EESA
Electric Energy Society of Australia

NATIONAL BULLETIN
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Our Energy Future – 100 percent renewable energy by 2025?

By Jeff Allen, National President of the Electric Energy Society of Australia | August 2021

Australian Electricity Market Operator's CEO - Daniel Westerman - recently committed to AEMO designing a grid capable of handling 100 per cent instantaneous renewable energy by 2025. Westerman – an Australian engineer - joined AEMO in May from the UK's National Grid, where he spearheaded its clean energy transition.

In an address to the Committee for Economic Development of Australia (CEDA) in mid-July, Westerman acknowledged the need to work closely and collaboratively with governments, industry, and communities to achieve the transition to a more renewable-friendly Australian grid.

He indicated in his presentation that the way Australia generates electricity is changing significantly. It is moving away from the traditional spinning thermal generators to electricity sourced from the sun and wind and injected into the grid by electronic inverters. He compared the two technologies as like analogue to digital, few to many, centralised to decentralised, one-way to two-way, emissions to no emissions, and from fuel that costs money, to fuel that comes for free.

He made the point that in Australia more than 90 cents in every dollar invested in generation since 2012 has been in wind and solar and per capita, Australia is leading the world in installing renewable generation. Per capita, we're investing in renewable generation at double the rate of our nearest rival, Germany, and about 10 times the world average. There has been approximately one thousand per cent increase in the number of large-scale solar farms in the last three years, and the number of windfarms has doubled in that same period.

He indicated that he intends that AEMO will harness the talents, capabilities, experience, and know-how across the industry in order to engineer grids that can run at 100% instantaneous penetration of renewable energy by 2025! A combination of technical innovation, economics, government policies and consumer choice, is driving this energy

transition faster than it ever has before. He used the example that on the 11th of October 2020, we saw for the first time, ever, that renewable energy, from South Australia's rooftop and large-scale solar and windfarm systems, was able to supply all the state's energy needs, at noon for an hour. He also made the point that to do this reliably, at any point in time – for both the NEM and WEM – is a difficult engineering challenge.

The challenge is due to inverter-based solar and wind generation reaching high penetration levels and displacing traditional spinning generators which have been needed for critical system stability. This means that frequency control and inertia – resilience against disturbances and the ability to keep the system at right voltage and frequency – are lost as spinning thermal generators don't get the market pricing signals to stay in the mix.

He also made the point that while it's not economic to generate power from old coal fired power stations but spinning the generator rotors to provide inertia is saving consumers millions of dollars each year.

Battery storage and pumped hydro are another component of our energy system that is invaluable, as large parts of our thermal generation fleet retire over the coming decades. Along with gas firming plants, he indicated that AEMO considers these as 'dispatchable capacity'.

He went on to argue for the need for Australia to invest in a more interconnected grid, to improve resilience, connect diverse sources of energy, and deliver more reliable, lower-cost energy for consumers. ElectraNet and TransGrid's Project Energy Connect is one example that will enable electricity from sunshine or wind in South Australia, to be carried across Australia to provide diversification,resilience, and cheap clean energy to the east coast.

He also indicated that "gas firming" is currently invaluable since it can be called on for short or long periods as required and that the recently announced gas-fired power station at Kurri Kurri that might only be needed for 2 per cent of the time, seemed to draw quite a lot of attention. Even at 2 per cent of the time, dispatchable generation like this unlocks many multiples of low-cost renewable generation capacity into the market, by providing the security for when the sun isn't shining, the wind isn't blowing, and other storage can't bridge the gap.

He then went on to look at the future and contemplate the new era of prosperity that plentiful, cheap, renewable electricity could deliver for Australia. The cheaper electricity becomes because of more solar and wind generation, then the more society will continue to become electrified.

Australia has nearly 20 million registered vehicles and he indicated that he was of the view that millions of motorists will make the switch to rechargeable EVs and that will have a profound effect on the grid.
Cheap decarbonised electricity also makes the prospect of a hydrogen economy much more likely and just as Australia has led the world in creating an LNG export industry, Australia can make green hydrogen the next major export product. Thus, he stated that AEMO is planning an energy system that's capable of handling 100% renewable energy, at any moment of the day, by 2025. .

As some further background, AEMO's 2022 Integrated System Plan (ISP) and the recently released 2021 Inputs, Assumptions and Scenarios Report (IASR) - which sets out the five future energy scenarios used to form AEMO's 2022 ISP – indicate how AEMO has considered a range of possibilities for the future electricity and gas system's needs.

He stated that AEMO will work closely and collaboratively with governments, industry, and communities to design the affordable, reliable energy system that Australia needs.

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

You are Invited to EECON 2021

By Russell Ellen, EECON 2021 Chair | August 2021

EECON 2201 has invited the WA Minster for Energy Hon Bill Johnston MLA and WA Minister for Hydrogen Industry Hon Allannah MacTIERNAN MLA. to speak at our conference.

The conference will cover energy network challenges and opportunities, the future energy map, and whether our regulations will drive a better, affordable, sustainable, Australia.

Perth is the place to see leading technologies and investment plans.

Here are three significant projects that are happening in WA that will be discussed at EECON2021

1. Horizon Power's first significant project to prove the "off the grid", shift to a distributed renewable grid. The Western Australia Pilbara town of Onslow, says its solar and battery microgrid is already helping to deliver "more reliable" and cleaner power – at levels of up to 90 per cent renewables.
2. ARENA has approved $1.5 million in funding for a $3.3 million project to trial the production, storage and use of renewable hydrogen to energise a commercial-scale microgrid for ATCO Clean Energy Innovation Hub.
3. The world's biggest renewable energy hub – comprising an astonishing 50 gigawatts of wind and solar capacity – has been proposed for the southern coast of Western Australia to create millions of tonnes of green hydrogen for use in Australia and for export. The scale of the $100 billion project – to be known as the Western Green Energy Hub – is unprecedented. It would rank as one of Australia's biggest ever projects of any kind, and not far short of the size of the country's main grid.

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AUSTRALIAN ARTICLES

TransGrid CEO Paul Italiano steps down

Transgrid news release | 26 July 2021 | Source: Transgrid news

The TransGrid Board today announced Paul Italiano will step down as CEO on July 31 after more than five years in the role.

TransGrid Chair Jerry Maycock, thanked Paul for his leadership during a transformative time for the business.

"The Board is grateful for the contribution Paul has made to TransGrid and more broadly to Australia's energy system. "During his tenure Paul transitioned the business from public to private ownership at a time of unprecedented external change.

"We thank Paul for his vision and leadership as CEO and the Board wishes him well in the next phase of his already successful career," Mr Maycock said.

Over the last five years, Paul oversaw the creation and growth of TransGrid's commercial arm – the recently rebranded – Lumea.

He also played central role in driving Australia's transition to a more robust and sustainable National Electricity Market (NEM) and oversaw TransGrid's investment and delivery of interconnector upgrades between NSW and Queensland, NSW and Victoria and the Powering Sydney's Future project to better deliver Sydney's electricity needs.

In May this year, Paul played an instrumental role in securing regulatory approval and TransGrid's investment in EnergyConnect, the new interconnector between NSW and South Australia, which is one of the largest transmission projects to be planned in the NEM for a generation and which will deliver substantial benefit to NSW consumers. The business also progressed planning for Humelink in southern NSW connecting Snowy 2.0 to the network and Australia's first coordinated renewable energy zone in the Central West Orana region of NSW.

Paul has been the driving force of TransGrid's innovation program which has included the first large-scale grid battery, currently under construction at a TransGrid substation in western Sydney.

Under Paul's leadership TransGrid embarked on its Reconciliation journey and is currently implementing its Innovate Reconciliation Action Plan. He committed the business to building relationships and providing opportunities for Aboriginal and Torres Strait Islander peoples.

Paul Italiano says it has been an honour to be the CEO of TransGrid since its privatisation in 2016 and praised employees. "TransGrid is filled with incredibly talented people, who are highly dedicated and committed to ensuring the vital role transmission plays in Australia's electricity system is delivered with excellence," Mr Italiano said.

TransGrid's Executive General Manager, Brian Salter, has been appointed Acting CEO while a global search is undertaken for a new CEO.

Is it time to retire network utilisation measures?

By Chris Gilbert | 29 July 2021 | Source: 2021 Energy Insider by Energy Networks Australia

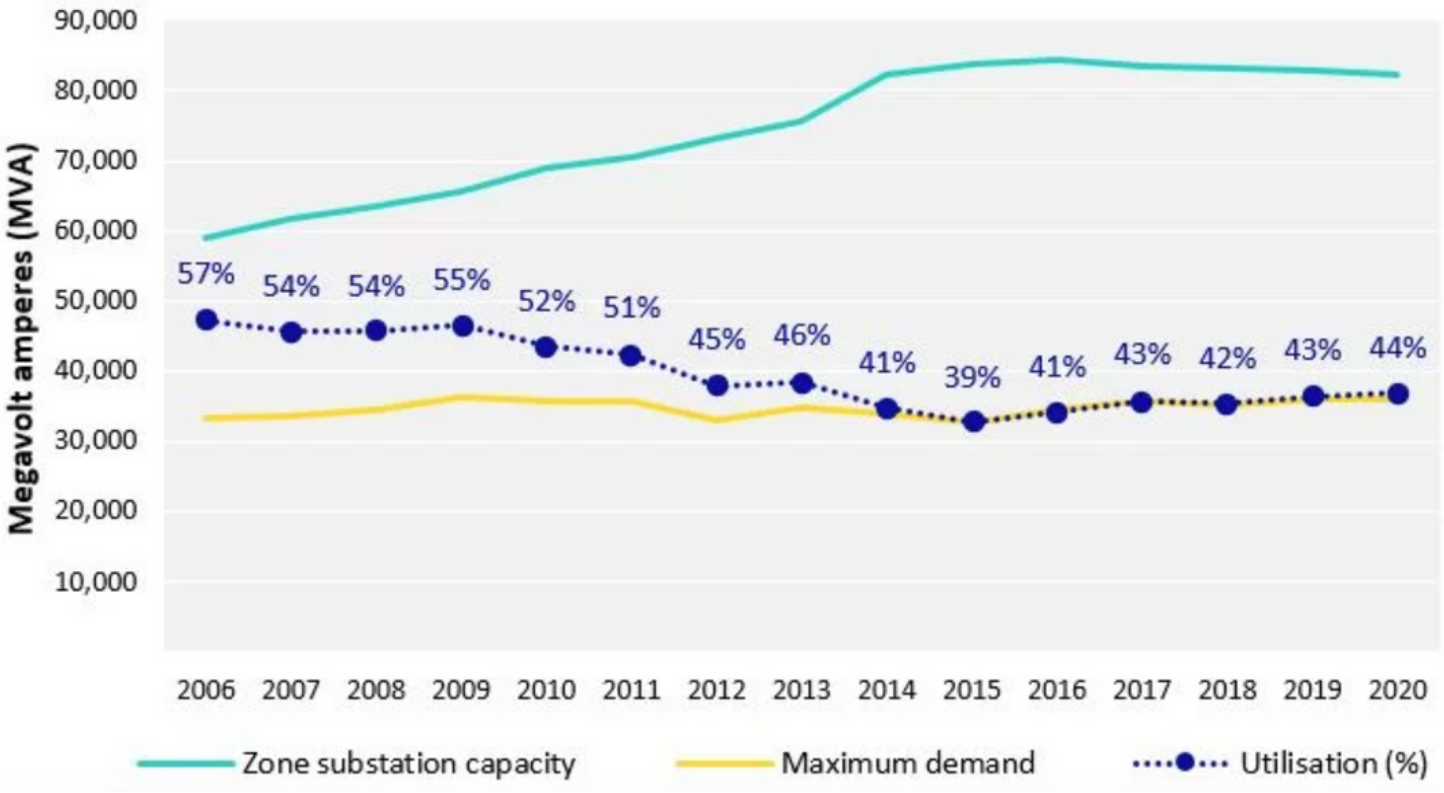
Utilisation measures have been referred to by various energy policy and regulatory bodies as well as public agencies throughout the years in different contexts. Often they are highlighted as providing some broad insights into either network efficiency or performance.

At its most fundamental, network utilisation measures how well a network's assets have been used to meet maximum demand and have been used as a signpost as to whether network investments are delivering value for customers. The most common utilisation measure is calculated as the very unpleasant phrase 'non–coincident summated raw system annual maximum demand'. In English this means the peak of each zone substation's highest demand at different times across the year without normalisation for temperature, divided by the total capacity of all zone substations on a network. Other measurement variations include normalising for temperature or looking at the highest demand across a network throughout the year rather than at zone-substations.

Times have changed

Network utilisation was traditionally very stable prior to the introduction of heightened state reliability targets. Previous overzealous targets in some cases drove additional network investment to mitigate against potential disaster on the most demanding days for the electricity network. These investments coincidentally resulted in some minimally-used capacity and a reduction in measures of network utilisation.

Figure 1 – Network utilisation of electricity distribution networks



Source: AER State of the Energy Market 2021, p. 168

In the years since, old State-based reliability targets have been wound back and Distributed Energy resources (DER) such as solar PV and battery uptake continues to surge. The measure of network utilisation has crept upwards as zone-substation capacity declined and distributors adapted to invest in new areas where it is now needed most, like high-growth suburban areas and DER-saturated parts of the network.

As DER continues to become a staple in the electricity system with customers seeking to lower bills and be environmentally savvy, its continued uptake is muddying the waters on what network utilisation measures actually show.

What do utilisation measures actually show?
Customers are demanding increased ability to export solar and connect their DER, creating local demand for network usage that may require additional network investment to facilitate. While DER might create network congestion at the local level, it can also result in a reduction in the overall demand requirement at the zone substation level.

This reduction in demand can have the effect of reducing utilisation measures, while also requiring additional investment in network reinforcement, raising questions about what these measures actually represent in a two-way energy system. Whether fortunate or by design, utilisation measures most often cited are related to peak demand on each zone substation. This traditionally occurs in the evening when DER output is low and its impact on reducing utilisation is less severe, but still exists In today's electricity system, customers are showing strong preferences for DER uptake and distributors are rightly targeting investment to enable these preferences. Is it sensible then, that enabling customer preferences might be having unintended negative impacts on measures often associated with network performance? This conundrum raises an interesting question about the usefulness of utilisation measures in a high-DER future, and whether we should be looking at alternatives.

Can we do better?
Discussing utilisation measures in the context of network performance may have made sense when we had single direction transmission 'highways' and large baseload generation centres, but much less so in a high-DER world with scattered, non-synchronous generation centres.

Network regulation in Australia doesn't directly draw on utilisation measures for benchmarking or productivity assessment, and rightly so. It's probably time to consider retiring utilisation measures and shifting focus to measures that have more meaning to customers in practice.

Perhaps something like the consumer facing output categories in OFGEM's recent RIIO-2 framework[i].

Australian-invented thermal storage start-up completes $8m investment raise

By Michael Mazengarb | 3 August 2021 | Source: Renew Economy

A Newcastle based thermal energy storage start-up will set its sights on international expansion after raising $8 million in early investment funds to commercialise its innovative thermal heat-storing technology.

MAG Thermal, headquartered in the Hunter Region, completed the funding round with the backing of the CSIRO founded venture capital fund Main Sequence, with additional investments from Alberts Impact Capital, New Zealand's Climate Venture Capital Fund, The Melt and other angel investors.

The company said the 'Miscibility Gaps Alloy' blocks it is seeking to commercialise could store energy as thermal heat that can be tapped on-demand to produce steam to run a conventional thermal generator.

The Miscibility Gaps Alloys have shown a high capacity to both store high-temperature heat as well as allowing for heat to be extracted rapidly from the materials as needed to drive thermal power generation.

The blocks could be used to store energy originally generated from solar or wind farms and used to provide dispatchable firming supplies of electricity.

MGA Thermal said the blocks created the potential for thermal generators, otherwise fuelled by coal or gas, could be switched to renewable sources of heat, allowing them to play a continued role during a transition to zero emissions energy.

Energy storage technologies have emerged as key to a successful transition to clean energy technologies, providing the ability to balance out the variability of primary sources like wind and solar to provide reliable supplies of power.

The company said the $8 million funding injection would be used to scale up its manufacturing capacity, allowing it to produce hundreds of thousands of thermal blocks each month and expand into international markets.

"Our mission is to help accelerate the shift to renewable energy by providing a new way to store energy that's clean, economical, and scalable," MGA Thermal's CEO Erich Kisi said. "We are gratified by our investors' recognition of our achievements and their confidence in our ability to execute on this exciting new phase of growth."

"We believe that thermal storage will play an important role in the energy transition, and are overwhelmed with international and domestic interest to date. The potential opportunities and use cases for our technology are extensive.

"Whether it's retrofitting our thermal power stations, providing power to remote communities, supplying heat to industry, heating houses and commercial spaces, or heating for electric vehicles, this can all be powered using renewable energy stored in our MGA blocks."

Main Sequence, which as previously invested in CSIRO affiliated ventures including renewable hydrogen producer Endua and innovative electricity retailer Amber Electric, said that it was focused on supporting the emergence of new technologies that had the potential to drive Australia's transition to clean energy sources.

"A core focus of our new fund is uncovering the scientific discoveries and helping to turn them into real, tangible technologies so we can reverse our climate impact," Main Sequence partner Martin Durrsma said.

"Erich Kisi and Alexander Post's impressive deep research backgrounds, their expert team, and innovative technology are paving the way for grid-scale energy storage and boosting the capability of a renewable energy future globally."

Crews battle Tesla battery fire at Moorabool, near Geelong

By Leanne Wong | 30 July 2021 | Source: ABC News

A toxic blaze at the site of Australia's largest Tesla battery project is set to burn throughout the night.

The fire broke out during testing of a Tesla megapack at the Victorian Big Battery site near Geelong.

A 13-tonne lithium battery was engulfed in flames, which then spread to an adjacent battery bank.

Key points:

- A 13-tonne Tesla lithium battery is on fire near Geelong
- The battery was expected to be ready later this year
- It was due to be the biggest battery in the southern hemisphere

More than 150 people from Fire Rescue Victoria and the Country Fire Authority responded to the blaze, which has been contained and will be closely monitored until it burns itself out.

"If we try and cool them down it just prolongs the process," the CFA's Assistant Chief Fire Officer Ian Beswicke said. "But we could be here anywhere from 8 to 24 hours while we wait for it to burn down."

The Tesla battery is expected to become the largest battery in the southern hemisphere as part of a Victorian Government push to transition to renewable energy.

Ambulance Victoria members are also on site monitoring the health of firefighters.

A toxic smoke warning has been issued near Geelong.

Residents have been warned to close windows, close fireplace flues and bring their pets inside in the Batesford, Bell Post Hill, Lovely Banks and Moorabool areas. No-one was injured and the site has been evacuated.

Australian Energy Market Operator (AEMO) said the battery had been isolated and disconnected from the main electricity grid and "there are no implications" for supply.

The Tesla battery was paid for by renewable energy company Neoen.

Neoen Australia's Managing Director, Louis de Sambucy said Neoen and Tesla were working closely with emergency services on site to manage the situation.

Left: Emergency crews say the fire could burn for up to 24-hours.
Supplied: Fire Rescue Victoria

Right: *Fire crews worked to contain the blaze and stop it spreading to nearby batteries.*
ABC News

Generators back power reforms to keep lights on

By Angela Macdonald-Smith | 29 July 2021 | Source: Financial Review

Major generators have backed proposals to overhaul the electricity market to retain coal and gas plants for as long as they are needed to keep supply reliable and spur new investment in firming power, despite staunch opposition from some renewables players.

Recommendations from the Energy Security Board that have gone to the federal and state energy ministers have not been fully made public and remain "cabinet-in-confidence" although the draft recommendations were leaked to industry and the media.

But federal Energy Minister Angus Taylor has confirmed they include advice to develop a "capacity mechanism" that would provide payments to generators to be able to supply power, not just for the power they actually generate.

That would ensure the power system can absorb renewables into the grid without threatening reliability and affordability, he said.

Renewables generators say such a system would only prolong the existence of ageing coal and gas plants in the market and would increase costs for consumers.

But the big generators see merit in a capacity system to help ensure a diverse range of generation to keep supply reliable, and to provide the incentive for new plants needed to firm up weather-dependent wind and solar power.

"Our current market is not providing the right investment signals for the flexible dispatchable capacity the system needs as ageing thermal baseload generation retires and Australia transitions to a low emissions future," said EnergyAustralia's head of markets, Ross Edwards.

"While the transition to renewable energy takes place, there needs to be a mechanism that provides confidence and ensures there is always adequate capacity in the system to meet consumer demand."

The options paper from the ESB, which includes the capacity market proposal, "lays out a nationally consistent framework and options to value crucial dispatchable capacity to maintain the reliability and affordability of our energy system in the coming decades," said Jeff Dimery, chief executive at Alinta, which owns coal plants, gas plants and renewables generation,

Mr Dimery urged state and federal governments to get behind the work of the ESB and commit to a transparent and consistent framework "to support a smooth and secure decarbonisation of our energy system".

AGL Energy told the ESB that measures to more directly incentivise investment in dispatchable capacity through capacity mechanisms might need to be considered if wholesale prices remained suppressed.

An AGL spokeswoman said on Thursday: "We support the ESB's work to develop a post-2025 market that can accommodate rapidly changing technologies, customer needs and community expectations.

"We encourage reforms that help maintain the security and reliability of the grid and provide certainty for future investment to support the energy transition, while also providing options for energy businesses to continue managing their assets efficiently."

Origin also said stronger long-term signals are needed for investment in new dispatchable generation to maintain reliability.

Andrew Richards, head of the Energy Users Association of Australia, said retaining existing plants in the system was more economically efficient than a faster switch to renewables but noted the rule changes could result in windfall gains for coal power generators.

"In the first instance we don't think there is sufficient evidence in the market that change is needed," he said, noting plenty of investment in batteries - a form of dispatchable capacity that firms renewables - is going ahead.

Still, Energy Security Board chair Kerry Schott emphasised the need for measures to ensure there are enough generation resources when they are needed.

'We only need one hot summer and we've got a real resource adequacy issue.' — Kerry Schott, ESB chair

"We have had a very mild summer, and everyone has got very complacent, but we only need one hot summer in three jurisdictions together or a major unexpected outage at a big coal plant and we've got a real resource adequacy issue right on top of us," she said in a statement.

Dr Schott was not available to comment as the recommendations remain confidential as they are considered by ministers.

But the Clean Energy Investor Group, a collection of 17 investors that includes US giant BlackRock, said the ESB's proposal for a capacity market through a beefed-up obligation on retailers to sign up to buy firmed power would further distort investment signals in the market.

CEIG chief executive Simon Corbell said: "A physical retail reliability obligation with a capacity market means thermal generation will be encouraged to stay in the system longer.

"This further compounds the risks faced by investors in committing to new clean energy projects due to grid congestion and connection delays."

The left-leaning Australia Institute welcomed the apparent move by the ESB to allow state governments more power to procure the electricity reserves they need as cheap renewables push coal power out of the market.

The draft recommendations include one that would set up a strategic reserve that could be accessed by states to procure any required reserves they consider necessary, and support for state renewable energy zones.

Australia Institute energy and regulatory lead Dan Cass said: "Building out the state renewable energy zones is what will provide Australia with energy security as coal power stations increasingly fail and retire early."

"The national electricity market is run by the states so it is the state energy ministers who hold all the cards, and federal minister Angus Taylor will need to collaborate and negotiate with them."

ELECTRIC VEHICLE UPDATE

High speed induction charging could be a reality for Tesla Semi

By Joshua Hill | 11 August 2021 | Source: The Driven

THE TESLA SEMI ELECTRIC TRUCK. SOURCE: TESLA

The much awaited Tesla Semi – its electric truck – is suffering more delays, but there are signs that its hefty charging requirements might be able to be met by inductive wireless charging technology developed by a US-based company called Wireless Advanced Vehicle Electrification, or Wave for short.

Wave recently made headlines after it was awarded a cooperative purchasing contract in the wireless inductive charging solutions category from Sourcewell – a self-funded American government cooperative purchasing organisation.

Signing with Wave – a subsidiary of Ideanomics, which was founded by none other than WWE wrestling veteran Shane McMahon – opens the door for greater access to the company's wireless battery charging systems.

"One of the biggest challenges fleet operators face in moving to climate-friendly, zero-emission vehicles is matching the range- and duty-cycle of outgoing fossil fuel-based vehicles," said Michael Masquelier, CEO of Wave.

"Fast, high-power, automated wireless charging will enable Sourcewell members to more easily extend the range of their next-generation EVs, making the transition to a more sustainable fleet easier."

Wave, which was acquired by Ideanomics in January, is a leading provider of induct wireless charging solutions for medium- and heavy-duty electric vehicles. Its wireless charging systems can be embedded in roadways or parking lots and provide fully automated and hands-free charging with power ranging from 125kW to 500kW and higher.

The company currently has commercially available wireless charging systems up to 250kW and is in the process of developing higher power systems.

The "park and charge" wireless charging made possible by Wave hopes to not only make EV adoption easier for fleet operators of all types, but can be used in a variety of sectors including mass transit, logistics, airport and campus shuttles, drayage fleets, and off-road vehicles at ports and industrial sites.

While the specifics of Wave's work have been hard to come by, a handful of Twitter sleuths recently got their hands on the contract between Sourcewell and Wave which has served to better illuminate the possibilities of WAVE's wireless charging

.Read more...

ELECTRIC VEHICLE UPDATE

Nio to release three new electric vehicles as EV market nears "tipping point"

By Joshua Hill | 12 August 2021 | Source: The Driven

THE NIO ES9 SUPERCAR. SOURCE: NIO

Chinese EV maker Nio revealed on Wednesday that it plans to deliver three new EVs in 2022 based on its Nio Technology Platform 2.0, including the already announced ET7, a flagship premium smart electric sedan.

Nio also published its second quarter financial results on Wednesday, beating analyst expectations and reporting deliveries for the first half of 2021 of over 40,000 – an increase of nearly 200% over the same period a year earlier.

The second quarter revealed that vehicle deliveries reached 21,896, an increase of 127% over the second quarter of 2020 – which, of course, was heavily impacted by the global COVID-19 pandemic, especially in China.

ELECTRIC VEHICLE UPDATE

Revenue was also up in the second quarter, to RMB8,448.0 million (US$1,308.4 million), an increase of 127.2% from the second quarter of 2020 and an increase of 5.8% from the first quarter of 2021.

"We achieved a record-high quarterly delivery of 21,896 vehicles in the second quarter of 2021, followed by 7,931 vehicles in July, bringing the cumulative deliveries of NIO vehicles to 125,528 as of July 31, 2021," said William Bin Li, founder, chairman and chief executive officer of NIO.

"While the global supply chain still faces uncertainties, we have been working closely with our partners to improve the overall supply chain production capacity.

But it was Bin Li's announcement that the company was planning more EVs that made the biggest headlines, as Nio seeks to expand its offerings into both electric vehicles as well as autonomous vehicles.

"We aim to deliver three new products based on the NIO Technology Platform 2.0 in 2022, including ET7, a flagship premium smart electric sedan," he said.

"As the EV adoption begins to reach a tipping point worldwide, we believe it is imperative to speed up the launch of new products to provide more premium smart EV offerings with superior holistic services to the growing user base in the global market."

Nio currently makes three EVs – the EC6, ES8, and ES6, all of which are SUVs and boast all-electric range of around 600-kilometres.

The company also unveiled earlier this year its flagship ET7 smart sedan, boasting an all-electric range starting at 500-kilometres with the 70kWh battery pack, and scaling up to over 1,000-kilometres with the company's new 150kWh battery pack.

The new Nio 150kWh battery will also be available for the company's three SUV models, providing the Nio ES8 with up to 850-kilometres, the ES6 with 900-kilometres, and the EC6 with 910-kilometres.

The ET7 was already announced as expected to launch in the first quarter of 2022, but with this week's announcement we know now that it will be followed by two more unspecified electric vehicles.

Nio also offers a unique Battery as a Service (BaaS) subscription which sees customers pay a monthly subscription cost and allow them to swap depleted batteries for fully charged batteries in a matter of minutes, as well as allowing customers access to the company's latest battery technology.

THIS MONTH'S HISTORY LESSON

Book review: 'World Brain' by HG Wells

By Vitali Vitaliev | 5 August 2021 | Source: Engineering and Technology

Timely reissue for the visionary author's prediction nearly a century ago of a global encyclopedia that would gather the world's knowledge and make it freely available to all.

The surest sign of a writer's fame is when they themselves become a literary hero. This is certainly the case with HG Wells - polymath, prophet, legendary fantasist and one of the 20th century's most prolific authors - who features as a character and/or a protagonist in a number of works of contemporary fiction. Ronald Wright's 'A Scientific Romance' and Robert Masello's 'The Haunting of HG Wells' are just two.

Wells' widely known literary and technological predictions range from the time machine, which has not (yet) come true, to the atomic bomb, which regrettably has. His less well-known techno prophecy is that of the 'World Brain'; a pre-digital, freely available 'World Encyclopaedia' accumulating the bulk of all human knowledge. This, he believed, would lead to an ideal, perennially peaceful world, with no conflicts or wars and where universal happiness reigns. Wells was - first and foremost - a Utopian thinker.

This timely reissue by the MIT Press of the book 'World Brain' ($24.95, ISBN 9780262542562), with a foreword by one of Wells' modern-day counterparts, science-fiction author Bruce Sterling, collects a series of essays and addresses that were published or delivered to audiences in Britain and America between 1936 and 1938. In them, Wells elaborates on his long-standing idea of creating a permanent encyclopaedia that would evolve as time goes by and result in unlimited "free knowledge" for everyone.

Anybody born and bred in a democracy is likely to take the concept of free knowledge for granted as one of the guaranteed rights a human being automatically acquires at birth. For someone like me, who spent the first 35 years of their life in the totalitarian USSR, where knowledge and information were rationed perhaps even more strictly than food and consumer goods, it will always remain one of life's main pleasures and wonders.

My first ever big purchase in the West after defecting in 1990 - long before I acquired my first car - was a full set of the Encyclopaedia Britannica, a treasure I could hardly afford but was unable to resist. Ten years on, with the development of the Internet and all kinds of computer software, my multi-volume treasure turned into a white elephant and millstone around my neck. I was physically unable to carry it with me on my never-ending travels and eventually had to swap it for just one floppy disk, then later a CD, which contained all of Britannica's contents plus lots of additional audio and video footage. It was something that even Wells, bent on improving the pre-digital publishing technology (or, in his own words, on "modernising" the existing "distribution of knowledge") failed to predict.

From the great writer's point of view, the World Encyclopaedia would be "a row of volumes in one's own home or in some neighbouring house or in a convenient public library or in any school or college, and in this row of volumes one would, without any great toil or difficulty, find in clear understandable language, and kept up to date, the ruling concepts of our social order, the outlines and main particulars in all fields of knowledge."

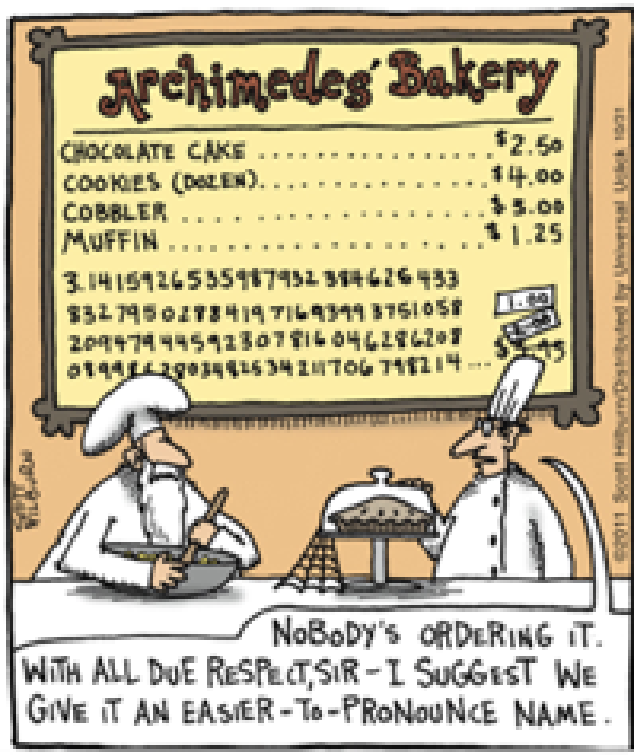
THIS MONTH'S HISTORY LESSON

According to Wells, the difference between that multi-volume treasure trove of knowledge and the encyclopaedias, gazetteers and other reference books that already existed was that it would be put together, edited, controlled and constantly altered not by a group of human beings, but by the so-called 'World Brain'. He envisioned this technological system of networked knowledge as "a hypothetical super-gadget", although its actual modus operandi remains even more mysterious than the no-less hypothetical time machine that he attempted to describe in his eponymous novel.

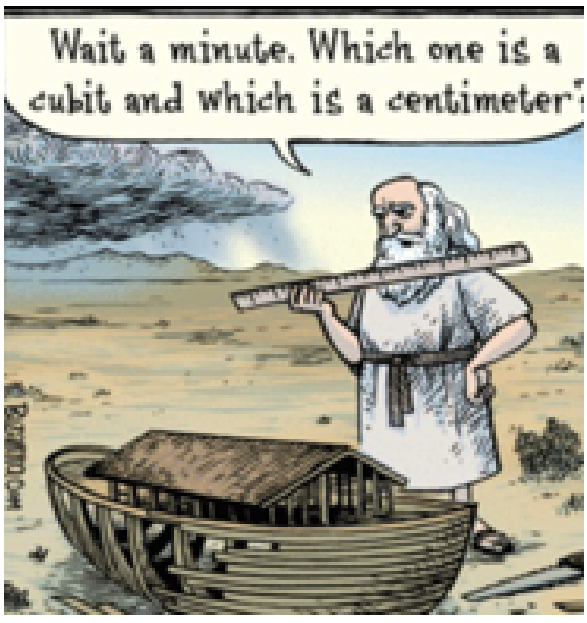
The reason why the World Brain cannot be dismissed as just another case of a great writer's wishful thinking is that Wells was the first to shape a philosophical concept of a free and seemingly limitless repository of knowledge that all citizens of planet Earth could easily access and to which they could all easily contribute. One would be tempted to regard Wikipedia, or the Internet in general, as a full materialisation of his dream. Yet, none of them has so far become "the greatest power on earth for the consolidation of humanity and the establishment of an enduring Pax for all mankind," in the way that the Utopian World Brain was meant to.

Will they ever evolve into such a cathartic power? To answer that question, I'm afraid we might all have to jump on board a real - as opposed to Wells' fictitious - future-bound time machine!

HUMOUR BREAK



MEASURE TWICE, CUT ONCE



INTERNATIONAL ARTICLES

Form Energy's $20/kWh, 100-hour iron-air battery could be a 'substantial breakthrough'

By Jason Plautz | 26 July 2021 | Source: Utility Dive

Dive Brief:

- Somerville, Massachusetts-based startup Form Energy on Thursday announced the chemistry for an iron-air-exchange battery that could offer long-duration storage at a price of less than $20/kWh.
- The technology relies on thousands of small iron pellets which rust when exposed to oxygen, then revert back to iron when oxygen is removed. That process can power a battery that Form claims can deliver electricity for 100 hours.
- Form also announced a $200 million Series D funding round led by an investment from the innovation fund of steelmaker ArcelorMittal, one of the world's leading iron ore producers. ArcelorMittal will also non-exclusively supply iron materials developed jointly with Form for use in the batteries.

Dive Insight:
Mateo Jaramillo, Form CEO and co-founder, said he doesn't consider the company's technology to be long-duration storage, instead preferring the term "multi-day storage." The capacity of the Form battery to dispatch energy for 100 hours, he said, "puts it in a different category" than the broad definition of long-duration storage, generally defined as systems with at least 10 hours of duration.

Jaramillo, who previously led Tesla's energy storage arm, said he considers the Form Energy technology as "complementary, not in competition" with shorter-duration lithium-ion batteries.

That balance, experts say, will be essential to transition the grid to renewable energy. While lithium-ion batteries can store energy for hours and distribute it throughout the day, a 100% renewable grid will need larger storage systems to tackle the day-to-day or seasonal variability in renewable production. While there are a variety of long-duration technologies on the market, the high cost and infrastructure difficulties have limited widespread penetration.

Mark Jacobson, director of the Atmosphere/Energy program at Stanford University, said a $20/kWh cost — if the commercial costs end up that low — would be a "substantial breakthrough" that "would enable the rapid transition to 100% clean, renewable electricity on a worldwide scale, while avoiding blackouts, at lower cost than previously thought." "It would eliminate the need for any more fossil fuels, nuclear power and bioenergy for electricity faster than we thought," Jacobson said in an email.

BloombergNEF found that lithium-ion battery pack prices fell to $137/kWh in 2020, with projected costs close to $100/kWh by 2023, and manufacturers like Tesla and CATL have dropped prices as low as $80/kWh. A March study published in Nature Energy found that the energy capacity cost of long-duration storage technology must fall below $20/kWh in order to reduce total carbon-free electricity system costs by at least 10%. Capacity costs would have to drop even lower to displace nuclear and natural gas plants, the study found.

The company will partner with Minnesota electric cooperative Great River Energy on a test project for the iron air exchange battery, with construction expected in 2023. Jaramillo said that other test projects are in the works but have not been announced.

"Early on, we had an indication that this type of technology had great potential," Jaramillo said. "Now we have to prove the bankability of the asset itself, proving that it is durable and meets the needs of the utilities. The only way to compare one type of storage to another is in real-world operating conditions."

Besides the investment from ArcelorMittal, Form Energy has been backed by Breakthrough Energy Ventures, the Bill Gates-led climate investment fund. A November 2020 Series C funding round raised $76 million, including investments from Energy Impact Partners, Temasek and NGP Energy Technology Partners III.

Is it time for you to consider undergrounding some of your distribution lines?

By Jennifer Runyon | 4 August 2021 | Source: Power Grid International

Two North American utilities are burying more than 6,000 miles of power lines combined. Project managers from each one describe why they did it, how they did it, and what lessons they have learned along the way.

Utilities are in the business of providing reliable, affordable electricity service to customers but what happens when there is an area that just keeps getting pummeled with storms and reliability can't be improved? For both Dominion Energy and WEC Energy Group, that's when strategic undergrounding came into play.

Undergrounding transmission and distribution wires has historically been so cost prohibitive that utilities dismiss the idea before even exploring it. But that's a mistake, says Mike Beehler, PE and spokesperson for the Power Delivery Intelligence Initiative (PDII).

"Engineers and planners need to evaluate overhead and underground and no longer work under the assumption that there is a rule of thumb that says, 'Underground is just too expensive. I'm not going to evaluate it," said Beehler in an interview.

"It's the 21st century [and] we're not building transmission and distribution lines like our grandfathers did on the legacy grid," he added.

Workers plan to underground a tap line to a home in Virginia as part of Dominion Energy's Strategic Undergrounding Program. Credit: Dominion Energy.

Indeed, the cost to bury electricity lines has fallen and new technologies make power lines not only easier to bury but also more robust once in the ground. Those lower costs and improved technologies are what led both Virginia's Dominion Energy and Wisconsin's WEC Energy Group to embark on decade-long projects to seriously increase reliability in hard-to-harden areas.

Dominion Energy – Strategic Undergrounding

For Karen Kinslow, Director of Electric Distribution Grid Resiliency at Dominion Energy, the decision to go underground with some of its wires was actually prompted by the state legislature. Frustration with extra-long customer restoration times (sometimes up to 14 days) following storms, hurricanes, and even a derecho led the state government to ask Dominion Energywhat else they could be doing to speed up electric recovery.

"So, one of our VPs said 'Look OK, we can't do everything but we can do something.'"

That's where the utility came up with the term 'strategic' undergrounding. The plan was to dig into the outage data and try to determine where putting wires underground would really affect restoration time.

"Back lot was big," said Kinslow, "you built it [the electric overhead wires] then you built the house and now we can't get our truck to it so that takes longer to restore," she explained.

After looking over a lot of data (all Excel, said Kinslow), and running scenarios on number of minutes out or number of customers out, the utility eventually landed on a metric of outages per mile.

"We focused on tap lines (other companies call them laterals) and we found that if we converted 20% of our overhead taps to underground we could cut our customers' outage time by half after a multi-day storm," she said.

Legislative Support

Because Dominion Energy's underground proposal was spurred by the state legislature, the state itself passed a law allowing the utility to recover some of its costs for the program via a small rate adjustment called a rider included on customer bills. An excerpt from the Virginia Electric Utility Regulatory Act is below:

"The replacement of any subset of a utility's existing overhead distribution tap lines that have, in the aggregate, an average of nine or more total unplanned outage events-per-mile over a preceding 10-year period with new underground facilities in order to improve electric service reliability is in the public interest.

"That is one way we are different from other states," explained Kinslow, we do get a rider on top of the base rates." "As long as an area has so many outages per mile and we can eliminate them, then it's deemed in the public interest and has to be approved," she explained.

Dominion Energy's Program

The project, which began in 2014 will likely run through 2028 according to Kinslow, will eventually result in about 4,000 miles of overhead distribution lines being converted to underground. Dominion Energy has been averaging about 300 miles per year and has completed about 1,700 miles of undergrounding already.

What's great she explained is that it is already showing results. These days when a storm rolls through and knocks out power, Dominion Energy can see which devices went out and note whether they are on the list to be undergrounded or not. This is giving the team the peace of mind knowing that they are hitting the right spots.

The total cost will be about $2 billion for the 4,000 miles of underground taps, she said.

Wisconsin Public Service – System Modernization and Reliability Project

It was improvements to cable and drilling technology coupled with rising vegetation management costs that led WEC Energy Group's utility subsidiary, Wisconsin Public Service (WPS) to consider undergrounding, according to Paul Gogan, Director of Electric Distribution Asset Management for WEC Energy Group.

"We saw that a lot of the construction techniques had changed with directional drilling and trenching and boring and we realized that we could do underground lines in a much more cost-effective manner," he said in an interview. Further, there were parts of its service territory that just weren't seeing the reliability improvements the company wanted. "We weren't able to make a game-change on it," said Gogan.

In order to gain approval for the project the utility commission told WPS to survey customers to see if and how much they would be willing to pay for better reliability. And lo and behold, the vast majority of customers said they were willing to pay more on their electric bill for reliability improvements. The utility estimated that the average residential customer would experience an approximate increase of 5% or $4.30 per month. Surprisingly, even customers who did not have service interruptions in the previous year were willing to pay more for the utility to make upgrades.

With approvals in hand, WPS began the 8-year $425 million project to underground 1294 miles of overhead lines with 1629 miles of underground circuits. Part of the project included automating mainline circuits to provide fault location, isolation and service restoration (FLISR) capabilities.

Like the Dominion Energyproject, WPS decided to underground the tap lines and keep the main line overhead. Locations were determined based on customer minutes of interruption (CMI). Currently in the last year of the project, the project has resulted in a 97% reduction in outages for customers.

Communications are key

Keeping customers informed about the project was key for both WPS and Dominion. Gogan explained that WPS took lessons learned from other utilities who had undertaken similar projects in the past. Using those learnings, WPS said they would cover the cost of bringing the wires to the customers' home.

Workers meet with homeowners in Virginia as part of Dominion Energy's Strategic Undergrounding Program. Credit: Dominion Energy

""It was a one-time opportunity," said Gogan, adding "they had to decide and commit to it because they couldn't go back say two years later and say now they wanted it."

That's what got the ball rolling, said Gogan. He said the utility started fielding calls from customers who weren't even in the undergrounding area but still requested the utility bury their lines.

Kinslow echoes the fact that keeping customers informed is incredibly important. "We look at this as a customer program," she said, "so communications are the cornerstone of everything we do."

For Dominion, that means there are always two dedicated points of contact for customers who are part of the undergrounding program. It's their job to make sure the communications are going well and that there are no surprises for customers.

"It's a big deal," she said.

WPS also needed to make sure that customers were satisfied with the project, per the original order from the utility commission. In addition to surveying customers before the project began to see if they would be willing to pay for it, the commission asked WPS to survey customers afterward to make sure they were happy, which they did for a few years.

"Eventually the results were all so glowingly positive that we didn't have to do surveys anymore," Gogan said.

Green hydrogen & electrolysis load factor: The elephant in the room

By Robert Schulte and Fredric Fletcher | 27 July 2021 | Source: Power Engineering

There is currently a lot of electric utility industry excitement about the prospect of using "green" hydrogen for power generation. "Green" meaning the hydrogen will be produced from renewable electrical energy using technology called electrolyzers, without causing carbon emissions associated with climate change.

Hydrogen electrolyzers use electricity to produce hydrogen from water. The resulting green hydrogen could then be stored for use later in fuel cells or gas turbines to regenerate electricity. The excitement goes so far as to tout that "surplus" renewables could be used — renewables that would otherwise be wasted.

Technology research sponsored by the U.S. Department of Energy (DOE) and others seeks to resolve the current technical challenges of producing and using green hydrogen. For the most part, these challenges include safety, improving electrolyzer performance, transporting and storing hydrogen and, the core challenge: reducing the cost of producing green hydrogen from the current $5 to $6 (US) per kilogram (kg) to $1 to $2 per kg.

Figure 1
The Elephant in the Room

Once the green hydrogen is produced, additional challenges await in combusting it for use in utility turbines. This includes issues like control of nitrous oxides (NOx) emissions, and the fact that combusted hydrogen is corrosive to the materials currently used to make turbine blades.

For purposes of this article, we assume all these technical challenges will be resolved. But there is still a proverbial elephant in the room. An elephant no one seems to be talking about (Figure 1 at top). The drive to reduce the cost of green hydrogen production is quietly assuming the electrolyzers would be operating at relatively high annual load factors. And reliance on only renewables local to the electrolyzer, or its local utility, or even the local wholesale market, will not support such high load factors. They lack constancy and, importantly, time diversity.

The solution? Time-diversified renewable energy resources brought together over long distances by cost-effective, interregional electric transmission.

Example Project
Consider for example the green hydrogen project underway at the Intermountain Power Project (IPP) site near Delta, Utah. There, an existing 1,800-MW coal plant serves baseload power to municipal utilities in Utah and Southern California. The Southern California municipals have elected to retire the plant in 2025, two years earlier than previously planned. The plant would still exist, but its California customers will go away.

Led by Los Angeles Department of Water and Power (LADWP), an 845-MW natural gas-fired combined-cycle gas turbine (CCGT) plant will serve as an alternative to the retired coal plant for the Southern California municipals. While natural gas has lower carbon emissions than coal, it still has significant carbon emissions. To reduce carbon emissions further, it has been proposed that the CCGT will initially be fired with a mix of 30% green hydrogen and 70% natural gas, increasing to 100% hydrogen over time as the current technical and cost challenges related to hydrogen are resolved.

Read the rest of the article...

Responsible End-of-Life Disposition for Power Equipment

By David Shadle | 11 August 2021 | Source: T & D World

It is worth considering lessons learned from the past such as capturing full lifecycle costs, including the proper recycling/disposal of spent materials/equipment.

Utilities have been on the forefront of power-related technology and product development, large-scale commercialization and use for more than 100 years. In essentially all cases, the primary result has been new or improved services for customers, greater worker safety and overall advancements for society. However, in a few rare instances, there were unforeseen consequences that lingered undetected for many decades. As utilities embark on new paths, owning, operating, and facilitating customer installations of new technologies, it is worth considering lessons learned from the past such as capturing full lifecycle costs, including the proper recycling/disposal of spent materials/equipment. Lithium Ion (Li-ion) batteries and solar panels are prominent examples from our current generation of energy strategies.

Thanks to years of hard-earned experience and a preponderance of new regulations, manufacturers, and users, including much of the public are far more aware today of the safety, health and environmental implications of products, processes, and ingredients. Material safety data sheets did not exist when communities across the country employed coal gasification in local plants to supply natural gas before pipelines were installed to deliver it. The process produced hazardous byproducts that were not always properly contained and disposed till years later. Likewise, coal ash was not treated or contained for many years until its potential hazards were understood. PCBs used as an insulating agent in many types of electrical equipment, which improved electrical safety and surely saved many lives, were not carefully managed until their carcinogenic implications and longevity in the environment came to light.

Many utilities are advocating for and participating in the electrification of our transportation sector. Some utilities are converting their own fleets, planning on servicing commercial fleets, and investing in infrastructure. Most batteries used in electric vehicles (EVs) are Li-ion. The Union of Concerned Scientists (UCS) estimates that by 2030, 1.6 million EV batteries will be retired annually from vehicle service. If disposed, those batteries would be considered hazardous in many jurisdictions due to their metal content, and currently there are no uniform standards as to who is responsible for the proper handling of retired batteries. California, which may have 45,000 retired batteries per year by 2027, is developing policies to ensure all EV batteries sold in the state are recycled or reused. The need for a comprehensive plan for retiring EV batteries also has come to the attention of the Biden Administration, which plans to make electrification in the transportation sector a major objective.

Some good news is manufacturer research and many DYI pilot studies indicate retiring EV batteries may have an extended service life if proper recertification programs are established, potential risks are fully understood, and liability standards adopted. EV batteries are retired from primary use after about 10 years when their cell capability declines below 80% of design. Several auto companies are already evaluating refurbishing such batteries for reuse in EVs requiring a replacement battery. Batteries not suitable for vehicle service, but capable of safely operating at a lower rating, may have a second life of five to eight years in the power sector. Once certified for duty, such batteries could be used for energy storage in a broad number of utility applications as well as commercial and residential energy storage. The widespread reuse of EV batteries has the potential to increase the value proposition of EVs as well as lower battery energy storage costs. The UCS estimates there will be 112 GWh/year of capacity available from retiring passenger EV batteries by 2030. Utilities should be helping formulate policy mechanisms for the proper reuse and disposal at end of life of EV batteries to make certain this valuable resource is managed in a responsible, equitable and sustainable way.

End-of-life solar panels represent another potential disposal issue. Unlike batteries, there is no known second service life for retiring panels. While panels contain critical materials as defined by the Department of the Interior, including arsenic, gallium, germanium, indium, and tellurium, they also include metals such as lead, aluminum, copper, and silver, as well as cadmium and other potentially hazardous materials. As a result, solar panels are difficult and expense to recycle and evidence shows some elements, including cadmium can be leached out of solar panel fragments by rainwater in mere months.

EPRI has recommended that utilities should not dispose of solar panels in regular landfills. Few states have solar waste recycling laws and, generally, the panel owner, not the manufacturer, is responsible for end-of-life disposition. As the solar industry in the U.S. ages, there will be millions of panels requiring disposal. As major solar installation owners and beneficiaries of privately owned solar projects, utilities may wish to apply lessons learned from the past and take a leadership role in establishing standards for the proper recordkeeping and recycling/disposal of unusable solar panels.

Patented Ideas Can Solve Energy Problems

By Wayne Hicks | 28 June 2021 | Source: T & D World

A method for forecasting demand for electric vehicle charging infrastructure and 187 other patents filed in 2020 by the National Renewable Energy Laboratory focus on finding answers to today's energy challenges.

For Greg Glatzmaier, the road between innovation and implementation runs along a dusty stretch of highway about a dozen miles south of Boulder City, Nevada, U.S., where his patented idea could solve an industry problem. The destination for his idea is Nevada Solar One, an outpost in the desert where 186,000 parabolic shaped mirrors tilt to capture the sun's rays.

"When the plant first opened, there was nothing around it but open desert with mountains to the west and east," said Glatzmaier, a senior engineer in the Thermal Energy Science and Technologies group at the National Renewable Energy Laboratory (NREL). "The only other landscape feature is a dry lakebed north of the plant."

Since Nevada Solar One began operations in the summer of 2007, other utility-scale solar power plants have opened in that lakebed. Nevada Solar One is the only concentrating solar power (CSP) plant in the region, however, and the technology faces a unique set of challenges.

The CSP facility uses concentrated beams of sunlight to heat a fluid flowing through 20,000 tubes to as high as 752 degrees Fahrenheit. The process creates steam to spin a turbine that powers a generator and produces electricity. Over time, however, the heat transfer fluid begins to break down and form hydrogen, which reduces the effectiveness of the process. Tiny metal pellets in the tubes absorb the hydrogen, but after about seven years they become saturated and cannot be removed and replaced. Glatzmaier developed a method to address the hydrogen problem.

"To try to go in individually and address the situation for each tube is not really practical," Glatzmaier said. "So, the method that I've developed, and what's in that patent, and what this project has been all about, is to reduce and control the level of hydrogen that's in the heat transfer fluid."

NREL applied for a patent on Glatzmaier's invention in the fall of 2017. The U.S. Patent and Trademark Office last May granted patent protection to what is simply called "Hydrogen sensing and separation."

Glatzmaier's patent was merely one of the 40 U.S. patents issued to NREL during fiscal 2020, a bump from the 32 issued during the prior fiscal year. Of the 269 disclosures filed with the laboratory's Technology Transfer Office as the first step toward either patent or copyright protection, 153 fell in the category of a record of invention and 116 in the area of software.

"We continue to see strong engagement from researchers who submit their ideas for evaluation, with especially strong growth in software," said Anne Miller, director of NREL's Technology Transfer Office. "It's great to see such growth because it tells us that the outreach to the lab to get people to report their innovations and work with us in getting them protected and deployed means that it's working, that people know who to contact. Hopefully, it means that they have some confidence in our ability to be helpful and steer them in the right direction."

NREL filed 188 patent applications in FY20, up from 124 the year before.

Lance Wheeler, a research scientist at NREL, has about a dozen patent applications in the pipeline tied to the discovery several years ago of a way to turn windows into solar cells. The technology relies on perovskite solar cells that enable the glass to darken and generate electricity, and also switch back to a clear pane. The most recent patent approved, for "Energy-harvesting chromogenic devices," was granted in November, or almost four years after the provisional application was filed.

"It's much different than writing a paper because you can write a paper and get it published within months," said Wheeler, who shares credit on the patent with colleagues Joey Luther, Jeffrey Christians and Joe Berry. "You'll never get a patent awarded in months. It's usually at least a year, and three is not crazy."

Buildings across the United States account for nearly two-thirds of energy used, so the notion of using these "smart windows" to take advantage of sunlight could bring that energy consumption down.

Lance Wheeler holds a perovskite window prototype, which demonstrates the variety of colors that can be obtained.
Photo by Dennis Schroeder, NREL

The patents issued so far for Wheeler's dynamic photovoltaic windows cover foundational aspects of the technology and sprang from the initial research. A series of patent applications followed.

"When you write the first patent application, you don't know everything," Wheeler said. "As you learn more and especially for very particular market needs, or what a product might look like, you learn what's important and you continue to protect the things that are working. Then you make more discoveries, and you patent more things, but they're all aligned in the same area."

Perovskite Composition Earns Patent Protection

Alignment, as it turns out, is a key part of making perovskites most effective in capturing the sun's energy. Unlike widely used silicon, which is a naturally occurring mineral, perovskites used in solar cells are grown through chemistry. The crystalline structure of perovskites has proven exceptionally efficient at converting sunlight to electricity.

NREL researchers have explored possible combinations for perovskite formulas to find the best. That work resulted in a patent issued in April 2020 for "Oriented perovskite crystals and methods for making the same." The process begins with a small crystal that's attached to another crystal and then another and on and on. The crystals are also oriented in the same direction. Kai Zhu, a senior scientist and one of the inventors, uses bricklaying as an analogy.

"You lay one layer down, you put one next to another, you align them perfectly," he said. "You have to do this in order to build a very large wall. But if you have some randomness in it, your wall will collapse."

The patent, which covers the composition of the perovskite, was issued to Zhu, Berry, and Donghoe Kim of NREL and to a scientist in Japan. NREL filed the patent application in 2017. Compared with a perovskite solar cell made of crystals allowed to grow randomly instead of in a specific orientation, the NREL-developed composition has been proven to have fewer defects and able to move charge carriers quickly. The result is a perovskite solar cell capable of reaching the highest efficiency.

"This represents the current best performing perovskite composition for the single-junction solar cell," Zhu said.

Software Filings Reach New Record

NREL's Technology Transfer Office received 116 software record (SWR) disclosures in fiscal 2020, establishing a new record and marking a big increase from 72 the prior year. The growth in submittals is partly due to more software being developed and authorized for free open-source release. One software record approved for closed-source licensing last year and now available for commercial users is the Electric Vehicle Infrastructure Projection tool, or EVI-Pro. A simplified, open-source version, known as EVI-Pro Lite, also has been released.

The core of EVI-Pro allows users to forecast the demand for electric vehicle charging infrastructure in a particular area. The predictive nature of the software also enables users to determine in advance how an influx of electric vehicles might affect the grid and energy demand. EVI-Pro relies on real-world information.

Eric Wood, the NREL researcher who oversaw the development of EVI-Pro, said it is not enough to simply consider how many charging stations were installed in an area previously and make an educated guess based on that information. "That misses some key points," he said. "The vehicle technology is evolving. The charging technology is evolving. And the behavior of individuals that own these vehicles is evolving."

Early adopters of electric vehicles could charge them at home, in their garage. As the market expands, Wood said, people living in apartments or who have to park on the street need to have a place to plug in.

"The role of public charging infrastructure is going to continue to elevate as the market grows," he said. "Continuing to develop the software with an eye on reflecting the latest situation in the market is one of the challenges that we face, so keeping EVI-Pro relevant and current is important."

From the Laboratory to the Outside World

For Glatzmaier, the journey to see how well his invention could perform at isolating and removing hydrogen from the concentrating solar power plant was not a quick one. Grounded from flying because of the pandemic, last year he made four trips to the Nevada site by car. Each trip took about 13 hours one way.

Scientists typically keep close to their laboratory space, with companies able to license ideas that sprang from the inventive minds at NREL. Often, with license in hand, a company will conduct research using its own people. In Glatzmaier's case, Nevada Solar One signed cooperative research and development agreements that have kept the scientist and company working closely together since 2015.

Glatzmaier initially planned to address the hydrogen buildup using two processes: one to measure the amount of the gas, and a second to extract it. Laboratory-scale tests showed his ideas would work, but he still expected some hesitation from company executives when it came time to trying out the devices on a much larger scale.

"I was thinking, they're going to be very reluctant because companies tend to not want to make changes to their power plants once they are up and running," he said. So he proposed installing the mechanism to only measure hydrogen buildup. Instead, the company wanted him to move ahead and tackle both problems at once. From the initial idea to installation has been a long road, but it does not end in Nevada.

Glatzmaier said 80 concentrating solar power plants exist around the world, and talks are in their final stages to license the technology for its use in these plants.

Wave Power Charges Ahead with Static Electricity Generators

By Maddie Bender | 10 August 2021 | Source: Scientific American

An ocean-powered buoy brings technology closer to the dream of obtaining energy from the sea.

One key to harvesting the ocean's clean energy—at least a little of it—may lie in static electricity. A team of researchers in Portugal has now successfully used it to run small generators inside a navigational buoy, powering the sensors and lights that the buoy uses to collect data and aid sailors. Though the project's scale is small so far, the researchers say it is an important proof of concept for a technique that could supplement existing attempts to harness the power of waves, as well as other kinds of naturally occurring motion.

Oceans are an appealing target for renewable energy generation. Waves alone produce 32,000 terawatt-hours of natural energy per year—for reference, the entire world uses around 23,000 terawatt-hours annually. And there is also the power of currents, tides and thermal energy. But despite decades of research, the motion of the ocean has proved difficult to harness. Wave patterns are unpredictable, seawater corrodes metal generating machinery, and waves' energy is simultaneously dispersed across three dimensions (up-down, forward-backward and left-right).

In part because of such challenges, the electrical output from several nascent, large-scale wave power projects has lagged behind predictions. The Portuguese researchers instead focused on something smaller and more manageable: powering navigational buoys, which often incorporate lights to guide boats and sensors to monitor ocean conditions. The team turned to so-called triboelectric nanogenerators, or TENGs, which convert motion into an electrical current using static electricity—the same principle as rubbing a balloon on a fuzzy sweater to generate charge. At each TENG's core are two surfaces, just a few square centimeters in area, that can easily become positively or negatively charged. Atop these two stacked surfaces, the researchers placed 10 stainless steel balls, about 12 millimeters in diameter, that are free to move around. When their container tilts, the balls roll around and rub the two surfaces together. This builds up a static charge, which can be converted into electricity to power a battery.

"We developed these novel devices that convert rhythm and mechanical energy into electrical power," says Cátia Rodrigues, a nanotechnology Ph.D. student at the University of Porto in Portugal. She delivered a presentation about her team's wave-powered buoy last week at an American Institute of Physics conference that was held online. "The devices are low-cost. They reach high power densities [with] high efficiencies," Rodrigues says, adding that TENGs continue to perform well even when waves are small and infrequent.

TENGs can generate power from any form of motion, but Rodrigues and her collaborators have focused on testing various TENG prototypes to optimize them for the specific conditions of wave motion. In their most recent tests, she and her colleagues wanted to see which setup would produce the most electricity the most consistently: placing all the balls together in a round basin shaped like a shallow bowl or creating individual "tracks" for each ball like swimmers in the lanes of a pool.

Working in a hydraulics lab at the University of Porto, the team tested designs for TENGs embedded in a one-eighth-scale replica of an oceanic buoy. They placed the model in a wave pool and simulated the five most frequent wave patterns that occur in the seaport in nearby Figueira da Foz, Portugal.

TENGs were invented by a researcher at the Georgia Institute of Technology in 2012. The new study marked the first time they have been tested under such realistic wave conditions, Rodrigues says. And it was a success: the swimming-lane-esque TENG design produced a maximum output of 230 microwatts—enough to power small devices such as medical implants. It also converted energy more consistently under different wave conditions than the bowl design did. Rodrigues says the output could be boosted by incorporating multiple TENGs or adding nanoparticles to the surfaces underneath the metal balls, increasing the materials' capacity to gather charge.

TENGs may offer a solution to a key problem that has stymied other ocean energy technologies, says Andrew Hamilton, engineering division chair at California's Monterey Bay Aquarium Research Institute, who was not involved in the new work. The ocean, he says, is a high-force, low-speed system: it contains a vast amount of energy, but that power is widely distributed. As a result, traditional spinning generators often require more energy to electricity than a small patch of ocean can provide, and other attempts to develop wave-powered buoys have been flawed. Monterey Bay's own buoy project generates power by using the difference in motion between the water's surface and a platform suspended dozens to hundreds of meters below. But to work at great depths, this requires a long cable that takes damage from breaking

waves and underwater currents. In 2017 a navigational buoy in India powered itself with an oscillating water column system: waves alternately filled and emptied a partially submerged chamber, accelerating air into and out of the column. The fast-moving air then turned a turbine to generate electricity. But this method produces potentially problematic loud noises, and it only takes advantage of the vertical motion of a wave.

A TENG's small size helps it avoid both of these pitfalls. Rodrigues says its compactness is one of its perks, allowing researchers to easily combine TENGs with other electricity-generating methods such as solar panels or different kinds of wave-energy harvesters. Based on the success of their wave pool trials, the researchers plan to modify their TENG prototype and install it in a full-scale buoy in Figueira da Foz. Hamilton notes that an open-ocean test may present challenges that cannot be simulated in a wave pool. "Anything you design for year-round use in the ocean, you have to design it for the storm that's statistically likely to happen every 100 years," he says. He explains that this type of extreme weatherproofing often makes a device bulkier, less maneuverable and less durable over time because the added surface area provides more opportunities for wear and tear.

Rodrigues is not daunted. She says she is studying TENGs' performance not just when they are in the ocean but also under other "harsh conditions," including when they are placed inside groundwater extraction wells—and sewn into the insoles of shoes. These wide-ranging applications are why, in the future, she expects to see TENGs "everywhere."

Ocean at Figueira da Foz, Portugal, where researchers plan to test a wave-powered navigational buoy.
Credit: Valery Zonov Getty Images

‘Blue hydrogen’ more carbon-intensive than gas and coal

By E&T editorial staff | 13 August 2021 | Source: Engineering and Technology

A study by Cornell and Stanford University researchers has found that – despite being touted as an environmentally friendly approach to heating – blue hydrogen has a carbon footprint significantly greater than natural gas, coal and diesel.

Hydrogen is a potentially zero-carbon fuel source, producing just heat and water when burned or used in fuel cells and making it an attractive alternative to fossil fuels in transport, heating and industry. For instance, part of the UK government’s decarbonisation plan is a significant expansion in hydrogen to 5GW of capacity by 2030.

There are two approaches to producing hydrogen: blue hydrogen (produced by splitting natural gas into hydrogen and carbon dioxide) and green hydrogen (produced by splitting water via electrolysis into hydrogen and oxygen). While green hydrogen requires a large energy input, blue hydrogen cannot be described as a zero-emission fuel source, though it may be described as net-zero when used in conjunction with efficient carbon capture. Climate think tanks and campaigners have warned the UK government that blue hydrogen expansion will compromise its net-zero target.

The Cornell and Stanford researchers assessed the carbon footprint associated with blue hydrogen as defined by the US Department of Energy. The process begins by converting methane to hydrogen and carbon dioxide using heat, steam and pressure (grey hydrogen). Once some of the carbon dioxide has been captured and sequestered along with other impurities, it can be classed as blue hydrogen. This is a particularly energy-intensive process, with energy typically provided by burning more natural gas.

The researchers calculated that the carbon footprint to create blue hydrogen is more than 20 per cent greater than using either natural gas or coal directly for heat and 60 per cent greater than using diesel oil for heat.

“In the past, no effort was made to capture the carbon dioxide by-product of grey hydrogen and the greenhouse gas emissions have been huge,” said Professor Robert Howarth, a Cornell University environmental biologist. “Now the industry promotes blue hydrogen as a solution, an approach that still uses the methane from natural gas, while attempting to capture the by-product carbon dioxide. Unfortunately, emissions remain very large.”

Methane is a potent greenhouse gas: more than 100 times stronger as an atmospheric warming agent than carbon dioxide when first emitted. The UN's recent climate change report called on governments to focus on cutting methane emissions in addition to decarbonisation efforts.

Emissions of blue hydrogen are less than for grey hydrogen by nine per cent to 12 per cent. The researchers wrote: "Blue hydrogen is hardly emissions free. Blue hydrogen as a strategy only works to the extent it is possible to store carbon dioxide long-term indefinitely into the future without leakage back to the atmosphere."

Commenting on indiscriminate political support for hydrogen, Howarth said: "Political forces may not have caught up with the science yet. Even progressive politicians may not understand for what they're voting. Blue hydrogen sounds good, sounds modern and sounds like a path to our energy future. It is not."

The researchers emphasised the difference between blue hydrogen and green hydrogen, the latter of which has not yet been commercially realised.

"The best hydrogen, the green hydrogen derived from electrolysis - if used widely and efficiently - can be that path to a sustainable future," said Howarth. "Blue hydrogen is totally different."

How To Bolster The Dwindling Value Of Solar And Wind

By Perry Sioshansi | August 2021 | Source: EEnergy Informer August Edition

Perry Sioshansi in the August edition of EEnergy Informer writes that in the long-run, new ways must be found to make better use of variable wind and solar

As the percentage of renewables in the electricity generation mix rises their value declines – it is the principle of diminishing marginal returns. But it is not an issue we can ignore or dismiss because in many parts of the world where wind and solar make up increasing share of power generation, sunny and windy days lead to a glut of electricity supply, driving down hourly prices and making it less attractive for renewable generators to increase investments in even more renewable energy. While lower prices are good for electricity consumers, this decline in market value is not as good for producers. It could potentially limit wind and solar deployment and thus endanger decarbonization goals.

A new study from the Lawrence Berkeley Lab (LBL) titled Solar and Wind Grid-System Value in the US: The Impact of Transmission Congestion, Generation Profiles, and Curtailment, which appeared in the journal Joule examines how market value – defined as the value of energy and capacity in regional power markets – has changed over time at 2,100 utility-scale power plants have come on line across the US through 2019.

The study looked at the 3 main determinants of market value:
* Output profiles: how the output of generators matches local market prices;
* Congestion: whether local prices are affected by transmission congestion; and
* Curtailment: whether wind and solar generators were cut off due to over-generation,

And found that as of the end of 2019, output profiles and congestion had the largest impacts on market value, varying by region, while curtailment had relatively little impact. The LBL study found that despite a decline over time, the average market value of wind and solar in 2019 was still higher than their average generation costs.

It notes that future market, technology, cost, and deployment trends may affect the value/cost dynamic, either positively or negatively while examining ways to mitigate the decline in renewables' market value.
Wind power in windy Texas (ERCOT) and the Southwest Power Pool (SPP) saw market values at 46% and 42% below the flat block value of generation, due mostly to congestion and the fact that the generation tends to be localized.

Solar, on the other hand, saw a 37% market value penalty – i.e., reduction from flat block value – in solar- heavy CAISO. California's solar output is grown so large to drive down market prices during sunny hours, hence its market value. California vastly outpaces other regions in solar penetration, accounting for over 19% of total annual generation – it is even higher today. By contrast in regions with low penetration, solar enjoys a market value premium. In all cases, the primary driver of the value of renewables was the coincidence of the peak output profile with relatively high hourly market prices.

The good news is that while wind and solar market values have declined, wind and solar costs have declined even more, which explains the continued investments and the long interconnection queues as more projects are planned.

The key question the LBL study examines is how will these two trends play out over time: will wind and solar costs decline even faster than their declining value as they continue to saturate many markets?

If the future market value declines outpace future cost drops, what can be done to mitigate the value decline? The answer is that it varies for in each region depending on what are the main drivers of value. For example, building more intra-regional transmission will relieve congestion but may provide only limited benefits where the output profile is mismatched with higher market prices. In many cases, shifting the output profile through energy storage, or by adjusting demand through innovative pricing, demand response or flexible loads such as charging EVs would be more effective. The value of solar is particularly sensitive to when it is generated – declining rapidly where there is too much solar generation, which explains why nearly all new solar plants are designed as hybrids, i.e., paired with battery storage.

As storage costs decline, solar-plus-storage plants become even more compelling. For wind, the shift towards larger blades relative to turbine capacity, allows for improved generation during low wind speeds, boosting capacity factors and effectively flattening the output profile. Progressive cost drops and performance gains have helped to maintain the value proposition of wind and solar, and are likely to continue, according to the LBL study.

Over the long-run additional solutions must be found to mitigate market value decline will be needed. Expanded transmission capacity can reduce congestion by connecting wind and solar to regions with higher market prices at advantageous times and regions. The increased electrification of transportation and buildings is also likely to increase he demand and the load profiles, allowing additional demand buildings is also likely to increase he demand and the load profiles, allowing additional demand side flexibility. Ultimately, there is a race between cost and value as everyone searches for profitable solutions.

DNV's Top 10 Energy Transition Technologies

Date: 2021 | Source: DNV

There is no silver bullet, no easy way out.

Perry Sioshansi in the August edition of EEnergy Informer writes that DNV, a consultancy, has released the DNV Technology Progress Report, a highly readable white paper to supplement an earlier Energy Transition Outlook. While it does not offer any surprises, it includes the top 10 technologies that – together – will be needed for the transition to a low carbon energy future, selected based on two criteria: whether it will lead to an observable shift in the energy system, and how the technologies interact with each other, or energy value-chain integration. Moreover, DNV says they are critical to decarbonization goals during the next 5 years.

According to DNV, "… the world needs to transition faster to a deeply decarbonized energy system, reducing emissions by around 8% each year to ensure an energy future in line with the 1.5-degree ambition set under the Paris Agreement. This urgent and complex challenge needs full energy-system thinking: understanding the timeline and interdependencies of technologies and policies. It also requires the courage to make difficult decisions." The report suggests that policy action to fulfill long-term goals is unprecedented and differentiates the current energy transition from previous ones that have mainly been driven by market forces coupled with the global finance industry adding momentum for decarbonization with the push for greater sustainability transparency and a surge in sustainable investing such as green bonds hitting record levels.

One can obviously argue about the choices, how they are grouped, and the order in which they appear. One can also argue that a few, potentially more consequential technologies, are missing from the list. But it is hard to argue that the ones identified are not important, especially once you read the well-documented report.

DNV's top 10 Energy Transition Technologies:
Energy Production
Floating Wind
Developments in solar PV
Waste to fuel and feedstock
Energy Transport, Storage & Distribution
Pipelines for low-carbon gases
Meshed HVDC grids
New battery technology
Energy Use & Conversion
Novel shipping technologies
EVs and grid integration
Green hydrogen production
Carbon capture and storage
Source: DNV Technology Progress Report

More important, DNV points out that the technologies highlighted "… are deeply interlinked, and interdependent; any discussion on green hydrogen, for example, must account for developments in renewable electricity, hydrogen storage and transport systems, and end-use technologies such as fuels cells."

The final word: "No single technology can solve the challenge, rather they will need to work together."

CIGRE UPDATE

Impacts from electric mobility in V2G and V4G modes in the distribution network planning and operation

By João Abel Peças Lopes | FIEEE, Full Professor of EE at Faculty of Engineering of Porto University (FEUP), Associate Director at INESC TEC – Porto – Portugal, Convenor WG C6.40
CIGRE Leadership article | 9 July 2021

Part of the effort in decarbonizing economy and society relies on mobility, involving the electrification of the transportation sector and leading to the so-called electric mobility phenomenon. The increase in electric mobility requires a considerable effort in the operation of electrical distribution networks to allow charging batteries of the electric vehicles (EV). As matter of fact, electric vehicles became a new electricity consumer presenting a special characteristic – flexibility. This new consumer can charge the batteries slowly, in periods ranging typically from four to six hours, or, in a fast manner, in periods between 15 and 30 minutes involving powers from the 50 kW to 350 kW for the case of the fast and ultra-fast chargers, respectively. The presence of this new type of consumer in the electrical grid is changing the patterns of load consumption, causing in some situations overloads in branches (like for dumb charging), excessive voltage drops and, in some cases, compromises power quality. In face of these concerns, the power systems community has timely identified and developed several solutions for charging the EV batteries taking profit of the flexibility of this new load type. The most common approach is the controlled charging of the EV batteries – the smart charging – involving the management of the chargers of the batteries in charging places of parking lots, garages of buildings and even in individual electrical installations, like households, managing the charging of the batteries together with the remaining loads of the electrical installations.

CIGRE UPDATE

Distribution system operators (DSO) are realizing that they need to monitor their grids closely to evaluate the need to reinforce the network in some areas, namely for those situations where they do not have control over the simultaneous charging of the EV batteries, like in residential areas around large cities. In fact, the regularity of the commuting patterns leads to situations where most EVs can start charging more or less at the same time, after the end of the last journey of the day. Even if a controlled battery charging is adopted at the building level, it might be challenging to keep individual branch power flows within technical limits. The existence of several residential buildings supplied by the same feeder will most likely provoke an overload in the upstream branches for those conditions, where simultaneity factors are no longer valid. In these cases, either a reinforcement of the LV distribution grid is adopted, or the management of the charging is supervised and controlled at grid level from the secondary substation, involving the deployment of a communication and management infrastructure. The same may be necessary for MV grids when they feed several fast and ultra-fast charging systems together with local slow controlled charging solutions in the same geographical area.

Up to now, the reversibility of EV power converters to be used according to the availability of the battery stored energy and willingness of EV owners – the so-called V2G mode, has little adherence from electric vehicle manufacturers. With the development of standards, like CHAdeMO, the V2G mode will become soon a widespread reality. However, only Nissan and Tesla are providing commercial EV charging systems with the capability to operate under the V2G mode. In addition, the already existing collective charging management solutions only exploit the controlled charging without functionalities of V2G mode. Apart from the injection of active power into the grid, it is possible to conceive that EV power converters can deliver reactive power, providing support for voltage control in some distribution grids, namely when the ratio between branch reactances and resistances is large enough. The EV power converters can also offer the capability to operate as active filters, helping in mitigating harmonic distortion in distribution grids due to increased presence of electronic power converters associated to different electrical devices connected to these grids. In these cases, the EV converters are said to operate in the V4G mode. Moreover, one can assume that battery charging converters can operate in both V2G and V4G modes. This provides a tremendous increase in controllability for distribution grid management.

In face of the electric mobility increase, foreseen in the coming years, together with the explosion of the distributed generation (microgeneration for LV grids) connected directly to distribution networks, it is time for DSOs, and naturally for Regulators, to value the ancillary services of peak shaving, voltage control and harmonic filtering that EV converters can provide in V2G and V4G modes. By exploiting these features, it is possible to develop and deploy optimization-based methods for control and active management of distribution grids facing large-scale integration of distributed generation and electric mobility. In fact, the V2G mode of operation in LV grids can be used to reduce line currents, by delivering locally power support in some grid areas. It can also create charging slots to be used during sunny periods for EVs parked near critical nodes, by avoiding overvoltages caused by solar PV power injections.

Apart from the above-mentioned services, EVs can deliver frequency support services by participating in primary and secondary frequency control in islanded systems. This will allow integrating larger volumes of renewable power sources, like PV and wind, while keeping frequency variations within narrow bands. This is exploited in pilots, like in the Bornohlm island in Denmark, the São Miguel island in the Azores / Portugal and in Japan by Toyota Tsusho and Chubu Electric Power.

The future implementation of ancillary services by EVs may require interfacing agents, like aggregators, that will communicate the control commands issued by the DSO to the EVs connected to the grid and will deal with the commercial management aspects.

CIGRE UPDATE

It is therefore important to launch pilots that will exploit the above mentioned functionalities, in order to evaluate the technical and economic benefits and define regulatory schemes that will promote the development of such control and management solutions. The technical management that involves these features needs to be integrated within smart grid approaches, already being deployed, that exploit advanced sensing solutions in conjunction with the information obtained from the advanced metering infrastructure delivered by smart meters. These solutions should be activated at the level of an ADMS (Advanced Distribution Management System) for functionalities related with voltage control, power flow control and three-phase balancing.

The development and adoption of the V2G and V4G functionalities requires now standardization to allow an adherence of more and more electric vehicle manufacturers to these features. We can then say that we are presently at the dawn of a real change of paradigm in the operation of distribution grids by exploiting actively the capability of injection of active and reactive powers from EV batteries. This will improve the efficiency in the operation of the grids, will allow postponing reinforcements and will improve quality of service, while electrifying more and more the economy and reducing CO2 emissions by allowing more renewable generation penetration in the distribution networks.

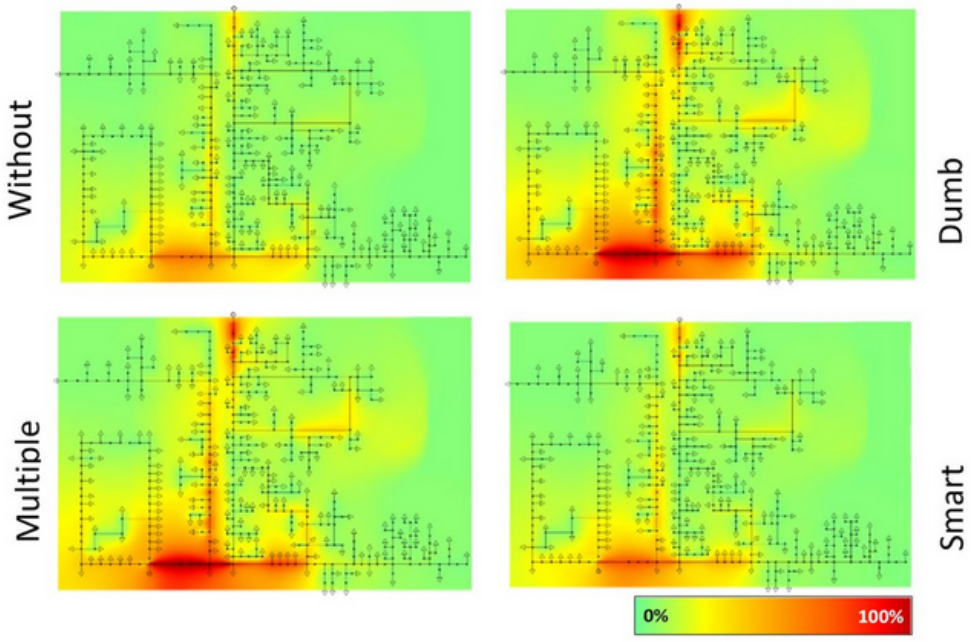


Illustration credit: Banner & thumbnail by nrqemi on iStock

CIRED UPDATE

Alternative Solutions for Advanced Security of Supply

CIRED Paper 980 | Madrid June 2019 | Henry.Lagland@uva.fi et al

ABSTRACT: The restrictions regarding the maximal length of outages especially under major storms has resulted in massive underground cabling (UGC) projects in the network companies in Finland and Sweden. Due to these expensive investments the network fees of many network companies have increased to the extent that the customers have reacted. In both countries, the authorities have announced restrictions to the rate of increase of the network fees. Thus, the network companies are now searching for alternative solutions to underground cabling. This task is here addressed by performing case studies on the network of a rural primary distribution substation area of the Vaasan Sähköverkko distribution company. The case studies include technical, reliability, economic and regulatory aspects and evaluations of possible implementations of different alternative network technologies.

DOWNLOAD PAPER

ENERGY ACTION WEBINAR

How to Get to Net Zero Without Costing the Earth

Webinar by Energy Action | 23 August 2021 | John Huggart, CEO at Energy Action and Barbara Albert, Co-CEO at 100% Renewables

Energy Action's CEO John Huggart and 100% Renewable's co-CEO Barbara Albert, do a deep dive into how to set up a responsible Net Zero plan at least cost. for more information, visit our website: www.energyaction.com.au

WATCH WEBINAR

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Energy Action's Net Zero 5-Step Action Plan

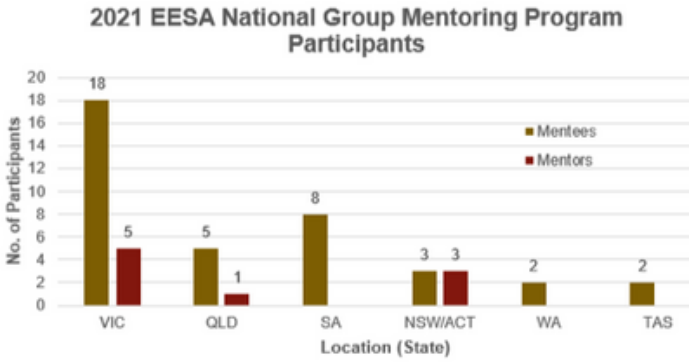
MENTORING PROGRAM UPDATE

2021 EESA National Group Mentoring Program

By Aditi Sachdeva, EESA National Council Young Professional Member & Mentoring Program Coordinator | August 2021

The Electric Energy Society of Australia proceeded with its second National Mentoring Program amid COVID-19 led by Aditi Sachdeva, Young Professional member of the National Council. The program this year is committed to empowering 40 Mentees who are young and upcoming Electrical Engineers, to flourish and develop professionally through mentoring provided by 9 well-established and experienced Engineers across Australia's Electric Energy industry. We're fortunate to have Jose Plata (NSW), John Wright-Smith (VIC), Raj Dhunlall (VIC), Luke Koedijk (VIC), Ash Gupta (QLD), Matthew James (NSW), Emma Miller-Olsen (VIC), Samriti Sharma (VIC) and Jessica Hui (NSW) as our explicit Mentors this year.

The 1st session was held on Wednesday, August 18th and featured Emma Miller-Olsen, Professional Engineer of the Year 2020 as the Guest Speaker. Emma sees her connection to the program as an opportunity to "empower others and network across the electric energy sector who are critical to my team's successful operation". Upon asking about What Went Well in the session, Ash Gupta said, "Enthused participation of all mentors and mentees across Australia, availing the networking opportunity presented. The program so far has been greatly appreciated by everyone involved, and there is a general understanding of the importance of connecting or just having a chat after weeks in lockdown. Post the session, I can see vibrant discussions unfolding and genuine progress being made on goal setting. The mentees are themselves coming up with great suggestions on the path forward and keeping the mentors on their toes, which has been awesome to see".



While Jose Plata believes mentoring "allows him to provide a different perspective regarding ideas and their implementation along with the opportunity to give guidance and discuss personal experience with future electrical engineers', Luke Koedijk hopes to "help foster ambition within developing engineers and to take time to reflect on these individuals' ambitions so I can focus my leadership goals in the coming months and years to set the groundwork within the industry for these individuals".

MENTORING PROGRAM UPDATE

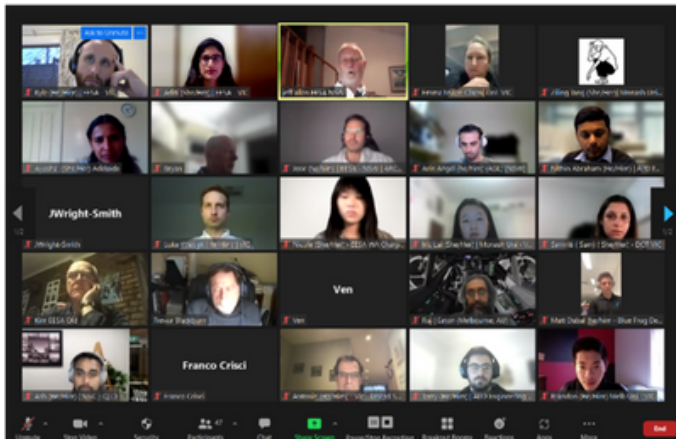


Figure 1: Session 1 - Participants

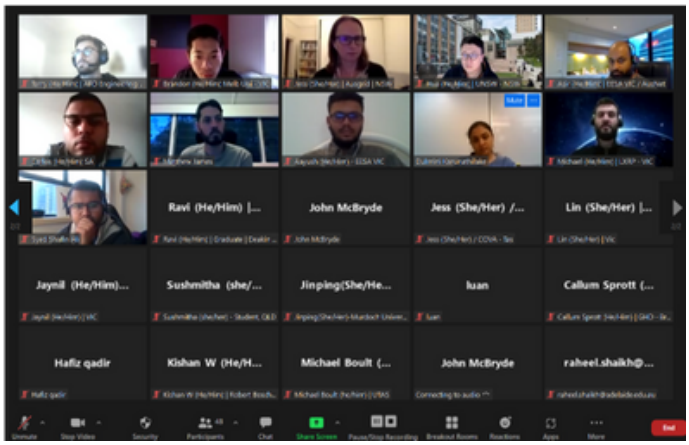


Figure 2: Session 1 - Participants

Overall, the virtual space and opportunity for both Mentors & Mentees to nurture their 'Growth' mindset through professional reflection, conversation and networking continues to be a key standout amongst the participants for their CPD this year. The 2nd and 3rd sessions of this Australia-wide initiative are due to be held on September 8th and 29th respectively and will feature Kate Summers, National Professional Electrical Engineer of the Year 2020 as the Guest Speaker for the finale.

UPCOMING EVENTS

Managing change in WA's SWIS from a system and market operator's perspective + WA Chapter AGM

WEDNESDAY, 8 SEPTEMBER 2021 | **WA** | **VIEW EVENT**

Overview:
Minimum demand continues to decline in the South-West Interconnected System (SWIS), driven by continued growth in distributed rooftop PV. Last year also saw grid-scale wind and solar generation on the SWIS almost double in scale. Cameron will outline the changes, opportunities and challenges this rapid transformation of the energy system is providing for the current and future operation of the system and... Read more.

Time: 4.30 PM AWST | 6.30 PM AEST

Location: Engineers Australia
712 Murray St, West Perth WA 6005
or Online

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

Vehicle to Grid – Turning Electric Vehicles into Grid Assets? + Tas Chapter AGM

WEDNESDAY, 15 SEPTEMBER 2021 | **NSW ACT** | **VIEW EVENT**

Overview:
Vehicle to Grid (V2G) is one of those technologies that look so promising. With a V2G-equipped Electric Vehicle (EV) you can green the energy system and the transport system at the same time! But as always the devil is in the detail. This presentation will speak of some of V2G's promise, details, and devils based on the Realizing Electric Vehicle-to-Grid services (REVS) trial.

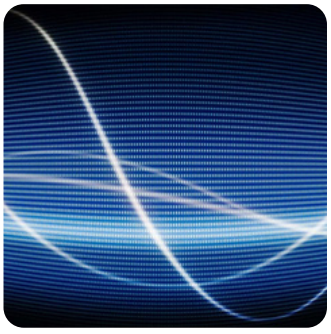
Time: 5:15 PM - 7.30 PM AEST

Location: Hydro Tasmania
4 Elizabeth St, Hobart
Or Online

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

Wide Area Monitoring in the NEM

WEDNESDAY, 15 SEPTEMBER 2021 | **QLD** | **VIEW EVENT**



Overview:
Over the last decade, we have seen a radical shift in the power system from large synchronous generators to distributed inverter-based resources. This shift has forced us to rethink how we operate the system as new phenomena emerge that threaten power system security. Wide Area Monitoring Systems is one such technology that AEMO has been investing in to help us face these new challenges. Read more.

Time: 3:30 PM - 5 PM AEST

Location: Energy Queensland
Level 1, 26 Reddacliff Street, Newstead Qld 4006
Or Online

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

UPCOMING EVENTS

SA Water Path to Zero Cost Energy Future (ZCEF) and the Technical Challenges

THURSDAY, 16 SEPTEMBER 2021 | SA NT | VIEW EVENT

Overview:
This webinar will describe SA Water's Zero Cost Energy Future (ZCEF) Program, which aims for achieving zero net electricity costs and the technical challenges and learnings along the implementation path. Energy management is to be improved by the installation of approximately 154 MW of solar photo-voltaic (PV) generation, and 17 MW / 33 MWh of Tesla Battery energy storage. Distributed generation and... Read more.

Time: 5:30 PM - 6.30 PM ACST

Location: Online

Cost:
EESA members: $0
EA members: $10
Non-members: $10

NSW ACT Chapter AGM and Technical Presentation

WEDNESDAY, 22 SEPTEMBER 2021 | NSW ACT | VIEW EVENT

Overview:
The NSW/ACT Chapter AGM will be followed by a technical presentation. Details will be shared soon.

Time: 5 PM - 6.30 PM AEST

Location: Online

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

EESA Technical site visit to Hitachi ABB Power Grids

FRIDAY, 24 SEPTEMBER 2021 | VIC | VIEW EVENT

Overview:
Hitachi ABB Power Grids are the industry leader in high voltage solutions and products. For decades, the Victorian head office in Lilydale has specialized in power quality products and solutions for the domestic and global markets, manufacturing capacitor banks, capacitor switches, and energy storage solutions to enable its customers, to operate more efficiently and with less environmental impact. Read more.

Time: 9 AM - 12 PM AEST

Location: 88 Beresford Road Lilydale Victoria, 3140

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

UPCOMING EVENTS

Distributed Energy Resources: Hosting Capacity as a Service + Victorian Chapter AGM

THURSDAY, 30 SEPTEMBER 2021 | VIC | VIEW EVENT

Overview:
Distribution Network Service Providers (DNSP) are evolving network infrastructure to accommodate Distributed Energy Resources (DER) such as solar PV, batteries and EVs. Low voltage networks were not designed for two-way power flows and their visibility has been kept poor by economic choice. Read more.

Time: 5:30 PM - 7 PM AEST

Location: Online

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

Engineers Australia Event: eDinner

THURSDAY, 14 OCTOBER 2021 | QLD | VIEW EVENT

Overview:
Join the Queensland branches of the Electrical and ITEE College, Queensland chapter of the EESA, IEEE, IET and their partners to celebrate the achievements of the past year and the contributions made by the participants.
This semi-formal event will be hosted at Customs House. Enjoy canapes on arrival with amazing views of the Story Bridge and a three-course meal and beverages. Don't miss out on the opportunity to... Read more.

Time: 6 PM - 10 PM AEST

Location: Customs House
399 Queen Street
Brisbane , Queensland , 4000

Cost:
EESA members: $70.00
EESA members concession: $20.00
EA members: $110.00
Non-members: $150.00

Engineers Australia Inaugural Climate Smart Engineering Conference

6 - 7 NOVEMBER 2021 | NSW | VIEW EVENT

Overview:
Engineers Australia will host its inaugural Climate Smart Engineering conference on 16–17 November 2021.
With attendance online or in person at the Hilton in Sydney, this conference will enable engineers to explore the relevant risks and opportunities, to network and to hear first-hand from business, finance, government and engineering leaders.
Engineers will be pivotal... Read more.

Time: Two-day event

Location: Hilton Sydney
488 George St, Sydney NSW 2000
Or Online

Cost:
See prices here.

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PROGRAM SNAPSHOT

PROGRAM HIGHLIGHT

WA Minster for Energy Hon Bill Johnston MLA is invited to open the Conference.

Violette Mouchaileh, Executive General Manager, Emerging Markets and Services AEMO will deliver the opening keynote address: **Evolution and Challenges in our Electricity Industry.**

TECHNICAL TOURS ANNOUNCED

**Spaces available to full ticket holders only*

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POWERFUL WOMEN LEADERSHIP PROGRAM

Building knowledge and capability in Industry Leadership for women in the Australian Power Sector

Register your interest now to receive more details on the Powerful Women program and an invite to an online Info session on Tuesday 7 September 2021 at 12:30pm AEST.

The API's new Powerful Women leadership and career development program will develop a transformational community of 200+ current and future female leaders for the Australian power sector over the next 3 years. The program is led by the Australian Power Institute and supported by our 20+ industry members with ~$900K financial support from the Department of the Prime Minister and Cabinet's Office for Women.

Starting in late 2021, two linked programs for Professionals and Early Career women will strengthen the leadership skills and career pathways of 65+ women each year (professionals and para professionals in technically oriented roles or undergraduate students). This includes developing their connections with 50+ other current and emerging industry leaders through the API's flagship residential Summer School in Adelaide in February 2022.

Register your interest to receive more information:

- ✓ Team leaders and individuals interested in placements in the Professional program (and 15x part and full scholarships worth $160,000+)
- ✓ Female undergraduate students and graduate women (the Early Career Pathway, with 50x part, full and student scholarships available worth $110,000+)
- ✓ Industry professionals keen to contribute to the Steering Committee (expected to be representatives from the API member communities and by invitation)
- ✓ Industry professionals who feel they can contribute content in the programs as a speaker/facilitator (online activities and live residential Summer School and Retreat)

Applications opening soon for the Professionals program that includes full registration for the API 2022 Summer School (14-25 February 2022 in Adelaide) and prior online activities.

REGISTER YOUR INTEREST

2021Continuing Professional Development Courses

THE AUSTRALIAN POWER QUALITY & RELIABILITY CENTRE IS OFFERING THE FOLLOWING CONTINUING PROFESSIONAL DEVELOPMENT COURSES IN 2021:

- **INTRODUCTION TO QUALITY OF ELECTRICAL SUPPLY**
  - **9-10 JUNE 2021**
- **INTRODUCTION TO PSCAD**
  - **16-17 JUNE 2021**
- **ADVANCED PSCAD TECHNICAL WORKSHOP**
  - **7-8 JULY 2021**
- **RENEWABLE & DISTRIBUTED GENERATION**
  - **28-29 JULY 2021**
- **BATTERY ENERGY STORAGE**
  - **4-5 AUGUST 2021**
- **ADVANCED QUALITY OF ELECTRICAL SUPPLY**
  - **18-19 AUGUST 2021**
- **GENERATOR CONNECTION**
  - **8-9 SEPTEMBER 2021**
- **POWER QUALITY WITH A FOCUS ON RENEWABLE ENERGY**
  - **22-23 SEPTEMBER 2021**
- **SOLAR PV ENERGY SYSTEMS**
  - **20-21 OCTOBER 2021**
- **APPLICATION OF AUSTRALIAN STANDARDS FOR MANAGEMENT OF HARMONICS, UNBALANCE AND FLICKER**
  - **3-4 NOVEMBER 2021**

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Ausgrid

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APD ENGINEERING

AMPCONTROL

EATON

Energy Queensland

evoenergy

GPA

WILSON TRANSFORMER

BRONZE

amsc

CitiPower

Powercor

Clarence Consultants

ElectraNet

POWER LINE SYSTEMS

energysafe VICTORIA

GRAPH MOSDORFER KNILL GRUPPE

MV Technology Solutions

Powerlink

SA Power Networks

safearth

Schneider Electric

united energy

ZEROSEQUENCE