NATIONAL BULLETIN

Bulletin 6 | 2022

National Energy Market Issues

By Jeff Allen, National President of the Electric Energy Society of Australia | 20 June 2022

In early June 2022 most of the discussion in the media was about the significant price increases in the east coast gas and electricity markets. This then turned to potential blackouts due to insufficient generation capacity and then to AEMO "closing the market".

Electricity prices reached extreme levels and the following were some examples:

- 2023 contracts trading at $217/MWh
- 2024 trading at $132/MWh and
- 2025 prices $115/MWh

Contract prices in early 2022 had been between $50 and $80 per MWh (depending on which state).

The electricity spot market also surged with average monthly prices above $300/MWh in 3 states and SA prices increasing by over 100% compared to the prior month. The spot price rose to over $15,000 per MWh in mid-June. The following table indicates the monthly pricing trends.

State	Dec 2021	Jan 2022	Feb 2022	Mar 2022	Apr 2022	May 2022
NSW	$67.96	$75.16	$83.00	$100.68	$186.87	$320.14
QLD	$128.64	$115.92	$162.67	$147.20	$219.76	$349.32
SA	$70.30	$76.39	$54.15	$67.00	$152.36	$318.46
TAS	$49.84	$61.71	$72.18	$74.83	$141.27	$215.51
VIC	$32.21	$47.50	$54.12	$54.78	$141.51	$233.98

Retail gas pricing also increased significantly as shown by the following pricing

- 2022 fixed price agreements trading above $30/GJ
- 2023 prices above $20/GJ and
- 2024 prices of $18/GJ

These figures compare with an average of about $6/GJ in previous years.

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

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While some of the contributing factors driving these price increases might be considered short term, it is difficult to see when these prices may return to "normal".

There are very few market-based solutions to address current conditions. As we saw recently, intervention by AEMO was required to administer the market and protect consumers, businesses, and industry. A domestic gas reservation policy for the east coast like the approach in Western Australia would be very useful. The Federal Government has also asked AEMO to purchase an appropriate level of gas reserve to help the availably of gas on the east coast and to mitigate price increases.

AEMO can also intervene in the market and cap gas prices as it did recently. Gas prices for the Sydney Short Term Trading Markets (STTM) and Victoria Declared Wholesale Gas Market (DWGM) were capped at $40/GJ after reaching cumulative high price thresholds in Victoria on 30 May and Sydney on 7 June. The pricing will remain capped in both markets until the cumulative price falls and remains below the threshold for a day.

Electricity prices in all east coast states reached extraordinary levels by historical standards. NSW had a shortfall of generation and thus was depending on Queensland and Victorian generation for making up the shortfall. The balance of supply and demand will remain tight due the due to unplanned outages and the early retirement of existing coal fired plant particularly in NSW. Another issue was insufficient domestic coal supplies due to export market demand and problems with flooding in some mines (because of the severe wet weather over the past few months). Recent cold weather conditions also impacted the amount of solar generation available and resulted in increased heating demand.

As a result of the electricity and gas pricing movements, all energy ministers (Federal and State), AEMO and the AER met on 8th June and that resulted in a decision that will see a National Transition Plan created by all Australian Governments in line with AEMO's 2022 Integrated System Plan (ISP). The draft ISP (which has been out for industry feedback) lays out the transmission and generation infrastructure necessary to meet future demand in the National Electricity Market.

The Federal Government has tasked the Energy Security Board with drafting a Capacity Mechanism for the electricity market. This mechanism will ensure there is adequate dispatchable capacity in the system to ensure demand is always met.

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As some background to these concerns, wholesale electricity spot prices surged during the month of May with increases of 109 % in SA and 71 % in NSW, compared to April's average price levels. Electricity spot prices rose significantly across all states for the third consecutive month. The primary reason was due to baseload plant outages, higher input fuel costs and lower levels of solar output. Another factor was the level of gas fired generation required to operate to support demand due to the reduced levels of coal and solar generation.

The following table shows the proportion of electrical generation in the NEM, by fuel type, during the months of April and May 2022 and for 1 week in mid-June.

Source	Month of April 2022	Month of May 2022	One week mid - June
Rooftop Solar	8.2%	5.1%	5.5%
Utility Solar	5.6%	3.8%	3.2%
Wind	19.8%	11.0%	15.4%
Hydro	5.3%	10.9%	11.2%
Gas (various)	5.6%	9.5%	11.4%
Black Coal	41.7%	43.1%	38.3%
Brown Coal	13.7%	16.4%	14.8%

As can be seen from the table the amount of gas-fired generation supporting the NEM increased and the increasing gas prices resulted in higher spot prices across the NEM.

On the 13th and 14th June AEMO intervened in the National Electricity Market (due to insufficient reserve generation in the market) directing generators in Queensland, NSW, Victoria, and South Australia to produce energy above the capped price ($300/MWh) that AEMO introduced to manage the price of generation in the market. These actions were about ensuring continuity of supply to customers.

On the 15th of June AEMO suspended the spot market in all regions of the National Electricity Market (NEM) from 14:05 AEST, under the National Electricity Rules (NER). AEMO took this step because it could not continue operating the spot market while ensuring a secure and reliable supply of electricity for consumers in accordance with the NER. A pre-determined suspension pricing schedule for each NEM region was applied and a compensation regime implemented for eligible generators who bid into the market during the suspension price periods.

The reality is that having an east coast National Energy Market (for gas and electricity) exposes customers to the price movements of coal and gas as a result of supply and demand issues both within Australia and internationally. A gas reservation scheme and implementing a capacity market mechanism in the NEM will assist. The risks of price increases and continuity of supply issues will continue as the NEM moves away from coal generation.

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ENERGY SECURITY BOARD PROPOSES MODEL FOR NEM CAPACITY MECHANISM

20 June 2022 | Source: ESB media release

The Energy Security Board (ESB) has released a high-level design paper for a capacity mechanism seeking stakeholder feedback on key issues that will inform the final detailed design recommended to Ministers.

Energy Ministers tasked the ESB with progressing detailed design work on a mechanism that specifically values capacity in the National Electricity Market (NEM), as part of the broader post-2025 suite of reforms.

The proposed high-level design outlines the ESB's preferred approach to key design choices, including:

- who is eligible to participate,
- the degree of centralisation of forecasting and procurement,
- the nature of the obligation placed on capacity providers in return for a capacity payment,
- the role of interstate trade, and
- how costs are passed through to customers.

One of the principles provided by Ministers to guide the design is to focus on continued emissions reductions in electricity supply. The ESB is seeking further guidance on this principle from Energy Ministers, to assist the ESB in appropriately reflecting this principle in detailed design choices regarding eligibility and auction design. This would not affect a jurisdiction's ability to determine which technology is eligible to participate.

ESB Chair Anna Collyer said a capacity mechanism will be a key tool to ensure we maintain reliability as the NEM undergoes an unprecedented period of transition.

"Coordinating exit and entry of supply, including the mix of resources to ensure an orderly transition, is an enormously complex task," Ms Collyer said.

"A capacity mechanism – which pays providers to have capacity available during certain periods – will help reduce the risk of a disorderly transition. It will provide a more direct and certain way to ensure we have the right amount of capacity and right mix of capacity available when and where we need it so we can continue to deliver reliable and affordable power as our system decarbonises.

"This is not a new concept – most markets in the world already operate markets that explicitly value capacity – but it is a big change for the NEM, so we are encouraging all stakeholders to participate in the design process so we can deliver a considered and collaborative design that is fit for the future."

The ESB is aware of concerns that a capacity mechanism could cause customers to pay more for the same level of service. This is not the intent, and will be avoided through careful design that balances the income that capacity providers would earn between capacity and energy sources to promote lower cost investment while ensuring payments are only made where benefits to consumers can be demonstrated.

The ESB will continue working with stakeholders on developing the final design, with a final recommendation due to Ministers by the end of the year. Submissions on the paper are due by 25 July 2022, with details of a stakeholder webinar to be confirmed and circulated in the coming days. For more information and to read the paper, click here.

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WHY WE NEED A CAPACITY MARKET IN THE NEM: FINKEL

By Alan Finkel | 20 June 2022 | Source: Sydney Morning Herald

With the right plan, Australia can take big strides towards reliable, zero-emissions electricity.

Australia's east coast electricity grid was under unprecedented pressure last week, laying bare the challenges of achieving a zero-emissions electrical system. It's hard, really hard. And it's only the beginning. The next step is to expand our zero-emissions electricity generation, and hydrogen produced from it, to replace oil and gas in transport, building heating and industry.

It has been easier for countries such as Norway and France because they have drawn on hydroelectricity and nuclear electricity to massively reduce their emissions. Tasmania, too, has achieved virtually 100 per cent emissions-free electricity through its combination of hydro and wind electricity.

From an engineering perspective, hydroelectricity and nuclear are dream players, producing electricity on demand and contributing to the reliable operation of the grid. Solar and wind generation are less co-operative , but realistically that's all the Australian mainland has at hand. To deploy them, they must be supported by transmission lines, storage and arguably a modest amount of natural gas generation.

There has been record investment in the past three years that has seen our solar and wind generation in the east coast grid almost double from 12 per cent to 23.5 per cent in 2021. On a per capita basis, our solar and wind generation is comparable with California; for solar electricity, Australia is No. 1 in the world.

Where we are behind schedule is on the construction of transmission lines, especially the local lines to connect solar and wind energy zones to metropolitan and industrial loads.

The requirements for transmission lines are well described in the Australian Energy Market Operator's integrated system plan, a recommendation of the 2017 review of the national electricity market that I chaired. The new federal government's $20 billion fund for transmission and grid strengthening will accelerate implementation.

As we design the electricity system of the future, it is essential to plan for the extremes, not the averages. In the past few weeks alone, we have suffered from floods , global price pressures, generator breakdowns, lower than usual wind and the normal low winter sunshine. A rare combination of events indeed, but rare events come in many shapes and sizes and, overall, one or the other happens frequently. More foreseeable is that every few years we will see low sunshine and low wind weather patterns lasting for days or a week or two.

The solution is to invest in long-duration storage. Today, the only way to achieve that is with pumped hydro, but such

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projects have been rare because of local objections to the facilities and to installing the transmission lines to connect them. In future, hydrogen made from excess solar and wind electricity during good weather will be stored in large volumes and used to fuel converted natural gas generators to provide long-duration storage.

The economics for investing in storage work well for short-duration storage of an hour or two. For that reason, investment in big batteries in Australia is already happening and growing rapidly. However, because the existing electricity market only pays for energy (megawatthours) dispatched, long-duration storage that will only be called upon infrequently is not an attractive investment. The solution is to introduce payments for the capacity to provide electricity on demand. This is an additional market mechanism known as a capacity market. Details for such a market have been planned by the Energy Security Board and, encouragingly, federal, state and territory energy ministers have agreed to fast-track its adoption.

There are questions about whether it should include coal and natural gas. If the federal government in 2017 had not rejected the clean energy target recommended by the Finkel review, coal generation owners would already be participating in an orderly exit consistent with the targeted emissions reduction.

On the other hand, natural gas generation could be included because it provides on-demand electricity that can ramp up and down within minutes to match the variable solar and wind. Natural gas generators will increasingly only be used as the last resort for a small number of hours per year. But the natural gas has to be available in volume and at reasonable price, which could be achieved by encouraging more supply and implementing a domestic reserve.

The fear that building new natural gas generators will lock them in for decades can be avoided by ensuring that in future they can be powered by hydrogen, as in the Tallawarra B power station under construction in NSW.

The imminent threat of blackouts has been averted through excellent system management by AEMO, supported by constructive action by the energy ministers. We must learn from the current price and availability crunch that the transition will not be easy, but with the kind of determination currently being manifest it should be eminently doable.

Alan Finkel, Australia's former chief scientist, chaired the 2017 national electricity market review, the 2019 hydrogen strategy and the 2021 low-emissions technology roadmap.

DAPTO SUBSTATION FIRE CONFIRMS DEPENDABILITY OF TRUSTED DESIGN

By Angus Dalton | 20 June 2022 | Source: Sydney Morning Herald

Editor's Note: The article below describes the spectacular and potentially catastrophic transformer fire at Transgrid's Dapto substation. Thankfully these are rare events, but when they do occur the reliability of our power supply depends on time proven design, construction and maintenance standards of our substations. These include built in redundancy and isolation of critical components, particularly transformers, to prevent the fire spreading uncontrollably. Here is proof of this in action. TM

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Authorities expect a blaze at an electrical substation south of Sydney to burn for days after 100,000 litres of oil caught fire and triggered explosions on Saturday.

The fire at the Dapto substation caused delays at Shellharbour Airport, said Fire and Rescue NSW Superintendent Adam Dewberry, grounding planes as thick clouds of black smoke belched into the atmosphere.

Sixty firefighters waited several hours for the site's electricity to be shut off as they prepared to fight the blaze.

Dewberry said it was a delicate operation and firefighters were working strategically to bring the fire under control.

"We need to make sure we've got a few things in place before we start applying foam and water," he said. "The 330,000 volts around us at site does make it a bit hard. It just adds that complexity.

We're working with TransGrid technicians, hazardous materials response technicians and the EPA to make sure that when we put this plan in place, it's an effective and safe plan for everyone and the environment."

Transgrid confirmed electricity supply to the surrounding area would not be affected.

"One of the redundant transformers at Dapto substation has mechanically failed, resulting in a contained oil fire," a Transgrid spokesperson said.

Energy Australia said the fire, which started about 3pm, resulted in the nearby Tallawarra Power Station being taken offline for about two hours, but the station was back online ahead of the evening energy peak.

No one was injured in the fire.

Police advised residents to stay inside and close their doors and windows as smoke moved across Wollongong and Unanderra. Transgrid said the smoke was not toxic.

Fire and Rescue NSW Commissioner Paul Baxter said it was a "very dangerous operation".

A second transformer was at risk of catching fire and high-voltage powerlines were damaged in the blaze, but Dewberry said that by 6.30pm the fire had reduced in intensity as the oil burned off.

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A POST-BLAME EXPLANATION OF THE CURRENT ENERGY CRISIS

By Sarah McNamara | 15 June 2022 | Source: Australian Energy Council

In times of crisis, it can be strangely satisfying to have someone to blame for it: a mistake, a villain, a government, a company. The bigger the crisis, the bigger the need to hold someone responsible.

Australia and the world are reeling from the most serious global energy crisis in decades. The imposition of economic sanctions against Russia following its invasion of Ukraine has created a global energy shortage. Europe was already facing tight energy supplies as below average wind generation for much of 2021 had forced it to use up much of its gas reserves.

Imposing sanctions on Russian oil, gas and coal has created major economic headaches in Europe, as they have few alternative suppliers. The aggressive re-contracting of available energy supply chains has sent global prices for these fossil fuels to record highs.

This price shock wave has now reached Australian energy markets, with spot market prices for black coal above $500 per tonne and $40 per GJ for gas. These prices are four to five times the long-term average.

These high fuel prices have driven up the price of electricity, as generators have had to compete with these international spot prices to buy some of their fuel. Coal generators are more exposed to spot prices now because they have been reducing forward-contracting in anticipation of continued increases in renewable generation. That's how the transformation was supposed to work.

This price spike hit Australia at the same time as a fierce June cold snap, following two months of low wind generation, reduced coal stockpiles, and heavy rains slowing coal mine output. Solar output is below average due to the shorter days.

The cold weather has exacerbated the problem by increasing demand, which made the energy shortage more acute. On top of this there were unscheduled outages in some coal generation units. The disruption to global supply chains is causing delays in getting essential parts to fix these units. It has been a combination punch of shocks: global energy shortage, increased exposure to spot prices, cold, wet weather and unplanned, prolonged outages.

Is the NEM broken?

The short answer is no. The long answer is recent events have revealed the need for some simple, but important repairs. The combination of all these energy shocks resulted in more than a week of very high wholesale electricity prices. When this happens, it triggers an automatic price cap mechanism in the National Electricity Market. As the name implies, this caps wholesale spot prices at $300/MWh.

This price cap mechanism was designed when the NEM was created in 1998 to manage short term events like summer

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heat waves. Longer term global energy shortages like now were not anticipated. Sustained higher wholesale prices are the market solving for the combination of problems it faces: high demand, some units unavailable and the need to ration scarce coal at some power stations.

Additionally, the cap price has not been updated in more than 20 years. It was originally designed to reflect the maximum price a gas peaker would need to recover its costs. But with gas prices currently at $40/GJ (which is also an artificial cap, so we know that's as high as it can go), this ceiling would need to be around $500/MWh to ensure all generators can cover their costs.

While coal is typically cheaper than gas, its problem is the currently constrained fuel supply. The coal rationing is critical, because coal generators need to run all the time, but want to make sure they have enough coal for the demand peaks in the mornings and evenings. So they deliberately bid in higher prices at other times to bid themselves out of the market. This lets them save more coal for when it is needed and lets generators with more coal take up the slack. It's an oddly elegant way the market solves for the third dimensional problem of coal scarcity.

When a price cap is introduced this coal rationing regime doesn't work. Under the market rules, a generator that has bid in must be fully utilised before the Australian Energy Market Operator (AEMO) can direct other generators to turn on. This inadvertently discourages generators with low coal reserves from bidding in at all. Once directed on by AEMO they can work together to manage limited coal stockpiles to optimise output.

The problem here isn't the generators withdrawing units. The problem is that the automatic price cap is interfering with the market doing its job and complicating the way generators are paid for doing the same thing. This response to the price cap has not increased the risk of outages or impacted on prices paid by consumers. If anything, it has helped reduce reliability risk.

The answer is to either remove the automatic price cap and let the market solve (as it was doing), or at least increase its value, or agree on conditions that trigger AEMO dispatching all generation, so that it can co-ordinate market dispatch under extreme conditions.

AEMO yesterday chose this latter solution, by suspending the NEM indefinitely. It's a radical step, reflective of the extreme market conditions. A suspended market is better than where we were before: where some generators were in the market while others were being directed.

High energy prices and increased reliability risk are bad for the economy and bad for consumers. They are hurting many small energy retailers and exposing the frailties of both relying on and demonising our ageing coal fired generation fleet at the same time.

We need to do everything we can to resolve this crisis as quickly as possible. Australia's energy industry will continue to work with governments, agencies and other stakeholders to achieve this.

It's understandable that people are concerned about this latest event in a series of ever escalating energy bad news. It's easy to apportion blame. It might help if we understood what was actually going on first before taking the moral high ground.

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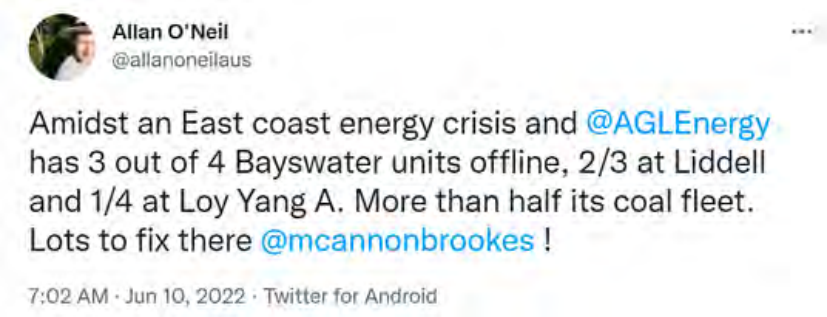
A CLOSER LOOK AT COAL FIRED GENERATION AVAILABILITY

By Allan O'Neil | 10 June 2022 | Source: Watt Clarity

Tweet at your own peril

A quick mea culpa: after squinting at an **ez2view** layout early this morning I dashed off a **tweet** suggesting that six of AGL Energy's eleven coal-fired generation units were offline – three at Bayswater, two at Liddell, and one at Loy Yang A, amounting to more than 50% of AGL's coal-fired fleet. In fact two out of three Liddell units are **online** so it's only 49% (by volume) offline, or a shade over 3,000 MW. A shame you can't edit tweets.



Penance done, this situation again highlights something that's drawn much attention in this East coast energy crisis, the performance of coal-fired generation in New South Wales, Queensland and Victoria. This shortish post tries to summarize – at high level – how performance has trended.

Promise versus reality

All **scheduled** generators in the NEM are required to provide rolling updates of their expected daily available capacity over a two-year forward window as part of the Medium Term PASA process. This is input to one of a whole suite of forecasts that AEMO runs over horizons ranging from hours to years ahead, assessing likely supply adequacy – ie reliability.

Thanks to a **relatively recent rule change**, these forecasts are publicly available down to individual generating unit level, which lets interested parties drill down into the data and more easily compare outcomes to what was projected, by individual unit, power station, fuel type or portfolio.

For example, here's how the outlook for available coal-fired capacity in the NEM over Q2 – up to today – appeared a few days before the quarter started. The top panel shows expected daily availability by generating unit – here filtered down to black and brown coal-fired stations – while the lower chart plots the aggregate forecast availability and "Maximum Capacity" of this fleet. For various historical reasons, that Maximum Capacity line is somewhat overstated and a more realistic figure, if all non-retired units were online, would be more like 22,400-23,000 MW. I'm going to use the lower end of that range as the "practical maximum" from here (which means that my measures of percentage availability are somewhat flattering to the coal fleet).

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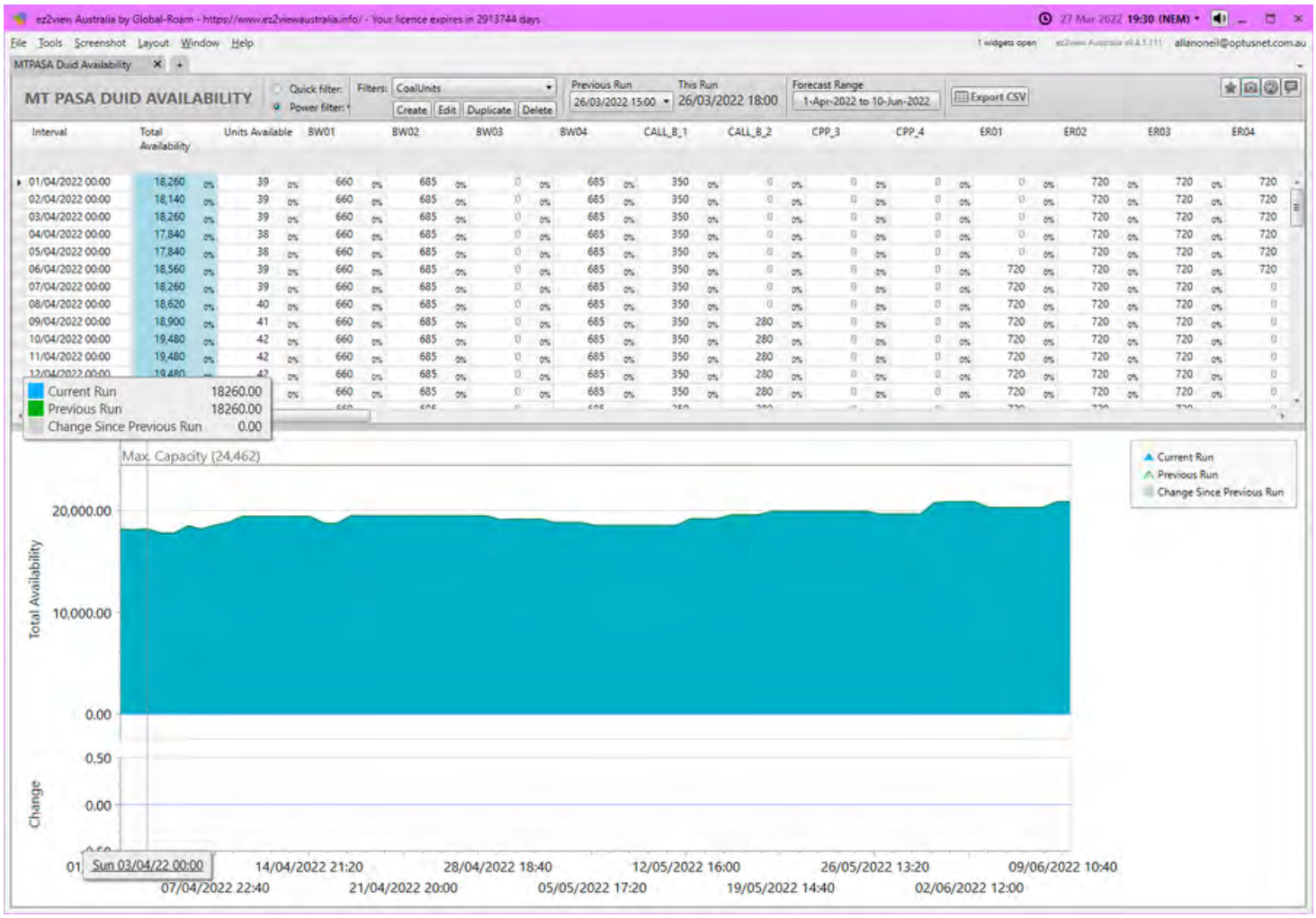

From the chart we can see that 18,260 MW of coal-fired capacity was projected to be available at the start of the quarter, amounting to 81% of fleet capacity, with 19% unavailable. Some of this "known" unavailability was due to planned major maintenance (for example at AGL's Bayswater unit 3 or EnergyAustralia's Mt. Piper unit 2), while some was the result of "forced" outages current at the start of the quarter due to breakdowns of various kinds, both short-term and long-term (for example the major rebuild required at Callide unit 4 after its **catastrophic failure over a year ago**).

By the end of the period charted (today), the expectation for availability was just over 20,900 MW or 93%, with units returning from planned maintenance and repairs. This should be seen as a best-case estimate at the time, as it's not realistic to forecast the timing and extent of the future forced outages which are inevitable across a coal fleet of 47 generating units.

Using other AEMO data on actual availability as the quarter unfolded, summarized at daily level, I've compared this outlook to reality in the next chart below. "Actual availability" represents the maximum level that generators declared they could provide in real time (here expressed as a daily average). Not all this capability was dispatched, as that depends on market conditions – demand, spot prices, generator bid prices and so on.

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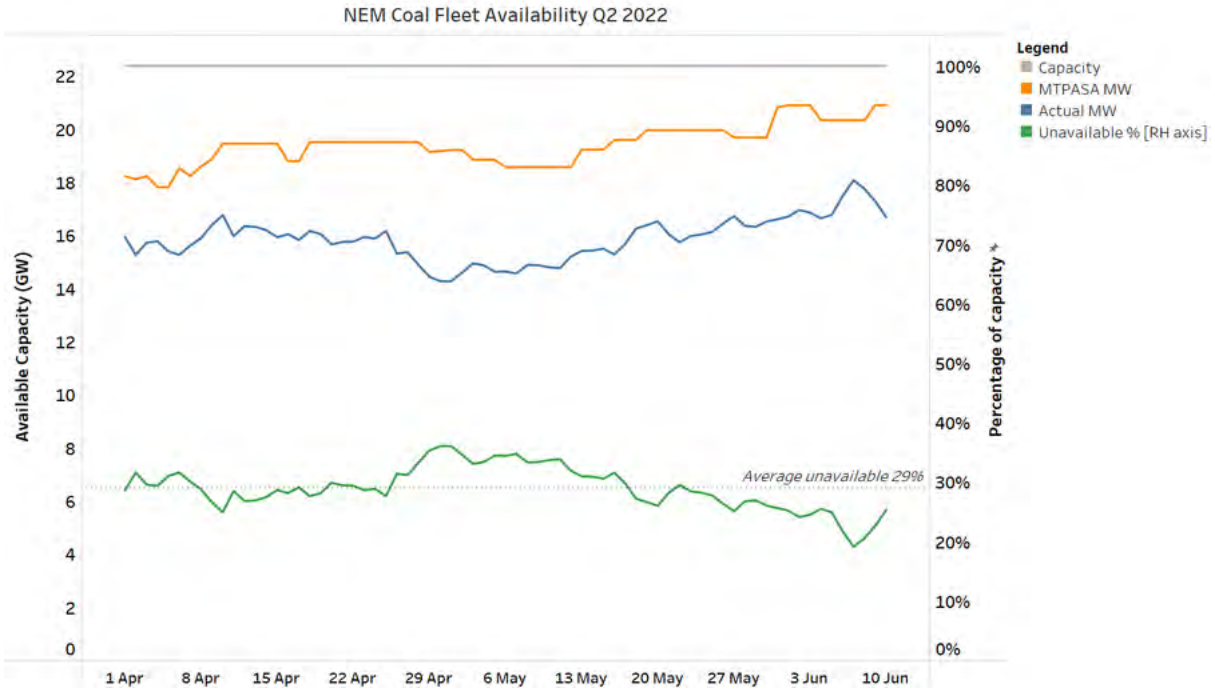

Here we see that actual availability, the blue line, sat well below the start-of-quarter forecast and reached a nadir of just over 14 GW, 64% of (practical) maximum at the end of April. From there until a couple of days ago the data show a slow but steady improvement to 80% availability earlier this week, and then a sudden reversal – just when things were looking better.

Some observations
Availability performance was poor

Availability at **71%** – measured as available generation vs fleet practical capacity – is a poor outcome. Even allowing for known long term outages such as Callide C4 and major maintenance outages at other stations over the period, one would hope to see availability exceeding 80-85% from a coal generation fleet performing well. The period in late April – mid May where unavailability exceeded 30% was particularly sub-standard.

A persistent gap to forecast

Throughout the period shown, actual availability sat consistently 2-4 GW below the MTPASA projection with a maximum gap of nearly 5 GW at the end of April. This gap effectively represents:

- unplanned outages,
- planned outages running for longer than expected,
- derating of unit maximum outputs – often due to technical problems or perhaps fuel supply issues – and
- in a few cases "economic withdrawal" where units were technically available to run if required for supply reliability, but were not offered into the market – for example this applied at times to units at Gladstone power station. Such offer behaviour might again reflect fuel supply limitations.

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This gap to forecast represented **16%** of the total 29% unavailability for the quarter to date, and is far higher than would be expected for an adequately performing coal fleet. An overall forced outage rate well under 10% would be an appropriate goal.

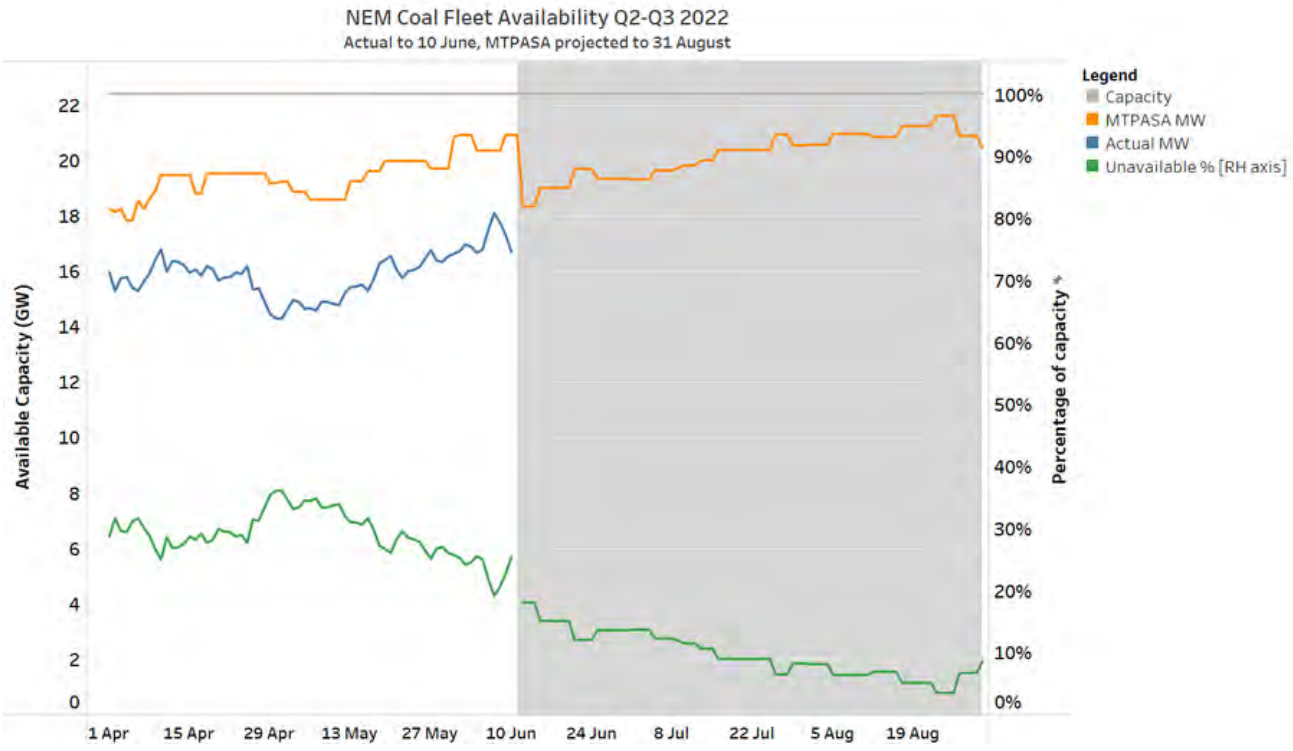
It was also surprising to see this gap start the quarter as high as it did at over 2 GW, as this was relative to forecasts submitted only a few days earlier.

Things can change rapidly

Having crawled to 80% earlier this week, fleet availability has suddenly dipped back towards 70% with unexpected outages in the last three days of two Bayswater units (prompting my tweet) and the remaining Callide C unit – totalling 1,765 MW. Hopefully these are all short outages as we head solidly into winter, particularly as AGL has announced that its Loy Yang A2 unit which went offline with a major electrical failure on April 15th will now **not return to service until the second half of September at the earliest**.

The outlook from here

Finally, what's the latest set of MTPASA forecasts saying about the outlook for coal availability over coming months? Here's the previous chart extended out to the end of August, obviously with no actual data for the forecast period, but with the most recent MTPASA forecasts spliced in – you can see that at the start of the forecast period, those forecasts more closely reflected the availability position as of a few days ago, but once again the forecast got "mugged by reality" with a gap of about 1.7 GW to today's actuals, presumably because of the three recent outages flagged above.



While we know that actual availability will almost certainly be lower – because it excludes future unplanned outages – let's nevertheless hope this forecast is a much better predictor of reality than it has been over the past few months!

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ERARING COAL SUPPLY PROBLEMS EXACERBATE MARKET WOES

By Terry Miller | 1 June 2022 | Source: ORIGIN ENERGY public release

Below is an extract from an Origin Energy advice lodged with the ASX. This highlights one of the current issues with the NEM wholesale price and supply shortages.

In Energy Markets, ongoing challenges with coal supply have been impacting Eraring Power Station throughout FY2022. However, the situation has deteriorated significantly in recent weeks, with material under-delivery of contracted coal compared to expectations, and with Centennial Coal notifying Origin of further production constraints at its Mandalong mine. Deliveries from the Mandalong mine are expected to be interrupted during the remainder of FY2022 and into the first half of FY2023. Equipment supply chain delays are also expected to impact coal deliveries in FY2023.

The recent material under-delivery of coal to Eraring results in lower output from the plant, additional replacement coal purchases at significantly higher prices, and is being exacerbated by coal delivery constraints via rail. Despite positioning the year with a relatively low short position across all states, the lower output from Eraring results in a greater exposure to the purchase of electricity at current high spot prices in order to meet customer demand.

BLAZING A TRAIL: THE SHIFT FROM GAS TO ELECTRIC FIREPLACES IN THE MODERN AUSTRALIAN HOME

By Castworks | 16 May 2022 | Source: Australian Architecture and Design

Editor's Note: This is a promotion from a leading architectural magazine, but highlights the current trends in the more than a century old competition between gas and electricity as a preferred energy source. TM

Modern fireplaces have become the focal point of both indoor and outdoor environments creating a warm, inviting space for family gatherings and social connection. However, the choice between a gas or electric fireplace is not always a straightforward one. While the latest electric models are impressive in their range of features, some designers and specifiers still perceive electric fireplaces as less authentic, less powerful and less value for money than their gas counterparts. As the market moves away from gas as an energy source, these misconceptions are being overturned with the emergence of highly-efficient electric fireplaces with 'smart' technological features and realistic flame patterns.

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Blazing a Trail: The shift from gas to electric fireplaces in the modern Australian home discusses the social, economic and industry trends that have made electric fireplaces the premier design feature for modern Australian homes. This includes the growing concerns regarding the environmental impact of the gas industry, the impact of rising gas prices, and the rise of solar energy installations across the country. We also consider the emergence of new electric fireplace solutions that offer highly-realistic flame patterns alongside premium features and performance.

Starting out as a family-owned business in the late 1990's specialising in wood-fired stoves, Castworks has grown into an industry pioneer driving a change in consumer choice away from the standard "square box on pedestal" towards European styled and design focused fires. Castworks. The Amantii Bespoke range is another example of the high-quality products on offer.

Download this whitepaper and learn why electric fireplaces are overtaking gas as the more environmentally-friendly, user-friendly, budget-friendly and aesthetic choice for modern Australian homes.

COMPRESSED AIR STORAGE BEST SOLUTION FOR BACKUP SUPPLY TO BROKEN HILL

By Transgrid | May 2022 | Source: Transgrid Projects Innovation

LOCAL NEWS

Transgrid has completed the final stage of the Regulatory Investment Test for Transmission (RIT-T) for a new backup supply and after assessing multiple options, identified Hydrostor's 200MW/1,500MWh compressed air storage as the preferred solution.

Transgrid's analysis found the clean technology:

Provides the highest net benefit for consumers and a reliable back-up supply for 17,000 people who live in Broken Hill Would be able to store up to 200 MW of renewable generation which could be made available to meet peak demand, benefiting existing generator customers and electricity consumers.

Aligns with the Federal Government's Technology Investment Roadmap and Low Emissions Technology Statement, which specifically identifies electricity storage for firming as a priority low emissions technology.

Aligns with the strategy of Broken Hill City Council to reach 100% renewable status by 2030, as outlined in their Sustainability Strategy 2018-2023 and Cities Power Partnership Pledge.

About Broken Hill

Broken Hill is located in the far west of New South Wales and is part of Transgrid's south western transmission network. It is currently supplied by a single 220 kV transmission line, 'Line X2', from Buronga which spans approximately 260 km.

When Line X2 is out of service due to a planned or unplanned outage, electricity supply to Broken Hill is supported by two diesel-fired turbines owned by Essential Energy to avoid involuntary load shedding (these turbines each have a nameplate rating of 25 MW). Transgrid relies on these diesel-fired turbines to meet the NSW Electricity Transmission Reliability and Performance Standards 2017 set by the NSW Energy Minister and regulated by the NSW Independent Pricing and Regulatory Tribunal (IPART). In accordance with these standards, Essential Energy's diesel-fired turbines allow Transgrid to operate its network so as not to expect more than 10 minutes of unserved energy (EUE) per year at average demand.

Essential Energy notified Transgrid of its decision to divest the diesel-fired turbines located at Broken Hill and that it would withdraw its provision of network support from 10 January 2022. If no action is taken by Transgrid, this will result in the required reliability of supply to Broken Hill not being maintained, and involuntary load shedding when Line X2 is on planned or unplanned outage.

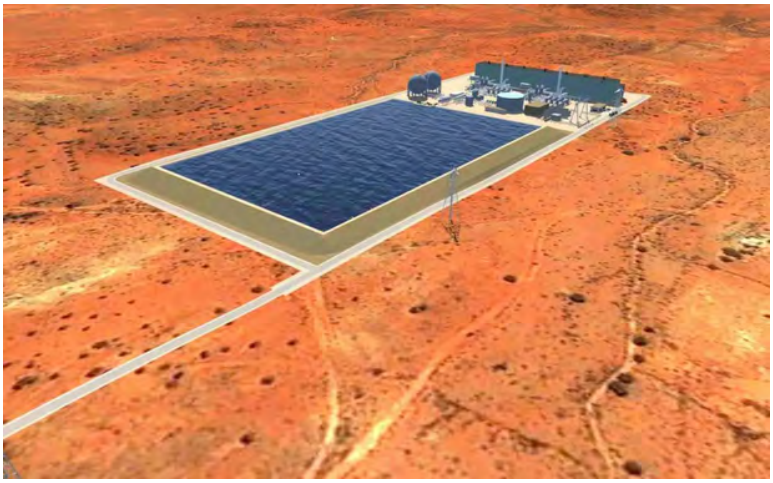
We consider this a 'reliability corrective action' under the RIT-T as the identified need is to ensure that the externally-imposed reliability standards for Broken Hill continue to be met.

In light of Essential Energy's notification that it would withdraw its provision of network support, we made the decision to purchase the existing turbines directly from Essential Energy. The continued use of the existing diesel-fired turbines is the only way for us to meet our supply reliability obligations at Broken Hill in the immediate term. The sale is expected to be completed by 31 May 2022. Essential Energy has agreed, as a condition of the sale, to continue to provide network support until the sale process has been completed. We consider this purchase to be a 'no regrets' decision, as the continued use of the existing turbines, at least in the near-term, was found to be a common feature across all three of the top-ranked options in the PADR assessment.

LOCAL NEWS

BROKEN HILL RENEWABLE MICROGRID REVIVED AFTER TRANSGRID FINDS A WAY TO DUMP DIESEL

By Giles Parkinson | 26 May 2022 | Source: Renew Economy



An artist's impression of the Silver City Compressed Air Storage facility. Source: Hydrostor.

Plans to power the remote New South Wales mining city of Broken Hill with a world-first renewable microgrid have been revived after transmission company Transgrid found a way to dump the diesel option that it was being forced to adopt by Australia's archaic energy rules and regulations.

The renewable micro-grid proposal is based around using – for the first time ever at such scale – a 200MW, 1500MWh storage facility using compressed air technology developed by Canadian company Hydrostor.

Those plans, first announced in 2020, were set to be dumped last year when Transgrid was forced instead to choose the installation of new diesel turbines because Australia's National Electricity Market rules allow no consideration of environmental benefits.

In a strict definition of economic benefits, the highly polluting diesel generators won out over the cleaner energy storage option, but Transgrid and Hydrostor and its project partner Energy Estate have now revisited the plan and – helped by an anticipated grant from the Australian Renewable Energy Agency – believe it wins out over the dirty diesel option.

It's a bold play by Transgrid. Historically, networks are not known for punting on new technologies over traditional poles and wires and other conventional options – partly because of the old fashioned rules that govern the market and discourage innovation.

But Transgrid insists there is little risk to it or consumers, because the nature of the deal with Hydrostor means that the Canadian company and its partner won't get paid if they can't deliver the project. Hydrostor has "proven" the technology at pilot scale, but not yet rolled it out at commercial scale.

"We like non-network solutions," Transgrid's head of delivery, Craig Stallan, told RenewEconomy, adding that Transgrid will nevertheless "upgrade" two existing diesel generators at Broken Hill, at minimal cost, just in case.

"We only pay if it works, we only pay (Hydrostor) if that service is provided," added Marie Jordan, Transgrid's newly appointed head of network.

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The decision to go with Hydrostor – if approved by the Australian Energy Regulator – will turn Broken Hill into a hot bed of edge-of-grid innovation, combing compressed air storage with the existing 200MW Silverton wind farm, the 50MW Broken Hill solar farm, and the newly committed 50MW/50MWh Broken Hill battery.

The region has had more wind and solar generation than it knows what to do with, and has often struggled to export the full output of those facilities to the rest of the grid, resulting in heavy curtailment of the local wind and solar farms.

The addition of the shorter term battery and the longer term compressed air storage will maximise the renewables output, provide more resilience to the local grid, and provide a ready supply of plentiful cheap, clean and reliable green energy for the mining and minerals processing industries that are expected to revive the local economy.

The latest project assessment estimates $268 million of economic benefits from the Hydrostor option, which Transgrid says is a 5 per cent better return than installing two new 25MW diesel generators, and Transgrid notes new investment in fossil fuels is less desirable given the green energy transition happening elsewhere.

The “economic advantage” is, however, dependent on ARENA agreeing to a grant. The size of the requested grant has not been revealed, given it has not been agreed, but the document suggests at least $13.2 million will be needed to keep the storage option ahead. If the grant is not forthcoming, it will be back to the diesels.

Hydrostor plans to install the compressed air storage facility in an old mining operation, using abandoned caverns to store the compressed air which is released when needed to spin turbines and generate power.

Hydrostor describes its technology as a “giant air battery”. It uses off-peak renewable electricity to run a compressor that produces heated, compressed air, which is then stored in underground caverns. When needed, the compressed air is expanded through a turbine to generate electricity.

“TransGrid understands the value offered by our A-CAES solution, and we are very pleased to have been selected as the preferred alternative over competing proposals,” said Hydrostor CEO Curtis Van Walleghem

“New South Wales is a global leader with its clean energy policy and net zero ambitions and we are looking forward to commencing our first A-CAES project in Australia.”

Transgrid’s Jordan says the decision is in the long-term interests of consumers.

“Hydrostor is proposing an exciting technology which would establish a mini-grid using compressed air storage in a disused mine, in conjunction with existing local wind and solar generation,” she said in a statement.

"This initiative would represent an Australian first and the scale of it is impressive.

“As one of the largest renewable mini-grids to be created worldwide, we’d expect it to secure supply for Broken Hill and create at least 260 construction jobs and a further 70 ongoing roles after project completion.”

LOCAL NEWS

NSW IDENTIFIES EIGHT COMMUNITIES FOR REGIONAL MICROGRIDS

By Sophie Vorrath | 16 June 2022 | Source: One Step Off The Grid

A project led by the Australian National University has selected eight sites on the New South Wales south coast for a deeper look into the feasibility of transitioning "at risk" regional communities to a network of islandable renewables and battery-based microgrids.

The Southcoast Microgrid Reliability Feasibility (SµRF) project, a recipient of federal funding under the previous government's Regional and Remote Communities Reliability Fund, is examining the use of microgrids to bolster local energy resilience.

The project is being led the Battery Storage and Grid Integration Program at ANU in partnership with the Southcoast Health and Sustainability Alliance (SHASA), network company Essential Energy, and technology company Zepben.

It came about when SHASA approached the ANU, in a bid to find solutions to the region's "power vulnerability," which had been brought into stark relief during the extreme bushfire season of 2019-20 in Australia.

This week, SµRF named eight sites in the NSW Eurobodalla Shire – Bodalla, Broulee, Central Tilba and Tilba Tilba (treated together), Congo, Mystery Bay, Nelligen, South Durras, and Tuross Head – as the focus for further studies.

The selected sites include small communities of less than 100 residents, medium townships of around 300 residents, and some of the region's larger towns with roughly 2000 residents.

Dr Bjorn Sturmberg, technical lead on the SµRF project with the Battery Storage and Grid Integration Program at the ANU, said the goal was to choose sites that would best address the need to build resilience.

"To do this, we developed an integrated approach that sought to assess the vulnerability of communities based on socio-economic factors, for example age or disability, as well as technical indicators such as historic data on power outages," Sturmberg said.

"It also assessed the ease of implementing a microgrid based on the amount of rooftop solar already installed in each location."

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The team says the selected sites all rank highly in terms of vulnerability, as well as having high rates of solar installs and at least one microgrid option that is relatively tractable.

Also considered were issues like consultation fatigue – especially pertinent in the wake of the investigations into the Black Summer fires – cultural and ethnic diversity, and the layout of the town and electricity network.

On balance, the combination of the sites was also assessed to ensure the project could cover the diversity of the region and, as much as possible, reflect the broader diversity of regional Australia.

"Today's announcement of the eight sites is a key milestone to progressing our understanding of how this may look in the future and more importantly, to working with these local communities to learn how this type of technology may best support them," said Essential Energy chief operating officer Luke Jenner.

"Microgrids will undoubtedly form a part of our broader future network to help local communities work together to access more resilient, cleaner and cheaper energy."

From here, the SμRF team will explore how the Eurobodalla could benefit from various microgrid designs, ranging from backup power for community shelters and essential services to large systems servicing the whole of community.

Research will also weigh up policy and regulatory barriers to feasibility as well as other non-technical factors that will play an important role in ensuring that grid-tied microgrids truly meet people's needs and expectations.

Crucially, the project will seek input from residents, businesses and other groups in all eight communities to gauge their perspectives on different microgrid options and their preferences for how these systems could operate.

"We hope this approach inspires other regional projects, policy makers, and funders to consider a wide range of factors in their efforts to boost resilience," Sturmberg said.

WA PLANS MORE THAN 1GB OF BATTERY STORAGE TO REPLACE COAL

By Michael Mazengarb | 17 June 2022 | Source: Renew Economy

Artist's impression of Yandin wind farm.

The Western Australian government is about to embark on an ambitious investment to replace its last two publicly-owned coal generators with wind, solar and battery storage – enough to take the state's main grid – the biggest isolated grid in the world – to 70 per cent renewables.

Earlier this week, Western Australian energy minister Bill Johnston unveiled a plan to invest $3.8 billion in new projects before the end of the decade, to build the capacity needed to replace the soon to be closed Muja and Collie coal fired power station.

LOCAL NEWS

The investment – which will be managed by government-owned utility Synergy – is expected to deliver upwards of 800MW of new wind generation capacity and more than 1,100MW of new energy storage capacity – the latter to consist mostly of big battery projects.

It would mark an almost doubling of WA's wind generation capacity, which currently sits at around 1,000MW, and a substantial increase to the state's energy storage capacity.

Synergy is currently developing a 100MW/200MWh 'big battery' project at the site of the Kwinana Power Station, expected to be operational by the end of this year.

Alinta also has a proposal for a big battery near the Wagerup refinery, but apart from existing and proposed big batteries in the Pilbara, a separate grid, Western Australian main grid does not feature any large scale battery projects.

Synergy says the specific details of the future renewable energy and storage projects are yet to be finalised, but will almost certainly involve the roll out of a number of additional battery projects, potentially repurposing infrastructure at the Muja and Collie power stations – similar to a proposal put forward by Ross Garnaut's Sunshot Energy.

The WA government expects that by the end of the decade, the state will host as much as 4,400MW of energy storage capacity, when other energy storage projects, community battery projects and residential battery systems are accounted for.

This could include the state's first pumped hydro energy storage project – with the WA government understood to be aiming for between 400 and 800MW of pumped hydro capacity – with Synergy to kick-start a feasibility study.

Under the plan announced on Tuesday, the 340MW Collie power station will close in 2027. The last two remaining units of the 1,100MW Muja power station – the C and D units – will close in 2024 and 2029, respectively.

Johnson says the viability of the two coal fired power stations is becoming eroded by strong growth in renewables uptake, particularly in rooftop solar, and it not longer made sense to prop up the generators.

Just over a third of WA households – around 400,000 in total – currently have solar installed with a combined capacity of more than 1,350MW. The state government expects uptake will grow until 2030 and beyond, with more than half of all WA households set to feature rooftop solar by 2030.

A new planning report by the Australian Energy Market Operator released on Friday predicts "distributed solar", which includes household rooftop solar mentioned above, commercial solar and small PV plants, will grow by at least 240MW a year from 2.2GW to more than 4.5GW in ten years.

The growth in distributed solar, and the government's active investment in new large-scale solar, wind and storage projects will help the state reach 70 per cent renewables by 2040, with the remainder largely provided by gas generation. That share of renewable energy generation represents a doubling of the state's renewables share, and may disappoint some energy activists who say a faster and bigger switch to renewables is possible.

Interestingly, the commitment to close the Collie and Muja power stations mirrors the commitments taken to the last state election by the former WA Liberal leader Zak Kirkup.

LOCAL NEWS

In an effort to shake up the election, Kirkup announced an ambitious plan to close the two power stations by 2025, and to replace them with expansive investments in replacement renewables and storage.

The Liberal party plan was even a bit too ambitious for the incumbent Labor government, which labelled it "risky". Unfortunately for Kirkup, the policy gamble didn't pay off, with the WA Liberals almost entirely wiped out at the 2021 election – winning just two seats.

In addition to the $3.8 billion spend on new electricity infrastructure announced on Tuesday, the decommissioning of the two coal generators is expected to cost the WA government $300 million on rehabilitation works.

Johnston says the state government expects to engage local workers and business from within the Collie region to undertake the dismantling works, while it will also provide additional funding to establish new industries and economic opportunities in the region.

"Our Government is squarely focused on making sure there continues to be high quality, well-paid local jobs in the kinds of heavy industries the Collie region is known for," Johnston said.

"Along with coordinated power station decommissioning works and new industrial projects, this program will provide new opportunities for blue collar workers from Collie and surrounding regions."

REGULATOR ISSUES SECOND URGENT RECALL OF "DANGEROUS" LG BATTERIES

By Sophie Vorrath | 25 May 2022 | Source: One Step Off The Grid

LOCAL NEWS

The Australian Competition and Consumer Commission has called on owners of a range of potentially "dangerous" home battery systems, recalled by LG Energy Solution more than a year ago, to "urgently check" if their systems need to be replaced.

A total of 7,200 LG Chem RESU batteries – which are also under the brand names SolaX Power or Opal system batteries – were originally recalled by LG in Australia in February of 2021, due to the risk of them overheating and catching fire.

But the ACCC says that, to date, about 6,400 of the recalled batteries have not yet been replaced, and it is concerned that this might be because consumers are unaware of the recall – and of the fire risk.

"These batteries have already caused injury and fire damage to properties and could lead to serious injuries or death," ACCC deputy chair Delia Rickard said in a statement issued last week.

"Consumers who identify they have an LG energy storage battery under recall are urged to immediately contact LG to discuss next steps, including a free replacement when available.

"The affected batteries have also been supplied in solar energy storage systems with brand names other than LG, so it is extremely important to check if you have a battery affected by the recall by checking the serial number on the LG website."

The ACCC says the batteries – you can check on the affected serial numbers here or the models in the table below – were supplied by retailers, installers and distributors including AGL Energy, Baywa, CSR, Energy Australia, Krannich Solar, MMEM, One Stop Warehouse, Rheem, Solar Juice, SolaX, Sonepar (as Solar Plus Solutions) and Supply Partners.

The 2021 Australian recall followed a November 2020 US recall issued by the South Korea-based company's North American division, following reports of thermal events causing "limited property damage," but no reported injuries.

At that stage in Australia, there had been no incidents recorded in Australia connected with the batteries, with LG issuing a recall "out of an abundance of caution."

Matters have now become more urgent, according to the ACCC, which notes that there is now a total of nine reported incidents involving the batteries in Australia, all resulting in property damage and, in one case, injury.

The ongoing recall – and potential for further incidents of property damage, or worse – remains a thorn in the side of LG Energy Solution, which has gone through a major rebranding and unveiled the third take on its lithium-ion RESU Home batteries using a different chemistry and design.

LG Energy Solution's general manager of residential ESS, Phillip Crotty, said at the time the recall was first issued that the company's RESU10H line was a fresh take on the battery that "basically bears no resemblance at all to the previous model."

LG Chem was last year also embroiled in a massive global Hyundai electric vehicle recall, after more than a dozen reported fires related to the Hyundai Kona's battery pack – battery packs that used LG Chem cells.

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Battery type	Dimensions
LG Chem RESU3.3	452 x 403 x 20 mm
LG Chem RESU6.5	452 x 656 x 120 mm
LG Chem RESU10	452 x 484 x 227 mm
LG Chem RESU13	452 x 626 x 227 mm
LG Chem RESU7H Type-R	744 x 692 x 206 mm
LG Chem RESU10H Type-R	744 x 907x 206mm
LG Chem RESU10H Type-R secondary	744 x 907 x 206mm
LG Chem RESU10H Type-C	744 x 907x 206mm
SolaX PowerStation (system size)	1570 x 750x x340 mm
Opal Storage (system size)	750 x 1550 x 410 mm (approx.)

EV NEWS

HOW AN AUSTRALIAN COMPANY HAS TRANSFORMED THE GLOBAL ELECTRIC VEHICLE INDUSTRY

By Lachlan Haycock | 25 May 2022 | Source: Engineers Australia CREATE Magazine

Electric vehicle sales are on the rise globally. One of the world's fastest growing EV charger companies capitalising on that rising interest in transport powered by renewable energy was founded right here in Australia.

Engineers Australia made addressing climate change one of its three priorities in advance of last weekend's federal election, reflecting the growing appetite among engineers and the general public alike for action on climate change.

Investment in technologies reliant on renewable energy, such as electric vehicles, or EVs, is paramount to reaching net zero and doing better by the environment.

One company that has put the pedal to the metal to capitalise on EVs is the charger design and manufacturing company Tritium.

The Australian company's transition from home-grown startup to New York Stock Exchange-listed multinational business provides a model for the future advancement of the EV industry.

An Aussie success story

The story of Tritium is one to make any lover of local manufacturing proud.

Founded by a trio of electrical engineers two decades ago, Tritium has expanded so significantly it has become one of the fastest growing EV charger companies in the world.

When *create* spoke with Tritium back in 2019, the Brisbane-based enterprise had around 300 staff and was primarily based out of suburban Murarrie, near the Gateway Bridge.

The company had just inked a deal to supply its new generation charging units to Europe's Ionity charging network. Now, a new factory in Tennessee with three times the capacity of their Brisbane factory will see the creation of 500 local jobs.

"IF AUSTRALIA GETS MOVING, THERE WILL BE A LOT OF INTERESTING BUSINESS OPPORTUNITIES. BUT IF WE START TO LAG BEHIND, OTHER COUNTRIES WILL HAVE AN ADVANTAGE OVER US."
Dr David Finn

EV NEWS

Dr David Finn, one of Tritium's three founding electrical engineers and their current Chief Vision Officer, told *create* that its NYSE listing has enabled the company to inject more money into production and expand their facilities.

"Our capacity in Australia is about 5000 pieces per annum," he said. "But that facility, on opening, will be able to produce 10,000 pieces per annum – and we'll be able to expand it over time to 30,000 pieces. That gives you some idea of the scale that we're dealing with at the moment."

Shifting gears

With sales of electric vehicles in Australia tripling in 2021 to 20,665 from 6,900 in 2020 according to the Electric Vehicle Council, upscaled production will be essential to secure the future of the industry.

Luckily, Tritium's forward momentum does not look like slowing down soon.

"I've been working with the engineers very closely over the last few years to have a product offering that runs all the way from 30 kilowatts all the way to megawatt-scale charging infrastructure, and build those products with a common architecture," Finn said.

EV sales have skyrocketed overseas, and although the Australian market hasn't yet reached the same heights, Finn believes the tipping point is not far away.

"We're going to benefit off the back of what's happening overseas, where there's been some real movement in the marketplace," he said.

This uptick would likely be necessary to put Australia on track to reach the recommended target of 100,000 public chargers by 2027 needed to support uptake of EVs consistent with net zero by 2050.

In the meantime, Tritium is making the most of their hard-earned success.

"Tritium's ability to win in this marketplace is due to the fact that we've managed to get in at the right time and ride the wave globally," Finn said. "We're one of the few players that works across multiple continents.

"It's going to get fascinating when there are more vehicles on the road. Then you can start to do some really interesting networking stuff – think of bidirectional capability, or colocation of charging hubs with energy storage."

His advice for other local industry players? Put the figurative key in the ignition and get moving.

"If Australia gets moving, there will be a lot of interesting business opportunities," he said. "But if we start to lag behind, other countries will have an advantage over us."

EV NEWS

ARE WE READY FOR THE EV REVOLUTION?

By Monaaf Al-Falahi | 2 June 2022 | Source: Energy Insider

A recent State of Electric Vehicles report by the Electric Vehicle Council indicated that electric vehicle (EV) sales in Australia have tripled in 2021. This increase represents a two per cent market share of all sales, compared with 0.78 per cent in 2020. The question is, are distribution networks ready for the EV uptake?

In our previous article Electric vehicles and the grid – can we just plug and play?, we presented some of the potential impacts of EVs on distribution networks, which included asset congestion, voltage issues, conductors and transformers overload. In this article, we look at the results from the University of Melbourne's EV Management and Time-of-Use Tariffs report which explores possible approaches to mitigate impacts from residential EV chargers on distribution networks. The report is part of the collaborative EV Integration project between Energy Networks Australia, University of Melbourne, the Centre for New Energy Technologies, and the Australian Power Institute.

This report investigates the effectiveness of EV management strategy and time of use (ToU). Selected rural and urban feeders (powerlines) for NSW, Tasmania and Victoria were considered in the study. It should be noted that the results presented apply to those feeders only, not the whole distribution network.

EV management strategy

There are a range of EV charging management strategies. This study utilised direct management of chargers, given it did not require models of low voltage (LV) feeders which are not readily available for most distribution network service providers (DNSPs). Sensors were installed on certain locations on the feeder to measure and monitor thermal and voltage changes. When the sensors detected changes outside optimal operating limits, a signal was sent to the EV chargers to connect or disconnect.

EV NEWS

Figure 1 shows the architecture of the proposed management strategy.

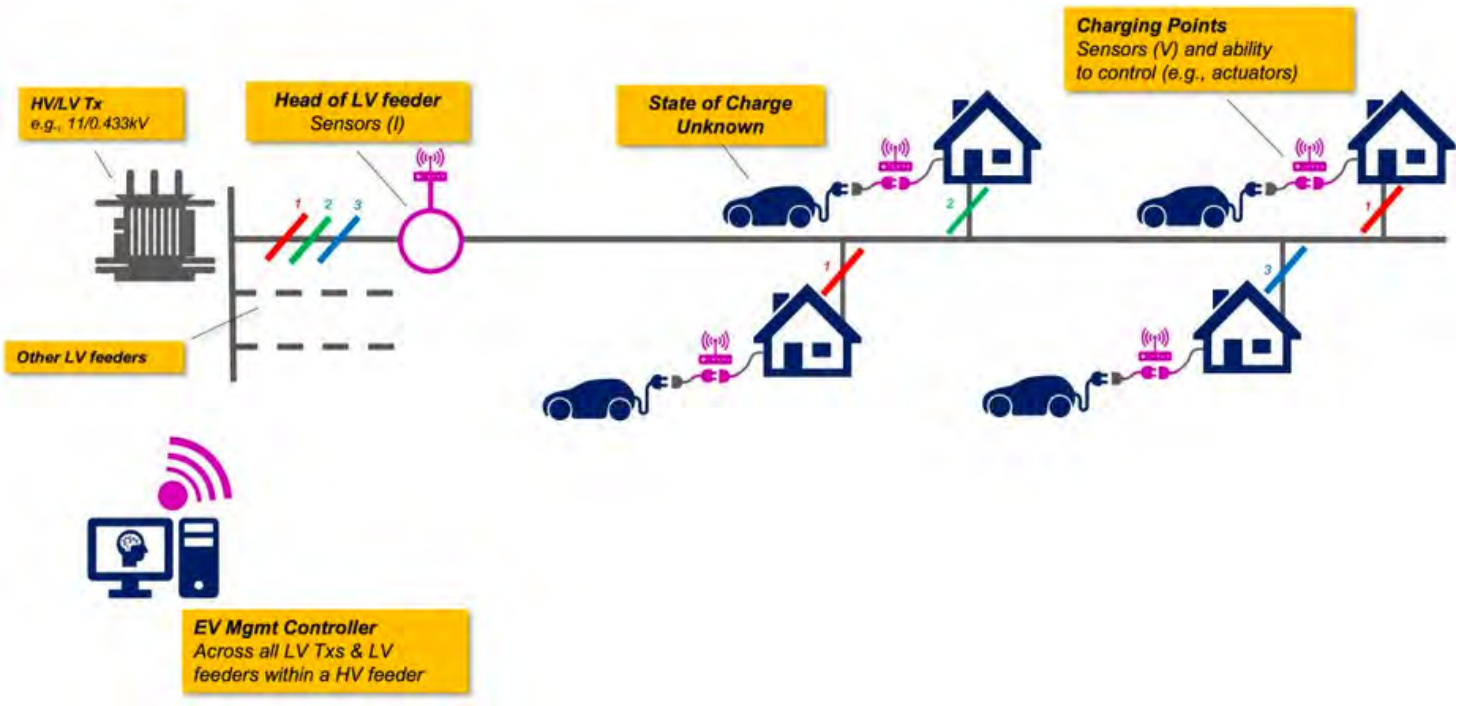

Figure 1: Architecture of EV Management Strategy

The report is not recommending which entity should manage these chargers, but rather aims to investigate the effectiveness of EV management strategies in terms of the impacts on customers and networks.

Some of high-level findings detailed in the report:

- Number of impacted customers: Most EV customers were not impacted by the EV management strategy. Even for the worst performing feeder (rural VIC), 62 per cent of customers were not impacted at 100 per cent EV penetration (100 per cent penetration means all residential customers connected to the feeder have EVs)
- Charging time: Implementing the direct EV management strategy could increase the charging time by maximum of three hours, while the average time increase was 1 hour. In a small number of cases, the charging time was increased by more than three hours.
- Location: Customers in urban areas were found to be much less likely to be impacted by higher EV penetration compared with customers in rural area. Rural areas required much more significant management (e.g., approximately 38 per cent of customers were impacted in the rural VIC feeder considered in this study).
- Hosting capacity: The findings show that a two to four-times increase in hosting capacity could be achieved with acceptable impacts (delays) to customers, as the EVs would still be charged by the morning.

The table below presents a summary of the impact on customers across the investigated feeders from 20 per cent to 100 per cent EV hosting capacity. The table can be read as: (for example) Rural NSW at 20 per cent hosting capacity – seven per cent of EV chargers are managed and 93 per cent of customers are not affected with an increased charging time of 0.2 hours per EV customer.

Table 1: Summary of the impact of customers across the investigated feeders

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Table 1: Summary of the impact of customers across the investigated feeders

Feeder	EV Hosting Capacity				
	20%	40%	60%	80%	100%
Rural NSW (Hazelbrook)	7% Managed 93% Unaffected 0.2hr Increase	10% Managed 90% Unaffected 0.4hr Increase	13% Managed 87% Unaffected 0.6hr Increase	17% Managed 83% Unaffected 0.8hr Increase	21% Managed 79% Unaffected 1hr increase
Urban NSW (Preston)	0% Managed 100% Unaffected 0hr Increase	0% Managed 100% Unaffected 0hr Increase	1% Managed 99% Unaffected 0hr Increase	1% Managed 99% Unaffected 0hr Increase	1% Managed 99% Unaffected 0hr Increase
Rural TAS (Norwood)	1% Managed 99% Unaffected 0hr Increase	2% Managed 98% Unaffected 0.2hr Increase	3% Managed 97% Unaffected 0.2hr Increase	6% Managed 94% Unaffected 0.4hr Increase	9% Managed 91% Unaffected 0.4hr Increase
Urban TAS (West Hobart)	2% Managed 98% Unaffected 0hr Increase	3% Managed 97% Unaffected 0.2hr Increase	7% Managed 93% Unaffected 0.2hr Increase	10% Managed 90% Unaffected 0.4hr Increase	13% Managed 87% Unaffected 0.4hr Increase
Rural VIC (SMR8)	26% Managed 74% Unaffected 1.5hr Increase	28% Managed 72% Unaffected 1.8hr Increase	32% Managed 68% Unaffected 2.1hr Increase	36% Managed 64% Unaffected 2.6hr Increase	38% Managed 62% Unaffected 3hr Increase
Urban VIC (CRE21)	3% Managed 97% Unaffected 0.1hr Increase	5% Managed 95% Unaffected 0.4hr Increase	7% Managed 93% Unaffected 0.5hr Increase	11% Managed 89% Unaffected 0.7hr Increase	13% Managed 87% Unaffected 0.9hr Increase

Time-of-use tariffs

ToU tariffs can be used to incentivise customers to shift their charging time to off peak periods. The ToU strategy investigated in this study aimed to understand the rate of customer adoption of ToU to the EV hosting capacity, i.e., how many customers needed to adopt TOU to reduce network issues.

Some of the high-level findings detailed in the report:

- **ToU adoption rate vs EV hosting capacity**: If 20 to 40 per cent customers are on ToU tariff, the EV hosting capacity can be increased by 20 per cent.
- **ToU tariffs might not be enough on their own:** In some congested feeders, the ToU tariffs need to be combined with an additional solution, e.g. an EV management strategy.
- **Additional benefits beyond increasing hosting capacity:** Generally higher adoption of ToU tariffs reduce the magnitude of asset congestion, which means less investment is needed to manage these issues. This could provide a better value-for-money return for customers and DNSPs.

The main take away from the study is that implementing an EV management strategy could help increase EV hosting capacity and reduce network issues. Combining EV management with ToU tariffs can maximise these benefits and save customers money in bills by increasing network utilisation and reducing the need for investment.

Generally, such solutions can be considered for a short or medium term given that they do not require detailed models of LV networks and significant asset replacement or augmentation. These solutions may be applicable for long term if modified and combined with other approaches to form a complete solution.

The full report is provided here.

Other project related materials are provided on our ENA website, University of Melbourne project page and C4NET project page.

EV NEWS

XCEL BECOMES FIRST US UTILITY TO USE ELECTRIC EPVS FOR LINE REPAIRS

By Joshua S Hill | 7 June 2022 | Source: The Driven

American utility company Xcel Energy has become the first energy company in the United States to add all-electric bucket trucks – or "cherry pickers" – to its fleet of vehicles.

Xcel Energy, which services customers in Colorado, Michigan, Minnesota, New Mexico, North Dakota, South Dakota, Texas, and Wisconsin, announced on Monday that it was introducing its first all-electric bucket truck to its fleet in Minneapolis, Minnesota.

The Optima 55-foot all-electric bucket truck is being delivered by Terex Utilities and features an electric chassis from Navistar.

Xcel Energy is the first of nine North American utilities who have ordered one of these all-electric "cherry pickers" – which includes Los Angeles Department of Water and Power, Con Edison, and San Diego Gas & Electric – with the first 10 units to be delivered through the rest of the year.

"We're proud to be the first energy company in the United States to add all-electric bucket trucks to our fleet," said Bob Frenzel, chairman, president, and CEO of Xcel Energy.

"By adding these clean energy vehicles to our fleet, Xcel Energy is demonstrating its commitment to leading the clean energy transition by becoming a net-zero energy provider for all our customers' energy needs – electricity, heating and transportation, while also helping shape the electrification of the truck industry, which complements our overall vision to provide 100% carbon-free electricity by 2050."

Xcel Energy was one of the first energy companies in the United States to develop a plan to electrify all its light-duty vehicles and 30% of its medium- and heavy-duty fleet by 2030. This plan supports the company's larger vision of powering 1.5 million electric vehicles by 2030.

Xcel Energy crews will use the new all-electric cherry picker in real working conditions during a six- to 12-month pilot, providing feedback to help ensure further development. However, there's a long way to go for Xcel Energry, who has 1,000 bucket trucks in its fleet.

FLASHBACK

WHEN COAL GAS WAS KING

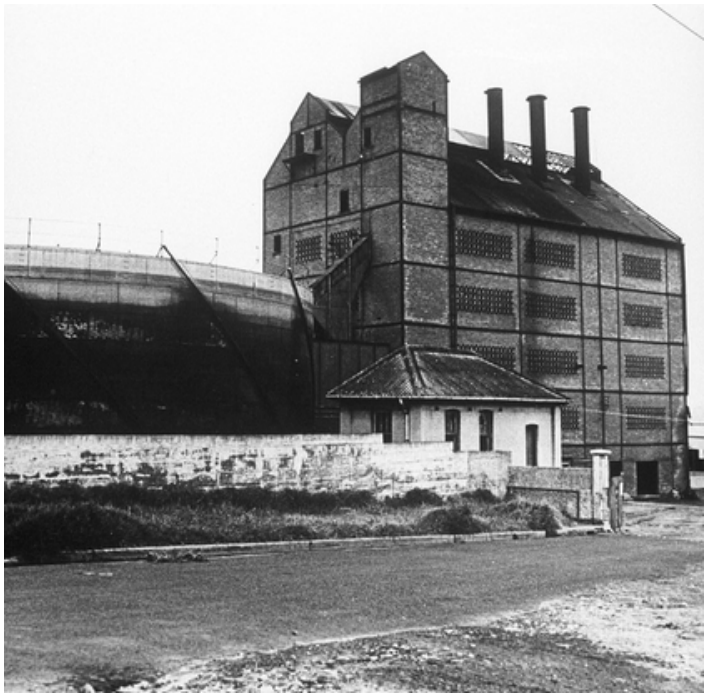
By Terry Miller | 20 June 2022

Gas distilled from coal was the primary plentiful and convenient source of energy for Sydney's homes, businesses and factories from the time of the establishment of AGL in the 1840s until the early 1900s when distributed electricity entered the market. Coal gas in turn was replaced by natural gas in the 1970s, a more cost effective product that revived the competitiveness of gas with electricity as a favoured energy source in all sectors. Today, gas is once again under threat from price rises due to exposure to world prices once we discovered how to liquefy it, bottle it and ship it overseas, and environmental conerns.

The coal gas plants occupied prime water front sites, as the coal was shipped in from Newcastle and Wollongong. (Similar facilities were needed to supply coal to early electric power stations at Pyrmont, Balmain and Bunnerong before improvements in high voltage transmission technologypermitted them to be built near the coal deposits rather than the end users.)

These plants were polluting and smelly.

The photos below show two of the sites, one at Lavendar Bay, which was subsequently used as a submarine base and is now in public hands, and at Little Manly, now a serene public park. The former workers' cottages at Little Manly, once regarded as an undesirable area due to the proximity of the gasworks, are now prime real estate with stunning pristine harbour waterfront nearby.



HUMOUR BREAK

USEFUL INPUT FROM GOVERNMENT

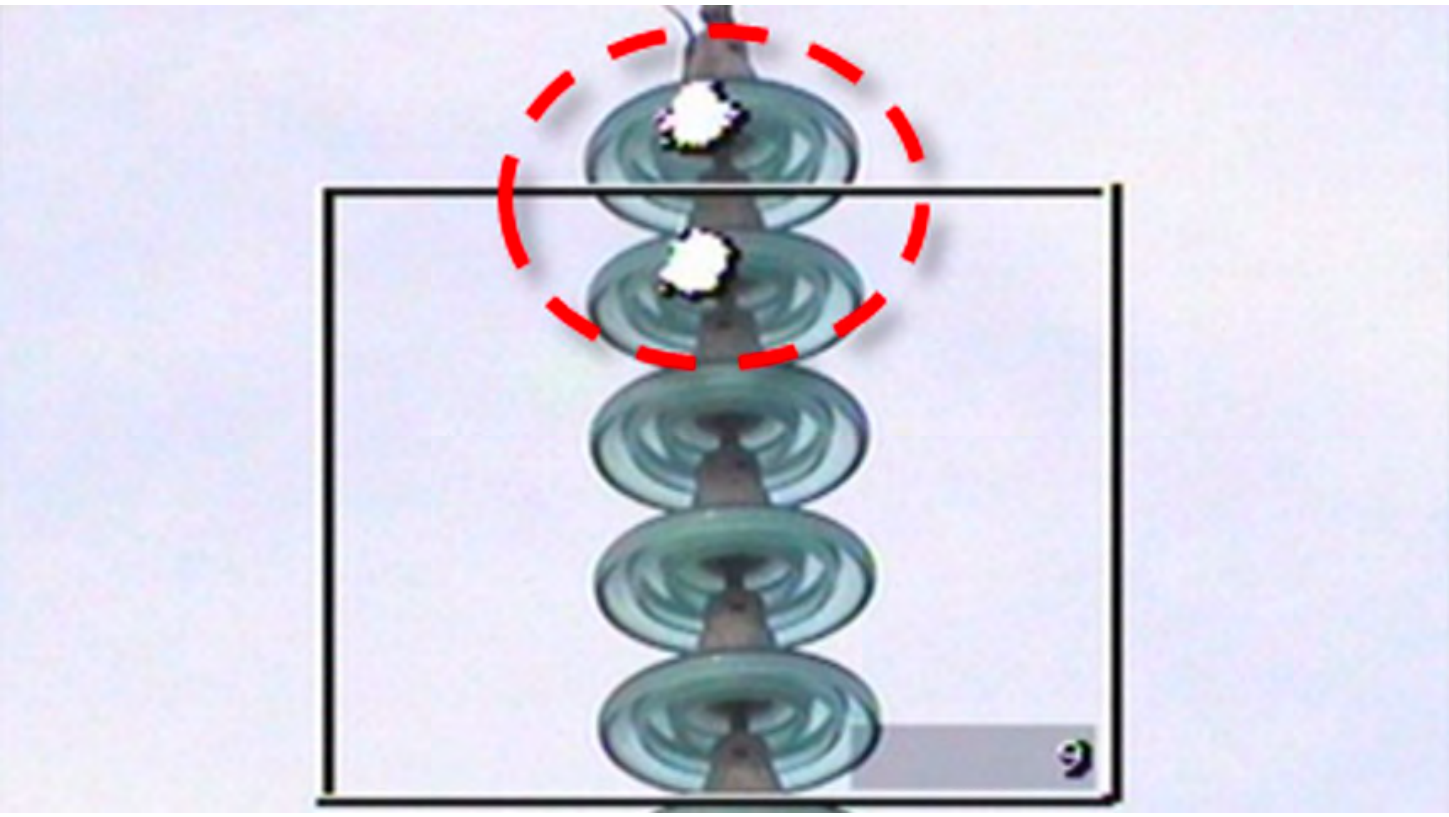
Last night I lay in my bed looking up at the stars in the sky and I thought; where the heck is my ceiling?

SO IT TURNS OUT THAT BEING AN ADULT IS MOSTLY JUST GOOGLING HOW TO DO STUFF.

INTERNATIONAL NEWS

Comparing UV vs. IR Inspection of Overhead Lines & Substations

10 June 2022 | INMR



A key issue in maintenance of power networks is understanding what is being revealed during ultraviolet and infrared inspections of equipment and hardware on overhead lines and at substations. Do the two technologies highlight the same problem or are they rather complementary, each revealing a different aspect of the problem? Moreover, is it correct to assume that every different potential defect carries some unique 'signature' and therefore requires its own specific inspection technology?

This edited past article, contributed to INMR by Roel Stolper, an expert in diagnostics with CSIR in South Africa, addressed these questions.

Scar-e / Image by Asteroid Mining Corporation

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Typical Problems on Lines

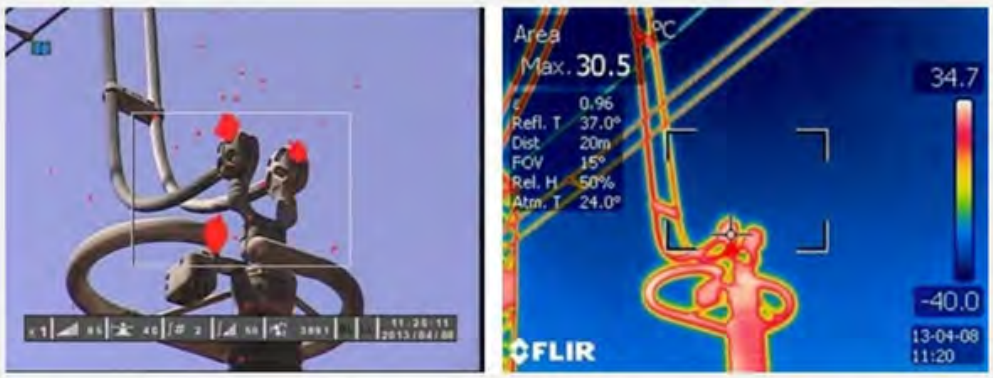
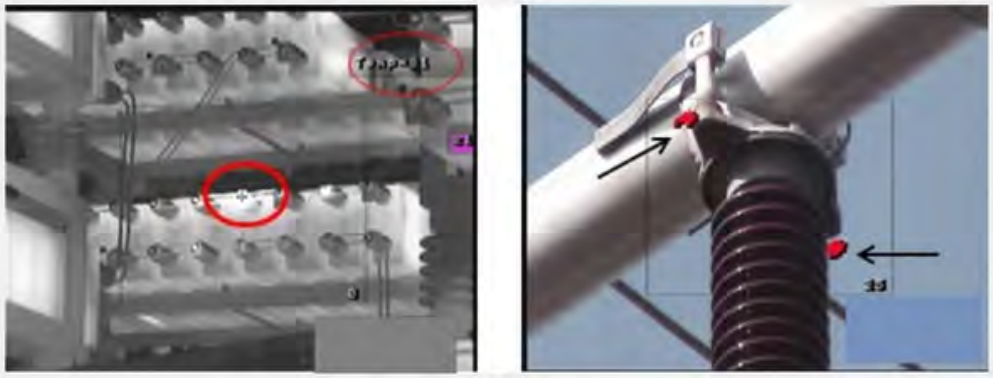
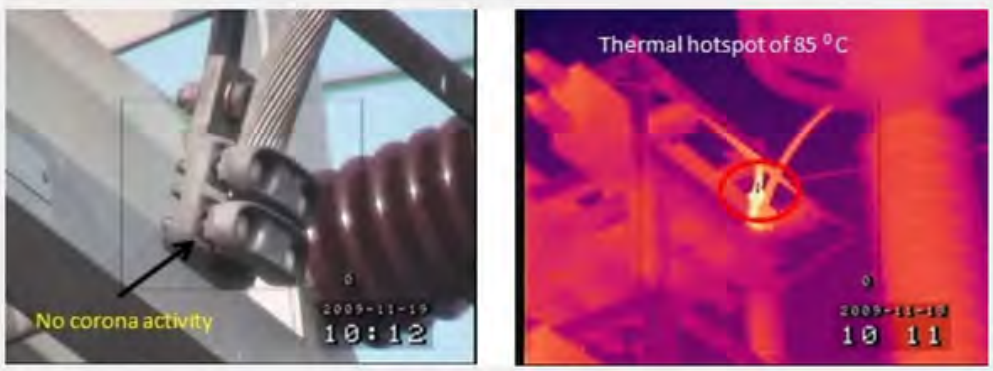


Fig. 1: Ultraviolet and infrared recoding of same phenomena show presence of corona but with no heat dissipation.



(Left) Fig. 2: Infrared recording of capacitor bank.
(Right) Fig. 3: Bus bar clamp with corona discharges.



(Left) Fig. 4a: Corona recording.
(Right) Fig. 4b: Infrared recording of same object.

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(Left) Fig. 5: Acoustic inspection. (Photo: Courtesy ndb Technologie).
(Right) Fig. 6: Ultraviolet corona camera inspection.

(Left) Fig. 7: Infrared camera inspection. (Photo: Courtesy FLIR).
(Right) Fig. 8: Combined ultraviolet, infrared and visible camera inspection.

INTERNATIONAL NEWS

Table 1: Overview of Different Line Components as well as Potential Associated Problems & Required Spectrum of Detection*

Item	Hardware		Concerns	Visual	Corona Sensor (UV)	Infrared Sensor (IR)	Rationale
1	Insulators	Glass	Corrosion, breakage, Dry band corona	√	√	√	Most dangerous at higher voltages.
		Porcelain	Corrosion, breakage, Dry band corona	√	√	√	Checking ageing aspects & pollution built up.
		Composite	Ageing	√	√	√	Recording corona on insulator surface as indication of material ageing.
		Shield wire	Correct position, insulators in place	√	√		Must be in correct position to deflect lightning strikes.
2	Insulator Hardware	Bolts, nuts, split pins	Loose pins coming out	√	√		Loose vibration dampers.
		Clamps	Loose	√		√	Are clamps correctly situated & tight?
		Corona rings	Wrong position or missing	√	√	√	Are rings correctly fitted & functioning?
3	Line Conductors	Configuration	Configuration according to design	√			Confirm installation according to design.
		Spacers	Spacers correctly positioned	√			Not travelled along conductor.
		Bundle configuration	Conductors bundle not twisted	√			Confirm that bundle is intertwined.
		Joints	Joints not rusted	√		√	Confirm joints are good conductors.
		Earth wire	Optical fibre - OPGW in position	√			OPGW not twisted or knotted at any location.
		Loose/Broken strands	Loose strands	√	√		Loose strands indicate wear & tear and cause RIF.
		Vibration dampers	Wrong position, drooping	√			Must be correctly positioned or will not function.

* Based on interviews with system operators across South Africa.

Current Inspection Technologies

Years of experience in line inspection have indicated that there is still no single technology that best meets every need. Moreover, no diagnostic sensor will detect and locate all possible different faults that can appear on a line. Given this, it is correct to state that the ideal inspection tool is one that integrates different types of sensors into a single instrument. Generally speaking, modern inspection technology can be classified into two main groups: ultrasound radio telescopes and camera detectors. Both make use of the basic phenomenon that any defect will emit radiation (i.e. energy in the electromagnetic spectrum) that can be detected and recorded by an inspection device.

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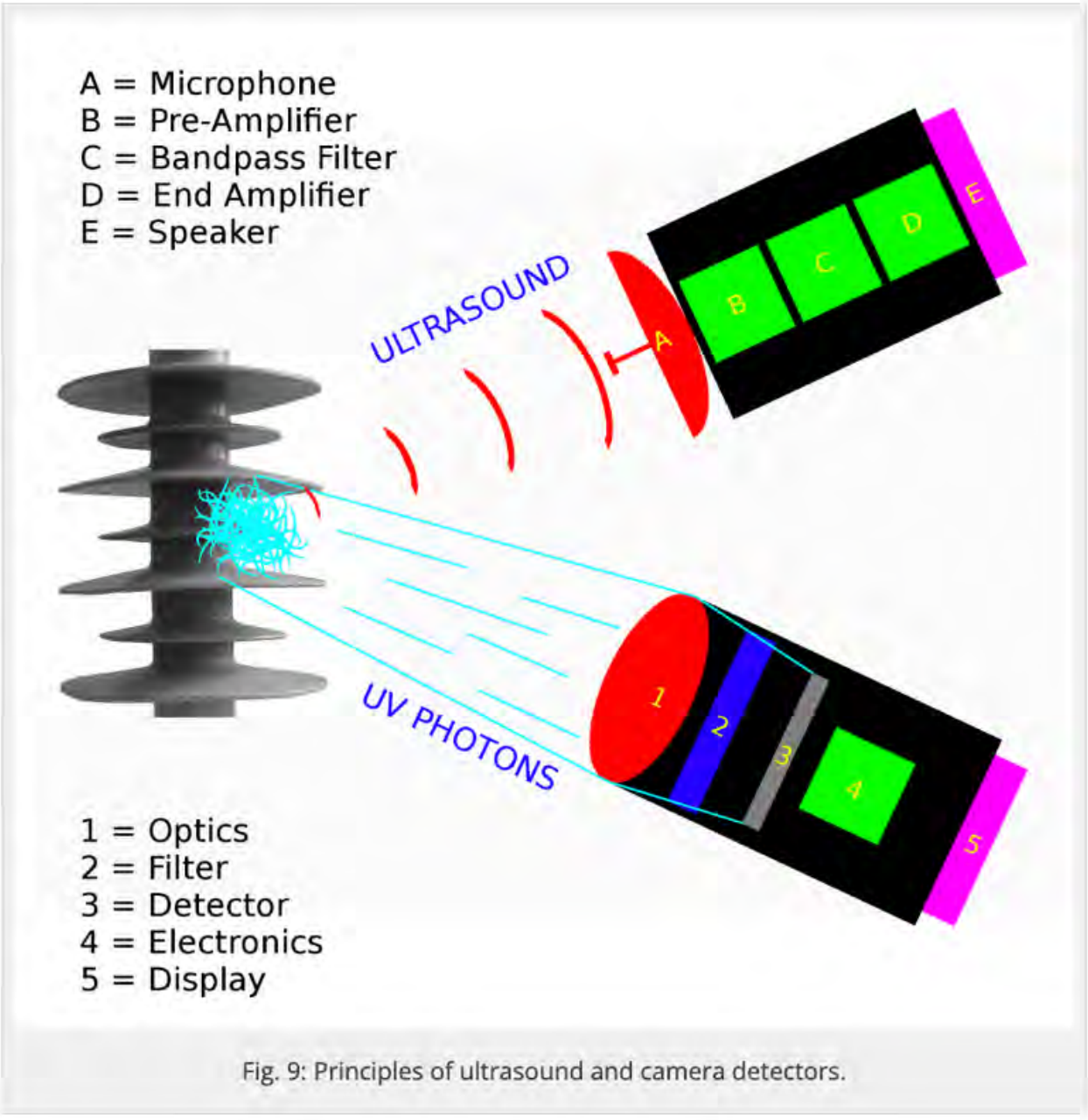

Fig. 9: Principles of ultrasound and camera detectors.

Basic Principle of Ultrasound Detectors
A round dish focuses ultrasound radio waves onto an RF detector (microphone) that amplifies and presents any weak signal detected to the operator by means of sound produced by an earphone.

Basic Principle of Camera Detectors
Light from a source is collected by a lens, projected through a filter onto a detector that converts the light energy into electric signals. The signals are electronically manipulated into a raster image and displayed to the operator

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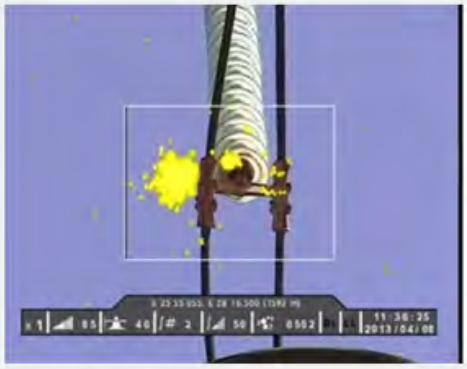
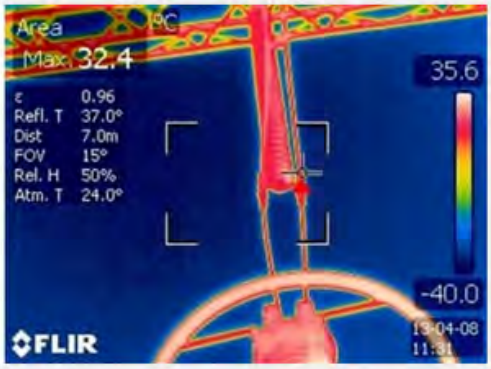
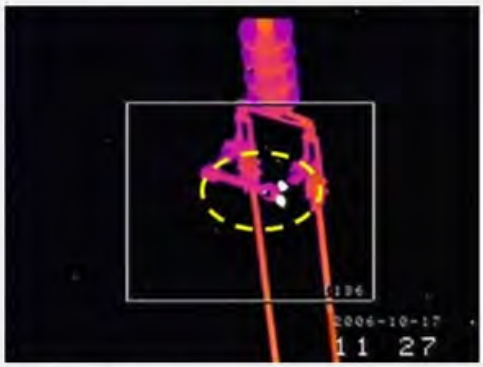
(Left) Fig. 10: Ultrasound disk. (Courtesy of CTRL Systems).
(Right) Fig. 11: Multi-spectral camera system.





(Left) Fig. 12: UVc overlaid onto visible image showing two corona sources: dry band and discharge from a protrusion. Discharge is offset to left due to wind.
(Right) Fig. 13: Thermal image showing slight heat source.



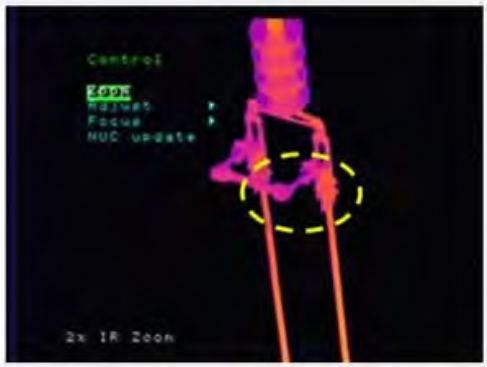


Fig. 14: Conductor termination with only corona discharges present due to protrusion.

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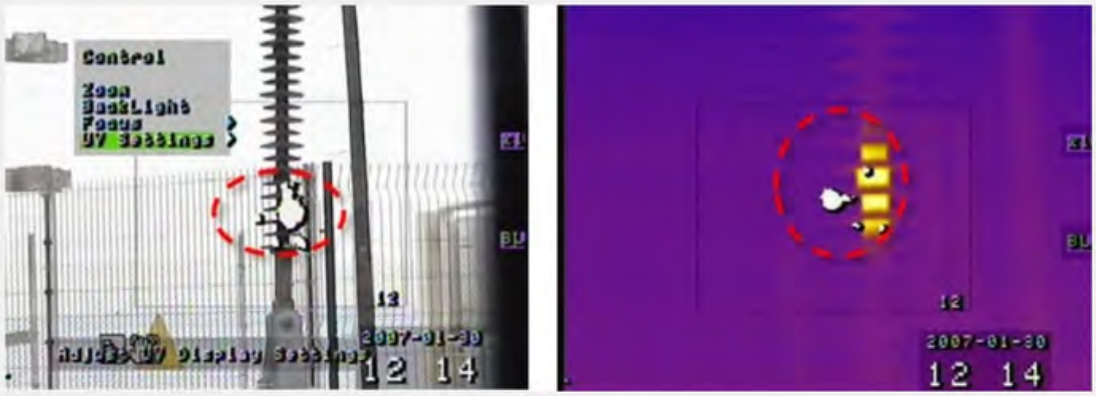

Fig. 15: Polymeric insulator with corona surface discharge and severe internally generated infrared heat.

Fig. 16: Ultraviolet and infrared red recording of discharge activity at corona ring.

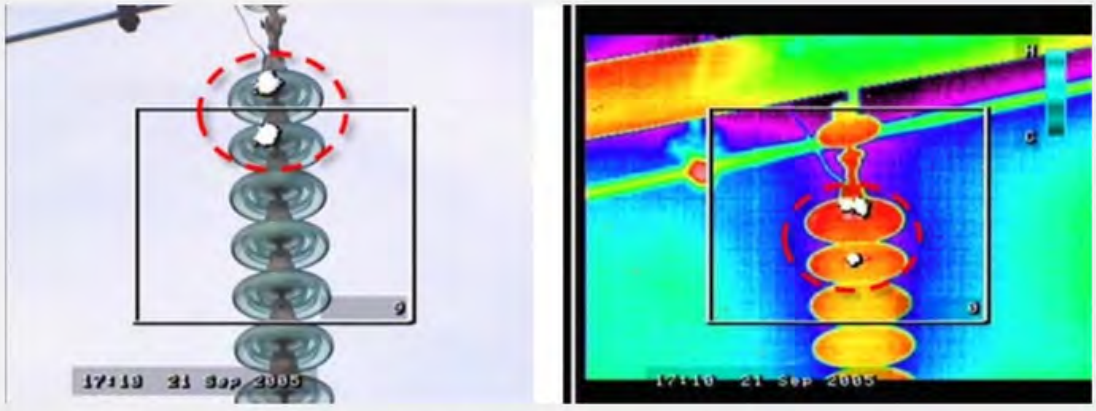

Fig. 17: Glass insulator string with dry band activity (left corona and right infrared recording).

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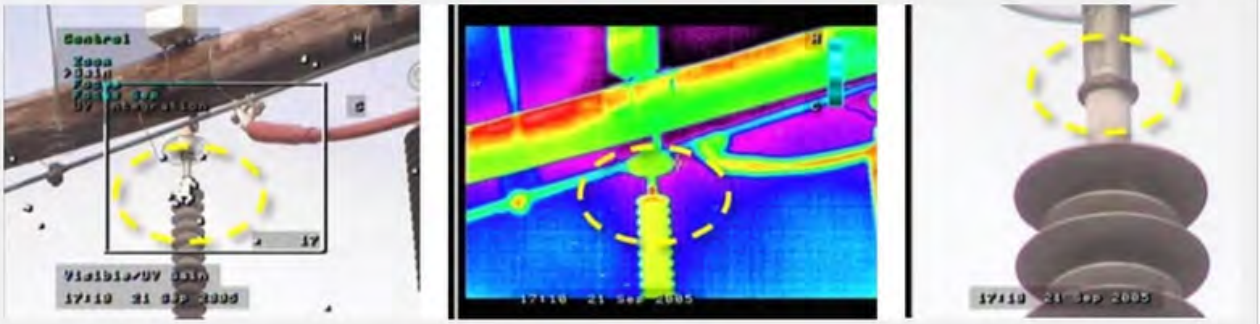

Fig. 18: Polymeric insulator, corona and infrared activities at dead end of insulator.

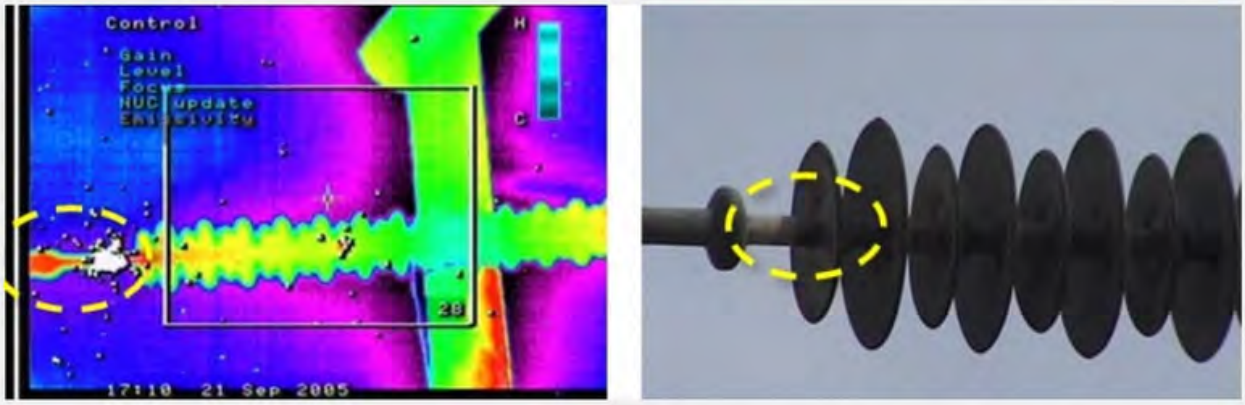

Fig. 19: Polymeric insulator, live end with corona and infrared hotspot.

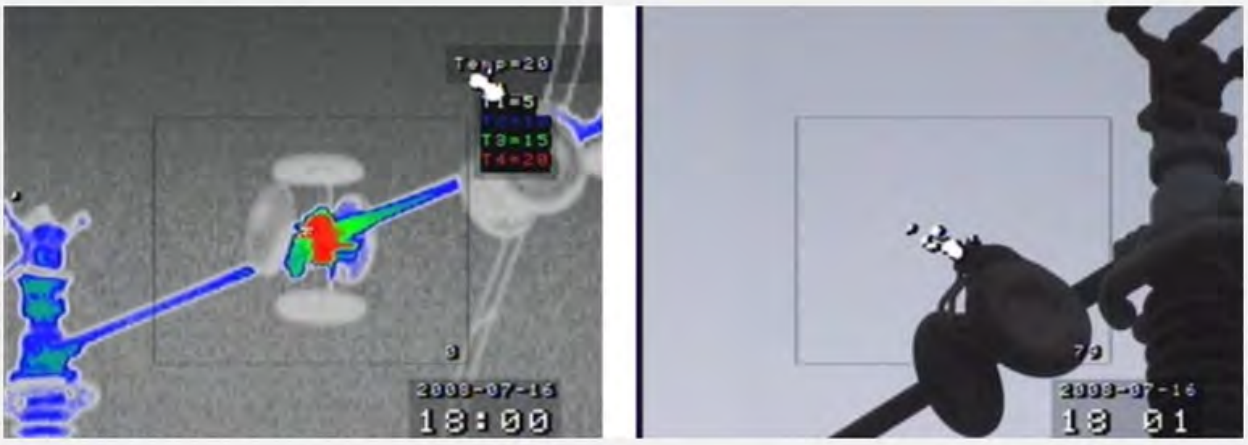

Fig. 20: Link with hot spot (middle) at contact surfaces and corona at disks (left hand).

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The images in Figs. 12 to 20 are from ultraviolet and infrared camera recordings of electromagnetic radiation related to unique defects occurring in line components. For example, a simple structural defect (e.g. a cut in a silicone insulator housing or a damaged ceramic disc) generates corona activity due to distortion of and increase in electric field. Similarly, an internal defect in a composite insulator can result in leakage current along the FRP core rod, causing heat dissipation. Viewed this way, it is clear that corona and thermal cameras are essentially complementary and that no single inspection technology is inherently superior. One can therefore also conclude that, ideally, IR and UV inspection should be conducted simultaneously. To demonstrate, Fig. 14 shows ultraviolet and infrared recordings of the same object. There is only corona activity present due in this case to sharp edges on the clamps. But there is no heat dissipation, suggesting that corona does not necessarily generate heat. Fig. 15 shows a defective polymeric insulator with corona activity at the sheds as well as internal defects that produce heat.

Ultraviolet/Infrared Inspection with Single Device

Corona discharges are detected using an ultraviolet detector that converts ultraviolet radiation to the wavelengths that can be seen by the human eye. This same principle applies to infrared heat radiation detected by the IR uncooled micro-bolometer and subsequently converted to wavelengths in the visible spectrum. In simple physical terms, corona is plasma discharge whenever ambient gases are ionized. During the subsequent de-ionization phase, photons are emitted with emission lines related to the spectral properties of these gases. Air is made up of about 80% nitrogen, which has its dominant spectral lines in the UVA and UVB spectrum and minor lines in the UVC spectrum. The spectrum where corona radiation appears is shown in Fig. 21.

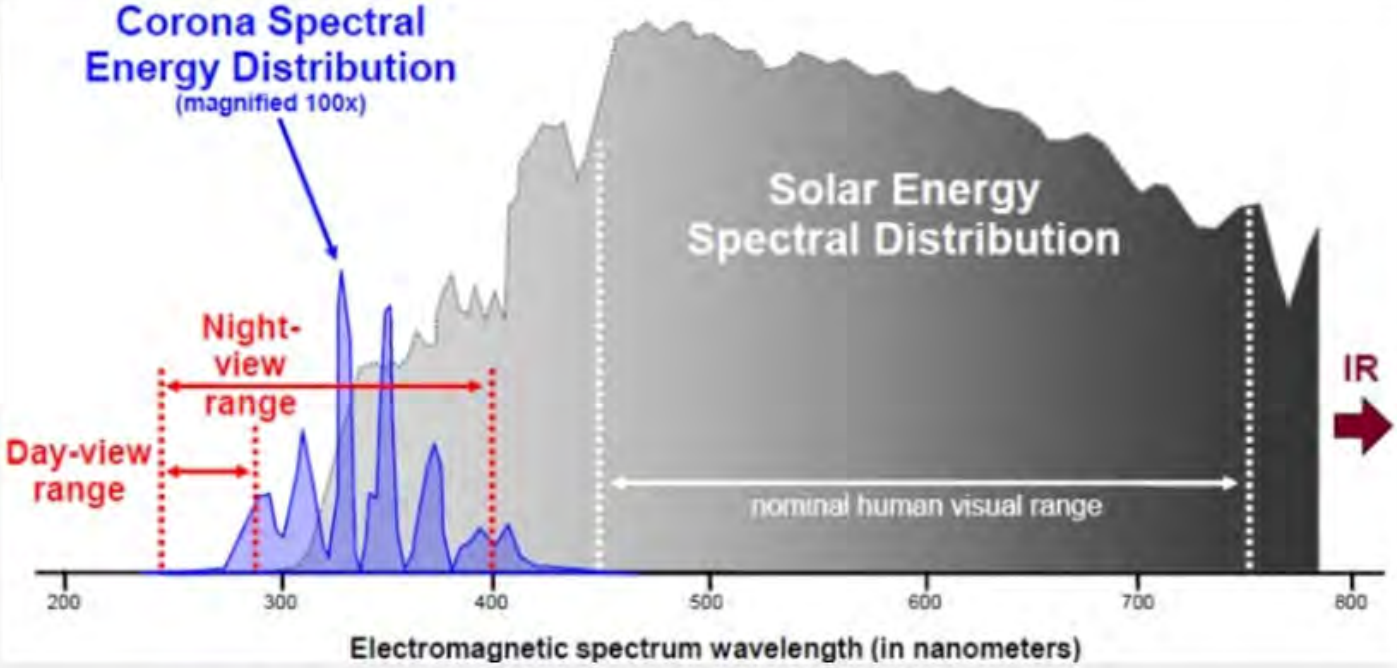

Fig. 21: Spectral lines of corona radiation with peaks at 340 and 360nm.

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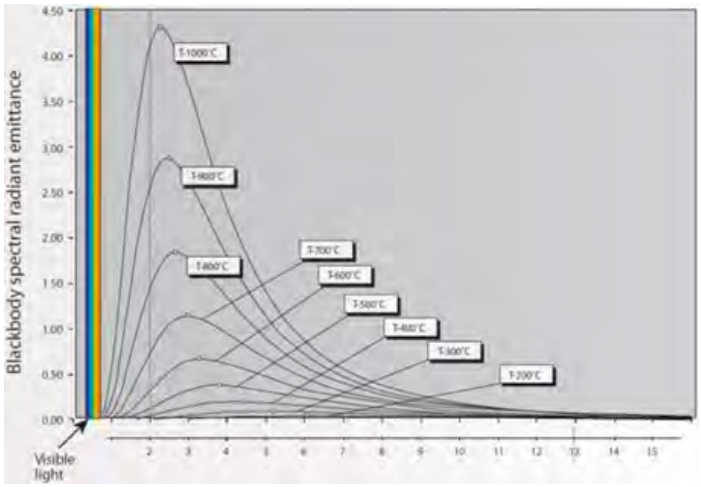
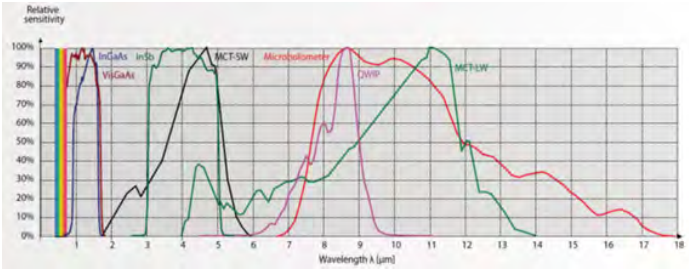
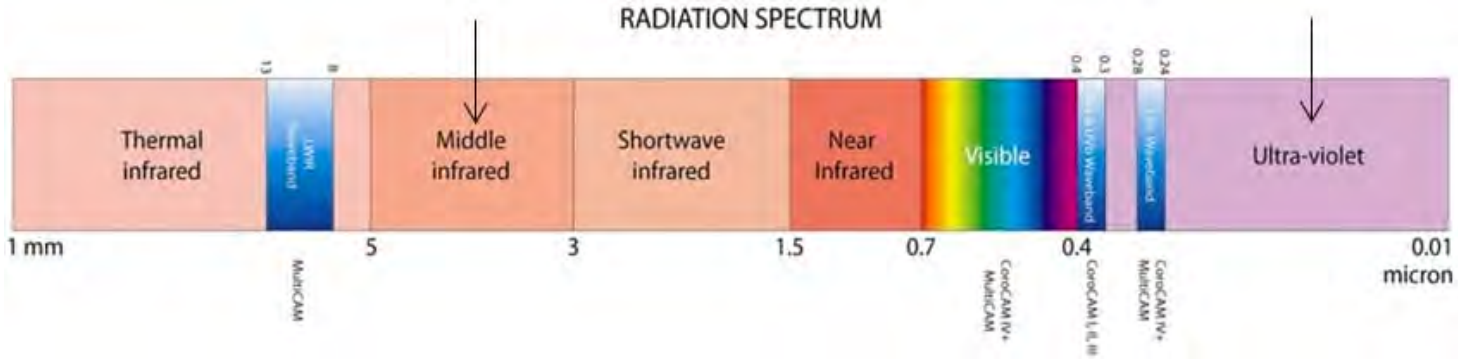
In regard to heat radiation, any material emits at a wavelength that depends on body temperature, its so-called kinetic surface energy. According to Wien's displacement law, peak wavelength, λmax, is at 2898/T, where λ is expressed in micrometers (1.10-6) and T is temperature in degrees Kelvin. Simple calculation reveals that a body at 27°C emits peak radiation at 10.55 µm such that, for example, a clamp at 100°C will have maximum radiation at 7.76 µm.



Calculation shows that, for any line inspection application where there are only low temperature sources, a heat detector is required to convert radiation at 8-10 µm wavelengths into the visible spectrum. There are a number of heat detectors available on the market and these are classified according to spectral sensitivity as determined by material composition of the detector.



The mercury cadmium telluride (MCT) and Quantum Well (QWIP) detectors, for example, are relatively expensive since Sterling engines are required to cool them to -70°C. The micro-bolometer detector, by contrast, is used by many camera manufacturers for industrial infrared inspections. This type of detector does not need cooling and works at room temperature. It is also compact with high pixel resolution, low cost and easy availability. Fig. 25 depicts the operating principle of a multi-camera, combining all inspection technologies, i.e. visible, infrared and ultraviolet and Fig 24 shows the spectra where it will operate.



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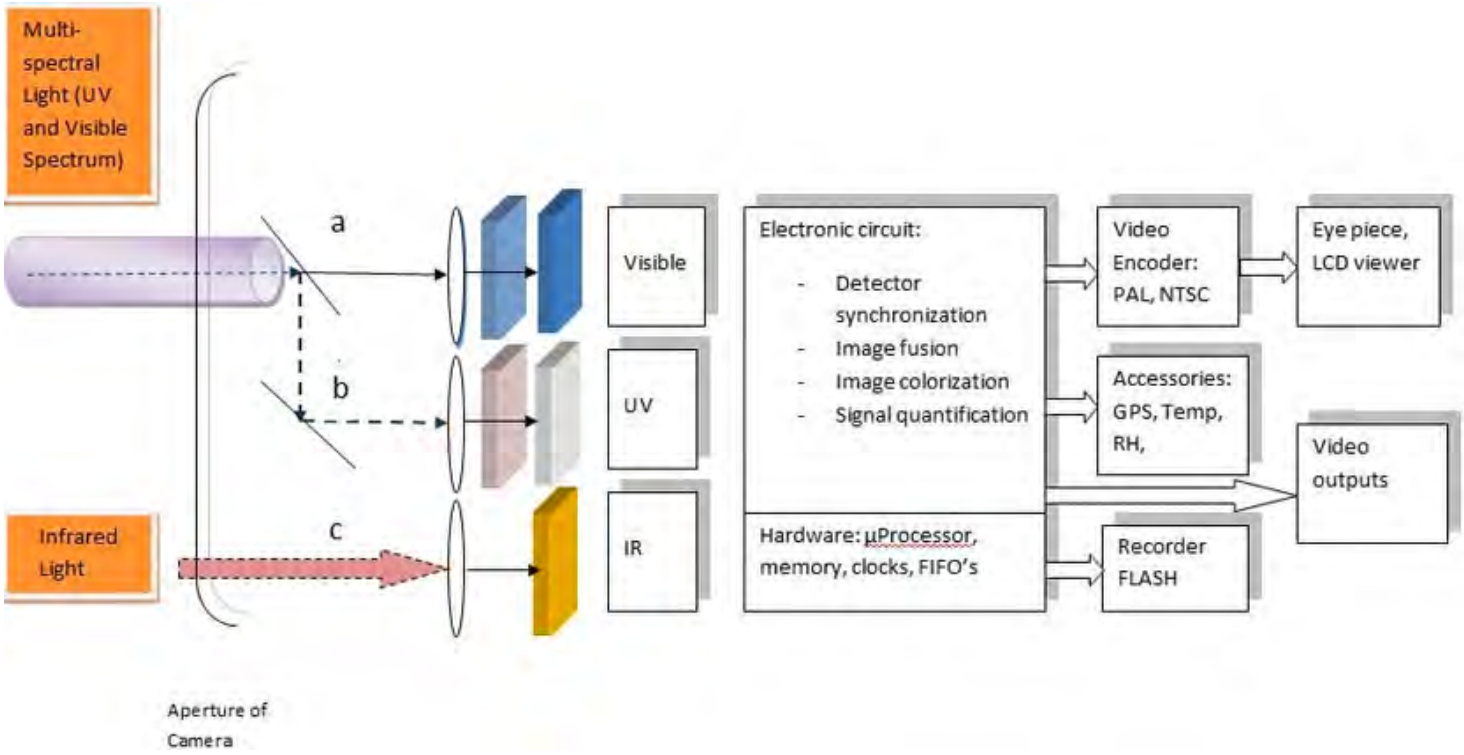

Conclusions

UV and IR inspection are not simply two alternative ways to look at the same problem. Instead, each inspection technology records a particular type of defect or abnormality within the component or equipment being inspected. In general, it can be said that ultraviolet recordings indicate the presence of corona activity while infrared recordings highlight heat phenomena. Moreover, UV corona recordings have to do with surface discharges and indicate the presence of high electric field. By contrast, infrared measurements highlight presence of leakage current. The first phenomenon depends on surface condition while the second depends on an internally generated heat source.

The latest developed multi-spectral cameras enable the power industry to simultaneously inspect electrical equipment for corona discharges and infrared hotspots. Specialized software assists the user to record, process, store and retrieve these recordings.

INTERNATIONAL NEWS

Looking for the Future Grid: The Top Five Trends at DISTRIBUTECH

By Rod Walton, EnergyTech Senior Editor | 8 June 2022 | Energy Tech

So priorities are changing from purely focusing on power generation and customer delivery to a radical shift in energy resources from carbon-based fuels to zero-carbon options such as solar, wind and battery storage, as well as the digital transformation.

To change the world, first we must change the priorities.

This paraphrase of Mark Twain may hardly be brand new, but it is always apropos to nearly any pivotal moment in history. And surely we have reached one at the crux of climate change and weather impacts.

One thing leads to another. The world is heating up and, while some may argue the causes, hardly any doubt exists on whether the rise of man-made energy in the industrial age has contributed a major part to the recorded rise in global temperatures.

So priorities are changing from purely focusing on power generation and customer delivery to a radical shift in energy resources from carbon-based fuels to zero-carbon options such as solar, wind and battery storage, as well as the digital transformation to analyze and control these variables.

All of these were key topics of wary concern at the recent DISTRIBUTECH International (DTECH) in Dallas. If we at T&D World and EnergyTech.com might be so bold, the main issues can be boiled down into Top Five Trends on topic at the event. And they are, in no particular order:

The Need for Speed: The Challenges of Fast Data and How to Make Sense of It

Data is king of resources these days. Digital tools and analytics are reshaping the utility world, bringing visionary tools into play such as sensoring, machine learning, predictive maintenance, artificial intelligence and control and operational data gathering and organization.

The last word is important. For, as many experts said at DTECH, reams of data surely offer comprehensive looks into how the grid operates, but organizing and making that information useful is really the only thing that ultimately matters. Datum needs eyes on the ground to prioritize it, and storage in the cloud to protect it.

The Clean Energy Conundrum: Renewable yet Resilient

Recently, the U.S. Energy Information Administration reported that utility-scale wind and solar together accounted for 20 percent of the nation's electricity resource mix in April. The portion was historic, putting those renewables basically equal with nuclear and coal-fired power. Together with nuclear and hydropower, it meant that generation resources with zero-carbon emissions were powering close to 45 percent of the power grid.

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We're getting closer, right? Of course, April was a good month with presumably many more to come. And yet those responsible for either operating or supplying grid technology are rightly concerned about the challenges of intermittent generation. Deep fluctuations and weather-related shutdowns put strain on the ability to maintain frequency on the grid and stress on conventional power resources now required to cycle up and down in response to the intermittencies.

Operational data and quick-response analytics offer some crucial assistance. Much more will be needed as the grid gets more renewable and less baseload.

The Next Frontier: Bringing Law and Order to the Grid Edge

Rooftop solar, community solar, microgrids, behind the meter, home EV charging. All of these and more are exciting new chapters in the energy transition age. But, as so many noted at DTECH, the macro grid is not totally ready for this wild and wooly grid edge future.

Upgrades and overhauls in GIS mapping certainly need to be on the agenda for utilities and their partners. Distributed energy management systems and interconnection protocols will be mission critical as some of that excess grid-edge electricity or unpredictable interaction (such as EV charging infrastructure) is directed right back into the main system.

Which brings us to. . .

Prosumer Appreciation Week

This rising tide of electricity customers who will no longer solely rely on their utilities, as noted above, could swamp the grid. More and more consumers, particularly in states incentivizing the practice, are acquiring rooftop solar or participating in community solar and microgrid projects. The good old one-way highway is fast becoming a bi-directional superhighway with electrons moving back and forth. The prosumer will benefit by deploying his or her own generation back into the main distribution systems.

Some companies exhibiting at DTECH announced new programs and technologies to reach the prosumer sector. Some also are offering both digital and physical tools to better deploy and decode the sometimes mysterious goings on at the edge of the grid.

Workforce Worries: Who's Going to Handle all of This in the Future?

The proverbial and truly omnipresent supply chain issues were front and center topics for OEMs and other industry leaders at DTECH. And yet lurking beyond all of that was a major need in the future: a newly trained and focused workforce for the energy transformation to net zero.

Some are truly concerned about the biggest priority of all—people, or the lack of them to handle the Grid 2050 era. How do utilities attract and maintain a committed new generation of workers, who themselves will also require wisdom and institutional memory from older workers who have weathered the journey from baseload to bi-directional, digital transformation and beyond?

INTERNATIONAL NEWS

Big question, because many in the Baby Boomer generation are retiring, while the Great Resignation also has depleted workforces in multiple sectors. Utilities, OEMs, EPCs and IoT firms will need to employ great diligence and care in developing and onboarding a new generation workforce.

In the end, coming up with Five Trends may seem a little too trite and limiting. So much more is in play as the energy sector faces paramount challenges in both decarbonizing the power grid, while also balancing security and resiliency priorities.

And there's that word again: priorities. The grid planners of today and tomorrow will have many of those to juggle and keep in sight if they are to stay relevant for decades to come.

Use of Robotics on the Grid is Growing

By Gene Wolf | 10 June 2022 | Source: T&D World

Autonomous drones and droids are one branch of technology that is gaining acceptance worldwide.

I'm a sucker for a good headline, but then aren't we all? They are designed to get our attention. That happened the other day when I was searching for some new material about advancements in drone technology for power grid asset surveying. The search engine came up with a wide selection of topics, but the one that caught my eye was titled, "Alien Spacecraft Found On Mars." There are a lot of these types of teasers, but this one was from a prominent news organization, so I had to look.

It turns out, the story was based on a NASA update about the amazing adventures of Perseverance and Ingenuity, that dynamic duo exploring Mars. The alien spacecraft was the lander that delivered these two intrepid explorers to the Martian surface. So technically it is an alien spacecraft, and the headline was correct. I'm really glad I clicked on the link because the story was interesting, and it included some of the closeup aerial photos of that crash site.

NASA said the equipment shown in aerial crash site photos are the capsule, its supersonic parachute, and other debris. On April 19, Ingenuity celebrated the one year anniversary of its first flight by taking these photos on its 26th flight. That's right, flight 26! Ingenuity has been racking up an impressive number of flights in the thin Martian atmosphere. It seems Ingenuity has proven itself to be more versatile than anyone expected. If you remember when NASA launched the Mars mission, there was a great deal of speculation about the Ingenuity being about to fly at all, but science overcame skepticism.

Autonomous Helicopter Rover

Not only did the little, autonomous Mars copter fly its scheduled five missions, but over the past year it has been setting new records every time it takes off. As of April 29, 2022, Ingenuity has logged 28 flights racking up 54.2 minutes of flight time. With those 28 flights, Ingenuity has traveled 4.29 miles (6.9 km), and has taken on a new mission for the exploration. Ingenuity is scouting the area to make Perseverance's ground exploration safer.

INTERNATIONAL NEWS

A NASA spokesperson explained previous photos of the crash site were taken by Perseverance's ground cameras. Ingenuity, however, offered a different perspective and provided more detail. It required a lot of complicated maneuvering on Ingenuity's part, which tested the helicopter's abilities. As I read these reports, it got me thinking about how this space-age technology will improve drone and droid systems that are working on the power grid.

Our industry has not been sitting around waiting when it comes to robotic applications. Utilities have been taking advantage of applications that are integrating artificial intelligence (AI) into droids and drones, making them autonomous. Back in the September 2020 a "Charging Ahead" article, "Droids and Drones" (https://tdworld.com/21138573), took a look at robotic technologies finding their way onto the smart grid.

Drone-in-a-Box

At that time Florida Power & Light was working on a pilot project with Percepto for autonomous "drones-in-a-box" systems that had started in 2018. If you're not familiar with drone-in-a-box systems, the drone is housed in a self-contained box that serves as a takeoff and landing platform, a charging station, and a computer management system. When I found the Perseverance and Ingenuity story, I also found an update on the FPL and Percepto collaboration project.

A recent report said that FPL had been issued a nationwide waiver by the FAA (Federal Aviation Administration) to fly Percepto drones beyond visual line of sight (BVLOS) for surveillance and inspection purposes at its sites. Getting the FAA BVLOS waiver was a significant advancement for the project. It gives FPL and Percepto the green light to move forward to the next phase of the project.

As a result, FPL will be adding 13 drones-in-a-box systems in the West Palm Beach area for observation and assessment of FPL's substations and distribution networks. Over the next five years, FPL's plans to add hundreds of Percepto drones systems to the project. The drones will be controlled by Percepto's AIM solution. This singular network will allow for remote operation of their drones statewide.

The use of robotics on the grid is growing and so are the assets. Autonomous drones and droids are one branch of technology that is gaining acceptance worldwide. Imagine when the AI technology used on Perseverance and Ingenuity finds its way into commercial applications. It's going to improve the grid in ways we can't imagine!

Challenges TSOs Will Face: Weakening Grid Stability

By Daksh Juneja, Amir Jose Daou Pulido, Lara Panjkov | 3 June 2022 | Source: T&D World

This is the second deep dive in a series on the five challenges TSOs will face in 2022 and beyond.

In many power systems around the world, a major transformation is underway. Proportions of synchronous generation, generally from coal and gas-fired power plants, are rapidly reducing. At the same time, the share of inverter-based resources, such as wind, solar and battery-based energy storage in the energy mix is increasing. Transmission System Operators (TSOs) must soon confront unparalleled challenges to maintain power systems stability.

INTERNATIONAL NEWS

In some regions, the change is approaching at gale-force speed, and requires TSOs to act now, while others are set to face these challenges in the coming years. For example, power systems in Australia and Great Britain must rapidly adapt to prepare for the change.

The Australian Energy Market Operator (AEMO) foresees it may need to operate in conditions of 100% instantaneous inverter-based resources as early as 2025.This follows in the footsteps of National Grid ESO, the system operator in Great Britain, which also aims to support instances of 'zero carbon generation' by 2025. Battery-based energy storage with advanced capabilities is emerging as a crucial tool to underpin a safe, reliable, and cost-effective transition.

This is the second deep dive in a series on the five challenges TSOs will face in 2022 and beyond. If you're new to the series, read the overview post, which summarizes each challenge.

Grid stability, in some markets referred to as system security, relates to a power system's ability to both remain stable in normal conditions, and to stabilize quickly when unexpected events occur, such as tripping of generators or large loads, or transmission line faults. This differs from reliability, which is the power system's ability to deliver electricity to where it's needed, when it's needed.

What is Inertia and System Strength?
While definitions vary in different markets, inertia generally refers to a power system's ability to resist changes in frequency and keep it within the desired range. Inertia can be 'shared' across interconnected regions.

System strength refers to a power system's ability to recover from a voltage disturbance. In Australia, Short Circuit Ratio (SCR) at a connection point is used as a proxy to measure system strength, generally a SCR of 3 is considered sufficient system strength in the National Electricity Market (NEM). This definition is evolving further to include the stability of the voltage waveform. Low levels of system strength can cause issues such as protection equipment to not work properly and sub-synchronous voltage oscillations or voltage instability can occur, as was observed in the West Murray region of Australia in 2019. It can also make connecting inverter-based resources in these areas more difficult. System strength is locational and decreases with electrical distance, so must be supplied locally.

Synchronous generators, like coal and gas plants, rotate at the frequency of the grid and provide stability services like inertia and system strength as a byproduct of their operations. Asynchronous resources (i.e., inverter-based resources) like wind, solar and battery-based energy storage are connected to the grid with power electronics, which do not inherently provide inertia and system strength (although have the potential to do so as we discuss in the next section). As aging and inflexible coal-fired power plants retire and are replaced by low-cost renewables and energy storage, TSOs are increasingly looking to alternative methods to ensure the grid remains stable.

Australia and Great Britain: The First Grids to Face Up to The Challenge
In most regions where inverter-based resource penetrations are increasing, declining grid stability is a challenge looming on the horizon. However, certain network characteristics mean that some grids are facing these issues sooner than others. Grids in Australia and Great Britain are relatively less interconnected, making them more vulnerable to the effects of disturbances.

While both markets face common system stability issues, they differ in market structure and frameworks available to rapidly implement solutions.

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At the end of 2021, the United Kingdom unveiled a plan to fully decarbonize its power system by 2035. In order to achieve this, more than 80% of Great Britain´s electricity generation will need to be from renewable resources between 2025 and 2030. In 2020, Great Britain´s share of renewable electricity generation was 50% and the estimated annual average national inertial level provided by synchronous generation available in the energy market was 197 gigawatt seconds (GW). It is forecasted that the average inertia provided by the market may decline to 119 GW in 2025, driven by the reduction of conventional power generation.

Great Britain´s transmission system operator, National Grid Electricity System Operator Limited (NGESO), has incorporated in its Network Development Roadmap, the Stability Pathfinder Program. The program's objective is to trial a long-term tender approach for the procurement of inertia, short circuit level and dynamic voltage services. With this, NGESO aims to establish the foundations for long- and short-term stability markets to procure stability services, which have been traditionally provided as a by-product during the dispatch of synchronous generation in the balancing market. This "learning by doing" approach has been proactive and consultative with industry. It has accelerated progress to make use of all technologies available, including advanced applications of energy storage.

The Stability Pathfinder Program Has Been Structured in Three Phases
Stability Pathfinder Phase 1 procured around 12.5GWs of inertia with long duration contracts between 2020 and 2026. In this first phase only synchronous 0MW machines were able to participate.

Stability Pathfinder Phase 2 expanded the technology scope by also allowing grid-forming inverted based technologies. Furthermore, revenue stacking is allowed to enhance provider´s business case - subject to securing availability of the asset for the stability service. This phase procured 8.4 GVA of short circuit level for Scotland and 6GW of inertia for the whole Great Britain. Contracts length have a maximum of 10 years.

Stability Pathfinder Phase 3 is still ongoing and combines the learnings of the Phase 1 and Phase 2 to run a more cost-effective procurement for 15 GW of inertia and 7.5 GVA of short circuit level for England and Wales.

On the other side of the globe, Australia's main electricity grid, the National Electricity Market (NEM), faces the perfect storm of system stability threats: a long, stringy, and sparsely interconnected network, the rapid build of large-scale renewables far from load centers and the looming retirements of aging coal plants.

Australia also has the highest uptake of rooftop solar globally, with around 30% of homes with rooftop PV. In its 2022 Draft Integrated System Plan, AEMO stated that industry consensus now considers the most rapid Step Change scenario to be the most likely future scenario, meaning the NEM could operate without coal by 2043, and 100% instantaneous renewable penetration could occur 36% of the time by 2040, and 65% by 2050. (See Figure 2)

This brings forth the challenge of how to prepare the power system for such a rapid change. In its Engineering the NEM Framework, AEMO has identified that "transitioning the system to operational conditions expected to emerge in the next 10 years will require the power system to be intentionally engineered for a step change in capability".

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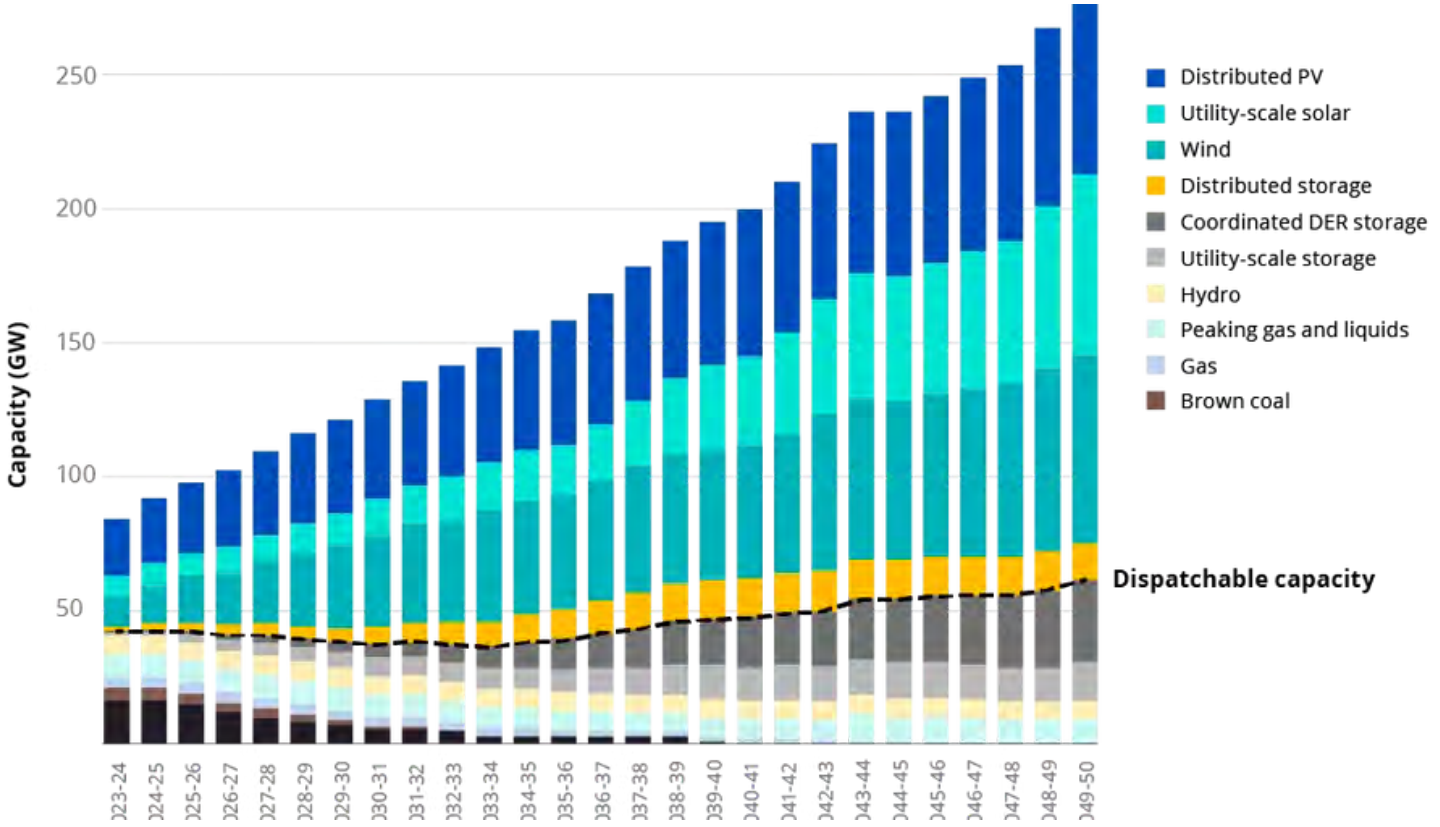

Figure 1: Forecast NEM capacity to 2050, Step Change scenario, with transmission.

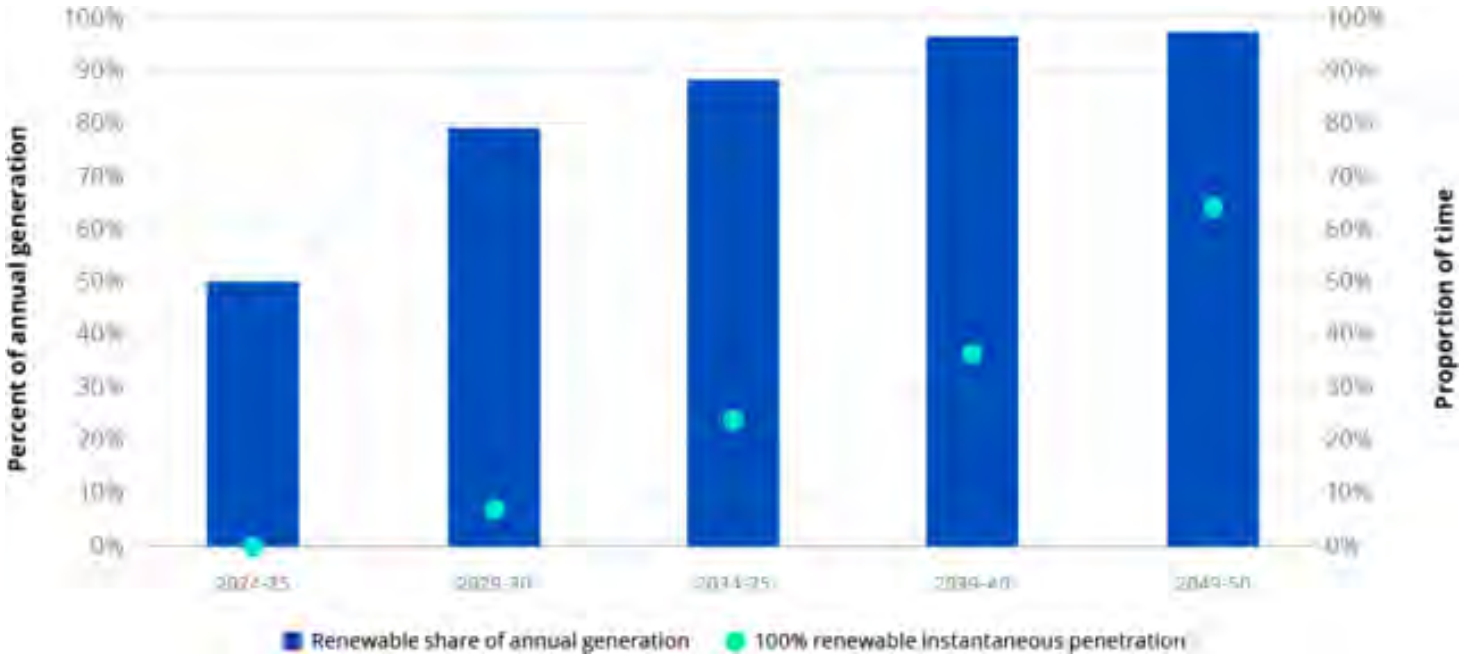

Figure 2: NEM annual share of renewable generation and instantaneous penetration, 2025-2050, Step Change scenario

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Compared to Great Britain, the fragmented regulatory structure in Australia's NEM makes it challenging to run a program like the Stability Pathfinder. Currently, AEMO identifies emerging gaps in inertia or system strength and declares a gap, which in turn triggers a time-consuming procurement process led by the applicable regional Network Service Provider.

New rules will soon allow Network Service Providers to proactively procure system strength in certain zones where many renewable generators will be built. The change also broadens the definition of system strength from being solely focused on fault current provision, to supporting a stronger voltage waveform. While uncertainties remain, this could help include energy storage with grid forming capabilities as well as other approaches like inverter re-tuning.

However, unlike a more holistic, services-led procurement program like the Stability Pathfinder, the NEM's approach may not adequately consider technologies for all the additional benefits they bring, and it may not be agile enough for a rapidly transitioning power system. AEMO has identified this in their Engineering the NEM Framework as an urgent requirement for action and encourages key decision makers to align on priorities, timing, and approach for transition efforts beyond the current work in progress.

Solutions to Help TSOs Manage this Change

Synchronous condensers are traditional method to support grid stability. They have been used in South Australia to reduce the need for AEMO to call on gas generators to manage periods of low system strength. But a downside of such equipment is that it has limited functionality aside from providing these services, can face lengthy manufacturing and deployment times and require frequent maintenance. Inverter tuning is also another method to help reduce the likelihood of voltage oscillations, which can arise in areas of low system strength.

Battery-based energy storage system incorporating grid forming inverters with virtual synchronous machine (VSM) based controls is an emerging solution to help provide advanced grid stabilizing features such as inertial response, instantaneous response to change in grid voltage and frequency, etc. to help TSOs maintain system strength.

While inverter-based resources don't traditionally provide this capability, demonstrations of new applications in the broader power system are underway. Advanced inverters can inherently respond to changes in frequency and voltage, and parameters can be tuned to an appropriate response. Unlike other options, a major benefit of storage is that it can provide multiple services from the same asset to stack revenue streams and can change its use with shifting market or power system needs.

Energy storage, in both grid forming and grid following modes, is highly controllable, adaptable and can be rapidly scaled and deployed, compared to traditional resources. Bidding software applications may also have a role to play to help storage optimize revenue and deliver the right grid services at the right times, in an ever-growing pool of market services.

The pace of the transition means that challenges are coming soon to a grid near you. And for most, this is uncharted territory. Even in strongly interconnected power systems, localized high concentrations of inverter-based resources can cause issues. Battery-based energy storage is rapidly emerging as a flexible tool to help manage grid stability, especially as advanced capabilities are demonstrated in the broader power system. TSOs have a unique window of opportunity to observe what other regions are tackling and assess whether existing regulatory mechanisms are up to scratch. This way, they will be ready to consider all the tools at their disposal, to navigate the approaching stability storm.

INTERNATIONAL NEWS

Next-Gen Long-Term Retardants Prevent and Protect

By Wes Bolsen | 20 May 2022 | Source: T&D World

Utilities are using new high-adherence and highly durable phosphate-based long-term retardants to help prevent wildfire ignitions and protect assets.

To address wildfire challenges, most utilities are hardening T&D lines and infrastructure, moving their lines underground, performing enhanced vegetation management and, in the worst cases, shutting off power to customers through public safety power shutoff (PSPS) events or changing settings to trip the power off even with small disturbances. However, some utilities are turning to a long-proven and effective solution: long-term fire retardants (LTRs). They are applying retardant to vegetation surrounding utility poles, substations and critical infrastructure at the beginning of wildfire season as well as directly applying it to the utility poles themselves in the event of an approaching wildfire.

Although retardants have been in use for decades, with recent advancements in the technology, utilities around the globe are now looking to this solution as a new tool. Retardants can be preventively and rapidly deployed to reduce catastrophic liability from T&D infrastructure causing ignitions, while at the same time protecting that same infrastructure from incoming wildfires. The use of LTR is expected to expand rapidly over the next two years to four years as utilities work to implement capital improvements that will cost billions of dollars and take much longer than a decade to complete.

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The application of phosphate-based LTRs on what many in the fire community call "light-flashy vegetation" (one-hour fuels), which signifies that even small sparks can cause ignition, then started to play a dual role the environmental community supported.

LTR History

LTRs have been safely and effectively used in the U.S. since the 1960s. The technology works by coating vegetation with a small amount of ammonia and phosphates that helps to render the vegetation and cellulosic material nonflammable until the active ingredients are removed by rainfall. Traditionally, the product is red in color, so that — when facing an oncoming wildfire — utilities and pilots who are applying more LTR can see where they have already applied retardants, to create continuous retardant lines with no breaks. The red color provides no additional effectiveness and does not change the environmental friendliness of retardants.

Many different fire-retardant chemicals have been tested by the U.S. Forest Service over the last 60 years for efficacy and environmental qualifications. Retardants with different ingredients have been explored for decades, including magnesium chloride and even boric acid. Independent studies have proven they were much less effective and worse for the environment than phosphate-based retardants. For these reasons, the Forest Service and fire agencies continue to use phosphate-based retardants to protect wildland vegetation from fire.

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Utilities began using the uncolored, durable LTR along roadsides and around utility poles as early as 2019.

Safety And Protection

Utilities adopted the application of LTRs around a decade ago and started applying the product directly to utility poles as well as around their assets in the face of approaching wildfires. Safety and infrastructure protection teams (SIPTs) have proven to be highly effective in saving poles as well as millions of dollars that otherwise would have been spent in replacing the destroyed infrastructure. One utility privately reported it applied LTR to 16,000 poles ahead of an approaching wildfire, and 3000 of them were impacted directly by wildfire. Of those poles impacted, 2820 of them, or 94%, did not have to be replaced. This resulted in US$63 million in savings in one year alone.

Utility-led SIPTs also have supported county, state and even federal firefighting agencies at times in some of the most devastating wildfires. They store hundreds of pallets of red, and sometimes uncolored, PHOS-CHEK liquid concentrate ahead of wildfire season. When a fire is approaching, an SIPT can mix roughly 5 gal (23 L) of water to every gallon of the stored concentrate and quickly apply the LTR themselves to the utility infrastructure.

Applying retardant under its power lines and around utility poles prevents possible ignitions from occurring under or near the lines, even if the ignition came from discarded smoking material, a car hitting the utility pole or hot metal coming off an overheated vehicle.

INTERNATIONAL NEWS

The product is applied up a pole approximately three times the fuel height, generally 10 ft to 15 ft (3 m to 5 m) up a utility pole. It should not be applied to the insulators or conductors, as the retardant could potentially affect conductivity, create an arc flash or relay, or cause an injury to the applicator (touch potential through hose stream) if sprayed onto the top of the pole on energized conductor (wire), given the water and salt content. Standard agricultural, tank and pump units, fire apparatus and garden spray equipment with liquid pumps and spray nozzles are used to cover the pole and surrounding vegetation until it is wet with retardant. After the water evaporates and the LTR dries, the product still provides retardant effectiveness until it is either washed off or removed by rainfall.

One California utility that placed the uncolored, durable LTR along a high-risk roadside where its infrastructure ran parallel to the road.

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Continued Advancement
Universities and companies have continued to innovate on fire chemical solutions that can be used not only in a reactive manner after fires begin but also in a preventive and proactive manner at the start of wildfire season. Professors at Stanford University published research in 2019 in the Proceedings of the National Academy of Sciences (PNAS) that a breakthrough polymer had been created to mix with the most effective phosphate-based LTRs in the industry. This uncolored product had significantly enhanced adherence and durability properties compared to traditional LTR, which allowed the retardant to be applied at the start of fire season and last potentially all the way through peak fire season with only a single application.

Although the breakthrough polymer had been in development for years, the necessity to bring a preventive LTR solution to the utility and transportation industry — where, in some geographies, 80% of fires were started — accelerated the new tool in becoming commercially available. In October 2021, the Forest Service added the first high-adherence and highly durable phosphate-based LTR to its qualified products list (QPL), granting its approval for it to be applied preventively in wildlands.

Utility Use
Utilities began using the uncolored, durable LTR along roadsides and around utility poles as early as 2019. They started applying the LTR specifically to utility infrastructure located along county roads and on private land, while they waited for official approval to come from the Forest Service. Given the urgent need for new solutions, California utilities were some of the first to deploy the technology. Other utilities started following their lead by using the new LTR ahead of prescribed burns and in collaboration with organizations, such as Pheasants International. This enabled them to maintain plant habitat during prescribed burns under their high-voltage power lines, so birds could have ground cover.

The environmental community also started to embrace the new, durable LTR solution as one of the best available options for utilities to deploy in the community. Some utilities and communities were starting to face liability after applying herbicides that killed vegetation and removed vegetation to reduce ignitions. In other situations, utilities were clearing vegetation down to bare mineral soil, which caused environmental issues with erosion, mudslides and soil health issues in some parts of the country. In Southern California, people even started getting sick with valley fever when the California Department of Transportation started to scrape roadsides to bare mineral soil, to help eliminate ignitions from automobiles.

The application of phosphate-based LTRs on what many in the fire community call “light-flashy vegetation” (one-hour fuels), which signifies that even small sparks can cause ignition, then started to play a dual role the environmental community supported. Using LTR, San Diego County and plant studies performed by Pepperdine University found vegetation habitats could be maintained in place while retardants helped to render it nonflammable throughout the fire season.

After the winter rains came, phosphate-based retardants helped the plants recover from the drought season by increasing microbial life, soil health and root health. In turn, this helped to prevent the erosion, silt and mudslides that occur when clearing vegetation, and kept the habitat in place for the environment, allowing native plant species to outcompete fast-growing invasive species that arrive after a wildfire moves through an area.

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Applying fire retardant to roadsides also helps evacuations as well as fire personnel and utility vehicle ingress and egress on roads with only one way in and one way out, enabling utility customers to safely evacuate and essential personnel to get into the area in the event of an approaching fire.

Community Partnerships

Many public utilities see themselves as a critical part of not only providing power to their customers but also protecting them from traditional causes of wildfire ignitions unrelated to utility infrastructure. Inside many utility wildfire mitigation plans (WMPs) today, dollars are being set aside for community wildfire safety.

This was proven highly valuable by one California utility that placed the uncolored, durable LTR along a high-risk roadside where its infrastructure ran parallel to the road. The utility applied some retardant under its power lines and around utility poles as well, which introduced two benefits simultaneously:

1. It prevented any possible ignitions from occurring under or near the lines, even if the ignition came from discarded smoking material, a car hitting the utility pole or hot metal coming off an overheated vehicle.
2. It enhanced public/residence evacuations as well as fire personnel and utility vehicle ingress and egress on roads with only one way in and one way out, enabling utility customers to safely evacuate and essential personnel to get into the area in the event of an approaching fire.

This proved true for the utility in late 2021 when a fire ignited on a road in San Diego County, California. A car caught on fire in Wildcat Canyon, across the road from where retardant had been applied previously under power lines, and the retardant helped to keep the fire from spreading.

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More state transportation agencies, fire agencies, and even communities are looking to partner with utilities for the preventive and proactive application of LTR going forward. Utilities will play an important role in not only taking care of their own vegetation management activities but also providing vegetation management up to 50 ft (15 m) out from their lines and even along roadsides parallel to their lines.

Two-Pronged Approach

In the future, utilities will take a two-pronged approach to the use of uncolored, durable, phosphate-based LTR:

- They will use it for preventive and proactive application underneath lines and around poles in an enhanced vegetation management situation, eliminating the need to remove vegetation. Utilities already have shown this to be up to 10 times more cost effective and 10 times faster than the mechanical removal of vegetation — if the community they are treating even allows vegetation to be removed. The preventive application also will go around substations, switchyards and high-value infrastructure in the most critical fire-prone areas. This will include areas where roadside ignitions could be likely near utility infrastructure and in support of community wildfire safety programs for effective ingress and egress of community members as well as firefighting and utility vehicles. In the face of red-flag fire warnings, high winds and potential catastrophic weather situations, utilities will start to deploy the preventive application of high-adherence, high-durability LTRs to circuits where it had not been applied at the start of fire season. This could include additional ingress and egress roads and even infrastructure leading into at-risk communities.
- Utilities will start to apply phosphate-based LTRs in a protection manner on and around thousands of poles and infrastructure that models show could be directly in the path of an oncoming wildfire. This will save utilities millions in replacement costs and help communities to restore power faster after the wildfire moves through the community.

The future will see utilities using every available tool to reduce liability from infrastructure-caused ignitions but also working side by side with transportation agencies, firefighting personnel, and even the U.S. Forest Service and communities to help prevent non-utility ignitions and protect their own assets.

Into the Void: Distributed Planning Poses Questions that Need to be Addressed

By Gerard Rendell, Mark Knight | 2 June 2022 | Source: T&D World

Since grid planning has always been the domain of electric utilities, the concept of distributed planning poses some interesting questions that need to be addressed.

Electricity delivery presents many challenges. The grid must be balanced in real time all of the time. The laws of physics require that. Try to bend the rules and bad things happen. Disruptions that can be measured in single cycles can cause potentially catastrophic problems, yet utilities plan new lines and substations to last for decades.

The impact of distributed energy resources (DERs) is already being seen with the need for distributed energy resource management systems (DERMS) and increased distribution automation through the adoption of advanced distribution management systems (ADMS) that include functionality for fault location, isolation and service restoration (FLISR) and other functionality to improve customer service and grid reliability.

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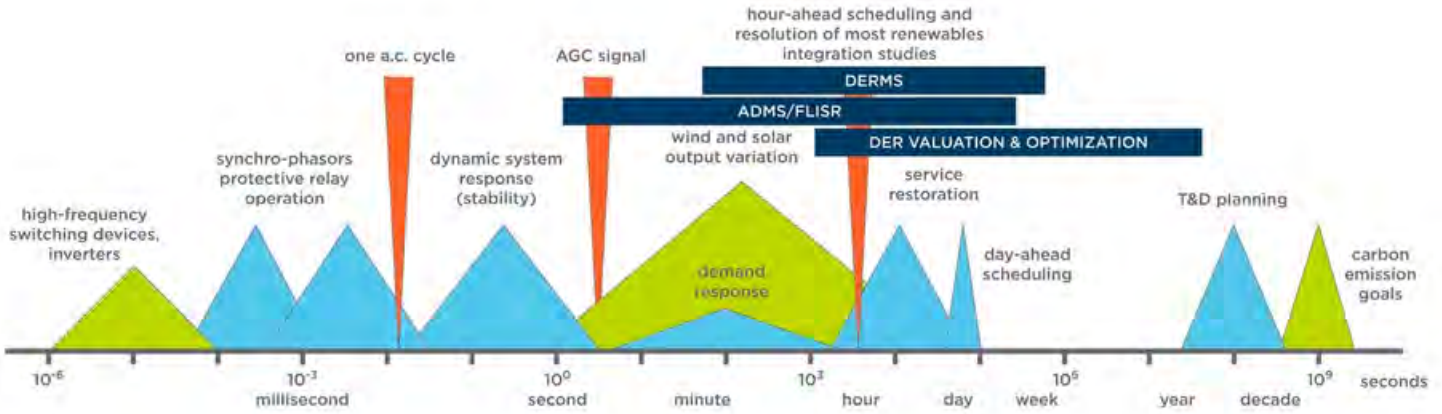
The deployment of DER is not showing signs of slowing down and as we see increased amounts of DER on the grid, future grid investment will require a valuation framework that considers the structure of an inclusive and extensible valuation framework that accounts for the value created by DER. This is necessary to account for the multiple dimensions involved in considering value associated with DER. With continued growth in types and uses of DER, a valuation framework will be a critical feature to enable transparency that achieves the broader social aims of economic value and importance from the perspective of both planning and operations. Using a transactive energy model of grid stability and reliability as this basis could provide consistent methods to address these challenges.



Owners and operators need visibility into structural changes to the distribution grid and into their facilities to support improvements to reliability and to rationalize the satisfaction of goals such as carbon reduction, fuels and system optimization, congestion costs, and customer needs. A valuation framework needs to assume that the measures of economic value and importance can be constructed as hard and soft in a fiat currency as cost reduction, cost avoidance, revenue and strategic value using a simplistic net cash flow model for both capital and operations and maintenance over a constrained time horizon sufficient for valuation.

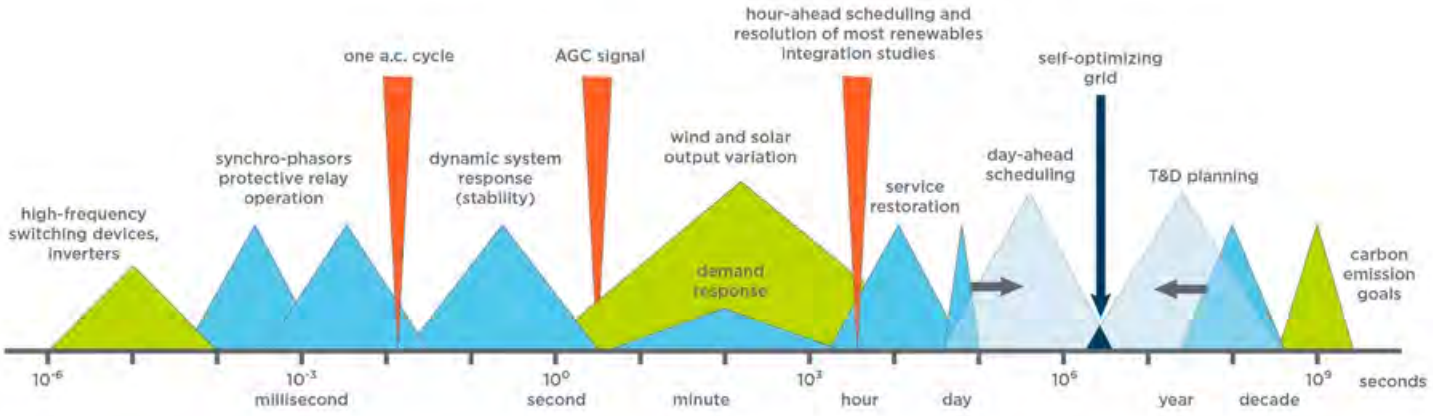
With lower barriers to entry for small commercial operations and for end-use customers, due to low-cost consumer DER, storage, and private financing, the timescales for planning will need to become much shorter as new non-utility-owned assets appear more frequently on the grid. Already, utilities are being overwhelmed with interconnection requests and this trend is expected to continue unabated or even increase. Additionally, as local DER cause reverse flows and phase imbalances, the emergence of local (transactive energy) markets is expected to provide much-needed low-voltage dynamic balancing where the assets themselves can provide not only grid services but also provide insights into their capability to provide those services and recommendations for changes to local capabilities.

In the future, these changes will become much more dynamic than in today's environment and will cause the temporal gap between operations and planning to shrink drastically as the void between them closes. We can no longer plan (largely radial) distribution grid changes, build them, and assume that they are operating as planned. We will need more looped schemes and more flexibility in how the grid is operated. The ability of DER to assess capabilities to provide service is one dimension of this complex valuation framework. This will include integrating these resources into local markets that include real and reactive power, capacity, ancillary services, and other services.

INTERNATIONAL NEWS

Evaluation of the framework itself will require a deep technical dive into the approach to provide some degree of mathematical assurance that convergence on a valid solution will occur and be timely along with assurances that a conceptual framework for transactive energy systems will actually solve some of the processing problems in the grid. However, the proliferation of DER is not likely to go away. Valuing the DER contribution to grid stability and value creation through retail markets is just as important as being able to mitigate the uncertainty caused by their intermittent operation if we were to choose instead not to coordinate their activity.

There has been much discussion over the past decade about the need for more dynamic balancing of distributed resources utilizing concepts like transactive energy. These types of approaches are being researched and modeled as potential solutions for retail energy and grid services markets. There are barriers, however, including barriers that are erected by dependency on enabling regulation. However, these approaches represent a viable technical approach to operating grids more dynamically at lower voltages. A variety of mechanisms have been studied and implemented (PNNL, TeMIX, PowerMatcher, Introspective Systems, PowerLedger, LO3, Opus One, and others) yet these have understandably been focused largely on the operations domain.



Currently there is a conceptual and temporal void between operations and planning, but as the grid moves from being load following to supply following, and especially during the transition of years between these states where the drivers for operating philosophies may not be clear, that void will start to shrink. There will be a time where they start to converge and the transition from distributed operations will start to extend into distributed planning. The following figure is an edited version of the previous figure. It shows the shorter planning timescales and extended operations timescales converging to a point where they overlap. At that point, planning and operations become indistinguishable in some facets. This area is one that is a prime solution space for non-wires alternatives.

For this to work effectively, a distribution grid is envisioned that is much more networked and far less radial. In this temporal overlap of planning and operations, we will have a grid where the value of resources depends on other resources and the goal of the system will be not only continual self-optimization through physical reconfiguration and changing how devices are used, but also extrapolating the usefulness and efficacy of such options so that future extensibility can be integrated.

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The existence of a percipient grid poses some challenges. For it to take on a distributed planning capability, it needs to be able to evaluate the new construction that has not yet been built, which could be addressed with software-in-the-loop inputs that the other devices recognize as being virtual, although this can introduce malware attack vectors. It also does not address the question of who should realize value from new configurations and new construction since this will be profit-driven if not utility-owned.

Since grid planning has always been the domain of electric utilities, the concept of distributed planning poses some interesting questions that need to be addressed. As distribution planning and operations start to converge, the grid will also be seeing increased demands from electrification. This will likely involve mobile storage in the form of vehicles and possibly mobile battery storage. This will create a need for unique device identifiers that may participate in multiple markets. As mobility and availability of responsive devices increase, this will necessitate the need for capabilities such as self-registration and other interoperability attributes.

Drivers of these trends will include distributed (artificial) intelligence and non-utility drivers. Perhaps by that (fast approaching) time, we will have rules for intelligent devices similar to Asimov's laws for robots such that:

- A device may not injure a human being or, through inaction, allow a human being or the electric grid to come to harm.
- A device must obey the orders given it by human beings, except where such orders would conflict with the First Law.
- A device must protect its own existence as long as such protection does not conflict with the First or Second Law.

Food for thought.

Urban magnetic fields reveal clues about energy efficiency and pollution

By E&T editorial staff | 31 May 2022 | Source: E&T

Examining a city's magnetic footprint can be used as an early warning system for detecting environmental issues caused by pollution and as a tool for optimising energy conservation, researchers have said.

Researchers from Germany and the US compared urban magnetic fields between two US cities: Berkeley, California, and the Brooklyn borough of New York City.

They looked at what kinds of information can be extracted using data from magnetic field sensors to understand the working of cities. Magnetic field activity from various sources could provide insight into what is going on during a 24-hour period, the researchers said.

"A city is viewed as a physical system akin to a distant astronomical object that can be studied using a variety of multispectral techniques," said Vincent Dumont, from Lawrence Berkeley National Laboratory. "In short, our project was inspired by our desire to apply what we learned practising fundamental physics research to the study of cities."

INTERNATIONAL NEWS

Researchers collected magnetic field data continuously during a four-week period, using synchronised measurements with a network of sensitive magnetometers. Data was processed and analysed using modern data analysis techniques. In their current work comparing two very different cities, Brooklyn and Berkeley, they discovered Berkeley reaches a near-zero magnetic field activity during the night, while Brooklyn's magnetic activity continues day and night.

"Again, not too surprisingly, we discovered that 'New York never sleeps,' or more seriously, there are indeed a number of magnetic signatures specific to each city," he said.

The researchers hope their network magnetometry and smart data analysis combination can become a valuable tool for multidisciplinary urban science.

"This work builds on our earlier experiments conducted around the city of Berkeley, in the San Francisco Bay Area," Dumont said. "We identified the dominant sources of magnetic signals – which, not too surprisingly, turned out to be the trains of the Bay Area Rapid Transit (BART) system, and learned to glean weaker signals from this dominant background." "We hope this line of research will be picked up and further developed both by the members of our team as well as others, hopefully within cities around the world," he said.

In March, the Australian city of Melbourne unveiled a new traffic-management system using the latest technology to reduce traffic jams and improve road safety.

A Zero Carbon Energy System: The Operability Challenge

Source: Catapult Energy Systems

The UK energy sector has been invigorated by the recent commitments to reach Net Zero carbon emissions by 2050 (2045 in Scotland), and a fully decarbonised electricity system by 2035. Meeting these legally-binding emissions targets will require a comprehensive rethink of how the UK power system – a central enabler of the transition to Net Zero – is developed and operated.

While work is underway to facilitate the near-term replacement of fossil-fuelled generation with renewable technologies, less attention is given to the end state – the operation of a fully decarbonised power system.

This report – created in collaboration with the Faraday Institution and supported by TNEI – presents fresh thinking about a zero carbon system and how it will be operated. It focusses on some of the key parameters that make up the system operation, and is intended as a starting point to generate conversation and debate.

INTERNATIONAL NEWS

Key findings

- In a net zero power system, flexible demand could be shifted to meet available renewable generation, rather than dispatching generation to meet demand. Today demand is mostly predictable, and generation is dispatched to meet it. In a net zero system, generation and demand will be more weather dependent and there will be new opportunities for flexible demand, e.g. battery and EV charging, heat pumps and hydrogen production, to be dispatched to use renewable generation when it is available.
- A net zero system will no longer have access to bulk stored energy in the form of fossil fuels and security of supply will need to be achieved by alternative sources. Consumers will become more dependent on their electricity supply due to increased electrification and demand will become more weather dependent. Securing supply during periods of high demand and low renewable output, e.g. a cold winter, will require new forms of storage spanning months and years.
- Digitalisation and enhanced data will provide an opportunity to use dynamic approaches to operability and move away from deterministic rules. Today a set of deterministic rules are used for system operation. Increasing data collection and using more sophisticated tools will provide the opportunity to use dynamic operability parameters in real time, e.g. dynamic assessment of the risk of network faults.
- Devices like Electric Vehicle (EV) chargers and heat pumps could support system operation by automatically and autonomously responding to frequency and voltage. Net zero system operation can be supported by devices, such as EV chargers and heat pumps, by enabling them to respond to frequency and voltage signals. This would facilitate an automated response without the need of central control.
- Growth in renewable, asynchronous generation brings the opportunity to reconsider the approaches and parameters used in system operation. Today system services are being used to replace the dynamic behaviours synchronous generators provide. A net zero system provides an opportunity to reconsider the technical parameters considered within system operation, e.g. the relaxation of frequency standards.
- The technological and societal changes that come with net zero present opportunities for different standards and approaches to operability. System operation is a product of the physical characteristics of the network, what is connected to it and the standards expected from it, e.g. security of supply. Societal, technological and political choices will interact with each other and influence how the system is operated.
- There will be many possible roles for energy storage in a net zero system. The cost will depend on several interacting technical factors including size, duration and how often it is used. Storage costs will depend on technological characteristics, like whether costs scale with power (MW) capacity or energy (MWh) capacity, and roundtrip efficiencies. How the storage is used, and how often it "cycles" will be very important in determining its levelised costs. Storage that cycles very infrequently might cost £1,000s or even £10,000s per MWh.
- Further research would be valuable in stress testing the system, understanding the economics of flexible demand, investigating net zero energy markets, and exploring the requirements for and cost of storage in a net zero system. Research and innovation are ongoing across the whole energy sector, which will contribute to reaching net zero. Further suggested research includes:
  - "Stress testing" the system against extreme events, e.g. long periods of low wind.
  - Interactions between weather and energy demand and the impact on demand flexibility from heat and transport.
  - The economics of demand side flexibility to support investment, policy, operational decisions and impact on customers' comfort and wellbeing.
  - Net zero electricity system and alignment of electricity markets.
  - The requirements for, and cost of, storage within a net-zero system.

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Nuclear waste energy could power the US for a century, scientist says

By E&T editorial staff | 6 June 2022 | Source: E&T

There is enough energy in the nuclear waste in the United States to power the entire country for 100 years with clean energy, according to Jess C. Gehin from the Idaho National Laboratory.

Scientists have long known the potential of nuclear fast reactors, which turn nuclear waste into energy. However, although the technology was proven in a US government pilot that took place between the 1960s and 1990s, it was never deemed profitable enough to be commercialised, until now.

According to Jess C. Gehin - an associate laboratory director at Idaho National Laboratory, one of the government's premier energy research labs - current levels of nuclear waste in the US could produce enough energy to power the entire country for 100 years. The technology would not only help alleviate the current energy crisis, but also solve the difficult challenge of managing nuclear waste.

The 2015 Paris Agreement, coupled with the recent rapid rise in energy costs, are driving the development of new and carbon-neutral energy sources. As a result, nuclear fast reactors are once again attracting serious attention.
"It feels like it's real - or realer - than it has ever has been to me," said Brett Rampal, a nuclear energy expert, speaking to CNBC.

At the moment there are 93 commercial nuclear reactors at 55 operating sites in the United States, according to the Nuclear Regulatory Commission. Twenty-six are at some stage of the decommissioning process and all of them produce radioactive waste that needs to be carefully discarded.

Currently, there are around 80,000 metric tonnes of used fuel from light-water nuclear reactors in the United States and the existing nuclear fleet produces approximately 2,000 additional tons of used fuel each year.
"We use a half a per cent of the energy that's in the uranium that's dug out of the ground," Gehin told CNBC. "You can get a large fraction of that energy if you were to recycle the fuel through fast reactors."

Fast reactors don't slow down the neutrons that are released in the fission reaction and faster neutrons beget more efficient fission reactions as they can more effectively convert uranium-238, which is predominantly what's in spent fuel, to plutonium for the fission process.

The technology for fast nuclear reactors has existed for more than fifty years. A fast reactor plant called the Experimental Breeder Reactor-II operated from 1964 to 1994, until the US Congress discontinued the funding.

"It's been proven that it can be done," Gehin said. "The trick would be going to commercial scale to ensure that it is done economically. It's very safe technology. All the basis for the technology has been proven."

Russia is the only country globally producing electricity with fast reactor technology, although India and China also have plans to build commercial fast reactors in the future.

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In 2019, the US Department of Energy announced it was building its own fast-spectrum test reactor, but that project is yet to receive financing. By not having a pilot test facility in the US for almost 30 years, the country is "effectively yielding leadership to Russia, China and India who have this critical capability," the Office of Nuclear Energy said in a written statement issued last month.

While the government is moving slowly, the private sector has already seen the potential in this type of energy. TerraPower says it is investing in supply chains and working with policymakers to build political support, while Oklo has received three government awards and is planning to commercialise fast reactor fuel supply chains domestically.

However, before nuclear waste can be used to power fast reactors, it has to go through reprocessing. Right now, only Russia has the capacity to do this at scale, while the Idaho National Lab can only reprocess enough fuel for research and development purposes.

These materials were meant to revolutionize the solar industry. Why hasn't it happened?

By Casey Crownhart | 18 May 2022 | Source: MIT Technology Review

Solar panels are basically synonymous with silicon. The material is used in about 95% of the panels in today's market. But silicon solar cells are limited in how much energy they can harness from the sun, and they are still relatively expensive to make.

For many, compounds called perovskites have long held promise as potentially cheaper, lighter, more efficient solar materials. But despite the excitement—and a flurry of startups to commercialize the technology—some experts caution that perovskite-based solar cells could still be nearly a decade away from having a significant commercial impact, if it ever happens.

Though recent studies on perovskite cells have shown progress in key metrics like efficiency, the reality is that the materials may still be far from being able to withstand real-world conditions.

"I think the [perovskite] community as a whole is projecting a misleading impression that things are about to go commercial," says Martin Green, a solar materials researcher at the University of New South Wales in Australia.

Perovskites are a family of synthetic materials that efficiently absorb sunlight and are relatively easily used to coat surfaces, creating cheap solar cells that can harness energy from the sun and transform it into electricity.

While silicon has a head start in the key metrics that researchers use to evaluate solar materials, perovskites are quickly catching up. That's especially true for efficiency—how much energy from the sun a cell converts to electricity. Both silicon and perovskites have recently set records above 25%.

The quick progress in work on perovskites has led to a large influx of researchers hoping to exploit the materials. Scientific papers have heralded new achievements, and the funding has followed. The US Department of Energy, for example, offers a startup prize for perovskite businesses.

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Several startup companies, like Microquanta Semiconductor, Oxford PV, and Saule Technologies, have raised millions in funding and even installed demonstration projects.

But despite the hype, there are a couple of key reasons why your next rooftop solar installation probably won't be powered by perovskites. At the top of the list: they're too fragile.

True, they're sturdier than they once were. Perovskites used to fall apart in the time it took researchers to carry a newly made sample across the lab to be tested. "That hasn't been true for like a decade," says Joseph Berry, a perovskite researcher at the National Renewable Energy Laboratory.

But stability remains a tough challenge.

In one recent study, published in Science in April, researchers discovered a new way to build perovskite solar cells with additives that improved efficiency and lifetime. The cells withstood 1,500 hours of high heat and humidity in the lab.

The problem is translating these results into the real world. It's hard for researchers to simulate real-world conditions, and silicon has set a high bar, with many manufacturers guaranteeing that their panels will maintain 80% of their performance for 30 or even 40 years.

In recent field testing, researchers found that perovskite-based cells performed at over 90% of their initial levels after a few months. But losing nearly 10% of a cell's performance in that time span isn't going to cut it.

Another wrinkle is that these tests have all been done using tiny cells. Scaling up perovskites and making the larger cells that can be strung together into full-size solar panels often leads to setbacks in efficiency and lifetime.

These challenges mean the day when perovskites take over solar markets isn't as close at hand, or inevitable, as some researchers make it out to be, Green says.

Fine-tuning perovskites with methods like adding stabilizers and materials that protect them from the elements could eventually enable these solar cells to last a couple of decades in normal operating conditions, says Letian Dou, a perovskite researcher at Purdue University. But he predicts it will be a decade or more before perovskites make meaningful commercial progress.

Despite the challenges, there is a real need for different types of solar cells. That's especially true now, when demand for solar materials is exploding, says Jenny Chase, head of solar analysis at BloombergNEF.

And perovskites wouldn't necessarily have to compete directly with silicon, because they can be used in tandem cells, where a perovskite layer is stacked on top of a silicon cell. Because the two materials capture different wavelengths of light, they could complement each other.

None of that is likely to happen unless someone can make perovskite solar cells that are far more stable. But certainly, researchers are not giving up on the promise. As Green puts it, "There's still a chance that someone will really nail it."

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Exposed: The national wiring scandal putting lives at risk

By Conor McGlone | 30 May 2022 | Source: E&T

Inadequate inspections on the safety of wiring in buildings across England are increasing the risk of fires, E&T has found. A flawed regulatory system has sparked a race to the bottom, with some businesses profiting at the expense of the public's safety.

Gareth Bourhill, who has worked in the electrical contracting industry for 40 years, says it is well-known in the industry that the public's safety is being jeopardised in search of profit. "People know it's a huge problem but it's all down to money. That is because your normal householder, or unscrupulous letting agents and landlords, are simply driven by costs," he says.

A new law first introduced in 2020 means that landlords must have an inspection – known as an Electrical Installation Condition Report (EICR) – carried out on their properties every five years, but E&T has found that many electricians are carrying out inadequate tests. In some cases, contractors are incorrectly passing unsafe properties while others are mis-selling unnecessary upgrades. E&T has also heard evidence of 'drive-by inspections', with contractors filling out paperwork without entering the properties at all, undercutting legitimate businesses – and putting lives at risk.

These scams are made possible by a voluntary competency assessment system that gives incompetent or corrupt businesses "a veneer of respectability", according to one industry insider.

As another puts it: "It all comes down to who's allowed to call themselves an electrician and the fact that there's no proper licensing."

The government has ordered a review of the inspection regime but says the industry must take more responsibility for increasing competence in the sector. Critics from the Labour Party say this amounts to passing the buck and that continued deregulation is putting residents in privately rented properties at risk.

According to a report by the charity Electric Safety First, electricity fires affect 20,000 homes in the UK every year. The 2017 Grenfell Tower fire is a stark reminder of the danger that faulty wiring can pose. It is thought that the blaze, which led to the deaths of 72 people, was caused by faulty electrics in a fridge freezer.

One retired electrician, who wishes to remain anonymous and has carried out hundreds of EICR inspections and testing when registered with an approved competency body, tells E&T he has seen "a number of dubious reports and poor practice including guys sitting in cafes filling in page after page from a pad containing report sheets and certificates".

"There are more people willing to file it away and tick the boxes to say that it is being done but nobody has grasped that the actual cost of doing a genuine EICR is way, way greater than what the market value is," says Bourhill. "It's purely driven by what people are prepared to pay but because they get a certificate and a signed report, they think then that their legal obligations are done with."

A race to the bottom

The issue was first highlighted during a price war sparked by the introduction of the Electrical Safety Standards in the Private Rented Sector (PRS) regulations, which have been gradually introduced in recent years.

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The regulations require that landlords ensure the electrical installations in their rented properties are inspected and tested by a 'qualified and competent person' at an interval of at least every five years. The standards that need to be met are set out in the Institution of Engineering and Technology's (IET) 18th Edition of the 'Wiring Regulations', which are published as British Standard 7671. From July 2020, all new tenancies required an EICR and then, in April 2021, the requirement was extended to all tenancies – new and existing.

Jordan Farley, managing director of Artisan Electrics, says the change in law last year led to a flood of landlords who needed to have EICRs carried out. He says landlords were shopping around for the EICRs and "getting offered ridiculously cheap prices by certain companies". He claims that the EICR price war was an issue even before the PRS regulations were introduced. "It was just that the PRS regulations highlighted it more because so many inspections were being carried out." The IET received more than one hundred calls to its technical helpline specifically concerning EICRs in the private rental sector. The volume of calls peaked around April 2021, which is when the legislation for the private rental sector came into effect for existing tenancies.

Of the calls, almost half related to concerns over the incorrect usage of certification coding, which determines whether a property is deemed either 'satisfactory' or 'unsatisfactory'. Approximately a quarter of calls sought advice on establishing whether inspectors were competent to undertake the work, while other calls included complaints about the mis-selling of unnecessary upgrade work.

Farley thinks "quite a large percentage of EICRs are not being done properly" and that the worryingly low prices being offered suggest corners are being cut. "We've had messages from companies that say, 'we need subcontractors, we have hundreds of EICRs that need doing and we'll pay you £60 per EICR'."

According to Bourhill, a thorough EICR can cost on average close to £500, although prices vary depending on the size of the property. "As a landlord, why would I pay £500 when someone says 'I could do it for £50'?" he says.
Experts have told E&T that to undertake an EICR in line with recognised industry guidance, would probably require a minimum of three hours on site for a small flat, and about four hours on site for a typical three-bedroomed small house. In each case, this would need to be supplemented with about two hours of office time producing the report and covering correspondence.

Taking into account an average hourly rate for a qualified, experienced and competent tradesperson, experts say alarm bells should ring when EICRs are offered for less than £100. These are likely to be "drive-by inspections", they claim.
But just how is such a climate that rewards taking short cuts at the expense of safety, able to exist post-Grenfell?

New rules on building safety have been introduced since the Grenfell fire but critics say they do not go far enough. Photograph: Alex Danila | Dreamstime.com

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Cash for logos

The PRS regulations state that inspections must be carried out by a 'qualified and competent person'. To this end, the government suggests landlords and other businesses use electricians that are registered on competent body schemes.

The two major schemes are NICEIC and NAPIT, who are paid for each report bearing their logo. These bodies do not assess individuals but instead each contractor has one 'qualified supervisor' who is assessed by the competency bodies to a standard known as the Electrotechnical Assessment Specification (EAS). The qualified supervisor is meant to ensure their employees are competent and adequately supervised for the work they undertake.

Certsure, which owns NICEIC, says its assessment regime is designed to "establish, on a regular basis, that the qualified supervisor is currently competent and demonstrating appropriate levels of supervision". In practice, E&T has learned this does not always happen.

One qualified supervisor, Fabian, who only wants his first name to be used, says that sometimes qualified supervisors countersign 50 EICRs a day. "A qualified supervisor will look at the results and the remarks on the report and if he doesn't see anything that sticks out like a sore thumb, he will pass it. One qualified supervisor might control 10-15 electricians," he adds.

Another electrician, who did not want to be named, tells E&T that "the only absolute duty of a qualified supervisor is to review the documents and sign them. This person usually sits in a remote office somewhere. The EAS says they should check on the inspections, but it does not happen. The qualified supervisor doesn't get time to go out and look at them. Often, the EICRs are digitally signed, and the qualified supervisor doesn't even see it. The EAS gives them an air of authority and a veneer of respectability."

He says there are "loads of really dodgy, dishonest, corrupt companies that send anyone out to do inspections. A lot of these companies are management only; they don't actually employ any technical staff that go to the sites. They are all off-the-book subcontractors."

He says while some firms might have NICEIC or NAPIT on their sleeves or the side of the van, they are often "totally incompetent".

The competent person schemes were set up to provide a self-assessment route for those electrical installers working in dwellings in England and Wales in 2005 with the implementation of Part P – Electrical Safety of the Building Regulations. However, they were originally not intended to approve inspection and testing including EICRs.

"The only thing they mean for certain is that they have paid the money. These companies are scamming it," says our source.

"The real victims," he adds, "are tenants and people buying houses. The landlords are complicit; they don't want a proper job. They just want the certificate to say they've had it done."

Currently around a fifth of the UK's population lives in rented housing.

Labour MP Andy Slaughter, who is campaigning for better building safety standards in the aftermath of the Grenfell fire,

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says the investigation "confirms what we should all know, which is that the best regulations fail if they are ignored or not enforced".

"We do need comprehensive and effective legislation to require regular testing of electrical appliances in all at-risk dwellings and I have been pushing for this to be included in the Building Safety Bill. But without competent electricians and adequate systems of inspection the risks will remain. Indeed, residents will be left with a false sense of security."

Fire risk

Responding to these concerns, a Department for Levelling Up, Housing and Communities (DLUHC) spokesperson told E&T that "statistics show accidents and fires caused by fixed electrical installations in homes have reduced but that it would continue to monitor safety statistics and registered electricians to inform future reviews and changes".

However, according to an E&T analysis of the available data, electrical fires have not reduced as a percentage of all fires, in fact they have increased slightly as a proportion, and are still the second highest cause after cooking.

Responding to the government's claims, the National Fire Chiefs Council says: "Electricity remains a major cause of accidental fires in UK homes, and NFCC strongly recommends that electrical installations and inspections are undertaken by qualified and competent professionals."

Electricians that have spoken to E&T say the current system is seriously increasing the risk of fires in the UK. "The EICR wants you to look behind switches and sockets. These guys are saying they are doing more tests than they are actually doing. It is physically impossible to do five tests in a day, let alone eight or nine or ten," says Fabian.

"Most of these guys will go into the property and just do live tests at the board and sockets and lights, do a plug-in socket tester, get a reading and have a look around to see what the state of the property is like. The visual inspections are not going to tell you about the state of connections behind the sockets, a socket can look nice and lovely on the outside but can have loose connections on the inside."

Farley from Artisan Electrics worries that if electricians "are just giving out valueless pieces of paper to help landlords be compliant in order for a quick buck, then it doesn't actually tackle that issue of these properties having unsafe electrics".

Fire chiefs say faulty wiring are a major cause of accidental fires in UK homes. Photograph: Emiralikokal | Dreamstime.com

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EICRs seen by E&T appear to back up these concerns.

One carried out for a new homeowner on their property in September 2020 is signed off as satisfactory and says no remedial action is required. But after a visit from another electrician, who noticed some of the wiring was not earthed properly, the property owner had another inspection. This time the five 'C2' codes were noted, meaning that installations are potentially dangerous and that the EICR should not have been signed off as satisfactory. In addition, the first inspector had estimated the age of the wiring as three years old while the second report estimated the wiring as 40 years old. Presented with the reports, Martyn Allen, technical director of Electrical Safety First, says it is "hard to believe they are the same installation... they clearly should not be so wildly different, and it disappoints me". He says a follow up audit or investigation should be carried out.

Of certification sent to the IET by concerned parties, some of the usual inconsistencies included circuit results not having been recorded in all instances, evidence of test values recorded not having been verified by the overseeing qualified supervisor, or inspection work excluded, often hidden in ambiguous small print, or sometimes not even listed.

Sharp practice

Farley says he has seen EICRs that have been carried out by other contractors "where they have not picked up on stuff that they should have picked up on". However, sometimes they go the opposite way and "seem to be ridiculously over the top to try and generate lots of extra work that might not be necessary".

Fabian alleges that often councils are complicit in this kind of scam. "Lots of council EICRs are done as a loss leader, so they go in knowing they are going to get remedial works. There's always going to be something that you can highlight. They go in at ridiculously cheap costs," he says.

Such sharp practice makes it difficult for legitimate electricians to make a living. While it is not compulsory for electricians to be registered with a competency scheme, Fabian says, "for those who are trying to stay on the right side and trying to be part of a competent person scheme, and be inspected, it's all adding cost". Another electrician complained that "the competent qualified guys don't get a look in, or they have to become corrupt to pay the mortgage".

Responding to E&T, Certsure said: "Like many across the industry, we share the concerns you have raised... where we are made aware of any concerns, we have a robust complaint process to deal with the issues raised. This could result in additional assessment visits, with the ultimate sanction of removing the enterprise from Certsure's schemes." The company refused to divulge figures relating to its complaints procedure.

NAPIT, the other competency body, says it operates a 'registered operative model' enabling it to assess multiple individuals within its registered electrical businesses.

Mike Andrews, chief executive at NAPIT, says: "This provides us with greater confidence that those undertaking electrical work on site are competent and qualified to do so and that employees who are not assessed are adequately supervised, which is critical for safety."

Andrews adds that NAPIT has been "proactive in making it easy for landlords to find qualified and competent business to undertake EICRs", through its free webinars and expert guidance, the creation of its Electrical Inspector Scheme and working with the wider industry to update the search facility on the Registered Competent Person Electrical website.

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"However," notes Andrews, "there is no legal requirement to use a registered electrical inspector and tester to undertake EICRs which means that many of the concerning practices being reported are not held to account as they would be within a registration scheme".

The shadow of Grenfell

Following the Grenfell Tower fire, the government commissioned Dame Judith Hackitt to review the building regulations and fire safety. The Hackitt review found that "a lack of legal accountability within the current system is exacerbated by industry fragmentation and multiple layers of sub-contracting".

Mark Coles, head of technical regulations at the IET, says the organisation "is committed to the reforms set out by Dame Judith Hackitt, especially concerning individual accountability and competence for people working in the construction industry".

The government says the Building Safety Act, which came into force on 28 April this year, will "ensure homes are made safe". The Bill includes measures to establish a Building Safety Regulator, which will be required to review within three years the cost and benefit of introducing regular inspections of electrical installations and provide recommendations. The House of Lords, which tabled the amendment in the first place, wanted a review to be conducted within two years.

The DLUHC said that "for the bill and legislation to be effective the industry itself must lead the change, take responsibility for raising competence, and set standards within their sectors based on the national framework".

But experts said while such work was being carried out by industry, stronger enforcement and more prosecutions were needed to avoid future tragedies. One industry insider told E&T that unfortunately, since Part P of the Building Regulations was introduced in 2005, the industry has seen very little evidence of high-profile prosecutions.

Labour MP Slaughter says the problem with the new regulator, as described by the government, is "that the responsibility for raising standards is being passed back to the private sector, meaning deregulation continues with the same lack of enforcement that got us into this dangerous situation".

Bourhill says current regulations are reactive rather than proactive. "Frameworks and schemes, no matter to what standard or quality, only go so far." If future tragedies such as the Grenfell Tower fire are to be avoided, he says, "people need to look far closer at the people with the screwdrivers in their hands".

Rising Ambition Drives Ever More Audacious Schemes

By Perry Sioshansi | June 2022 | Source: EEnergy Informer

Perry Sioshansi in the June edition of EEnergy Informer writes that solar and wind are increasingly seen as the cheapest way to produce electricity all over. Moreover being green, clean and sustainable is in vogue. This explains why a number of oil and gas super majors – whose coffers are overflowing with the current high oil and gas prices – are getting into the renewable electricity generation business on large scale. TotalEnergies, for example, further expanded its presence in the US renewable sector by acquiring Austin-based Core Solar, LLC whose portfolio includes more than 4 GW of utility-scale solar and energy storage projects at various stages of development in several states. With its latest acquisition, TotalEnergies now has a portfolio of more than 10 GW renewable gross capacity with projects in operation, under

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construction or in development.It is developing 2.2 GW with SunChase Power, and 1.6 GW in partnership with Hanwha Energy,including some energy storage projects. In offshore wind it is starting with the development of a 3 GW wind farm off the coast of New York and New Jersey while preparing to bid in the upcoming auction of offshore wind projects off the coast of California.

In distributed solar, TotalEnergies acquired the industrial and commercial solar activities of SunPower with the objective to develop more than 100 MW of additional distributed capacity per annum. Vincent Stoquart, Senior Vice President Renewables at TotalEnergies said,

"We are delighted with this new addition to our portfolio of solar projects in the US, a key region for achieving our global target of 100 GW of renewable projects in operation by 2030."

Beyond such ventures, investors and developers are thinking big and getting even more ambitious. In a few cases they are now looking into generating renewable energy where it is plentiful and cheap and exporting it to places where the demand is high and so are the prices. The plans include transmission across distances that would have been unimaginable until now.

An Australian venture, Sun Cable, for example, envisages up to 20 GW of utility-scale solar in the Australia's Northern Territory paired with up to 42 GWhs of battery storage supplying Darwin and exporting power to Singapore via a 4,200 km sub-sea cable. From Singapore, the power can flow to the neighboring countries in the fast growing ASEAN region and beyond.

Another similarly audacious scheme is beingpursued – apparently seriously – by Xlinks, the company that plans to install a subsea cable to deliver renewable energy from Morocco to the UK . The link will consist of four 3,800 km-long subsea cables to connect massive wind and solar farms in the Moroccan desert with Devon in Southwest England. The scheme envisions to supply the UK with 3.6 GW of clean power for an average of 20 hours a day. Xlinks says the project is currently in the development phase, scheduled to become operational in 2027.

In mid May 2022, Octopus Energy announced a financial and strategic partnership with Xlink to buy the energy once it reaches the shore. Perhaps it is not a pie in the sky after all.

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PREPARING THE POWER SYSTEM FOR A CHANGING CLIMATE

By Chris Warren | 13 June 2022 | Source: EPRI Journal

Chronicling extreme weather these days can be an exercise in the use of superlatives. The past seven years, for instance, have been the hottest in recorded history.

The extreme weather in 2021 included an extraordinary cold spell in Texas, known as Winter Storm Uri, which led to power outages that impacted 10 million people and contributed to over 200 deaths. Although not presently attributed to climate change, events like Winter Storm Uri demonstrate the need to consider and plan for the full range of climate conditions that could affect the electricity system in different locations.

Another example—more closely linked to climate change—was the heat dome that descended on the Pacific Northwest and broke records for all-time high temperatures in Seattle and Portland. The so-called whiplash effect of some weather extremes was also evident in 2021. In one instance, intense drought and wildfires spread across the western United States, even after California was hit by heavy rains and flooding in early 2021.

Overall, 2021 was a year of record-setting extreme weather events across the United States. According to the National Oceanic and Atmospheric Administration (NOAA), there were 20 individual weather and climate disasters whose overall losses exceeded $1 billion. In total, extreme weather across the country caused nearly 700 deaths and close to $150 billion in damages.

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What were once accurately referred to as 1-in-50 or 1-in-100-year floods, droughts, or heatwaves may now occur more regularly or be more intense. Although many factors contribute to changing weather extremes, including natural climate variability, it is clear that the electric power system is increasingly exposed to multiple extreme weather and climate-related hazards that can produce severe consequences for customers if not adequately planned for.

This need is only exacerbated by society's growing dependence on electricity as a final energy source, driven in large part by decarbonization efforts. As a result, the industry needs to focus on proactively preparing the power system for the climate conditions of today and the future.

Acute and Chronic Climate-related Impacts on the Power System

Increasingly frequent and severe extreme weather has been accompanied by more extensive power outages, underlining the need to examine power system preparedness in relation to current and future climate conditions. A recent Associated Press analysis of utility data submitted to the U.S. Department of Energy (DOE) found that the number of severe weather-related outages more than doubled from about 50 each year in the early 2000s to over 100 in each of the past five years. On average, U.S. customers experienced about eight hours of power outages in 2020.

The physical impacts of climate on the power system, and the potential changes associated with climate change, aren't limited to intense heatwaves, wildfires, and other extreme events—also known as acute climate impacts. More incremental, chronic climate impacts also pose challenges. For example, over the past few decades, unusually hot summer days have become more common across the contiguous 48 states, according to data from the U.S. Environmental Protection Agency (EPA).

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Both acute and chronic climate impacts can have significant implications for the operation of a resilient and reliable electric power system. In fact, the challenges posed by a changing climate are increasingly apparent in all aspects of the power system, from generation to delivery to customer utilization, as well as power company operations, including planning, operations, and response to outages.

A Collaborative Approach to Power System Resilience and Adaptation
In response to the need to prepare the power system against the effects of climate change, EPRI launched the Climate Resilience and Adaptation Initiative (Climate READiTM) in April. The initiative is built on the understanding that the resilience of the electric power system requires unprecedented collaboration among utilities, regulators, policymakers, climate scientists, communities, and other stakeholders. It's also driven by the belief that adaptation and resilience investments must be responsive to unique local conditions and guided by technically rigorous and scientifically-informed insights that consider everything from worker health and safety to nature-based solutions.

"The motivation for this work is that we have observed changes in climate and understand that more change may be coming in the future," said Laura Fischer, a technical leader for climate resilience analysis at EPRI and technical lead for the Climate READi Workstream, Physical Climate Data, and Guidance. "The power system is affected by climate change and climate generally because it's a physical system exposed to weather-related hazards. The way the system is planned, designed, and operated has to be influenced by our understanding of current and changing weather and climate conditions."

Climate READi will leverage decades of research by EPRI, U.S. National Research Laboratories, the DOE, academic institutions, and others to create a comprehensive, industry-accepted framework to guide electricity system adaptation and resilience decisions and investments. Working collaboratively is a way to avoid duplicating research efforts and enhance transparency and confidence in the common framework.

The initiative currently has 18 members, including AES, Alliant Energy Corporation, Ameren Corporation, American Electric Power, Consolidated Edison Co. of New York, Exelon Corporation, National Grid PLC, New York Power Authority, Pacific Gas & Electric, Portland General Electric, PPL Corporation, Puget Sound Energy, Seattle City Light, Southern California Edison, Southern Company, Southwest Power Pool, Vistra, and WEC Energy Group.

The initiative will ultimately result in the creation of a series of Climate READi Power Guidebooks and other decision-support tools that will provide detailed guidance about how to implement different aspects of the framework.
For example, the Climate READi framework will:

- Provide guidance on the specific climate and secondary physical data, datasets, variables, specifications, and interpretation needed to facilitate the assessment of a full range of power system-related applications. This includes characterizing how to treat the inherent uncertainty of climate and ecosystem modeling in power system applications.
- Deliver a consistent approach that power system stakeholders can use to apply climate-related information, including data about extreme weather and locationally specific climate data trends. This information can be used to analyze the potential vulnerability to chronic and acute climate impacts of individual assets and the system as a whole.
- Develop a common risk-based approach to prioritizing electricity system resilience and adaptation investments and decisions. It's impractical to expect that all new and existing electricity system assets can be made invulnerable to all climate impacts. The framework aims to build a cost-benefit analysis to evaluate and identify the adaptation investments that should be made to deliver an acceptable level of climate resiliency while also achieving other electricity system objectives, such as decarbonization, affordability, and equity.

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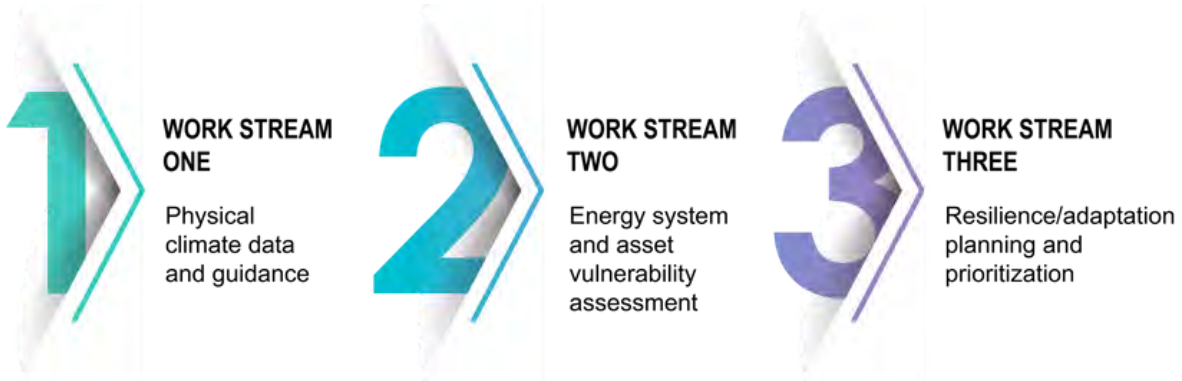
- Provide stakeholders with confidence that the methods and approaches used in the framework are science-informed, technically rigorous, well-vetted, and consistently applied across the industry while still being flexible enough to account for regional differences in future climate trends and system configurations. At the same time, the framework seeks to understand the inherent uncertainty and limitations of methods and approaches so that the users of the guidebooks can be well informed when considering and prioritizing investments.

While Climate READi is focused on bolstering the resilience of the electricity system, the imperative of achieving that goal has much broader societal implications, as electricity is projected to meet greater energy demand in the future. Many states, for instance, have identified electrification as a key strategy for achieving emissions reduction goals.

According to the Clean Energy States Alliance, states from New York and Connecticut to New Mexico and California have set goals to achieve 100 percent carbon-free electricity by 2050 or sooner.

At the federal level, the Biden administration set a goal of decarbonizing the electric power sector by 2035 as part of a larger effort to reduce greenhouse gas emissions by 50 to 52% across the entire economy by 2030 and achieve net-zero emissions by 2050. As transportation, heating and cooling, industry and other sectors increasingly rely on electricity, society depends on the entire electricity system being prepared to withstand the impacts of a changing climate.



To develop a common and consistent framework to inform power system planning, operations, and investments, Climate READi includes three work streams. They are:

Physical climate data and guidance. Utilities have long made data-driven decisions to plan and operate their assets to maximize efficiency for their local conditions. Design choices for substations, power plants, and transmission and distribution lines have typically been based on a historical understanding of the local climate, including the occurrence of weather extremes. But as the understanding of trends in future climate variables and weather events improves, there is an opportunity for decisions to reflect that improvement. "We are focused on understanding the climate data requirements to make informed decisions about the physical risk to electricity systems or to make better investment decisions in the future," said Fischer.

Data on historical and current climate comes from both information collected at surface stations worldwide and reanalysis that combines observation data, including satellite measurements, with weather forecasting models to produce a more coherent picture of the past.

Forward-looking weather and climate data can be produced from near-term weather forecasting models or statistical

INTERNATIONAL NEWS

extrapolations, as well as global climate models that simulate future decades to make projections about longer-term changes in variables such as temperature, precipitation, and wind speeds. Outputs from climate models can serve as inputs to secondary models to project future trends in other climate-related events like wildfire or drought.

Determining which data should be used in power system applications – and identifying data gaps—is not straightforward. This work stream seeks to identify relevant data that can be used to understand individual asset and power system vulnerabilities; it also will provide guidance about using the data in specific analysis contexts.

"It gets tricky because interpreting and consuming this vast world of climate data requires its own set of literacy skills," Fischer said. "One of the goals of this work is to provide guidance about how to apply the right climate data to specific circumstances. In the absence of uniform guidance that can be tailored to local conditions, companies are left to find their own way. That ends up being a heterogeneous approach where everyone has their own piecemeal solution."

Energy system and asset vulnerability assessment. The power system is made up of a vast collection of assets, from power plants and transmission lines to substations, feeders, and distribution lines. This work stream will apply the guidance on selecting and applying climate data produced in the first work stream to assets across the power system. The aim is to determine whether exposure to changes in chronic and acute climate hazards poses a substantial concern to their reliable operation.

"We are trying to build the tools and processes to assess the risks to assets based on their location and the climate data and modeling," said Brandon Delis, an EPRI director leading work stream two, along with colleague Jeffrey Thomas. This work stream will produce a probabilistic risk analysis methodology for analyzing asset vulnerability. This comprehensive approach for gauging risk includes an evaluation of what could go wrong, how likely it is that a specific problem could arise, and what the consequences would be.

Climate change can negatively impact power system assets in many potential ways. For example, a report by the DOE's Oak Ridge National Laboratory found that high ambient air temperatures can reduce the efficiency of thermal power plants and lower their overall generation capacity. Hydropower plants have reduced generation in the drought conditions that have settled over much of the western United States—in fact, every one-foot decline in Lake Mead results in a five- to six-megawatt loss of capacity at Hoover Dam.

The location and design criteria of individual plant assets also play an important role in their resilience to climate change. "In the power industry, climate models generally project a decrease in extreme cold events. But they don't project that they will disappear altogether," Delis said. "This is challenging for the power sector, particularly in places that historically don't experience much extreme cold. Even if these events happen less often, you still need to be prepared for them because their consequences can be catastrophic."

Delis says the first task of the work stream will be to collaboratively figure out what is already known about asset vulnerability and what still needs to be researched to close knowledge gaps.

Resilience/adaptation planning and prioritization. Improving the power system's resilience to weather extremes and more chronic impacts of climate change requires investment. But the reality is that budgets for those adaptation and mitigation investments are limited and must be targeted in ways that deliver the biggest and most equitable benefits to both the power system and society.

INTERNATIONAL NEWS

The aim of work stream three is to build on the climate data and asset vulnerability efforts to develop a framework to prioritize investments. "That framework will look at impacts across generation, transmission, distribution, and the customer to develop consistent ways to compare risk mitigation options and consider investments," said Anish Gaikwad, a program manager at EPRI who is heading up work stream three. "In addition to the power system, we will also look at societal impacts since you will have extreme climate events that will impact the health and safety of people, and we want to make sure the risk mitigation options are equitable."

Put another way, the framework to be developed will provide a cost-benefit analysis to guide investments to address the most concerning risks to both the power system and society. Many factors go into that prioritization. For example, imagine that climate modeling projects that the average number of extreme heat days in a certain location will increase. That increase could lead to a reduction in both generator output and transmission line capacity, reducing the amount of electricity that could be delivered to a community. At the same time, demand for air conditioning could spike.

Working through all those complex factors with a consistent framework is essential. It will help inform the work of the long-term system, resource, and transmission and distribution planners as well as utility decision makers and regulators. The framework developed will also be useful in preparing for non-climate impacts. "The aim is to be able to also consider non-climate extreme events, like earthquakes, because at the end of the day, we want to be able to assess the range of impacts on the power system," Gaikwad said. "It also will consider other utility objectives around long-term reliability and decarbonization pathways. Climate change can't just be thought of in isolation from other utility objectives."

As Climate READi launched in April, many utilities have already signed up to participate, indicating the industry-wide recognition that action should be fast and collaborative. "It's incredible to see the momentum with which Climate READi is already moving. Proactively strengthening grid resilience against potential climate and weather impacts, now and in the future, will require unprecedented collaboration among the power sector and its stakeholders," said Arshad Mansoor, president and CEO of EPRI. "For years, utilities have done a great job of responding to extreme events—raising substations, installing concrete poles—but this framework will provide a consistent way to evaluate and prioritize proactive investments that can mitigate the risks of extreme weather and chronic climate change for the power system."

EERE Success Story—Solar Forecasting Platform Helps Grid Operators Plan Energy Mix

23 May 2022 | Source: Office of Energy Efficiency & Renewable Energy

If a snowstorm is coming, we check the forecast to learn how much snow we will get and when it will start. Many of us even consult multiple weather apps in pursuit of the most accurate information, only to despair when we find varying predictions.

Utility companies and grid operators face the same uncertainty when trying to figure out how much solar power could be generated on a given day. Forecasts vary, and some can predict only one to three hours ahead with accuracy. The industry needs a better way to look at forecasts to plan for available solar power.

INTERNATIONAL NEWS

In 2018, the U.S. Department of Energy (DOE) Solar Energy Technologies Office (SETO) **awarded $1 million to the University of Arizona** (UArizona) to tackle this challenge. The resulting Solar Forecast Arbiter (SFA) is a first-of-its-kind platform that analyzes solar forecasts, comparing them against a standard so grid operators can better manage the amount of solar energy on the grid.

UArizona and its partners developed the SFA to help utilities and grid operators compare and evaluate the accuracy of solar power production forecasts from different providers so they can make better decisions about their energy mix. UArizona has operated the SFA on behalf of utilities and grid operators; now the nonprofit Electric Power Research Institute (EPRI) will manage its operations.

While the energy reaching solar panels is predictable under clear skies, it is difficult to calculate how much energy will make it to the ground surface when there are clouds. When a cloud passes over a solar panel, the amount of electricity the panel generates fluctuates. How much it changes depends on the cloud's size, thickness, and shape, and other atmospheric factors. The SFA enables users to assess the reliability of solar generation estimates over the next 24–48 hours and the likelihoods of the predicted power outputs.

Before DOE funded this project, there was no transparent and uniform way to compare forecasting methods or tools. UArizona designed the SFA as an open-source platform so anyone in the field can access benchmark data and unbiased metrics to evaluate forecast models. The software can help forecast vendors improve the accuracy of their forecasts, too. Recently, teams competing in the **American-Made Solar Forecasting Prize** submitted day-ahead solar forecasts to the SFA every day for four weeks. The SFA calculated the models' performance against a benchmark forecast that the platform generated. The prize administrator, the National Renewable Energy Laboratory, used the SFA results to evaluate each team. SETO expects the competition will raise awareness and increase adoption of the SFA.

As UArizona concludes its DOE-funded project in the next few weeks, EPRI will take over stewardship of the SFA, offering a tiered user subscription. While anyone can access the platform and its code at no cost (after signing a user agreement), premium SFA subscribers will have access to hands-on support and training, the ability to create reference forecasts, and a professional network.

EPRI researchers will work to expand the SFA to support wind energy and power demand forecast evaluation, and plan to use the tool to support forecasting trials. When this feature is ready, the renamed Forecast Arbiter will have a comprehensive multi-technology evaluation platform that can better predict and integrate clean energy into the U.S. electricity grid.

Learn more about the Solar Forecast Arbiter

CIGRE INTERNATIONAL UPDATE

Knowledge Transfer of Substation Engineering and Experiences in Future Connections

By Akira Okada, Convenor WG B3.58, Robert Slebodnik, Member of WG B3.58 and Koji Kawakita, Chairperson of Study Committee B3 | 17 May 2022

"It is of benefit to have improved life through discovered knowledge."
Virgil (ancient Roman poet, author of Aeneid)

Introduction

Certainly "knowledge" is a major defining characteristic of mankind and a major contributor to our civilization and achievements. Ancient Rome was a milestone in technical achievement with engineered material (concrete), engineered structures (the Colosseum), and engineered systems (roads and aqueducts). All that preceded, such as the primitive use of fire and tools, to all that followed, like modern probing of atomic nucleus to the extents of the universe, have been the result of acquired knowledge. It is a clear fact that knowledge is a cornerstone of civilization. However, the discovery of even the smallest bit of "knowledge" is worth nothing in the long run without "knowledge transfer". The transfer of knowledge throughout history was the real key to our civilization and success. And nothing is truer than this going forward.

To bring this to the perspective of our shared interest in "Large Electric Systems" (as designated by our CIGRE name), knowledge and knowledge transfer have been key to developing our power systems to the current state-of-the-art for the benefit and improvement of life. To be more specific to the topic of this article — Substations, volumes of knowledge have been transferred to keep substations (the vital hubs of the power generation-transmission-distribution critical infrastructure network) working in a safe, economical, resilient and beneficial manner

But nothing happens without effort. Nothing lasts without maintenance. We have the knowledge, but we are apparently at a crossroad regarding knowledge transfer, perhaps like one we have never encountered before in our industry's history. One that requires effort and maintenance to meet the challenge to progress onward without interruption.

Background

This crossroad is where the egress of many aging and retiring experienced substation engineers intersects the ingress of few young and newly hired inexperienced substation engineers. This intersection is the ideal location for the transfer of knowledge so vital to the continual successful operation of the grid. At this crossroad, these two groups either are either meeting or failing to meet in the transition. As an analogy, the baton can either be passed or dropped in the relay; the marathon will be either won or lost.

The concern of this crossroad and the need for knowledge transfer has been known for some time now in the industry. The adverse trend and concern persist and grow over the years. It is essential to maintain a knowledgeable workforce for resilient service. However, industry surveys indicate roughly 25 percent of employees have the potential to retire in the next 5 years.Almost half of the utilities see the potential for much institutional knowledge to walk out the door among

CIGRE INTERNATIONAL UPDATE

their top challenges.

Recognizing the growing concern, CIGRE SC B3 approved a new Working Group B3.58 "Knowledge Transfer of Substation Engineering and Experiences" in January 2020. Realizing the importance, this WG quickly recruited 39 members and convened in May 2020. The world was dealing with a pandemic, so it was necessary to conduct all meetings virtually.

- Problem Recognition: Substation assets remain in service longer than several generations of the engineers working on them, thus requiring a continual process of knowledge transfer through these generations. This is a worldwide issue encompassing highly developed to developing remote regions. It concerns utilities, consultants and manufacturers. How will necessary knowledge and experience be transferred as the gap widens?
- Extent: Effort is needed to ensure practical knowledge is transferred in all areas of expertise: planning, designing, construction, commissioning, operating, maintaining, retrofitting, expanding and retiring substations. What important corporate knowledge exists now for these phases? How is it being recorded for future generations? What gaps exist?
- Coverage: Focus on power fundamentals taught in university curriculum, progress to advanced on-the-job training required for complex designs, and finally to subject matter expert specialist assignments. Consider the technology evolution (perhaps even revolution) from analog, electro-mechanical to the digital software-microprocessor era. Consider business evolution from traditional utilities to RTOs, deregulation, consortiums, mandated regulatory rules and the like.
- Methods & Techniques: Identify what knowledge transfer plans and processes exist now. Where are the gaps? What techniques are used or should be used: in-house training programs, university continuing education, webinars, professional certification, mentoring, industry forums, manufacturer seminars, research institutions, professional organization tutorials and conferences? Which are better utilized for near-term vs. long-term transfer?
- Tools & Technologies: Use of digital libraries, knowledge management systems, 3D modelling, advanced design software (e.g., grounding, shielding), digital communications, mobile devices, social media, video meetings, augmented reality and virtual reality.
- Survey: a 42-question survey was completed by 84 respondents from all regions of the globe, all segments of the industry, all engineering roles, and all levels of experience.

Conclusion

"An investment in knowledge pays the best interest."
Benjamin Franklin (American writer, scientist, inventor, electrical experimenter, statesman, diplomat)

Those companies investing systematically in training are usually very well positioned in their market since their skilled employees add value to their business. Focusing back on our "Large Electric Systems", this is very important in the power sector due to the constant and profound rate at which technical knowledge is expanding and its vital role in successful operations. Investing time, effort and money in education pays substantial dividends in cost-effective, resilient and efficient substations where innovations flourish and where cost overruns, misoperations and safety hazards can be prevented.

But even on a much higher level, knowledge transfer takes on a much more significant meaning. Failure to transfer this technical knowledge can result in a critical failure of a company's operational and safety performance. It is not so much that the "transfer of knowledge" in itself is vital, it is the vital "transfer of success" for a company... which is dependent on that knowledge.

CIGRE Session 2022 Paris Workshop (Face to Face discussions on September 2nd 8:30 am)
Please be confirmed to conduct a workshop to s[illegible] purpose and progress will be described. Smaller break-down groups will discuss 2 to 3 relevant topics moderated by WG

CIGRE INTERNATIONAL UPDATE

CIGRE Session 2022 Paris Workshop (Face to Face discussions on September 2nd 8:30 am)

Plans have been confirmed to conduct a workshop to solicit input directly from engineers facing the challenge. The WG's purpose and progress will be described. Smaller break-down groups will discuss 2 to 3 relevant topics moderated by WG members. The feedback will be presented to the group with relevant input added to the TB. The WG extends an open invitation to all attendees to participate in this workshop and contribute their input.

CIRED INTERNATIONAL NEWS

The call for papers for CIRED 2023 is open!

CIRED, the Leading Forum where the Electricity Distribution Community meets, holds the major International Electricity Conference & Exhibition every two years in different venues in Europe with a worldwide perspective and participation.

Submit your abstract for CIRED 2023 by 14 September

CIRED is always evolving and the 2023 event is the conference's 27th edition. It will take place in Rome, located in the heart of Italy on 12-15 June 2023.

The call for papers is now open. Submit your abstract before 14 September on the submission website.

Call for papers

How to submit
Find out more about the submission process on our website. You can head to the submission platform to submit your abstract for CIRED 2023.

Do not forget to use the mandatory template and upload your abstract in PDF.

Submission process

Important dates
April-May 2022 - Call for papers available online

14 September 2022 - Abstracts submission deadline

12-15 June 2023 - CIRED 2023 Conference

EESA

CIRED PAPER

INTEGRATION OF DISTRIBUTED REACTIVE POWER SOURCES THROUGH VIRTUAL POWER PLANT TO PROVIDE VOLTAGE CONTROL TO TRANSMISSION NETWORK

Paper 2055 | Madrid | June 2019

This paper describes the results of studies carried out as part of the on-going Network Innovation Competition (NIC) Power Potential project which is investigating the use of distributed energy resources (DER) to support voltage control on transmission network. In order to enable the use of DER for transmission services, a sequential two-stage reactive market approach and security constrained optimal power flows based reactive power allocation have been developed. It considers the dynamic availability and cost characteristics of virtual power plant (VPP) driven by changes in the local distribution system conditions in coordination with the state of the transmission network. A set of studies was carried out on the South East part of the GB transmission system to demonstrate the feasibility and effectiveness of the proposed methodology; the key findings from the analysis are presented and discussed in this paper.

Editor note: more results are probably now available from the authors and Ofgem.

DOWNLOAD PAPER

API UPDATE

Latest webinar and project reports for the Electric Vehicle Charging Project

A quick update on the latest webinar and project reports for the Electric Vehicle Charging Project being undertaken by the University of Melbourne in collaboration with ENA, C4Net and the API.

To quote Prof Nando Ochoa: **"Managing the charging of electric vehicles or adopting time of use tariffs are strategies that can help make the most of the existing power distribution infrastructure (the poles and wires). But to what extent? And what might be the side effects?"**

The recording of the 5th webinar in the series is available on the API's YouTube channel (with Dr William Nacmanson); keynotes Nando and Will start at 5.35 mins in: https://www.youtube.com/watch?v=37AS1Tl8CLQ

Find the full series of the 5x webinars here: https://youtube.com/playlist?list=PLtzPHmqq2HIwtSLvbedyrIAjiemf5t1Hu

Slides for 5th webinar: https://lnkd.in/dEwt5UcN

Slides for other webinars are available from C4Net's project page: https://c4net.com.au/projects/electric-vehicles-an-exploration-on-adoption-and-impacts/

The Full Project Report is available here:
https://www.researchgate.net/publication/360887067_Milestone_8_EV_Management_and_Time-of-Use_Tariff_Profiles

More info about the #EV Integration project: https://lnkd.in/ghuKpg9m

For other news:
A summary article on the EV charging project by Dr Monaaf Al-Falahi shared recently by ENA:
https://www.energynetworks.com.au/news/energy-insider/2022-energy-insider/are-we-ready-for-the-ev-revolution/

Info on the API's other projects in the innovation space available from our latest Community Update (June 2022):
https://comms.api.edu.au/v/57191/1097297/email.html?k=IjeNsFI0SJR9hRNTYNbPGkQUoyEL4moYhYKjwHFXNx8

JOB BOARD

MATHWORKS SEEKING SENIOR APPLICATION ENGINEER

Job Summary
As a Senior Application Engineer, you will use your technical expertise in modelling, simulation, and programming to accelerate the pace of engineering development and innovation through Model-Based Design with MATLAB and Simulink. Working with ANZ customers across a range of industries and applications, and colleagues from Engineering, Development, Sales, and Marketing, you will enable the successful adoption, application, and evolution of MathWorks technology.

Travel can be expected around 25% generally throughout ANZ.

Responsibilities
Supporting successful adoption of MATLAB, Simulink, and related tools for analysis and simulation, by:

- Analysing customer requirements, tools, and workflows at the individual and team levels
- Designing and guiding evaluations and demonstrator projects
- Solving demanding technical problems in modelling, simulation, control, and software engineering
- Identifying new trends and collaborating with the worldwide team to develop compelling messages and demonstrations
- Advocating for the future direction of MathWorks products based on customer interactions
- Collaborating with sales teams to provide technical guidance for selling strategies toward successful achievement of sales goals

Minimum Qualifications

- A bachelor's degree and 7 years of professional work experience (or a master's degree and 5 years of professional work experience, or a PhD degree, or equivalent experience) is required.

Additional Qualifications
The successful candidate must have:

- Strong first degree in Electrical Engineering (or equivalent)
- Experience in developing and using simulation models of electrical, mechanical and/or fluid systems
- Excellent verbal and written communication and presentation skills
- Ability to work on multiple technical projects concurrently
- Experience with Simulink and Simscape or similar tools
- Experience working in cross-functional teams

In addition, experience in the following areas will be advantageous:

- Designing, implementing, and/or working with control systems
- Programming in MATLAB, Python and/or C/C++
- Scoping and leading technical projects
- Experience working on Utilities, Energy, Defence, and Mining projects

Experience with other engineering tools such as PSCAD, PSS/E, Power Factory, ADAMS, AMESim, Modelica, CarSim, or SPIC

FOR MORE INFO CLICK HERE

EECON 2021 RECORDINGS AVAILABLE

SESSION RECORDINGS FROM EECON 2021 ARE NOW AVAILABLE TO STREAM.

EECON is the annual national technical conference by the Electric Energy Society of Australia. The set of video recordings from EECON 2021 is now available to stream online.

The theme of the conference was The New Energy Landscape – Challenges and Opportunities. The conference presented a constructive dialogue on addressing the issues found to deliver clean energy, sustainably and economically, through stimulating discussions and debates by leading global experts who will bring a wealth of experience from all over the world. It also provided trends, steps, and examples already taken, by industry and with industry to achieve renewable replacements of fossil fuel energy.

The videos are available for sale to the general public at the full rate, and discounts are available as below. If you were a registrant for the conference you are entitled to free access to the recordings.

EESA members that did not attend the conference can access the recordings for a reduced rate of $20. Use this code at checkout: **EECON21member22**

UPCOMING EVENTS

EECON 2022 'Our Energy Future – Unlocking Net Zero'

October 11-12th 2022 at the Royal International Convention Centre Brisbane Queensland. Pre-conference drinks and tours will be on October 10th 2022.

EECON is coming to Brisbane in 2022! The Australian Government has made a commitment to carbon neutrality, commonly referred to as Net Zero, in the not so distant future. With the target set, the questions now in everyone's mind are 'How will Australia (we) get there?', 'What will the future Australian energy mix look like' or 'What future opportunities should we investigate now?'

Come and join us at Bowen Hills, Brisbane where we will discuss our energy future with senior industry leaders and practioners, innovators, entrepreneurs and analysts.

The Technical Program:
Abstract submissions are currently open (closing 1st June 2022) with authors able to submit their exciting work in the following key focus areas:

- The future Australian and global energy landscape.
- People, technology and systems unlocking net zero.
- The impact of new generation and of retiring generation.
- Customer-centric developments in the electricity industry.
- The future of utility assets and asset management.
- The relationship between policy, regulatory and economic settings and the evolving grid.

The Venue:
EECON2022 will visit the historic Brisbane Showgrounds which is a world-class events and lifestyle precinct located on the fringe of the city's CBD. It's home to the state-of-the-art Royal International Convention Centre (Royal ICC), a four and a half star Rydges Hotel and vibrant King Street dining hub, making it a sought-after and leading events destination. Events held at the Brisbane Showground's Royal ICC are sure to impress with their exceptional menus. It's the ONLY centre in Australia offering award-winning food and wine carefully selected from the RNA's prestigious Royal Queensland Food and Wine Show (RQFWS) and iconic Ekka.

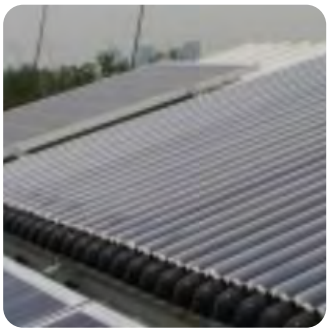
Registration:
Registration is now open through the conference website (www.eecon2022.com.au) with EESA members able to use their membership to receive a discount on conference attendance rates. Early bird registration discounts will only apply until 11th August 2022 so get in quick to secure your place at the conference.

We look forward to seeing you at EECON2022 and working together to unlock Australia's energy future.

UPCOMING EVENTS

Application of the NER for Connection of Renewable Energy

29 - 30 JUNE 2022 | NAT | VIEW EVENT



Overview:
A two-day professional development course in power engineering presented by the Australian Power Quality and Reliability Centre from the University of Wollongong... Read more.

Time: 2-day event

Location: Online delivery

Cost: $1770

EESA National mentoring program 2022

13 JULY - 28 SEPTEMBER 2022 | QLD | VIEW EVENT

Overview:
The National Group Mentoring Program organised by the Electric Energy Society of Australia (EESA) is a program committed to empowering the young and upcoming Engineers to flourish across Australia's Electric Energy industry. Whether mentee or mentor, you will benefit from personal growth and contribute to a culture of positive learning that will support the capability of... Read more.

Six sessions over 3 months.

Time: 5.30 PM - 7 PM AEST

Location: Online meetings

Cost: Free

The Microgrid and Isolated Systems Test (MIST) facility in Queensland

THURSDAY 14 JULY 2022 | EA | VIEW EVENT

Overview:
Research is a crucial part of the renewable energy ecosystem. It drives change and initiatives to improve and adapt current systems or introduce game-changing ways of working. This session will explore the research aimed at maximising the performance of solar installations and battery storage systems before they're installed, which could provide environmental and financial benefits... Read more.

Time: 12 PM - 1.30 PM AEST

Location: Online delivery via webinar

Cost:
EA members: $0
Non-members: $30

UPCOMING EVENTS

Conductor Recognition Using Semantic Segmentation

TUESDAY 19 JULY 2022 | NSW | VIEW EVENT

Overview:
Worldwide electricity distribution companies are moving towards risk-driven network replacement and maintenance strategies, and part of the risk assessment is to evaluate or estimate the asset condition. Unison has an ageing overhead conductor fleet consisting of over 4,200 km of high voltage lines, there are approximately 500 km of 7/0.064 Plain Hard-drawn Copper (PHC) 11 kV conductor in the fleet... Read more.

Time: 11 AM - 12 PM AEST

Location: Online delivery via webinar

Cost:
EESA members: $0
EA members: $20
Non-members: $30

Modelling the Australian National Electricity Market (NEM)

WEDNESDAY 20 JULY 2022 | EA | VIEW EVENT

Overview:
Explore the role of Nuclear Small Modular Reactor (SMR) in a low-carbon NEM and the importance of expanding the portfolio of technologies capable of providing firm, clean and affordable electricity supply.
The Australian NEM must undergo a large and rapid transformation if deep decarbonisation is to be achieved. A UQ modelling study developed a long-term electricity capacity... Read more.

Time: 6 PM – 7.30 PM

Location: Harricks Auditorium, Engineers Australia, Sydney CBD Office
44 Market St, Sydney NSW
OR online webinar

Cost:
EA members: $0
Non-members: $30

EECON 2022 - Our Energy Future – Unlocking Net Zero

11 - 12 OCTOBER 2022 | QLD | VIEW EVENT

Overview:
Even in the time since Brisbane hosted the highly regarded EECON 2018, the pace of change in the electricity industry has only accelerated. EECON 2022 offers delegates from across Australia and elsewhere the opportunity to gather and together solve the many challenges with which we are faced, be they technical, economic, commercial, regulatory, political, or stakeholder.. Read more.

Time: 2-day event

Location: In person at Royal International Convention Centre, Brisbane Queensland
OR
Online delivery via webinar

UPCOMING EVENTS

The Next Generation Technology Project | Showcase & Awards 2022

TUESDAY 22 NOVEMBER 2022 | **WA** | **VIEW EVENT**

Overview:
The Western Australia Chapter of the Electric Energy Society of Australia extends a special invitation to you to attend the 2022 Next Generation Technology Project Showcase & Awards. Entry is free and refreshments are available.
The competition is open to all university students who have an Electric Energy project as part of their university degree; undergraduate... Read more.

Time: 1 pm - 4.30 pm AWST

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

Cost: Free

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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."

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