing if not organised. One customer received a letter this week from the supplier of his gas heater, Seeley International, which included a raft of misleading claims, and outright lies.

The one that struck us most was the suggestion that the Victoria government's decision would effectively break the grid, a meme that must be sticking because RenewEconomy has received emails from aggrieved punters, or possibly gas bots, saying much the same thing.

There are a couple of important points to be made here. Victoria has the biggest use of gas in the country because it is cold, and that means that gas is used mostly in winter. Right now there is plenty of capacity on the local grid in winter – peak demand averages around 2GW lower than the summer.

You would have to add a lot of electric heat pumps, convection stoves and even EVs in very rapid time to put pressure on the grid.

Indeed, in the most recent market forecast put out by the Australian Energy Market Operator, which operates both the electricity and gas networks, it said winter demand peaks are unlikely to overtake summer demand peaks for at least another decade, even with strong electrification scenarios.

If anything, electrification might help the grid, because it will address an emerging problem which goes to the other end of the scale – minimum demand.

Having all those electric appliances creating demand means that AEMO will not have to revert to switching off rooftop solar PV, as it has to do from time to time in other states.



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Gavin Mooney posted the letter from Seeley International on [his LinkedIn page](#), and because he is an expert in the energy transition, he knows his stuff and can see through the bollocks sent to him by his gas appliance supplier.

He cited a number of other problems with the Seeley letter:

For instance, **Seeley says:** *"We wanted to...address recent concerns over the Victorian government's short-sighted ban on new houses."*

**Mooney writes** that "it's actually just the sort of decisive policy action we need."

**Seeley:** *"Given Victorian electricity comes from burning brown coal, gas is a much cleaner alternative and better for the environment."*

Not so. Mooney says brown coal is still over 50% of Victoria's electricity, but this ignores the more than 40% that comes from renewables. And the government has a legislated target of 95 per cent renewables by 2035.

**Seeley:** *"Constant, cosy performance. Ducted gas heating operates independently of how cold it gets outside."*

Mooney: "This is a dig at heat pumps, but it doesn't get cold enough in Victoria for heat pumps to have any serious problems. They work fine in Scandinavia."

**Seeley:** *"The average cost to use gas in your home is less than half of what it costs to provide the same amount of energy when using electricity."*

Mooney: "This ignores the magic of a heat pump providing 3-4 times more heating than energy consumed."

**Seeley:** *"Gas is cleaner than the current alternatives."*

Mooney: "Simply not true, there are viable alternatives and Victoria is racing towards its target of 95% renewables by 2035."

**Seeley:** *"Reliable Energy Supply. Gas is not dependent on weather conditions."*

Mooney: "Renewables are variable, not unreliable. The variability is why we have to firm with energy storage and other measures."

**Seeley:** *"It's expensive to switch from gas to electricity."*

Mooney: "There is an up front cost, but there are savings over the longer term." See also [this story that shows a typical home in Victoria can save 75%](#) on the winter heating bills by switching from gas heating to heat-pump electric.

**Seeley:** *"The renewable gas future is coming ... Gas has a future. The gas industry is committed to decarbonising."*

Mooney: "If that were the case (the gas industry being committed to decarbonising), the gas industry would be encouraging electrification."

Don't expect it to stop there. Other sectors of the gas industry have warned that the government is about to ban the backyard BBQ, and have repeatedly warned about impending blackouts if households quit gas. And they get a lot of amplification on social media, and the Murdoch media too.

## INTERNATIONAL NEWS

### HOW WE CAN ADAPT TO LIVE WITH EXTREME HEAT

By Daniel Cusick | 21 July 2023 | Source: [Scientific American](#)



Firefighters from Phoenix Fire Engine 18 check the vital signs of a resident having trouble breathing during a heat wave in Phoenix, Ariz., on July 20, 2023. Credit: [Caitlin O'Hara/Bloomberg via Getty Images](#)

#### CLIMATEWIRE Broiling Phoenix is waiting to cool down.

The desert metropolis has sweltered through 21 days of temperatures that reached at least 110 degrees Fahrenheit, blowing by an 18-day record set in 1974. Downtown streets are nearly deserted. No one stops in a tree grove planted on a hot plaza. A woman washes her hair in the pfft-pfft-pfft of a park's sprinkler system.

As millions of people huddle indoors amid the region's dangerous heat wave, the intensity and persistence of the hot streak raises questions about what can be done to protect people as climate change promises to make Phoenix — and regions around the world — hotter and hotter.

One thing is clear: Adapting to blazing temperatures is different than adapting to hurricanes, wildfires and floods. People can run from hurricanes, elevate homes in flood zones and buy wildfire insurance.

Heat is different. It can last for weeks, blanket large areas and result in more deaths.

"We're at a moment where we have to think about this problem in new ways: first, in the near term, helping people get through emergencies like the one happening in Phoenix," said Kurt Shickman, director of extreme heat initiatives at the Arsht-Rockefeller Resilience Center. "But also in the long term. We have to help communities get prepared for what's coming because it's only going to get hotter and more dangerous."

Climate adaptation to heat comes in many forms — from opening cooling centers and extending the hours of public pools, to girding electric grids for peak air-conditioning demand.

It can be complicated and expensive, requiring major infrastructure investment. Or it can be as simple as planting a tree grove or terra-scaping a yard.





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Experts say the problem is most acute in urban areas with heat islands and older, less efficient housing, much of which was built without central air conditioning. Risks are also growing in normally cool climates like the Pacific Northwest, where nearly 300 people died in Oregon and Washington two years ago when the region sat under an oppressive heat dome for more than a week.

"This is no longer a southern thing — this is an everywhere thing," Shickman said.

The Centers for Disease Control and Prevention estimates there are more than 700 heat-related deaths and 9,235 hospitalizations annually in the United States. That's much higher on average than any other type of disaster, including hurricanes, floods and wildfires.

The most vulnerable people — the poor, elderly and health-compromised — are more likely to die, according to the CDC. Increasingly, large urban centers like Phoenix, Los Angeles and Miami-Dade County are developing heat response strategies and appointing heat officers to steer policy and oversee emergency response. Hundreds of hot cities — from Houston to Las Vegas to Washington, D.C. — have not, leaving heat concerns to emergency managers.

David Hondula became director of Phoenix's newly created Office of Heat Response & Mitigation in 2021. He has likened Arizona in the summer "to sticking your head in an oven." He spent much of his first two years on the job working on heat mitigation strategies — heat-resilient housing, urban tree planting and creating a network of emergency cooling centers.

The current heat wave — which extends across multiple states but is centered on south-central Arizona — will be a critical test of the government's ability to respond to extreme heat and "will literally be a matter of life and death for some Americans," Hondula told The New York Times in a recent podcast.

Currently, heat response focuses on air conditioning and, in critical cases, medical treatment where first responders give cold fluids intravenously and emergency room doctors pour ice over patients experiencing heat stroke symptoms. So far this year, Maricopa County, where Phoenix is located, has attributed 18 deaths to heat-associated causes, and 69 are being investigated for heat factors. One-third of victims were at least 75 years old, and one-third were homeless, according to county records.

Shickman of the Arsht Center, which has helped to establish heat officers around the world, said such mortality rates are frightening.

"Our bodies disregulate around 101 degrees, so this kind of weather is imposing a fever on people," he said. "And those temperatures can go much higher, way beyond what a body can withstand. But we often don't realize what's happening until it's too late."

Heat deaths are rising even in moderate summer temperatures, in part because the number of unsheltered people has spiked during Covid and its economic aftermath, but also because heat island cities in the Sunbelt continue to grow rapidly without planning for worsening heat.



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Experts say more public money should be invested in home upgrades and retrofits, tree planting, restoration of natural landscapes that have a cooling effect on the earth and, in urban areas, using lighter colors on heat-absorbing surfaces like roads and roofs to reflect the sun.

Nancy Grimm, an ecosystem ecologist at Arizona State University who studies climate adaptation, said those solutions are often overlooked or not fully understood.

“What people don’t realize is that it’s not a foregone conclusion that we have to accept the heat, at least not the heat island component of it,” she said in an email.

Beyond the immediate threat to human health, extended periods of extreme heat can zap regional economies as workers and consumers hole up in their homes and offices. The same is true of military bases and ranges, where training and other activities stop during extreme heat, officials say.

Steve Cohen, director of Columbia University’s Research Program on Sustainability Policy and Management, said that in affluent societies where air conditioning is ubiquitous, officials may view it as the primary solution to extreme heat. But it raises issues of access and affordability for individuals and families, “It’s an issue of resources as much as anything else,” Cohen said. “If we can afford the energy and the air-conditioning [technology], we can survive these things. But these are all assumptions that may prove to be false in the future.”

In fact, heavy reliance on air conditioning can run counter to broader adaptation and resilience goals because it places more stress on electricity grids, raising the risk of blackouts.

Under such scenarios, houses and apartments equipped with air conditioning can become death traps.

Studies and historic heat waves — such as the catastrophic 1995 heat wave in Chicago — have shown that lower-income people, including the elderly, sometimes forgo air conditioning to avoid high power bills. Homeless people sometimes choose to stay outdoors in extreme heat because shelters are inaccessible, overcrowded or unpleasant.

“There are huge swaths of our population that can’t afford air conditioning or have to be outside to earn the money they need for food,” Shickman said. “And just because you see an air conditioner in a window doesn’t mean it’s running.”

## INTERNATIONAL NEWS

### Bushing Technologies

Bushings for transformers and other applications evolved considerably over the decades, from simple hollow insulators made of porcelain to more elaborate, engineered designs. For example, as bushing voltage levels increased, technologies such as capacitance grading and resin-bonded paper (RBP) bushings were developed.

Later, when RBP bushings reached their limits in terms of partial discharge and dielectric loss, other insulation technologies emerged. Oil-impregnated paper (OIP) technology, although mature and also still the most widespread in terms of application, comes with serious risks inherent to use of mineral oil as the insulating fluid:

- Possible loss of insulation media due to ageing of gasket;
- Potential catastrophic failure and fire when operated under abnormal conditions;
- Flammability of oil.

Moreover, under unusual conditions and in the presence of heat as well as the by-products of cellulose degradation, there is risk of physical and chemical reactions between mineral oil and other materials inside the bushing. These have been known to cause corrosive sulfur and copper mobility problems.

Another potential issue inherent to use of OIP bushings is onset of internal partial discharges due to formation of gas bubbles within the oil. Whenever oil and a gas, whether air or nitrogen, is confined in a fixed volume, as the case for a bushing, pressure equilibrium is reached over time at any given temperature. But when temperature changes so too do volume of oil and also gas space. Three variables then come into play. Firstly, gas pressure changes with volume. Second, gas pressure changes with temperature and third, the ability of the oil to absorb gas varies with temperature. As a result, major fluctuations in temperature result in a continuous change in the amount of gas dissolved in the oil. For example, if temperature drops rapidly after being high for some time, the gas cannot escape quickly enough to avoid formation of bubbles in the oil. This phenomenon occurs mostly during transformer testing in the factory but can also take place when the equipment operates under severe cyclic loading combined with rapid cooling, such as in solar and wind generation.



*Resin-bonded paper insulation.*



*Oil-impregnated paper insulation.*

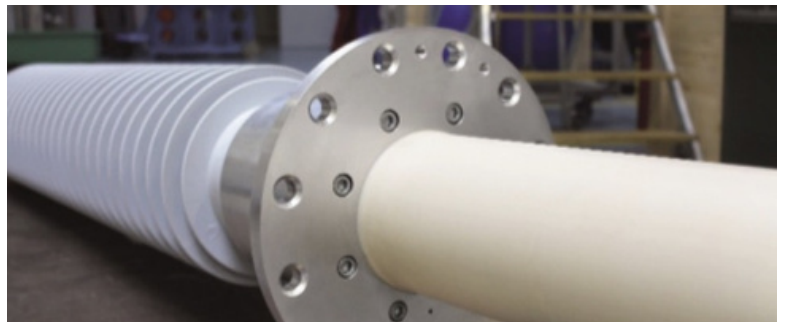


*Resin-impregnated paper insulation.*

## INTERNATIONAL NEWS

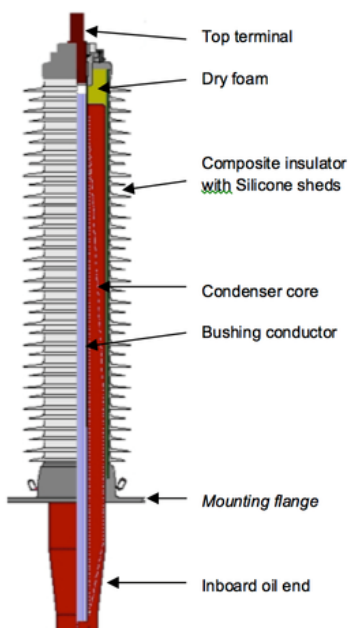
Dry-type resin-impregnated paper (RIP) bushings have been successfully applied worldwide for many years and effectively eliminate issues related to oil reactions, leaks and flammability. This lowers risk of bushing failures that result in explosions or transformer fires, particularly when used in conjunction with composite housings in place of porcelain. Indeed, as RIP technology has become more and more widespread and with demonstrated reliability, utilities in areas that used to be entirely focused on OIP technology, such as the U.S. and IEEE markets, are increasingly adopting dry bushings as the preferred solution. This is especially the case for high and extra high voltage classes ranging from 230 kV and above. However, RIP bushings still present a shortcoming, namely the potential for moisture ingress in the exposed oil side during long-term storage. That risk requires specific storage methods, including use of oil- or gas-filled tanks to protect an RIP bushing's lower section.

More recently, the crepe paper used in winding the RIP core has been replaced by a polyester synthetic material. This has resulted in development of what has become known as the resin-impregnated synthetic or RIS type bushing. These are based on the same established condenser grading technology and manufacturing processes as RIP but use of a non-hygroscopic synthetic material eliminates risk of moisture ingress. At the same time, other bushing insulation characteristics improve as well.

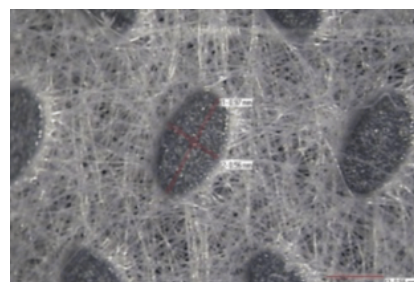


*RIS bushing with composite housing.*

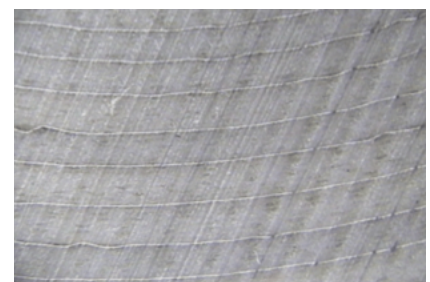
### RIS Bushing Construction



The construction of an RIS type bushing is similar to that of other technologies with available drawlead or bottom connection options. The active part, or condenser core, consists of a thin non-woven synthetic fabric wound tightly around an aluminum tube or solid copper rod. During winding, condenser electrodes made of thin aluminum foil are introduced at specific locations and intervals in order to provide electric field grading in the bushing's radial and axial directions. The synthetic fabric, manufactured to specific tolerances, has homogeneous properties, consistent thickness and smooth surface finish that together allow smooth insertion of aluminum foil during the winding process. The result is superior placing of concentric layers and more uniform electric field distribution.



*Macro view of synthetic fabric.*



*Smooth synthetic material allows for even placing of aluminum foil.*

*Fig. 1: Main components of RIS type bushing.*



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### Synthetic Insulation Properties

The synthetic insulating material used in RIS bushing condenser cores is non-hygroscopic. This ensures that virtually no ambient moisture is absorbed either during raw material storage in the factory or later within the finished bushing condenser core.

Fig. 2 compares moisture content, in percentage of weight, after prolonged storage at 50% relative humidity and 23°C for a range of different insulating materials. As can be seen, cellulose gains 6.24% in weight due to moisture absorption whereas synthetic materials remain at only 0.23% to 0.32% weight gain. In fact, samples of resin-impregnated insulation stored under water for a long-term yielded similar low water absorption results, as shown in Fig. 3.

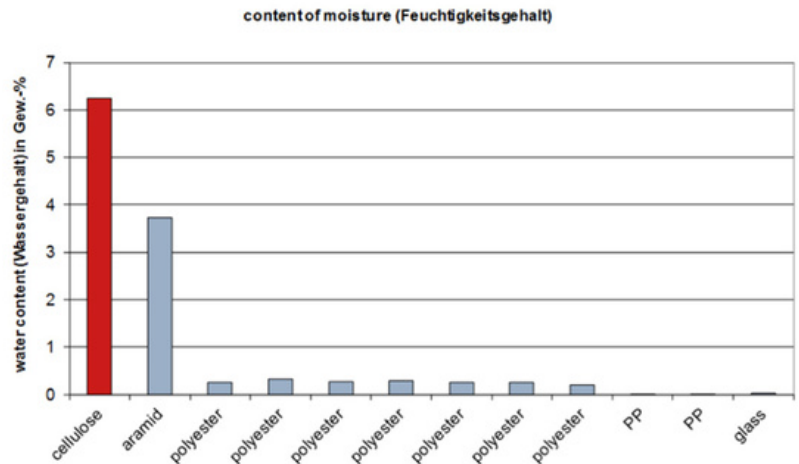


Fig. 2: Moisture content of different insulating materials after long-term storage.

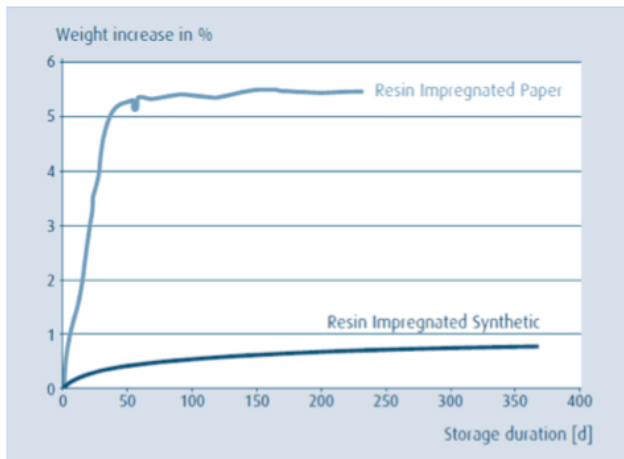


Fig. 3: Water absorption for resin-impregnated paper and resin-impregnated synthetic.

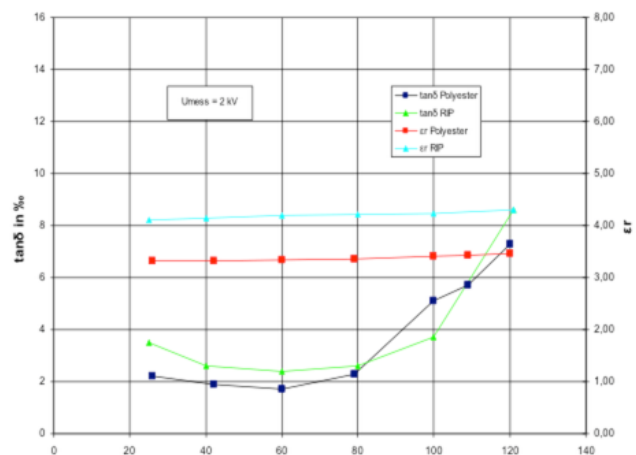


Fig. 4: RIS & RIP power factor and relative permittivity as function of temperature.

At the same time, from a dielectric point of view, resin-impregnated synthetic material has stable properties that are comparable in permittivity and power factor to the crepe paper used in RIP bushings. The curves in Fig. 4 show power factor and relative permittivity for these materials as a function of temperature. This similarity in dielectric properties allows for easy interchangeability of RIP/RIS bushing designs in terms of dimensions as well as electrical ratings.

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### RIS Bushings

Since introduction, RIS style bushings have been installed and placed in service around the world. For example, RIS bushings from HSP with catalogue designation, SESTFta, were introduced into the IEEE market in 2016, mainly at 230 kV, 345 kV and 550 kV system voltages. Annex 1 shows the typical technical specification for a 550 kV 3000-amp RIS replacement bushing according to IEEE C57.19.01 ratings. The distinctive slender construction of these bushings and use of standard components such as insulators, flanges, etc. allows easy customization of an RIS transformer bushing to dimensionally match whatever legacy bushings are being replaced.

The main advantages of RIS bushings, equipped with composite insulator housings, include:

- Construction free of oil and paper;
- Flame-resistant properties;
- Insulation thermal class of 120°C;
- Lower sensitivity to humidity ingress during long-term storage;
- More controlled winding and also better electric field profiles;
- No dangerous fragments if housing damaged by internal or external factors;
- Low risk of damage due to improper handling and vandalism due to high impact strength and shock resistance;
- Lower weight, simplifying handling and reducing stress on transformer tank;
- Suitability for even very low ambient temperatures;
- Seals designed as O-rings in self-contained channels and made of temperature-resistant elastomers;
- Voltage tap and/or test tap according to IEEE requirements;
- Easier transport and storage in any position;
- Availability per IEEE voltage classes and current ratings up to 550 kV;
- Complying and exceeding applicable IEEE bushing standards and tested accordingly.



*RIS synthetic insulation allows for homogeneous and consistent material properties as well as winding process.*

### Routine Testing

According to IEEE C57.19.00, routine tests are intended to verify quality and uniformity of workmanship and materials used in manufacturing transformer bushings. Every unit manufactured to this standard must undergo a full such test as part of the production process. Since condenser bushings made of synthetic materials are yet to be covered by any IEEE standards, acceptance criteria for some routine tests are still not defined. Manufacturers are therefore required to demonstrate ratings by what they consider equivalent or more adequate test limits. Suitable limits for power factor and partial discharge testing in the case of RIS bushings are discussed below:

### Bushing Power Factor

Power factor is the measure of internal dielectric losses within the bushing insulation, relative to its capacitive reactive power, expressed in percentage. Fig. 5 shows the phasor representation of the resistive and total currents flowing

## INTERNATIONAL NEWS

through the condenser core, with  $\text{Cos } \emptyset$  being the 'power factor' of the insulation. In an ideal capacitor, the active current,  $I_{\text{act}}$ , would be near zero (i.e. no losses) and the ideal power factor would also approach zero as the phase angle,  $\emptyset$ , nears  $90^\circ$ . In practical terms, a power factor of 0.005 (0.5%) or lower is considered healthy.

As for bushings using other insulation technologies, RIS bushings are factory tested for C1 main insulation capacitance and power factor at 10 kV at normalized ambient temperature of  $20^\circ\text{C}$ . These values are stamped in the nameplate for reference and condition assessment of the bushing in the field. Typical C1 power factor values for a new RIS bushing range in the order of 0.25% to 0.4%, depending on bushing voltage class. Field-testing RIS bushings at temperatures other than the normalized  $20^\circ\text{C}$  requires application of correction factors, available in the instruction manual or from the manufacturer, as shown in Fig. 6. Deviations in C1 capacitance or power factor are indications of possible ageing or damage within the insulation and therefore must be investigated.

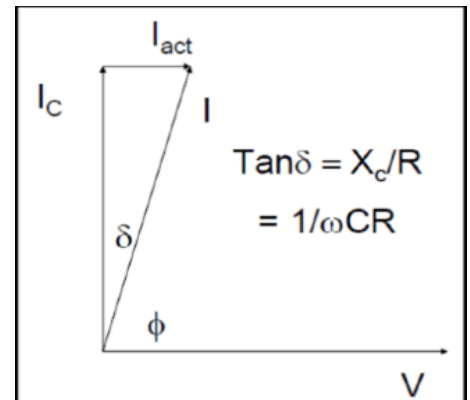


Fig. 5: Phasor diagram of current components flowing in condenser core.

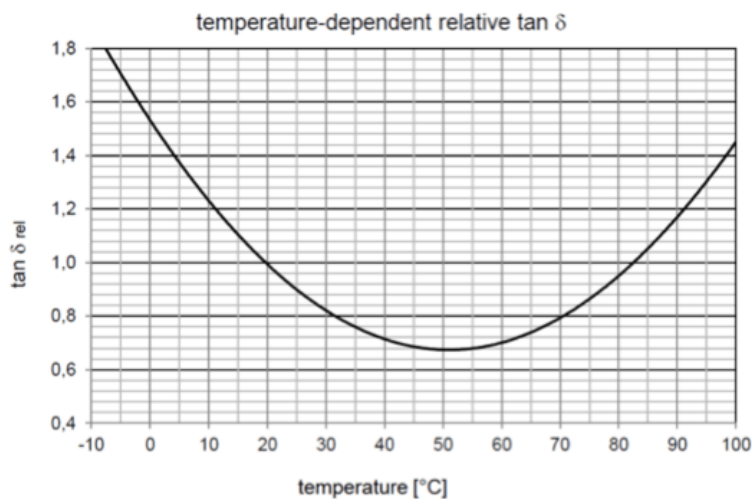


Fig. 6: Relative  $\text{Cos } \emptyset$  for RIS bushings supplied by HSP. The reference temperature ( $\text{Cos } \emptyset_{\text{rel}} = 1$ ) is  $20^\circ\text{C}$ . Note:  $\text{Cos } \emptyset$  and  $\text{Tan } \delta$  are numerically equal in normal measured range.

Correction factor,  $K$ , is the reciprocal of the relative  $\text{Cos } \emptyset_{\text{rel}}$ : from the correction curve in Fig. 6:  $K = 1/\text{Cos } \emptyset_{\text{rel}}$ . For example, C1 field-testing of an RIS bushing, with nameplate power factor of 0.26%, at cold ambient temperature yielded:

Mean temperature of bushing based on ambient and transformer oil temperature:

$T_{\text{bushing}} = 10^\circ\text{C}$

Measured C1  $\text{Cos } \emptyset$  from insulation analyzer:

$\text{Cos } \emptyset @ 10^\circ\text{C} = 0.32\%$

Relative  $\text{Cos } \emptyset$  for  $10^\circ\text{C}$ , from curve:

$\text{Cos } \emptyset_{\text{rel}} = 1.2$

Correction factor:  $K = 1/\text{Cos } \emptyset_{\text{rel}} = 0.83$

Corrected C1 power factor to normalized ambient of  $20^\circ\text{C}$ :  $\text{Cos } \emptyset = K * 0.32 = 0.26\%$ , matching nameplate value.



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### Partial Discharge (PD)

Partial discharges occur whenever there is discontinuity in electric field intensity that exceeds the dielectric withstand of a small portion of an insulating material. It is therefore critical that factory acceptance testing detects any PD anomaly for inception and extinction at the prescribed voltage level. Dry type RBP bushings have intrinsically higher partial discharge levels since tiny voids and cracks are normally formed during manufacture of their condenser cores. In fact, PD-related damage is a common cause of failure for this type of bushing since self-healing of the insulation, as the case for air or OIP insulation, is not possible.

By contrast, modern resin-impregnated RIS dry-type condenser cores for transformer bushings undergo more stringent impregnation and drying. This process is carried out under vacuum and strictly controlled temperature and duration, ensuring no formation of voids or cracks. The result is bushings with no detectable PD up to the highest system voltages. Validation of the manufacturing process is done during routine testing of the complete bushing. Here, PD is measured at increasing AC test voltage steps up to the one-minute power frequency withstand test level, UP, while simultaneously also measuring main insulation C1 capacitance and power factor. Only external test laboratory background PD should be detected and 1 pC internal PD is set as acceptance criteria during the bushing test at 10 kV; 0.5VL-G; 1.05VL-G; 1.5VL-G; 1.82VL-G; 2.0VL-G; UP and decreasing back to 10 kV through the same voltage steps. This special factory test confirms that PD inception voltages for RIS bushings are never reached, even at the highest possible bushing operating voltages or temporary system overvoltages. It also verifies that there are no deviations in C1 capacitance and power factor values at various test voltages.

### Impulse Testing

According to IEEE C57.19.00-2004, Section 7, any impulse testing of transformer bushings is considered a design test and not a routine test. This means that impulse tests are not required during factory acceptance tests. For end-users, it is considered best practice to include impulse tests in the transformer bushing technical specifications they issue in order to ensure that the manufacturer selected has implemented some form of impulse testing during the routine test plan. For example, the impulse test sequence included in IEC 60137-2017, Section 9.3 should be requested for all bushings rated above 69 kV voltage class. The impulse test sequence should include, as a minimum:

- one full lightning impulse of negative polarity at 105 % of rated withstand voltage followed by;
- two chopped lightning impulses of negative polarity at 115 % of rated withstand voltage, followed by;
- four full lightning impulses of negative polarity applied at 105 % of rated withstand voltage.

Full AC routine tests should be performed before and then repeated after the impulse test sequence. This practice is particularly important for replacement bushings, where these would not be subjected to any impulse tests during the transformer factory test.

### Bushing Replacement

During routine maintenance and inspection of power transformers, several critical aspects are checked in regard to the bushings. Condition of the bushings is assessed based on results of this inspection or through an on-line bushing sensor. Main reasons why a bushing needs to be replaced include:



## INTERNATIONAL NEWS

- Increase in power factor, capacitance or PD above manufacturer recommended values;
- Loss of oil or identified oil leak;
- Presence of combustible gasses in the bushing oil;
- Damaged bushing.

Other factors to consider in determining whether or not to replace a bushing are:

- Inadequate bushing specification or technology for the application;
- Older style bushing that do not allow for installation of remote monitoring.

Further special issues to consider include:

- Outdated/changed technical specification or obsolete standards;
- Unusual operating conditions and renewable energy/special applications;
- Demanding load profiles under abrupt changes in operating and ambient temperatures;
- Bushing air-side termination with rigid bus connection.

### Selecting Replacement Bushings

Thousands of transformer bushings are replaced every year. RIS bushings are compatible for replacing legacy bushings from most manufacturers and their manufacturing process allows for customization of dimensions as well as for special designs. When replacing bushings connected via draw lead cables, RIS bushings can be provided with customized adapter bolts or studs to match existing draw lead studs with no or only minimal changes to the draw lead cable. When replacing bushings in high seismic zones or near coastal region where pollution and salinity are severe, bushings equipped with composite insulators and hydrophobic silicone sheds should be used. These insulators are ideal for such service locations since they are mechanically stronger than porcelain and also provide better performance under heavy pollution.

### Key Parameters to Consider

Fig. 7 provides critical dimensions, as per IEEE C57.19.01-2017 Section 4.



Composite insulator with hydrophobic silicone sheds.

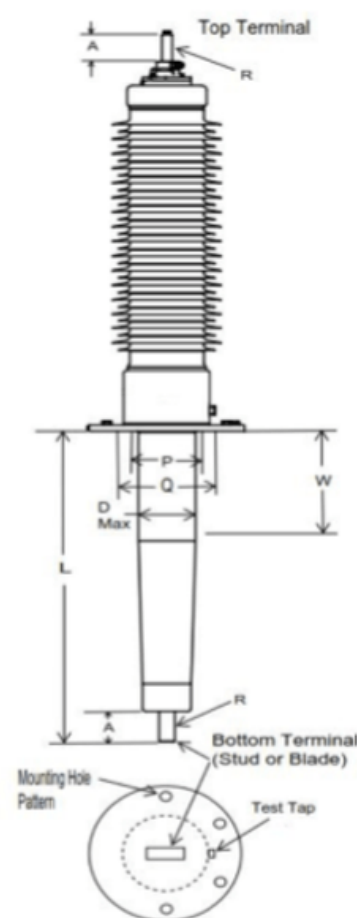


Fig. 7: Critical dimensions when selecting a replacement bushing.



## INTERNATIONAL NEWS

- Suitable bushing technology;
- Current rating equal or greater than existing bushing;
- Turret, tank cover and CT opening allowance;
- Static shielding requirements and tank clearances;
- Lower length "L" dimension;
- Lower end diameter 'Dmax';
- Bottom connection configuration A, R;
- Flange mounting BCD and number of holes;
- Air side height and air clearance requirements;
- Mounting angle to vertical;
- Top terminal configuration, A, R.

Meeting the above critical dimensions as well as verifying internal transformer tank electrical clearances and shielding provisions will help minimize risk of bushing incompatibility.

In addition to improvements in bushing technology, on-line sensors also contribute to prevention of transformer failures. For example, Siemens has an upcoming sensor system measuring capacitive leakage current and providing comparison/sum of values to provide basic information on health of a bushing. Benefits include reducing unplanned outages as well as cost savings achieved through planning replacement or mitigation measures.

### Conclusions

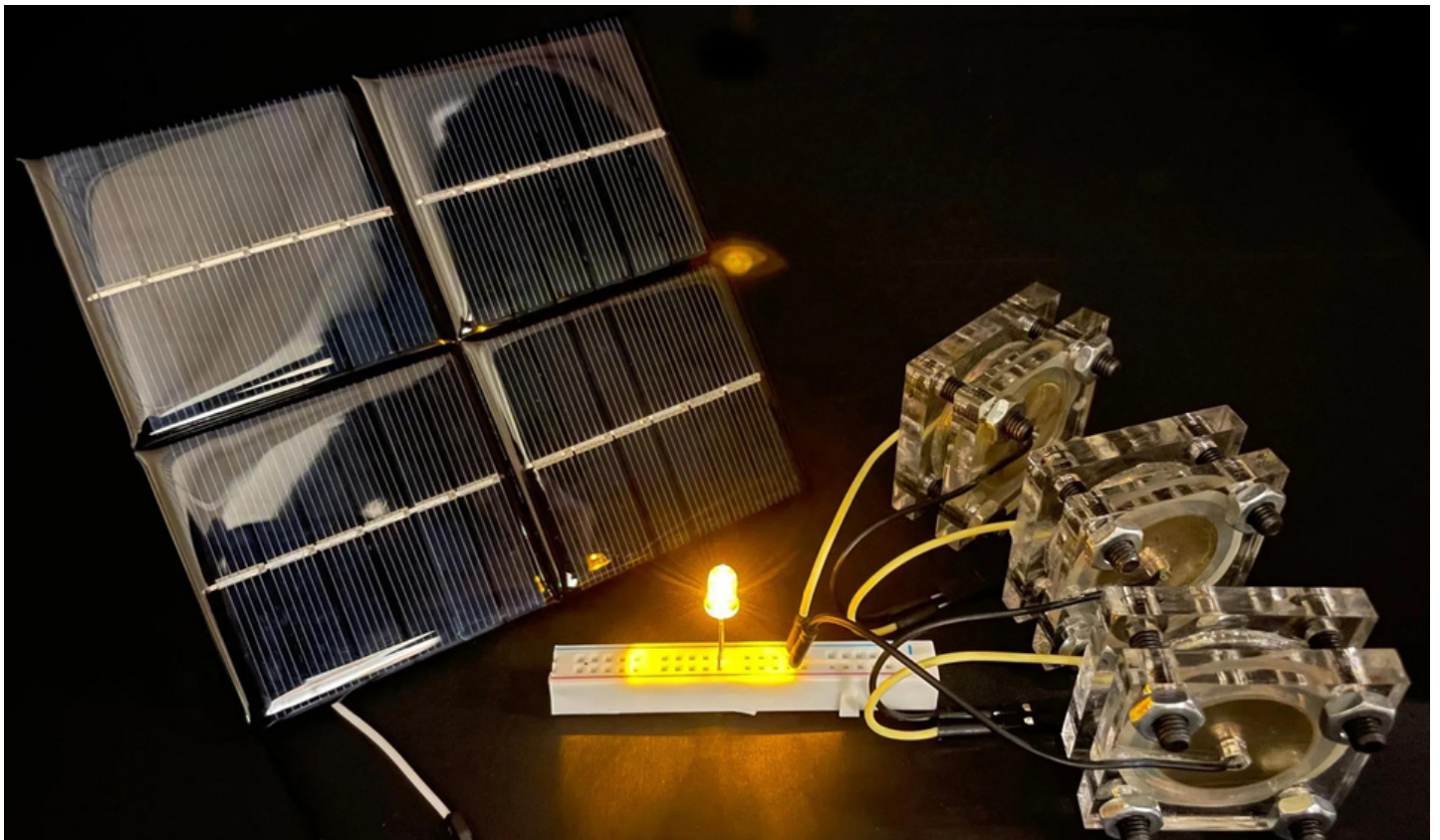
Resin-impregnated synthetic style bushings represent an exciting technological innovation and these oil-free, paper-free dry transformer bushings are now available for system voltages up to 550 kV. The flame-resistant insulating body of each RIS condenser bushing is made of a special synthetic impregnated with epoxy resin under vacuum. The design of these new bushings is based on mature RIP condenser core technology, proven in field for more than 60 years. While paper is a good electrical insulation material, it is also hygroscopic and absorbs moisture from its environment. Humidity negatively impacts power factor and ageing of bushings but proper drying of paper is time and labor-intensive process during manufacture. Following an intensive development program, the special paper used in RIP bushings can now be replaced with a synthetic web with more homogeneous properties and minimal moisture absorption that substantially reduces or even eliminates such disadvantages.

RIS bushings are characterized by stable dielectric properties, attributable in part to the major reduction in risk of moisture absorption at exposed active surfaces, e.g. the oil end of transformer bushings. In addition, their higher temperature class gives bushings of this series greater thermal reserves. Since RIS bushings are not oil-filled, there are no constraints with regards to the storage position. The standard RIS bushing are designed for installation in a position 0 – 30° from the vertical and in many cases horizontal installations at 90° from vertical are possible.

## INTERNATIONAL NEWS

### THIS SUPERCAPACITOR IS MADE FROM CEMENT

By Sarah Wells | 3 Aug 2023 | Source: [IEEE Spectrum](#)



*Using ancient materials, MIT researchers have designed a supercapacitor that could one day help power homes and even wirelessly charge EVs. FRANZ-JOSEF ULM, ADMIR MASIC, AND YANG-SHAO HORN/MIT*

As the world continues to try and move away from fossil fuels, researchers are looking for new ways to store energy produced from greener sources like solar panels. As part of that effort, a team of researchers from Harvard's [Wyss Institute for Biologically Inspired Engineering](#) and [MIT](#) have developed a supercapacitor using only cement, water, and a form of carbon called carbon black.

Energy produced from renewable sources often needs to be stored for a rainy day. But batteries are not always the best option. They take time to charge, and building them requires difficult-to-source materials like lithium which can be costly and harmful to the environment.

[Franz-Josef Ulm](#), a professor of civil and environmental engineering at MIT, and his colleagues were interested in developing supercapacitors with readily available materials, like cement, to not only fill a gap left by battery technology but to also address another environmental issue: [concrete's carbon footprint](#). Their [work](#) was published 31 July in the journal PNAS.

"One [motivating issue] is the enormous environmental footprint of the worldwide cement and concrete production which amounts to roughly 8 percent of the worldwide CO<sub>2</sub> emissions," says Ulm, who is senior author on the new paper.



## INTERNATIONAL NEWS

“We can use this energy-storage solution to support the urgently needed transition from fossil fuels to renewable energy—brick by brick, wall by wall, road by road.”

The team sought to redeem cement’s image by using it as the base for their supercapacitor’s electrodes. Unlike batteries, which use chemical reactions to hold and discharge electricity, supercapacitors work by creating a charge difference between two conductive plates. This charge can be maintained for a long time and discharged quickly when needed.

To build their supercapacitor, the team mixed together a paste made of cement and water, and then introduced a small amount of carbon black—a fine, charcoal-like form of carbon that has been used as a pigment and writing material for thousands of years. For instance, carbon black was used to pen the Dead Sea Scrolls in the 3rd century BCE. History aside, carbon black is also a highly conductive material.



*This new supercapacitor can be easily scaled thanks to its large internal surface area of conductive material created by using carbon black. FRANZ-JOSEF ULM, ADMIR MASIC, AND YANG-SHAO HORN/MIT*

As the cement mixture cured, the water was absorbed and left behind a branching network of tunnels that the carbon black filled. The end result is that the cement paste is filled with a large surface area of conductive, wirelike tunnels, without expanding the overall volume of the electrode.

Ulm says that the reaction of carbon black in the electrode is a crucial discovery because it could make scaling this supercapacitor much simpler.

“What we found is that the maximum energy storage capacity only depends on the specific surface of the carbon black,” Ulm says. “Since this carbon black is space-filling—thanks to the magic of chemistry!—we can simply increase the volume to create large-scale bulk energy solutions.”

The team completed the supercapacitor by soaking two electrodes in an electrolyte solution to provide charged particles to the system. In their trials, they fabricated button-size capacitors capable of holding 1 volt of charge and determined that the capacitor was able to maintain its storage capacity with minimal loss over 10,000 charge-discharge cycles. Three of the 1-V supercapacitors were also able to charge a 3-V LED.

The team also developed button-size capacitors with different ratios of cement to carbon black but found that while adding more carbon black (above 10 percent by volume) to the mixture increased its storage capacity, this came at the cost of the cement’s structural integrity. And for the use cases that Ulm and colleagues have in mind, the structural strength of the cement is essential.

Concrete is already used to construct roads, and so the team sees an opportunity for concrete roads that could also wirelessly charge cars as they’re driving, similar to wireless charging pads for smartphones. “Such self-charging roads already exist, but use coils embedded in the road system and connected (mostly) to a grid energy source. The energy in our system would be harvested from clean energy sources and stored into the pavement structure.”

The team also has plans to integrate these supercapacitors into the foundations of residential homes. They estimate that a 45 cubic meter sample of their supercapacitor could hold 10 kilowatt-hours of energy—equivalent to about one-third of an average U.S. household’s daily electricity usage.

As the next step, Ulm says the team is now focused on developing a 12-V supercapacitor using these materials. “[We’ll] continue to have fun...pushing this technology to its limit,” he says.

This story was updated on 4 August 2023 to correct and clarify several distinctions between concrete and cement.



## INTERNATIONAL NEWS

# COULD SCR CATALYST TECHNOLOGY ADOPTION BE A ROADMAP FOR POWER PLANTS SEEKING ECONOMICAL AND EFFICIENT CO<sub>2</sub> POINT

By [CORMETECH](#) | 8 Aug 2023 | Source: [Power Magazine](#)

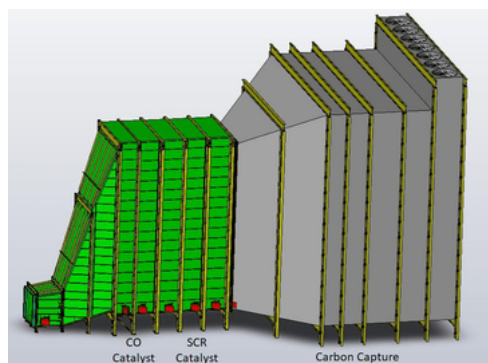
As the quest to develop a net-zero carbon emissions electricity grid marches on, global entities like the International Energy Agency (IEA) increasingly point to a big role for carbon capture, utilization, and storage (CCUS). The IEA goes so far as to say reaching net-zero will be nearly impossible without CCUS.

Proposed governmental greenhouse gas emissions standards, intense scrutiny of carbon footprints, and a flood of public- and private-sector investment have fueled an explosion of interest in CCUS technology and solutions. Still, widespread point-source CO<sub>2</sub> capture on the industrial level is in the early stages.

Nowhere is this more apparent than in the natural gas-fired power plant environment. Successfully mitigating CO<sub>2</sub> emissions at their source during electricity production would tip the balance toward natural gas power being embraced as a plentiful and reliable source of clean power in the net-zero era.

While CCUS technology long has existed—particularly as the foundation of enhanced oil recovery—a major hurdle to widespread adoption has been the high cost and inefficiency associated with conventional liquid amine-based CO<sub>2</sub> capture methods. Traditional carbon capture technologies often require substantial energy input, resulting in reduced plant efficiency and increased operational costs. The capital required for implementing large-scale CO<sub>2</sub> capture facilities has also been significant, deterring power plant operators from pursuing these solutions. Moreover, the footprint required for these systems often makes it impractical to retrofit existing facilities.

As we grapple with the complexities of implementing point-source carbon capture in the power plant sector, the triumphs of selective catalytic reduction (SCR) system adoption may offer valuable lessons. Since the early 1990s, SCR catalysts have been widely employed to reduce nitrogen oxide (NO<sub>x</sub>) emissions from fossil fuel combustion, leading to cleaner, smog-free air.



1. The CORMETECH PSC concept for natural gas-fired power plants combines SCR and carbon capture to address both NO<sub>x</sub> and CO<sub>2</sub>. Courtesy: [CORMETECH](#)

The journey to economical and space-efficient SCR systems offers more than a case study, though. Some emerging point-source capture (PSC) technologies (Figure 1) are currently being engineered to work in concert with and as an extension of existing SCR systems, offering the potent punch of combined NO<sub>x</sub> and CO<sub>2</sub> reduction.

### Back to the Future: The SCR Innovation Curve

SCR systems were first patented in the U.S. in 1959. Early applications to reduce NO<sub>x</sub> were installed on natural gas combined cycle (NGCC) plants, followed closely by installations on coal-fired power plants in the early 1990s.



## INTERNATIONAL NEWS

By 2006, 100 GW of SCR-equipped coal-fired capacity was operational. More than 300 coal-fired plants have received SCR technology in the U.S. alone, principally retrofits on existing steam generators, with many more installations internationally. Many of those installations, which continue to operate successfully today, have SCR catalysts manufactured by [CORMETECH](#).

Significant operating experience and technological advances have made SCR a safe, reliable, and economical approach to NOx reduction. Modern SCR systems can reduce NOx emissions from coal-fired and combined cycle plants by more than 90%, and gas-fired applications typically achieve greater than 95% NOx reduction. The systems' modular design affords seamless retrofit into existing plants and straightforward integration into new builds.

### Moving to Net-Zero Carbon Emissions

The world is rapidly progressing toward a net-zero carbon emissions electricity grid, with developed nations leading the way. The IEA has presented the "essential conditions" for the global energy sector to reach net-zero carbon emissions by 2050 to limit global warming.

While urgency existed to reduce toxic smog causing NOx emissions, CO2 emissions pose an existential crisis to people and the planet. The path to net-zero is multi-faceted and nuanced, where SCR reduction was targeted to a particular industry and technology. However, CCUS is receiving an increasing share of industry and government investment because the potential to capture CO2 at the emission source is a proven and straightforward strategy that the SCR analog shows has worked before.

Recognizing the adjacency between environmental catalyst technology and CO2 monolith adsorber development, the U.S. Department of Energy has awarded CORMETECH pilot funding to advance direct air capture (DAC) and PSC technologies. For PSC, CORMETECH—with support from power industry partners including Southern Company and Middle River Power—will deploy in early 2024 at the U.S. National Carbon Capture Center a fully integrated process model intended to achieve at least a 20% cost reduction versus established liquid amine system technology.

The CORMETECH approach begins with a patent-pending sorbent-infused honeycomb-structure monolith adsorber module. This breakthrough technology employs a fully functional wall for increased CO2 capture versus a monolith surface coated with sorbent. This design approach eliminates solvent regeneration and much of the capital costs for pumps, heat exchangers, piping, and controls.

The modular system housing the infused monoliths employs a temperature-swing adsorption/desorption process to separate CO2 from flue gas. Direct steam injection facilitates desorption, and once condensed, readies the CO2 for transport and utilization or sequestration. Borrowing from CORMETECH's expertise in catalyst geometry, modular design, regeneration, and recycling, this emerging PSC concept promises a significantly smaller and more integrated emissions control footprint than existing liquid amine systems with significantly lower costs.

Central to the cost-reduction is a patented circular-sustainability platform that already lengthens CORMETECH catalyst product life through regeneration of deactivated catalysts and then extends to recycling end-of-life catalysts to produce raw material for the manufacture of new catalysts. Applying this same model to CO2 adsorbers opens the door to the PSC system's adsorbers being regenerated (versus fully replaced) with next-generation sorbents that would make them even more effective and powerful CO2 capture engines. Other major advantages of this approach are that virtually no landfill waste is generated and the carbon footprint is greatly reduced.



## INTERNATIONAL NEWS

### The Advantage of Adsorbent-Based CO<sub>2</sub> Capture in NGCC Plants

- Simple, efficient, highly scalable design with low capital cost.
- Much smaller footprint than liquid amine systems
- Adsorbers operate at low pressure drop, allowing the use of low-cost fans.
- High efficiency due to increased contact area between flue gases and the adsorbent.
- Adsorbent PEI (polyethyleneimine) is contained (in a fixed position) within the monolith's internal pore structure eliminating direct contact of the bulk flue gas with the adsorbent.
- No movement of the adsorbent produces negligible stack emissions and no operation loss of the adsorbent.
- No equipment corrosion concerns as the adsorbent is contained and not recirculated.
- High efficiency as the adsorber only requires low-quality steam available from the heat recovery steam generator to regenerate.
- Manageable lifecycle costs as demonstrated through CORMETECH expertise and capabilities for monolith regeneration.

CORMETECH's new design approach is elegant in its simplicity, yet features strong integration with existing power plant systems. This process occurs in a multi-bed cyclic process unit but without the need for a vacuum, which enhances scalability to large NGCC plants. The process uses familiar components (such as SCR modules), there are no liquid amine solutions used in the process, pressure drop on the gas side is kept low to minimize the impact on plant efficiency, and the thermal swing in operation is low so thermal energy requirements are minimized. Like an SCR system, CORMETECH's modular deployment is scalable for specific applications.

Even with the passage of the U.S. Clean Air Act Amendments of 1990, no one could have imagined that a few decades later power plant generated NO<sub>x</sub> emissions would be 87% lower, even as fossil fuel-powered plants continue to be the backbone of the U.S. electricity grid. SCR catalysts enabled cleaner power generation across coal, natural gas, and newer hydrogen-oriented facilities.

Could the potential answer to CO<sub>2</sub> abatement that doesn't compromise affordable and reliable electricity generation emerge from the SCR adoption roadmap? Don't bet against it.



## CIGRE UPDATE

### **Welcome to Next Generation Network (NGN) Australia**

CIGRE Next Generation Network (NGN) is a division of CIGRE Australia that aims to develop the next generation of power engineering professionals.

CIGRE NGN is the first step for young engineers (up to 35 years old) to directly interact with one of the largest and most prestigious international power industry bodies. CIGRE was established to develop and distribute technical knowledge and experience in the field of generation, transmission and distribution of high voltage electricity. It does this by providing an interactive forum that brings together key players, research workers, producers, manufacturers, system operators, traders, and regulatory bodies.

### **Women in Energy Australia (WiEA) Network and NGN Australia**

The Women in Energy Australia (WiEA) Network is a group of CIGRE and NGN members, working together to empower both current and future members to build fulfilling careers in the energy industry and in CIGRE. The NGN Australia committee plays an integral role in supporting the Women in CIGRE group.

To find out more about the WiEA Network: [Click here](#).

### **For NGN Members**

Find more member-only content and discussions on the NGN Australia KMS Group pages.  
Go to NGN Australia KMS Homepage: [Click here](#).





## CIGRE UPDATE

### CIGRE CAIRNS UPDATE

CIGRE Australia is proud to announce that it will be hosting the Global CIGRE Symposium at the Cairns Convention Centre 4-7 September 2023. (This is an in-person event only)

On behalf of the Australian National Committee, we are very pleased to welcome you to the 2023 CIGRE Symposium, which will be held between September 4 and 7 in Cairns, Australia. These technical challenges.

The theme of the Symposium is the end-to-end electricity system: transition, development operation and integration. The Symposium will focus on the integrated power system and the transformation into the power system of the future. It looks to identify what can be learned from experience and current developments in the power system and the changes that are necessary to move towards a sustainable power system.

These themes are particularly relevant as the world moves to transition the electricity industry to a lower carbon future. The transition is affecting all aspects of the power system from the end customer load through transmission and distribution networks to the largest generators. Solutions will require new technologies, complemented by innovative ideas to optimise load and generation balance. The timing of this global Symposium is therefore very opportune and will allow attendees to discuss how various countries are tackling these issues from both technical and economic perspectives.

The four-day international event will involve eleven of CIGRE's sixteen Study Committees, A3,B1, B3, B5, C1, C2, C4, C5, C6, D1 and D2. and in excess of forty working group meetings. There will therefore be many opportunities to engage with experts involved in these technical challenges.

#### **A call for papers was published in August.**

The event will be held in the multi-award-winning Convention Centre in Cairns on the north east coast of Australia. This is on the doorstep of the World Heritage listed Great Barrier Reef and the foot of the Daintree rain forest. The coral reef is the world's largest and is composed of more than 2,900 individual reefs and 900 islands over an area of approximately 344,400 square kilometres.

A technical tour and a range of activities have been organised to ensure there is an opportunity for all to enjoy the outstanding location.

We look forward to welcoming you to Cairns and our CIGRE 2023 Symposium,

Kind Regards,  
Dr.Sean McGoldrick Chairman CIGRE Australia  
Phil Southwell Chair of the Local Organising Committee



## CIREP PAPER

# FORECASTING PROCEDURE AND TECHNOLOGIES FOR A CONGESTION MANAGEMENT IN LOW VOLTAGE GRIDS

CIREP Paper 1156 - Porto 2022

### ABSTRACT

The increase in decentralised generation and the massive expansion of e-mobility are causing short-term load and generation peaks in the distribution grid. To prevent these power peaks from overloading operating equipment, the flexQgrid project is testing automated congestion management. This congestion management is based on forecasts of the future grid status generated by building energy management systems and an external provider.

### INTRODUCTION

The low voltage grid faces new challenges due to further increase in renewable decentralized power generation and flexible consumption units such as private charging infrastructure for electric vehicles in low voltage grids. The simultaneity of charging processes is a widely discussed topic. However, considering current funding programs and the following strong increase of installed charging stations, even a lower simultaneity of charging processes can cause grid congestions. To avoid these situations, charging stations requiring approval can be rejected in the future if the number of charging stations is already too high in the considered grid cluster. In order to enable the energy transition and a quick and secure integration of the requested number of charging stations into the grid of the future, new concepts for the coordination of flexibilities to avoid grid congestions are required.

The approach tested in the federally funded project *flexQgrid* uses quotas at the grid connection point of buildings and plant sites to avoid predicted congestion as well as to optimise the utilisation of the existing grid and the individual preferences of customers. The operation of charging stations for electric vehicles, heat pumps, photovoltaics and battery storages within households is optimised and coordinated by building energy management systems (BEMS). Each BEMS can react differently in situations of a predicted congestion and adapt its planned operation schedules – for example throttling the charging power of the electric vehicle or shifting the charging times.

[DOWNLOAD PAPER](#)



## ANNOUNCEMENT

# SPONSORSHIP & EXHIBITION BOOKINGS NOW OPEN

### ABOUT EECON

EECON is a highly anticipated annual conference brought to you by the Electric Energy Society of Australia that brings together industry leaders, experts, and professionals from the Australian electric energy sector. This year's conference, which will take place on the 15th and 16th of November at Crown Promenade Melbourne, promises to be a groundbreaking platform for networking, knowledge sharing, and business growth. Learn more about EECON at our website:

**EECON2023.com.au**

### WHO CAN I EXPECT TO MEET AT EECON?

As a sponsor or exhibitor at EECON 2023, you will have the opportunity to showcase your company's products, services, and innovations to a diverse and influential audience. Last year we hosted over 270 delegates including representatives from utility companies, regulating bodies, academic institutions, project proponents, and consulting firms. EECON 2023 is the ideal platform for you to gain valuable exposure and generate new business prospects.

### WHAT SPONSORSHIP AND EXHIBITION OPPORTUNITIES ARE AVAILABLE?

To explore the various sponsorship and exhibition packages available, please visit our official website: [www.eecon2023.com.au/sponsorship](http://www.eecon2023.com.au/sponsorship). You can also download the prospectus via the button below. You will find detailed information about the packages, pricing, and the exclusive benefits each option offers. We have tailored these packages to suit businesses of all sizes, ensuring there is an opportunity for everyone to participate and benefit from this event.

**DOWNLOAD THE PROSPECTUS**

### I'VE GOT QUESTIONS, WHO CAN HELP?

Should you have any questions or require further information, please do not hesitate to reach out to our conference organiser Candice at [candice@2em.com.au](mailto:candice@2em.com.au). We are here to assist you and provide any necessary support throughout the process.

We look forward to welcoming you as a valued sponsor or exhibitor at EECON 2023!



## UPCOMING EVENTS

### GENERATOR PERFORMANCE STANDARDS (GPS)

WEDNESDAY 6 SEPTEMBER 2023

WA

[VIEW EVENT](#)



**Overview:**

This presentation offers a comprehensive insight into the dynamic realm of Generator Performance Standards (GPS) within the Wholesale Electricity Market (WEM). It initiates a focused dialogue, delving into the experiential feedback of customers navigating the transition from Tech rules to WEM rules. [Read more.](#)

**Time:** 4:30 PM to 5:45 PM AWST

**Location:** Online via webinar or in-person at Western Power Auditorium, 363 Wellington St, Perth 6000

**Cost:** Member: \$0  
EA Member \$20.00  
Non-member: \$30.00

### HV CABLE RATING CALCULATIONS COMBINING IEC 60287 WITH THE FINITE ELEMENT TECHNIQUE

TUESDAY 12 SEPTEMBER 2023

NSW  
ACT

[VIEW EVENT](#)



**Overview:**

The IEC 60287 series of standards provides equations for calculating high-voltage power cable current ratings based on an equivalent thermal model. Problems with the standard methods include they are limited to certain installation configurations and make assumptions that are often inaccurate. For example, they are unsuitable for solar farm installations where dozens of power circuits are installed in shallow trenches within multiple backfills.

**Time:** 11:00 AM - 12:00 PM AEST

**Location:** Online Webinar

**Cost:** Member: \$0  
EA Member \$20.00  
Non-member: \$30.00

### SYDNEY SPRING SOCIAL & NSW ACT CHAPTER AGM

TUESDAY 12 SEPTEMBER 2023

NSW  
ACT

[VIEW EVENT](#)



**Overview:**

Join us for the EESA Sydney Spring Social. Enjoy a delightful evening with great conversation, drinks, and nibbles. Connect with other power professionals in a relaxed and enjoyable space.

We are calling for nominations for the 2024 EESA NSW/ACT Chapter Committee and the EESA NSW/ACT Chapter AGM will take place during the evening.

**Location:** Mezzanine Level  
44 Market Street  
Sydney NSW 2000

**Cost:** Member \$0  
Member Concession \$0  
EA Member \$0  
Non-member: \$30





## UPCOMING EVENTS

### QUEENSLAND PUMPED HYDRO + EESA QLD CHAPTER AGM

WEDNESDAY 13 SEPTEMBER 2023

QLD

[VIEW EVENT](#)



The EESA Qld AGM will be followed by a presentation on Queensland Pumped Hydro.

The Pioneer-Burdekin Pumped Hydro project is a key deliverable as part of Queensland Government's Energy and Jobs Plan. As the transition to renewables accelerates, reliable and stable energy supply cannot be achieved without large-scale storage and on-demand generation.

**Location:** Aurecon Brisbane  
25 King Street, Bowen Hills  
OR online via webinar

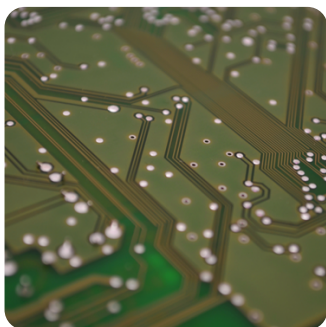
**Cost:** Member \$0  
Member Concession \$0  
EA Member \$20  
Non-member: \$30

### AUSTRALIA 4.0 SESSION #6 - CRITICAL DIGITAL TECHNOLOGIES

THURSDAY 14 SEPTEMBER 2023

NSW  
ACT

[VIEW EVENT](#)



**Overview:**

The new grid will take on many similarities to a truly distributed communications network. Clearly, the ICT community is to be encouraged to embrace this transformation and rapidly assess the challenges and opportunities this will raise.

**Time:** 9:30-11:00 AM AEST

**Location:** Online webinar

**Cost:** Member: \$0  
EA Member \$0  
Non-member: \$0

### HANDS ON PRACTICAL LOW CODE AI

TUESDAY 19 SEPTEMBER 2023

NSW

[VIEW EVENT](#)



**Overview:**

This workshop is designed for domain experts such as engineers in the field that need, or want, to add AI enhanced workflows to their daily operations. We start with an overview of the key theory of AI numerical methods with a focus on practical day-to-day operations and finish out with collaborative, hands on worked examples that show low-code methods for undertaking unsupervised learning, supervised clustering and unsupervised deep learning problems.

**Time:** 9 - 1 PM AEST

**Location:** Mezzanine Floor 44 Market Street ,  
Sydney New South Wales, 2000

**Cost:** Member: \$0  
EA Member \$0  
Non-member: \$30.00



## UPCOMING EVENTS

### MANAGING EVS IN AUSTRALIAN URBAN AND RURAL GRIDS

THURSDAY 21 SEPTEMBER 2023

NSW  
ACT

[VIEW EVENT](#)



**Overview:**

The adoption of electric vehicles (EVs) poses technical and economic challenges for our power grid. Electricity distribution networks were not designed with a high penetration of electric vehicles in mind. Charging EVs at home can significantly increase our normal demand, affecting the poles and wires. [Read more.](#)

**Time:** 11 AM - 12 PM AEST

**Location:** Online Webinar

**Cost:** Member: \$0  
EA Member \$20  
Non-member: \$30

### THE NEXT GENERATION TECHNOLOGY PROJECT | SHOWCASE & AWARDS 2023

TUESDAY 26 SEPTEMBER 2023

WA

[VIEW EVENT](#)



**Overview:**

The Western Australia Chapter of the Electric Energy Society of Australia extends a special invitation to you to attend the 2023 Next Generation Technology Project Showcase & Awards. Entry is free and refreshments are available.

**Time:** 01:00 - 4:30 PM AWST

**Location:** Western Power Corporation, Ground Floor Auditorium, 363 Wellington St, Perth WA

**Cost:** Member: \$0  
EA Member \$0  
Non-member: \$0

### NET ZERO - AUTONOMOUS NETWORKS FOR THE FUTURE

WEDNESDAY 18 OCTOBER 2023

WA

[VIEW EVENT](#)



**Overview:**

Following the success of the one-day seminar and training day last year, the WA chapter is holding another one this year.

This seminar will look at networks of the future, from microgrids to those connected to a larger grid that can operate with minimal direct control and meet the requirements of Net Zero.

**Time:** 9 AM - 4 PM AWST

**Location:** Mercure Hotel, 417 Hay Street Perth WA 6000

**Cost:** Member: \$150.00  
EA Member \$150.00  
Non-member: \$175.00



## UPCOMING EVENTS

### WOMEN IN ENGINEERING SUMMIT 2023

18 OCTOBER - 02 NOVEMBER 2023

NSW  
ACT

[VIEW EVENT](#)

#### Overview:

Elevate your skills, guide your organisation & advance your career.

Following last year's sold-out event, the Women in Engineering Summit returns in 2023 as the premier gathering point for women working in the engineering sector throughout Australia.



**Time:** 8:15 AM - 6:30 PM AEST

**Location:** Aerial UTS Function Centre, Sydney

**Cost:** Member: \$3,695.00  
EA Member \$3,695.00  
Non-member: \$3,695.00

### EECON 2023

WED - THU 15-16 NOVEMBER 2023

VIC

[VIEW EVENT](#)



#### Overview:

The National Council and Victorian Chapter of the Electric Energy Society of Australia extend a warm invitation to join us at EECON 2023.

This year's EECON conference will take place on 15th and 16th November 2023 at the Crown Promenade Conference Centre in Melbourne, and the theme is Leading the energy transition the Australian way - Powering up with Resilience.

**Time:** 2 day event

**Location:** Crown Promenade Conference Centre 8 Whiteman Street, Southbank, VIC 3006, Australia

**Cost:** Early bird rates until 14 August  
Member: \$850.00  
EA Member \$900.00  
Non-member: \$950.00

## UPCOMING EVENTS

### Hands on practical low code AI

An Introduction to practical AI theory with applied hands on worked examples to creating and evaluating the quality of models.

This workshop is designed for domain experts such as engineers in the field that need, or want, to add AI enhanced workflows to their daily operations. We start with an overview of the key theory of AI numerical methods with a focus on practical day-to-day operations and finish out with collaborative, hands on worked examples that show low-code methods for undertaking unsupervised learning, supervised clustering and unsupervised deep learning problems.

**You will need your own laptop.**

[engineersaustralia.org.au](http://engineersaustralia.org.au)

#### Date & time

Tuesday, 19 September  
9:00AM - 1:00PM AEST

#### Venue

Engineers Australia Sydney Office  
Mezzanine Level, 44 Market Street  
Sydney NSW 2000

#### Tickets (incl. GST)

Members & students \$0  
Non-members \$30

#### Registration close

Tuesday 19 September | 8:00 AM AEST

[REGISTER NOW](#)

### About the speaker



**Dr Peter Brady** MIEAust CPEng NER  
Principal Application Engineer

Dr Peter Brady is a Principal Application Engineer at the MathWorks where he works across the engineering spectrum with a focus on maths, statistics, optimisation, machine and deep learning as well as cloud scale out. Before MathWorks Peter worked in the areas in surface water, hydraulics and hydrology as well as fluid dynamics and submarine cavitation inception. He has undertaken research in free surface hydraulic simulation, thermodynamics and nanofluidics. Peter has a PhD in Mechanical Engineering and a Bachelors in Civil Engineering, both from UTS, and is a Chartered Practicing Engineer with Engineers Australia and a Certified Professional with the Australian Computer Society.





## UPCOMING EVENTS



31 October - 2 November 2023 | Sydney | Australia

Elevating your skills: Innovation, advancement & the profession's future

Following last year's sold-out event, the [Women in Engineering Summit](#) returns in 2023 as the premier gathering point for women working in the engineering sector throughout Australia.

**The Women in Engineering Summit 2023** is your chance to hear from inspirational & industry-leading women working at the forefront of the profession. Gain firsthand insights into game-changing new innovations revolutionising the area & what they mean for your organisation and your career. Develop strategies to grow your leadership skills so that you can cultivate and mentor resilient future leaders in your organisation.

This unique, one-of-a-kind program is tailor-made for women in engineering who want to bolster their knowledge, hone their skills, advance their careers, and guide their organisation into the future.

### Speakers include:

- Asha Mathew, Director, Engineering Policy and Engagement, Defence Australia
- Ingrid Fuentes, Manager, Network Safety and Risk, Energy Queensland
- Dr Gunilla Burrowes, Director, Civil Engineering Infrastructure, Blue Economy Cooperative Research Centre
- Praema Ranga, Engineering Capability Manager, Boeing Defence Australia
- Sarah Hannah, General Manager, Operations, Windlab
- Dr Gunilla Burrowes, Director, Civil Engineering Infrastructure, Blue Economy Cooperative Research Centre
- Beatriz Toribio Lopez, Head of Asset Engineering, RES
- 

*View all speakers [here](#).*

### Why you need to be at the Women in Engineering Summit:

- Build an effective engineering leader's toolbox & chart your path to a successful long-term career
- Improve your project outcomes by developing key project and risk management skills
- Learn how to create and thrive in a more diverse, inclusive & functional workplace
- Gain strategies solve the engineering skills shortage, build your skillset & strengthen your team
- Unleash the impact of technology in your role to increase efficiency & elevate project outcomes
- Embrace ESG & sustainable engineering to create innovative & environmentally conscious solutions
- Connect with inspiring leaders who can help you achieve your potential as an engineer and a leader

*Register with VIP code 'EESA10' to save 10% off the registration fee for EESA members.*

*Book online [here](#) or call +61 (0)2 9977 0565.*



## THANKS TO OUR CORPORATE MEMBERS

### PLATINUM



#### MISSION

"Through our passion for innovation and always finding a better way, we are taking reliability, customer service and product value- for-money to a new level in the transformer industry."

### GOLD



### SILVER



### BRONZE

